



Assessing Digital Readiness in Vocational Higher Education: A Mixed-Methods Study of Polytechnic Students

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Abstract

Digital transformation requires vocational higher education institutions to ensure that students possess digital readiness that goes beyond mere access to technology and encompasses critical, collaborative, safe, and ethical learning competencies. This study aims to assess students' digital readiness in vocational higher education based on four key indicators: (1) digital access and operational skills, (2) information literacy and evaluation of digital sources, (3) digital content creation and collaboration, and (4) digital ethics, security, and professionalism. This research employed a mixed-methods approach using a sequential explanatory design. Quantitative data were collected through a 24-item closed-ended Likert-scale questionnaire administered to 187 students, while qualitative data were obtained through limited interviews with students and lecturers. Data were analyzed using descriptive statistics and thematic analysis. The findings indicate that students' digital readiness is generally at a moderately good level; however, disparities remain across the indicators. While access to digital devices and internet connectivity is relatively adequate, advanced operational skills, critical evaluation of information sources, digital collaboration, and awareness of digital security and professionalism require further strengthening. These findings highlight the importance of integrating critical digital literacy, project-based collaborative learning, and the reinforcement of digital ethics and security within vocational higher education curricula.

INTRODUCTION

Digital transformation has reshaped the ways individuals learn, work, and participate in society, making digital readiness a crucial prerequisite for the success of higher education, including vocational higher education that is oriented toward workforce preparedness and the needs of industry (Pahomova et al., 2023; Sloup et al., 2023). Digital acceleration in Indonesia is reflected in the increasing rate of internet penetration. The Indonesian Internet Service Providers Association reported

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reported that the number of internet users reached approximately 221.56 million, with a penetration rate of 79.5% in 2024. However, increased access to digital technology does not automatically translate into individuals' ability to use technology for meaningful and productive learning. The UNESCO *Global Education Monitoring Report* emphasizes that technology can improve learning quality only when it is implemented under appropriate conditions, particularly through the strengthening of user competencies and well-planned governance of implementation (Maheshwari et al., 2025; Rojas-Estrada et al., 2024).

Digital readiness should not be understood merely as ownership of digital devices or the intensity of digital application use, but rather as a multidimensional construct encompassing the knowledge, skills, and attitudes required to learn effectively, critically, safely, and ethically in digital environments (Bryceson & Vuorela, 2020; Redecker, 2017). One of the most widely referenced digital competence frameworks is the Digital Competence Framework for Citizens (DigComp 2.2), which emphasizes five core dimensions: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. This framework also accommodates recent technological developments, including artificial intelligence, which increasingly influence learning processes and the world of work in the digital era (Calp & Bütüner, 2022; Engkizar et al., 2025).

At the same time, the Organisation for Economic Co-operation and Development (OECD) highlights that green and digital transitions have intensified the demand for 21st-century skills, particularly adaptive and cross-contextual digital skills. Higher education institutions are therefore expected to ensure that graduates are not only capable of using technology, but also able to adapt to rapid changes in jobs and technologies (Damica et al., 2022). In line with this, the World Bank underscores the existence of a digital skills gap, especially in middle-income countries, which is influenced by weak digital competence assessment practices and the insufficient integration of digital skills into formal education (Hukubun et al., 2024; Jannah et al., 2023; Setiawan et al., 2023).

Within the context of national education policy, Indonesia's educational development agenda places digital literacy and digital competencies as strategic long-term priorities, including at the levels of higher education and vocational education (Ministry of Education and Culture, 2020). Nevertheless, empirical studies that specifically examine the digital readiness of vocational higher education students by conceptualizing digital readiness as a learning competence rather than merely technology use remain relatively limited. This limitation is particularly evident in vocational institutions located in regional areas and among students with diverse digital experience backgrounds (UNESCO, 2023). Such conditions may give rise to an *assumption gap*, whereby institutions assume that students are digitally ready due to their familiarity with the internet, while essential digital learning competencies such as evaluating the credibility of information sources, managing information, collaborating productively, ensuring data security, and solving digital learning problems may not yet be adequately developed (Redecker, 2017).

Based on this gap, the present study focuses on examining the digital readiness of vocational higher education students in responding to the demands of digital learning, viewed from competency aspects relevant to both learning and workforce preparedness. The findings of this study are expected to contribute by; providing an empirical mapping of digital competency areas that have been developed and those that require further strengthening, and offering an evidence-based foundation for academic decision-making and institutional policy formulation in vocational higher education.

METHODS

This study employed a mixed-methods approach with a sequential explanatory design. In the first phase, a quantitative method was used to map students' levels of digital readiness. In the second phase, a qualitative method was applied to explain and deepen the quantitative findings through limited interviews (Adl-Amini et al., 2024; Gierus et al., 2025; Johannes et al., 2024; Snelson, 2016). The quantitative approach was used to measure the level of digital literacy among students of the Business Management Study Program at Medan State Polytechnic.

The research instrument consisted of a closed-ended questionnaire administered to students. The questionnaire was developed by the researcher based on four indicators of digital literacy: (1) digital access and operational skills, (2) information literacy and evaluation of digital sources, (3) digital content creation and digital collaboration, and (4) digital ethics, security, and professionalism. Prior to data collection, the questionnaire underwent logical validity testing by soliciting evaluations from three experts regarding the relevance and clarity of the items used to measure students' digital literacy in the Business Management Study Program at Medan State Polytechnic. Based on the experts' feedback, several revisions were made to improve the questionnaire.

Subsequently, a pilot test was conducted with 30 respondents to examine the empirical validity of the questionnaire. The results indicated that the validity index of the instrument was 0.87, which falls within the very high category. This value was compared with the *r*-table value of 0.3610, and the results showed that the validity index exceeded the *r*-table value, indicating that the questionnaire was valid. In addition, reliability testing revealed a reliability index of 0.954, which was also higher than the *r*-table value of 0.3610. Therefore, the questionnaire was deemed reliable.

After completing the pilot testing stage, the questionnaire was distributed to 187 respondents selected from a total population of 253 students in the Business Management Study Program at Medan State Polytechnic. The sample size was determined using the Slovin formula with a 5% margin of error, and respondents were selected using random sampling. The use of the Slovin formula was based on the consideration that students in the Business Management Study Program at Medan State Polytechnic have heterogeneous characteristics in terms of ethnicity, gender, and other backgrounds. Data obtained from the questionnaire were analyzed using descriptive statistical techniques in the form of percentages.

Following the quantitative data collection, qualitative data were gathered through interviews to explore field phenomena and factual conditions related to the digital literacy skills of students in the Business Management Study Program at Medan State Polytechnic. Interviews were conducted with both students and lecturers. The qualitative data obtained from the interviews were analyzed using the Miles and Huberman data analysis technique, which consists of data reduction, data display, and conclusion drawing (Busrul et al., 2025; Engkizar et al., 2024; Engkizar et al., 2025). Through this analytical process, significant findings related to the digital literacy skills of students in the Business Management Study Program at Medan State Polytechnic were identified.

RESULT AND DISCUSSION

This study involved 187 students as respondents who completed a digital literacy questionnaire consisting of 24 statements using a four-point Likert scale. The instrument was developed based on four main indicators, namely: digital access and operational skills (items 1–6), information literacy and evaluation of digital sources (items 7–12), digital content production and digital collaboration (items 13–18), and digital ethics, security, and professionalism (items 19–24).

Overall, the results of the analysis indicate that the average level of students' digital literacy falls within the moderately good category, with an overall mean score of 2.68 on a four-point scale. This finding suggests that students have acquired basic digital literacy skills; however, these competencies have not yet developed optimally or evenly across all indicators. The results of the analysis of students' digital literacy based on each indicator are presented as follows.

Digital Access and Operational Skills

The analysis of the digital access and operational skills indicator consists of three aspects, namely access to devices and connectivity, operation of the learning management system and supporting devices, as well as digital footprint and professional communication. The data obtained from these three aspects show a mean score of 2.66, which falls within the moderately good category. Overall, Indicator 1 demonstrates that students' readiness in terms of device access and digital operational skills is at a moderate to good level. Students generally possess devices and basic access that support digital learning. Nevertheless, advanced operational skills, particularly in managing digital learning accounts, still require serious attention (Raehani et al., 2022).

These findings are consistent with the results of interviews conducted with lecturers and students, which indicate that access to digital devices and internet connectivity is not a major obstacle for most students. Both lecturers and students stated that the availability of devices and network infrastructure is adequate to support the learning process. However, limitations were still identified in the area of digital access and operational skills, particularly in managing learning accounts and utilizing online learning systems. Students frequently experience technical difficulties, such as account settings, task upload processes, and the management of digital learning activities, which leads them to rely on assistance from peers. These findings indicate that although digital access has been fulfilled, students' digital operational readiness has not yet been evenly developed and remains at a basic level (Bali & Fadilah, 2019; Dewi et al., 2023; Kabba, 2024). Therefore, systematic strengthening of digital operational skills is required within vocational higher education learning processes.

Based on these findings, it can be concluded that the digital readiness of vocational higher education students has not yet reached an optimal level in terms of operational aspects. Accordingly, early digital literacy orientation programs, training on learning management system usage, and the habituation of academic digital account and system management from the beginning of the study period are necessary.

Information Literacy and Evaluation of Digital Sources

The indicator of information literacy and evaluation of digital sources consists of three aspects, namely information search strategies, evaluation of source credibility, and verification and selection of information. This indicator obtained a mean score of 2.71, which is also categorized as moderately good. Overall, the results indicate that students' information literacy and ability to evaluate digital sources are at a moderate level. Students have relatively acquired basic skills in searching for and using digital information, particularly in aligning information with the needs of vocational fields. However, cross-verification of sources, critical evaluation, and consistency in using credible sources still require improvement (Baroud et al., 2025; Rahman et al., 2025).

These findings are supported by interview results with lecturers and students, which reveal that students are accustomed to using the internet as their primary source of academic information. However, their ability to evaluate the quality and credibility of digital sources remains limited. Students tend to select sources that are easily accessible without conducting verification or comparison across sources, while

lecturers confirmed that critical evaluation of differences between scientific and non-scientific sources is rarely practiced. These findings indicate that students' information literacy remains at an instrumental stage, where information is used merely to complete assignments, rather than at a critical and reflective level. The interview results reinforce the questionnaire findings for Indicator 2, which show that students' ability to evaluate digital sources is not yet optimal, and further emphasize the gap between ease of access to information and the ability to critically evaluate digital information. This condition indicates that the digital readiness of vocational higher education students has not yet been fully developed in terms of information evaluation (Kassymova et al., 2025). Therefore, strengthening is required through digital literacy-based learning, training in searching for scientific sources, and the integration of source evaluation practices into coursework assignments and projects.

Digital Content Production and Digital Collaboration

The third indicator consists of three aspects, namely the creation of digital-based content, reports, and presentations, as well as collaboration and the use of productivity tools relevant to the field of study. The indicator of digital content production and digital collaboration shows the lowest mean score among all indicators, at 2.57, although it still falls within the moderately good category. Overall, the results indicate that students' digital content production skills are in the good category, particularly in producing reports, presentations, and supporting content for vocational learning. However, aspects related to digital collaboration and project management using digital platforms remain at a low to moderate level.

Furthermore, interviews conducted with lecturers and students revealed that students are relatively capable of producing digital content individually, such as preparing technology-based reports and presentations, and perceive that the use of digital technology facilitates and accelerates the completion of academic tasks. These findings are consistent with the questionnaire results for Indicator 3, which show good achievement in digital content production aspects.

Nevertheless, in terms of digital collaboration, both lecturers and students indicated that group work activities are still carried out in a conventional manner and have not yet optimally utilized digital collaborative platforms. Students tend to divide tasks separately without system-based digital coordination, which indicates low digital readiness in collaboration and project management. These interview findings further strengthen the questionnaire results, which reveal a gap between students' individual digital content production skills and their digital collaboration skills under Indicator 3.

This gap indicates that students are more prepared to work individually using digital technology than to work collaboratively. In fact, digital collaboration is a key competency in vocational higher education, which emphasizes teamwork, project-based learning, and readiness to enter the workforce. Therefore, learning strategies that place greater emphasis on project-based learning, the use of digital collaboration platforms, and active lecturer facilitation in technology-based group work activities are required.

Digital Ethics, Security, and Professionalism

The fourth indicator consists of three assessed aspects, namely account security and data privacy, academic ethics, and digital footprint and professional communication. This indicator obtained the highest mean score, at 2.77, and falls within the moderately good category. Overall, the results indicate that students' digital academic ethics are at a high level, while digital security and digital professionalism are at a moderate level. Students have an understanding of the importance of ethics in the use of digital resources; however, consistency in the

application of data security practices and awareness of digital footprints has not yet been fully established.

Furthermore, interview results show that students demonstrate a fairly good normative understanding of digital academic ethics, such as the prohibition of plagiarism and the obligation to cite sources, as also reflected in the questionnaire results for Indicator 4, which show positive tendencies in digital ethics aspects. Nevertheless, lecturers reported that minor violations related to citation practices and source usage are still found in practice, indicating a gap between understanding and implementation of digital ethics.

In terms of digital security, interview findings reinforce the questionnaire results, indicating that students' awareness remains limited, particularly with regard to personal data protection and account security management. In addition, regarding digital professionalism, students have not yet fully recognized the long-term implications of digital behavior and digital footprints for their academic and career futures, and they tend to use informal patterns of digital communication.

Thus, the interview findings strengthen the questionnaire results for Indicator 4, indicating that although students' digital academic ethics are relatively good, aspects of digital security and digital professionalism still require further strengthening.

The results of this study indicate that the digital capabilities of vocational higher education students are at a relatively adequate level; however, they have not yet developed optimally or evenly across all measured aspects. This condition suggests that students possess a sufficient foundational level of digital competence to support the learning process, yet their mastery remains transitional and has not fully reached a critical and reflective stage. This finding aligns with the perspective that university students' digital competence generally develops gradually, progressing from basic skills toward more complex and academically meaningful competencies (Ng, 2012; Sari et al., 2025).

With regard to the indicator of digital access and operational skills, the findings show that the availability of digital devices and internet access is no longer a primary issue for students. This result reinforces the argument that the digital divide at the access level has begun to narrow within higher education contexts (Lythreathis et al., 2022). Nevertheless, students' digital readiness is not yet fully reflected in advanced operational skills, particularly in managing learning accounts and utilizing online learning systems such as Learning Management Systems. These findings demonstrate that digital readiness is determined not merely by technology ownership, but also by operational competence and sustained experience in effectively using academic digital systems (Bond et al., 2021). In the context of vocational education, such limitations may hinder technology-based learning that requires independence, procedural accuracy, and adaptability to digital systems commonly used in the workplace.

Furthermore, regarding the indicator of information literacy and evaluation of digital sources, this study reveals that students are accustomed to using the internet as their primary source of academic information. However, this practice is not accompanied by adequate critical evaluation of the quality and credibility of sources. Students tend to use information solely to fulfill assignment requirements without engaging in verification, comparison, or reflection on the validity of the sources employed. This condition indicates that students' information literacy remains at an instrumental stage, oriented toward task completion rather than critical and reflective engagement. This finding is consistent with previous studies showing that students often exhibit high confidence in information-seeking activities but demonstrate relatively weak abilities in assessing the accuracy, reliability, and authority of scholarly sources (Coiro et al., 2018; Head et al., 2018). In vocational education, limited information evaluation skills represent a significant challenge, as the quality of

information directly influences the accuracy of practice-based and project-based decision-making.

In terms of the indicator of digital content production and digital collaboration, the results reveal a clear distinction between students' individual digital content production skills and their digital collaboration abilities. Students are relatively capable of independently producing digital-based reports, presentations, and academic outputs. However, the use of collaborative platforms and digital project management tools remains suboptimal. This finding supports the view that students' digital literacy tends to develop in an individualistic manner, while digital collaborative competence requires learning designs that explicitly train technology-mediated teamwork (Caena & Redecker, 2019; Falloon, 2020). In fact, digital collaboration is a key competency in vocational higher education, which emphasizes project-based learning, teamwork, and readiness to enter the industrial workforce.

Meanwhile, the indicator of digital ethics, security, and professionalism demonstrates a more positive tendency, particularly in terms of digital academic ethics. Students generally understand basic norms such as the prohibition of plagiarism and the obligation to cite sources. However, this normative understanding is not yet consistently translated into academic practice. In addition, awareness of digital security and digital professionalism remains relatively limited, especially regarding personal data protection, account management, and awareness of the long-term consequences of digital footprints. These findings are consistent with previous research indicating that understanding digital ethics is often not accompanied by adequate awareness of information security and reflective digital identity management (Grace, 1991; Marinho & Carneiro, 2018). In the vocational education context, weaknesses in these aspects may directly affect graduates' work readiness and professional reputation.

Overall, this discussion highlights that the academic and digital literacy readiness of vocational higher education students is not yet holistic, but rather remains fragmented across specific aspects. Therefore, more integrated, applied, and contextual learning approaches are required. Such approaches should emphasize the strengthening of critical information literacy, the development of project-based digital collaboration, and the internalization of digital ethics, security, and professionalism as core competencies of twenty-first-century vocational graduates.

CONCLUSION

This study concludes that the digital readiness of vocational higher education students is at a moderately adequate level to support digital-based learning. Students generally have sufficient access to digital devices and internet connectivity and are able to use technology for basic academic purposes. However, digital readiness has not yet developed optimally or evenly across the core competencies required for vocational learning and workforce preparation. While basic technological access is no longer a major constraint, deficiencies remain in advanced operational skills, critical information literacy, digital collaboration, as well as digital security and professionalism. Students tend to engage with digital technologies in an instrumental and individual manner, particularly in information seeking and content production, without consistently applying critical evaluation of sources or effective collaboration through digital platforms. Moreover, although awareness of digital academic ethics is relatively well established, the internalization of data security practices and long-term digital footprint awareness remains limited. Overall, digital readiness among vocational students appears fragmented rather than holistic. These findings underscore the need for systematic institutional efforts to integrate critical digital literacy, project-based collaborative learning, and the reinforcement of digital ethics, security, and professionalism into vocational higher education curricula to better

align graduate competencies with twenty-first-century workforce demands.

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