Technology Literacy of Undergraduate Students: A Survey in Universitas Muhammadiyah Malang

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Abstract: The development of information technology has impacted the learning process of higher education in Indonesia. This study aims to describe the level of technological literacy of students at the University of Muhammadiyah Malang in supporting the Independent Learning Campus (MBKM) policy of universities in Indonesia. This study uses survey method through likert scale adopted by the PISA standard, UNESCO. The results of this study indicate that the level of technological literacy for students who have participated in the Merdeka Learn Campus Merdeka (MBKM) is high. Furthermore, the information literacy and digital literacy have good scores from the four elements of technological literacy. Two faculties have high technological literacy, namely the Faculty of Health Sciences and Teacher Training and Education. This study is to provide input information for higher education managers to make decisions on the development of the Independent Learning Campus Merdeka (MBKM) in higher education.

INTRODUCTION

Since the last of the twentieth century, the exponential increase of knowledge and the emergence of economic globalization have revealed that citizens worldwide must interpret information from a global viewpoint (Kong, 2008; Martin & Grudziecki, 2006). Entering the 21st century, the use of Information and Communications Technology (ICT) is increasingly massive in all aspects of life (Quinn & Fitch, 2014). As a result, the use of technology has dramatically changed the structure of old jobs, and the need for skilled workers for ICT is increasing (Ali & Katz, 2010; Buckingham, 2008). Accordingly, the challenges of universities to produce professional graduates in the technological era are getting bigger. (Simpson & Obdalova, 2014).

As an effort to link & match the needs of the job market with university graduates in Indonesia, through the Ministry of Education and Culture, the

Indonesian government has formulated the Independent Learning Campus (MBKM) policy. This policy is a revolutionary form of the higher education system in Indonesia so that it remains a practical knowledge center. Therefore, higher education institutions in Indonesia have a challenging task: to prepare superior human resources to develop science and technology. However, to support the implementation of the Independent Learning Campus (MBKM) and prepare superior human resources, many things need to be considered by higher education stakeholders in Indonesia, one of which is technological literacy.

According to Davies (2011), technology literacy is an individual's ability to adapt, discover and evaluate technology for its positive impact on life, society, and the environment. The rapid development of information technology has brought about changes in education (Judson, 2010; Rizk & Davies, 2021). The ability to use technology is increasingly needed in the educational process. Technology is a mandatory choice that must be applied in the world of education, not only in the context of education in general but also in education in particular, namely learning (Lankshear & Knobel, 2015). Motivation to use technology alone is not enough; students must think critically through technology to facilitate their learning process. The use of technology in the learning process in higher education provides convenience, flexibility, and variety to students (Gamage & Perera, 2021).

Currently, the number of universities in Indonesia is 4,593, both public and private. One of these private universities is the University of Muhammadiyah Malang. University of Muhammadiyah Malang (UMM) has 35,204 active students. Meanwhile, undergraduate students reach 3584. Referring to the 2016 World Most Literate Nations Ranked research by Central Connecticut State University, Indonesia's literacy rate is ranked 60 out of 61 countries. As a campus that prioritizes scientific knowledge and problem solved-oriented aspects, UMM has started implementing several MBKM activities for some students. Furthermore, starting in 2022, the MBKM policy will be applied to most students following the requirements. This policy is expected to provide students with a different experience to prepare them for the competitive world of work in the 21st century. Ironically, even though the literacy rate is low, Indonesian people use technology such as smartphones for an average of 9 hours. This fact is also found at the student level (Irhandayaningsih, 2021), who is familiar with several digital technology platforms. Especially with implementing an online learning system due to the COVID-19 pandemic (Gamage & Perera, 2021; König et al., 2020; Roziqin et al., 2021).

As a form of preparation to support Independent Learning Campus (MBKM), this study aims to describe the technological literacy level of UMM undergraduate students. The present article is organized as follows: firstly, the urgency of technology literacy in higher education in Indonesia. Then, the challenges and barriers to technology literacy are discussed, focusing on higher education. Additionally, the impacts of accessibility of educational technologies on learning are discussed in the following section. Next, we present the results of a survey conducted on undergraduate students from a wide range of backgrounds on their device use during the transition of the independent Learning Campus (MBKM) policy. Finally, the survey's outcomes are discussed, and conclusions are made based on the finding.

Technology Literacy: A Literature Review in Indonesia

Technology literacy is an essential skill in the twenty-first century (Moore, 2011). Modern information and communication technologies (ICT) have drastically changed the abilities required to successfully engage, communicate, and work in all aspects of society (Gnambs, 2021), including education. Information and Communications Technology (ICT) is actively used in the world of education both in terms of processes and supporting tools in learning (Jang et al., 2021). Due to technological developments and the COVID-19 pandemic, uncertainty conditions impact the educational environment, including higher education (Adnan & Anwar, 2020; Marinagi et al., 2017).

Technology literacy means having the knowledge and ability to use technology platforms efficiently (Quinn & Fitch, 2014). Advances in ICT and the spread of smartphones and internet applications in educational institutions have fundamentally changed the way people find, process, and evaluate information (Gnambs, 2021; Marinagi et al., 2017). The massive volume of information that is now electronically accessible has also given rise to new affordances of information use, allowing individuals to successfully live in and cope with the demands of a technological society. According to (Gnambs, 2021), Digital competence, 21st-century skills, or ICT literacy are some of the terminology used to describe these new talents. The ability to critically appraise information quality or digitally process accessible data (Cetindamar Kozanoglu & Abedin, 2021; Griffin et al., 2012).

In the Indonesian case, motivation and learning strategies are considered more influential on student achievement than literacy knowledge about information technology (Sulisworo & Suryani, 2014). However, in 2019 and digital technology, students' information technology literacy skills are significant because they can influence students' learning abilities and knowledge when learning at home (Mustakim et al., 2020; Setyaningsih et al., 2019). According to Sulthan & Istiyanto (2019), students use ICT advice according to their needs.

Based on previous studies, problems regarding the lack of digital literacy and limited knowledgeable resources have resulted in non-connectivity barriers to accessing and delivering electronic services (Barnard et al., 2003). In fact, in some cases, technological literacy skills can have implications for efficiency and ease of movement in processing data into information and knowledge (Dewi et al., 2019; Quinn & Fitch, 2014). Furthermore, Gnambs (2021) argues that literacy regarding information and communication technology in Germany has increased as children grow up like teenagers at the age of 15-18 years. This literacy affects their ability to adapt to the challenges of the technological society and the development of digital information. Technological literacy here is considered to present a significant setting for several policies, one of which is education policy and students' ways of thinking and learning (Lankshear & Knobel, 2015). Educational systems influenced by new technologies require students to have a high ability to use technology to complete many tasks, but the increasing ability of technology here also raises concerns about the decline in students' ethics and social behavior (Langer & Knefelkamp, 2008).

The skills and competencies of teachers also serve to meet the needs of teaching adaptation with students in digital technology-based learning (König et al.,

2020). Furthermore, research conducted at the University of Putra Indonesia shows that most lecturers understand and know the importance of digital literacy to improve the quality of learning and higher education. However, some learning methods and models have not been able to accommodate the increase in skills competitiveness in the era of globalization, so technology is only used to meet the demands of the three main pillars, especially research (Dewi et al., 2019).

The information technology approach in education is not enough to add media and or information technology into the curriculum, but also must build principles and abstract methods of using technology as an instrument of learning (Buckingham, 2008). In Hong Kong, the curriculum regarding the development of information technology has shifted to the development of information literacy, where this curriculum functions more to provide opportunities for students to learn the operation of information technology tools to support learning abilities (Kong, 2008) because good digital literacy is believed here. It is an element that can support and influence achieving goals in studies, careers, and personal life growth of individuals (Martin & Grudziecki, 2006).

Furthermore, unique strategies in increasing the use of digital technology must be balanced with programs, instructions, and skills training regarding information literacy and digital literacy for students (Jang et al., 2021), where institutions are required to design appropriate and compelling content as well as digital literacy training. For better learning outcomes (Adnan & Anwar, 2020). Theoretically, to reach the ICT-Literacy level, four stages must be passed, namely: (1) Information Literacy, (2) Computer Literacy, (3) Digital Literacy, and (4) Internet Literacy (Ministry of Communication And Information Technology, 2006).

1) Information Literacy

One of the skills in information literacy is identifying verified information, finding databases, and identifying opinion statements. If information literacy is defined and developed concerning the digital environment, then information literacy emphasizes navigating and finding information (Livingstone, 2008).

Mokhtar, Majid, and Foo (Mokhtar et al., 2008) provide table guidelines to see the level or level of Information Literacy as follows:

Table 1. Information Literacy Evaluation Instrument

Indicator	Descriptions
1. Identify information needs	(i) define information need (ii) define search questions and objectives
2. Sources of information and tracking behavior	(i) information format (audio-visual/print/electronic) (ii) type of information source (primary/secondary/tertiary) (iii) choice of sources of information for various tasks or needs
3. Search techniques and strategies	(i) using print/online catalogs (ii) types of catalogs and basic cataloging rules (iii) using electronic databases and resources (iv) using Internet search engines

	(v) formulate a search strategy
	(vi) basic and advanced search
	(vii) Boolean Search
4. Location and evaluation information	
	(i) understand the definitions of credibility, authority, accuracy, and currency
	(ii) evaluation criteria
	(iii) selection of required information
5. Use of information and related issues	(i) use of citations or bibliographies
	(ii) write a quote
	(iii) copyright issues - fair dealing and plagiarism
6. Information sharing and knowledge creation	(i) collaborative discourse to verify the information and make an informed opinion or decision
	(ii) collaborative learning and knowledge sharing

2) Computer Literacy

According to Mustakim et al. (2020), computer literacy can understand and use information technology in various formats from various sources displayed through computers.

3) Digital Literacy

Paul Gilster (1997), as quoted from Lankshear & Knobel (2015), defines digital literacy as the ability to understand and use information in many formats from various sources when it is presented through a computer. Gilster (1997) defines digital literacy as reading, understanding, and analyzing various digital sources.

Elaborating from various sources, the Network of Indonesian Digital Literacy Activists (Japelidi) made the levels of digital literacy as follows:

Table 2. Digital Literacy Competency Level

Competency	Descriptions
Access	Competence in obtaining information by operating digital media
Selecting	Competence in selecting and sorting various information from various sources that are accessed and judged to be useful for digital media users
Understand	Competence to understand previously selected information
Analyze	Competence to analyze by looking at the pluses and minuses of previously understood information
Verify	Competence to cross-confirm with similar information
Evaluate	Competence in considering risk mitigation before distributing information by considering the method and platform to be used
Distribute	Competence in sharing information by considering who will access the information
Produce	Competence in compiling new information that is accurate, clear, and pays attention to ethics
Participate	Competence to play an active role in sharing good and ethical information through social media and other online communication activities

Collaborate	Competence to initiate and distribute honest, accurate, and ethical information in collaboration with other stakeholders

Souce: Kurnia et al., (Kurnia et al., 2020)

4) Internet Literacy

Internet literacy is the ability to use theoretical and practical knowledge about the internet as a medium of communication and information retrieval (Doyle, 1996). Based on the discussion above, it can be concluded that Technological Literacy is a person's ability to know the use of technology functionally, analyze the benefits of technology and evaluate technology critically. If it is associated with the Independent Learning Campus (MBKM) process, the following indicators can be made:

Table 3. Technology Literacy Level Indicator for Independent Learning Campus (MBKM)

Literacy Level (PISA)	Technology Literacy Indicator
Level I. Identification	Identify hardware, software, and applications for Independent Learning Campus (MBKM)
	Able to use various hardware, software, and applications for Independent Learning Campus (MBKM)
Level 2. Implementation	Able to choose hardware, software, and applications according to Independent Learning Campus (MBKM) needs
Level 3. Reasoning	Able to use hardware, software, and applications critically to work in Independent Learning Campus (MBKM)

METHOD

This article used quantitative with approach survey. An online questionnaire was conducted among 1612 undergraduate students at the University of Muhammadiyah Malang, Indonesia, to describe the level of technological literacy in the preparation of Independent Learning Campus (MBKM) policies. This questionnaire was administered using the google form platform, with a likert scale, concerning "A Global Framework of Reference on Digital Literacy Skills" (UNESCO, 2018), i.e.;

1. = Strongly disagree
2. = Disagree
3. = Slightly Disagree
4. = Agree
5. = Strongly agree

Determination of respondents is by purposive sampling. This research is in the form of student statements indicating technological literacy, including knowledge, analysis, and reasoning—then tabulated with Microsoft excel and descriptive quantitative analysis.

RESULTS AND DISCUSSION
1. Technology Literacy

Based on the survey results of 1612 undergraduate students at, University of Muhammadiyah Malang, the overall score is 4.08 (good). Furthermore, these values are described in detail in the image below:
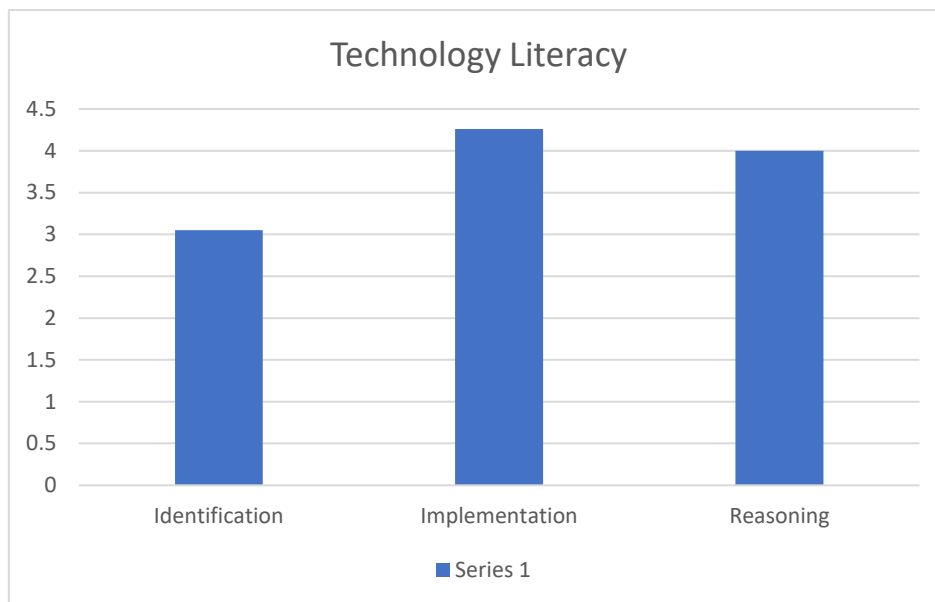
Figure 1. Technology Literacy

Figure 1 shows that the implementation score is higher in the PISA standard than the Identification and Reasoning score. It means that respondents have higher skills and usage than their knowledge of technology and use technology for more productive things as students. It is known that the indicators on the level of knowledge measure students' understanding of technology concepts which include names, categories, and their uses—for example, being able to distinguish and access hardware, software, and various applications. Meanwhile, at the implementation level, it is measured by the respondent's acknowledgment in choosing hardware, software, and applications and their skills in choosing the appropriate device according to their needs. There are many technology options, but respondents will determine which one is right for their needs. The implementation phase also measures the respondent's ability to access technology.

The reasoning stage is the highest level of literacy. This stage measures respondents' awareness of using technology fully aware of all the consequences and using technology to produce works that are beneficial to themselves and others (society). Participation as a community member through technological mediation is one of the indicators. For example, does the respondent also have works distributed to the public and are actively involved in anti-hoax campaigns through the technology tools they have access to?
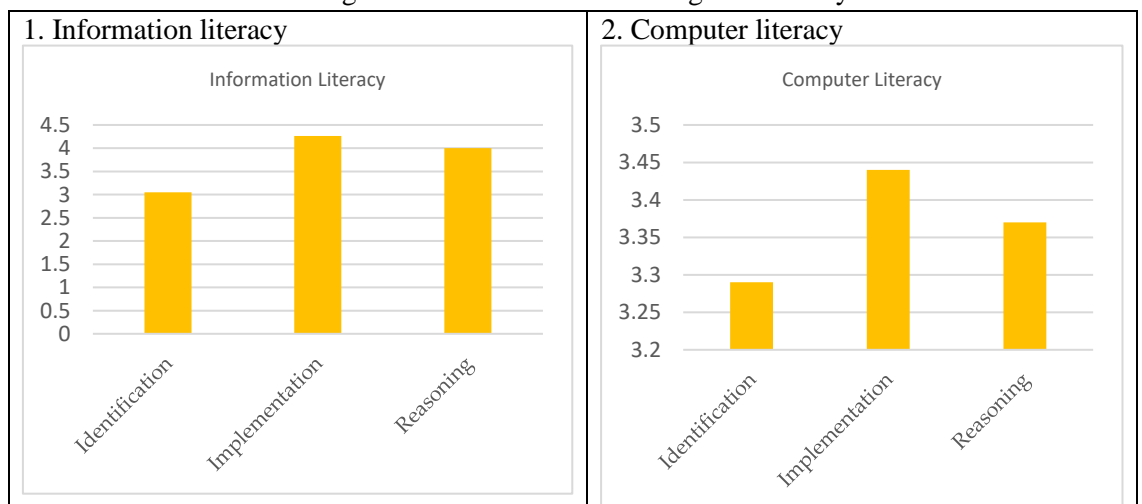
Based on the summary of the total literacy level, it is interesting that students' technology use skills are high but conceptually lower. Technology skills have an essential role in delivering information (Barnard et al., 2003; Moore, 2011). Meanwhile, the score of technology use with all its impacts and use for people's lives is still below its application but above the conceptual level (identification). This study confirms that Dewi et al. (2019) presented that the level of ability of the academic community is still low in accessing technology to support the learning process.

*2. Elements in Technological Literacy

Technological literacy in this study includes Information Literacy, Computer Literacy, Internet Literacy, and Digital Literacy. The research calculates the score of each element to get a detailed picture of students' understanding, application, and critical power according to technological developments. It must be admitted that not all study programs must always use the most advanced technology. The presence of digital technology as the most sophisticated does not mean that computers are entirely abandoned. Some computer software is more relevant for specific purposes than digital applications. Therefore, this study decided to keep testing technological literacy into four elements.

In the following, the findings in more detail on each element of technological literacy are presented in the figure:

Figure 2. Elements in Technological Literacy

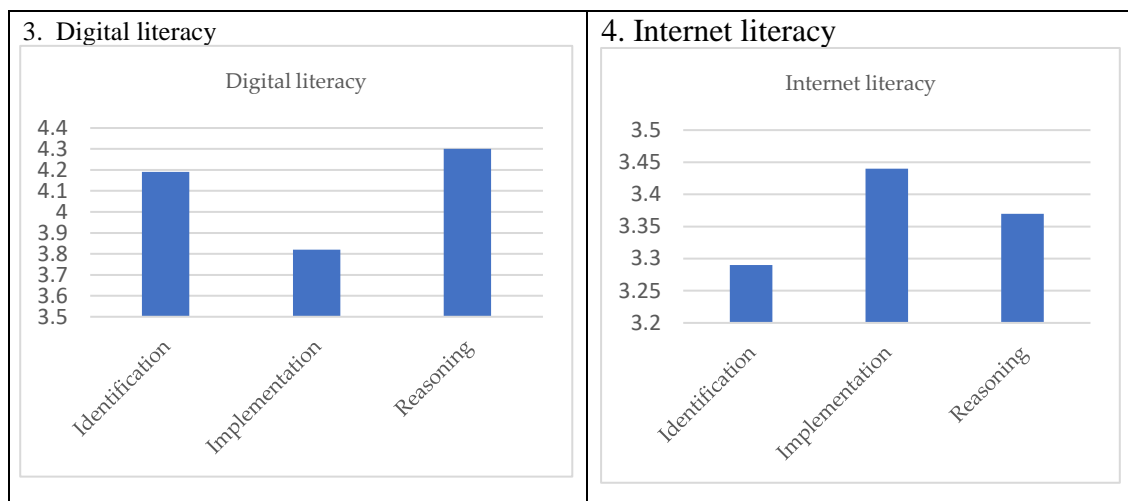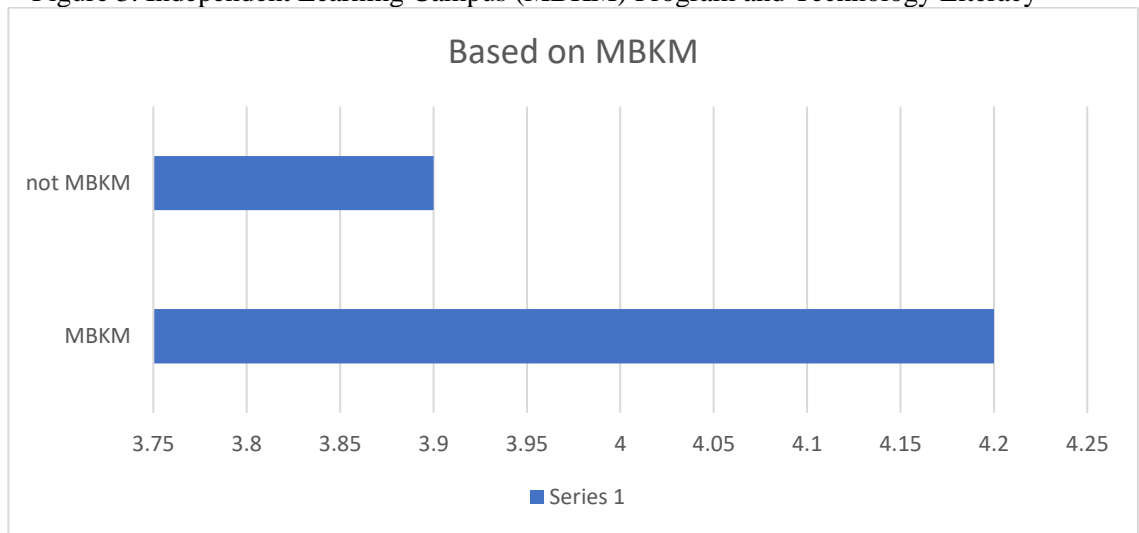| 3. Digital literacy	4. Internet literacy

Figure 2 shows an overview of the four technologies tested, including Information, Computers, Internet, and Digital. Interesting findings on Digital Literacy. As the latest technology, respondents are the original generation of digital technology (native digital). The data shows that respondents got a high score (4.2). Likewise, the reasoning score on Digital Literacy even has the highest score. Uniquely the implementation score is lower than the identification score and reasoning score. It can be interpreted that respondents choose a few applications but use them optimally. It could also be because they understand, so they are selective in using or selectively choosing digital applications.

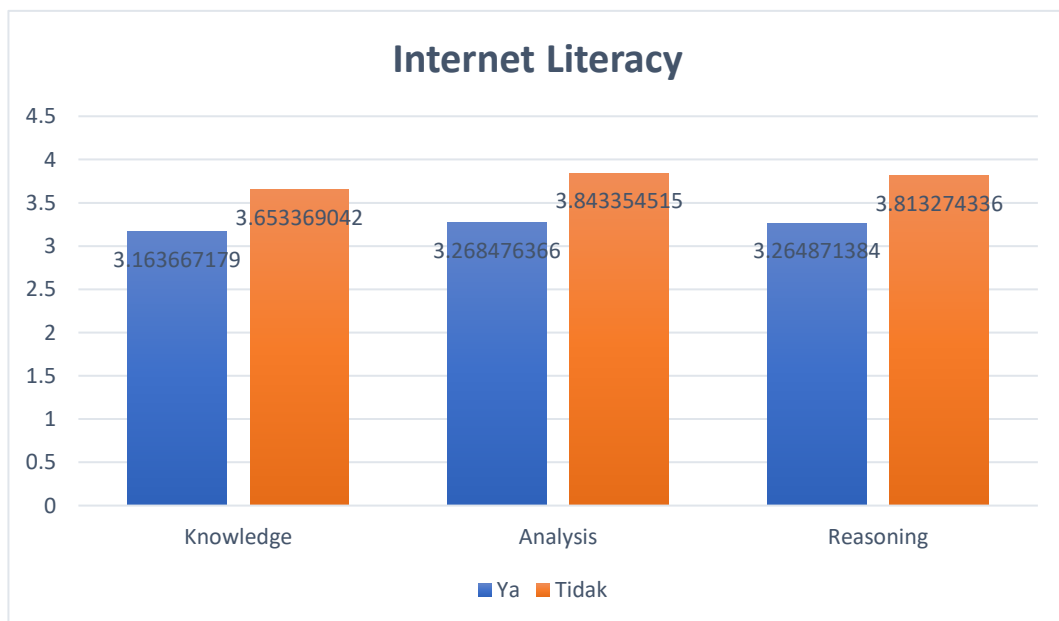## 3. Relationship between Independent Learning Campus (MBKM) and Technological Literacy

The data obtained in this study were successfully separated based on the scores of students who have followed the Independent Learning Campus (MBKM) and students who have not been implementing Independent Learning Campus (MBKM). At the University of Muhammadiyah Malang Independent Learning Campus (MBKM), the students have taken internships, thematic Community Service Program (KKN), teaching assistance in academic units, independent projects. Not all of the seven have been set by the Ministry of Education and Culture. The results showed that respondents who had implemented Independent Learning Campus (MBKM) had higher scores in Data Literacy, Technology Literacy, and Human Literacy than respondents who had not implemented Independent Learning Campus (MBKM)

Figure 3. Independent Learning Campus (MBKM) Program and Technology Literacy

Based on the findings of this data, it can be interpreted that students who implement Independent Learning Campus (MBKM) benefit from Independent Learning Campus (MBKM) related to their Technological Literacy. Applying technology in companies where internships and Independent Learning Campus (MBKM) programs make students more motivated to understand, be more skilled, and use technology more for beneficial work. So, this study confirms that the application of technology in learning impacts students' technological skills indirectly (Jang et al., 2021). Furthermore, the most striking difference is the impact of Independent Learning Campus (MBKM) on Internet Literacy, as shown in the following figure.

Figure 4. Internet literacy for students who are in Independent Learning Campus (MBKM) program and those who are not

The difference in Internet Literacy scores between students who have implemented Independent Learning Campus (MBKM) and those who have not implemented Independent Learning Campus (MBKM) appears to be far (0.55). It is somewhat different from the scores of students who have not implemented MBKM on Information, Computer, and Digital Literacy, which is not much different (ranging from 0.28 to 0.36). Thus, Independent Learning Campus (MBKM) most significant impact on technology literacy is internet literacy. While the minor impact on increasing Digital Literacy (0.28)

4. Technology Literacy based on Faculties

Of the 1612 students who filled out the online survey questionnaire, there were nine faculties out of a total of 11 faculties at the University of Muhammadiyah Malang. For details of scores per faculty, the following is the detailed data.

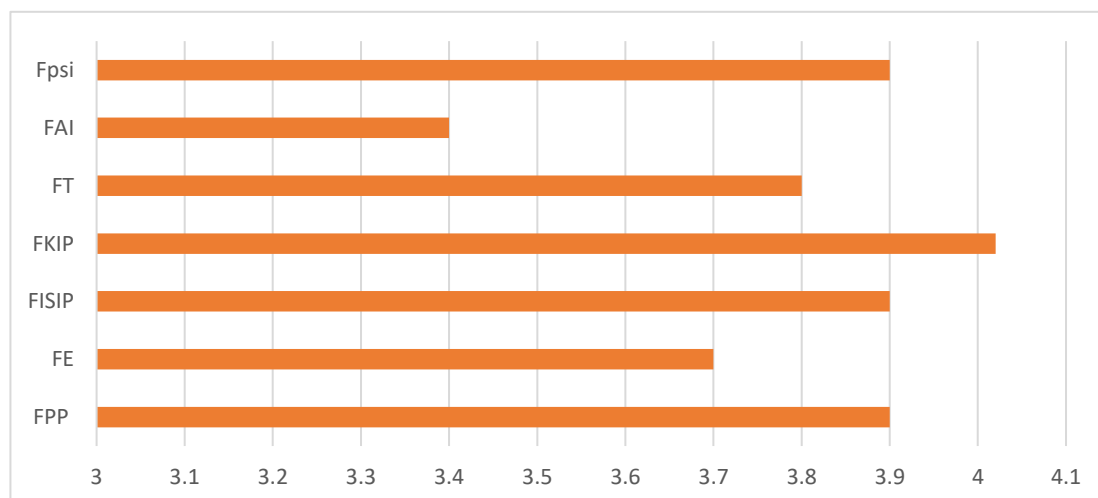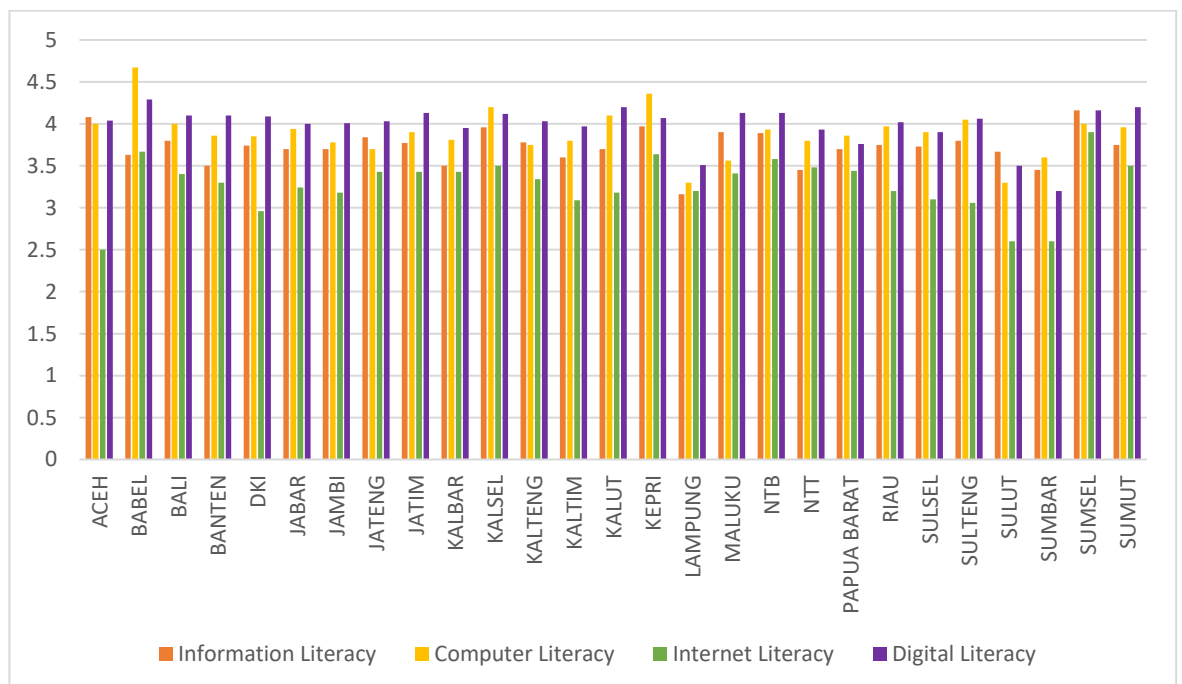Figure 5. Technology Literacy by Faculty

Figure 4 shows that students from the Faculty of Teacher Training and Education (FKIP) and the Faculty of Agriculture and Animal Husbandry (FPP) have a good level of technological literacy compared to other faculties at the University of Muhammadiyah Malang. It means that most of the students of the two faculties have proven that they are more capable and skilled in using online sources online platforms in supporting lecture assignments. While the faculty with the lowest level of technological literacy in the Faculty of Islamic Religion (FAI), this is possible because the sources used by students of the Faculty of Islamic Religion (FAI) are more conventional or classical books in physical form, and there are still few online sources/platforms available which discusses credibly on religious issues digitally.

5. Technology Literacy based on Place of Origin

As a large private campus in East Java, the composition of its students comes from various regions in Indonesia. Figure 6 shows several areas of origin of students who were recorded as filling out online questionnaires. The result is that the level of technological literacy of students is not affected by where they come from, meaning that even though they come from developed regions/cities, it is not necessarily a high literacy rate.

The highest information literacy scores were among students from South Sumatra. Furthermore, computer and digital literacy came from Bangka Belitung. Meanwhile, internet literacy comes from South Sumatra.

Gambar 6. Technology Literacy based on Place Origin

CONCLUSION

This article describes technological literacy in students at the University of Muhammadiyah Malang in supporting the Independent Learning Campus (MBKM) policy. The results of this study indicate a positive impact from the Independent Learning Campus (MBKM) on the level of student technology literacy. Of the four essential elements in technological literacy, two things, namely information, and digital literacy, generally have a good literacy level for students at the University of Muhammadiyah Malang. Meanwhile, faculty with technological literacy is the Faculty of Health Sciences (FIKES) and Teacher Training and Education (FKIP).

The implication of this research is to provide input information for higher education managers as a basis for making decisions on the development of Independent Learning Campus (MBKM) in higher education. University leaders are expected to have the right strategy to increase the technological literacy level of students with low indexes and continue to develop continuously for good literacy scores, therefore the impact of the level of technological literacy can support the

implementation of the Independent Learning Campus (MBKM) at the University to face the era of competition and technology in the future.

SUGGESTION

Based on these findings, MBKM developers, especially in private univeristies, need to pay attention to the literacy level of students as a carrying capacity for carrying out activities derived from MBKM. Campus managers must provide adequate infrastructure to increase student literacy levels. This can be done by conducting intensive training and provision of technological literacy for new students. Further research that can be developed is to compare the level of technological literacy between private universities and other private universities or public higher education

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