



THE USE OF EMB (ENGINEERING MECHANICS BOOK) MOBILE APP TO TRAIN STUDENTS' DIGITAL LITERACY SKILLS DURING COVID-19 PANDEMIC

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ABSTRACT

Learning media plays an essential role in conveying material to students. Learning media can be divided into media that Teacher directly use in learning and media made by Teacher that later adapted to the abilities and needs of students. Engineering mechanics is one of the primary subjects that civil engineering students must master at. The engineering mechanics course discusses the analysis of the balance of a structure. Students can use mobile application-based teaching materials as online learning media amid the COVID-19 pandemic. Engineering mechanics book, we called EMB, can be used by students to study independently at home during learning online but still in the monitoring/monitoring of Teacher (lecturers). The research and development use ADDIE design. The stage includes 1) Analysis, 2) Design, 3) Develop, 4) Implementation, and 5) Evaluation. EMB product had been tested the validity and implementation during the learning process. EMB got 3.32 valid results for the product. EMB can also train students in digital literacy. Students' digital literacy is in the quite proficient category. This condition is not regardless of the influence of student habits in using technology which is more often used for online communication and entertainment. The frequency of using digital technology for entertainment purposes is higher compared to use for academic purposes.

Key Words: digital literacy; mobile learning; mechanic; vocational; covid.

INTRODUCTION

The development of digital technology today happened rapidly and had an impact on people's lifestyles (Sutisna et al., 2020). This technological advancement gave birth to a new generation called digital natives. A digital native is a generation that cannot be separated from technology digital. They are always connected with the internet, requires skills to process information quickly and instant, and often interact in the world virtually without being limited by distance and time. This generation tends to quickly look for specific information without reading, studying, and understanding detailed information promptly.

The technologies, especially the integration to the learning process, change the way face-to-face learning (Sutisna et al., 2020; Becker, 2021). Learning tends to encourage students to find out from various sources of observation, not just given information in one direction or teacher-entered. Designed learning student-centered (student-entered) will have good learning outcomes higher than teacher-centered learning (teachers and lecturers).

Coronavirus Disease (COVID-19) is a global health problem in early 2020. Coronaviruses are a large family of viruses that cause the disease ranges from mild to severe symptoms. At least two types of coronaviruses are known to cause disease that can cause severe symptoms, such as Middle East Respiratory Syndrome

(MERS) and Severe Acute Respiratory Syndrome (SARS). The increase in the number of COVID-19 cases is happening quite quickly and has spread between countries. Indonesia first reported a confirmed case of COVID-19 on March 2, 2020. The spread and transmission of COVID-19 are increasingly out of control. There have been reported positive cases of COVID-19 as many as 4,25 million with 144 thousand deaths in all provinces in Indonesia. The emergency state makes the national government forces the Minister of Education to cancel activities face-to-face learning at all levels of education, including lectures conducted online.

In online learning, one of the tools that teachers can use is learning media. Students can use learning media to understand the topics they are studying comprehensively. Media learning plays an essential role in conveying material to students (Hobbs & Coiro, 2019; Maulani et al., 2021). Before the COVID-19 pandemic, learning media were used to help students understand the studied topic. However, when COVID-19 began to spread, learning media, especially online media, were used to keep the learning process going. The learning system is carried out through a PC/laptop or smartphone connected to an internet network connection. Teachers can do learning together simultaneously using groups on social media such as WhatsApp (WA), telegram, Instagram, zoom applications, or other learning media. Thus, the teacher can ensure that students take part in learning simultaneously, even though in different places. Teacher can also give measurable assignments following the objectives of the material presented to students.

Learning media can be divided into media that teacher directly use in learning and media made by teacher that later adapted to the abilities and needs of students. The use of appropriate learning media is expected to support the implementation of face-to-face learning

well and effectively. Mobile devices (smartphone) are mobile device that shows fast development (Maulani et al., 2021; Hakim et al., 2019). Almost all people who use smartphones open up opportunities for the use of smartphones in education (Hakim et al., 2019). The use of smartphones in learning can improve students' digital literacy skills, where today's students must own these abilities (Nelson et al., 2011; Griffin & Care, 2015).

The PISA - Program for International Student Assessment (2016) reveals that Indonesia's reading/literacy level is ranked 62 out of 70 countries with an average score of 397. The highest score was achieved in literacy of 535, with an average reading/literacy level score of 493 out of 70 countries. It shows that reading/literacy in Indonesia is still low and below average. By 2030, Indonesia will get a demographic bonus where Generation Z will dominate Indonesian society. Therefore, it is hoped that students' literacy skills (students) can be trained and aligned with the needs of the 21st Century (Techataweewan & Prasertsin, 2017). Smartphones in learning to support students' digital literacy skills (Alexander et al., 2017; Al-Qallaf & Al-Mutairi, 2016).

Digital literacy is the ability to use information and communication technology in various activities, including understanding, discovering, evaluating, creating, and communicating digital information from various sources. Such digital information can be presented via mobile devices or other devices information technology. Digital literacy has four dimensions, namely: social-emotional, cognitive, technical, and attitudinal dimensions (Mishra et al., 2017, Al-Qallaf, et al., 2016). In the social-emotional dimension, there are six indicators, namely: teamwork, networking, sharing, ethics, legal literacy, and self-preservation (Becker, 2021). The cognitive dimension consists of 3 indicators, namely: analysis, evaluation, and creativity. The technical dimension consists of three

indicators, namely: cognition, discovery, and presentation (Güneş & Bahçivan, 2018; List, 2019). The attitude dimension consists of four indicators, namely: interest, confidence, curiosity, and openness to experience. The four dimensions must be applied within the educational framework to support the integration of technology and information can run effectively. Digital literacy can deliver the process of learning that incidentally is classical into learning-based digital. These demands gave birth to the importance of digital literacy in the world of education, mainly if it is applied at the certainly level (Güneş & Bahçivan, 2018, Alexander et al., 2017).

Teaching materials can also support the implementation of learning well. Teacher can use teaching materials as a complement and addition in explaining the material so that students get a wide and exciting variety of learning activities (Hartini et al., 2019). Teacher and students can also take advantage of teaching as a guide in the learning process to achieve goals of learning that has been formulated. It underlies that teaching materials are the primary and decisive component in the implementation of education where its role as the leading media in learning interactions is essential. Suitable teaching materials contain at least basic competencies and indicators to be achieved, mastery of competence in its application in daily life activities, supporting materials, learning activities, evaluation activities, achievement of competence, and assignments to students (Wahyuni, 2012; Misbah et al., 2018). The good teaching materials use communicative language, and the ideas that arise must be conceptualized and visualized according to student experience (Hakim et al., 2019). The existence of teaching materials will also overcome various problems barriers, including communication barriers, limited classrooms, passivity students, and the nature of the learning object that is less

special so that it does not allow learning without media (Wang et al., 2018).

Engineering mechanics is one of the primary subjects that civil engineering students must master at. The engineering mechanics course contains about understanding and analysis of the equilibrium structure. It includes the decomposition of forces, the concept of support, simple beam construction, and lines of influence. Based on the field studies on teaching materials, students' mechanical mechanics have limited to a detailed explanation of the concept of mechanics, then continued with practice questions. Use the teaching materials have not run effectively because they still lack students' understanding of engineering mechanics courses.

Students can use mobile application-based teaching materials as online learning media during the COVID-19 pandemic. Engineering mechanics book, we called EMB, can used by students to study independently at home during learning online but still in the monitoring/monitoring of Teacher (lecturers). Using EMB can also practice digital literacy skills as demands learning in the 21st Century (Judge et al., 2019). EMB will help students understand the concept of engineering mechanics, which they find difficult. It also filled learning outcomes that students must master at, teaching materials (can be in the form of facts, concepts, and principles), and practice questions or tests that can measure how far students' understanding after using the teaching materials. Presentation, multimedia teaching materials, are accompanied by pictures, graphics, animations, audio, and videos can help students understand the concept as a whole (Tondeur et al., 2016). Presentation of practise questions accompanied by feedback direct, where students know when answering incorrectly or answering correctly.

The development of EMB aims to improve students' conceptual

understanding and digital literacy skills, especially in engineering mechanics. The multimedia teaching materials are accompanied by pictures, graphics, animations, audio, and videos that can help students understand the concept. Practice presentation questions are accompanied by direct feedback, where students know when to answer incorrectly or answer correctly. Likewise, students can immediately find out the score they get after answering the matter with the test feature. With this type of formative assessment, students can monitor their learning progress. Feedback directly after spelling the questions is also intended so that students will gain confidence in the success of their work (Griffin & Care, 2015).

EMB are hoped to train and familiarize students with the four dimensions companion of digital literacy. A similar study was conducted by Hartini et al. (2019); Misbah et al. (2018); Rahayu et al. (2019); Porat et al., 2018; Setyaningsih et al., 2019) revealed that digital literacy is the evidence of understanding and individual learning on applying integration-based teaching materials technology in learning. In addition, the integration of digital literacy assessments within the educational framework supports the creation of digital literacy progress and sustainability in the future (Porat et al., 2018, Griffin & Care, 2015).

RESEARCH METHOD

Research development using ADDIE design. This design includes five stages, namely Analysis, Design, Development, Implementation, and Evaluation. The development of an EMB mobile app using the ADDIE model is shown in Figure 1.

The first stage is the analysis stage. The analysis phase aims to know the needs related to the product to be developed. Through the analysis stage, we can find out the teaching materials needed by students

and lecturers. In addition, at this analysis stage, it is necessary to consider various alternatives for developing similar products or other different products. At the analysis stage, the objectives of the product to be developed are also formulated.

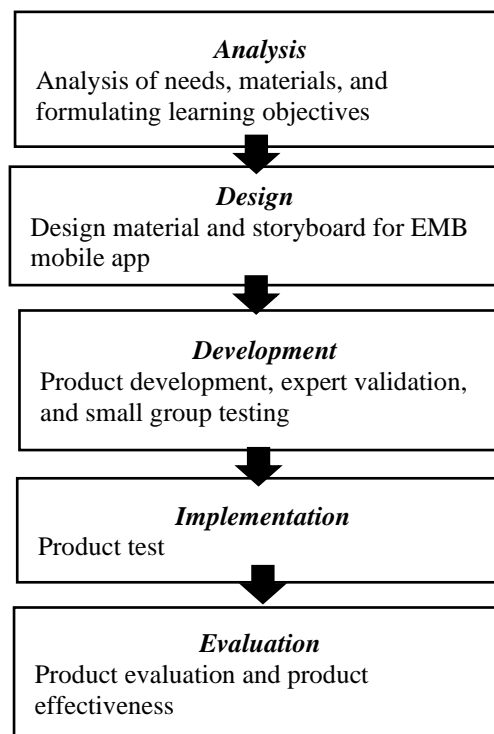


Figure 1. ADDIE Research and Development

The next stage is on hold design. At this stage, it is related to the product development steps following the learning outcomes that are compiled. The product is also made based on the conclusions of previous needs, tasks, and concepts so that the learning outcomes of mobile application-based teaching materials are compiled. The learning achievement is derived from the learning achievement of the subject and the learning achievement of the study program. Next, an initial design is made, where the initial design represents the entire product design that will be developed before the trial phase is carried out. It started by making learning objective materials or storyboards from EMB.

The third stage is the development stage. This stage aims to produce the final form of the product of teaching materials. When the product is finished being

developed, it will be revised based on input from expert and data from product trials. Expert assessment or expert validation of teaching materials includes two aspects, namely content validation/product content and content validation. Aspects included in product content validation are (1) conformity product content components, (2) suitability of product presentation components, (3) components language used in the preparation of the product, and (4) design components product. Two people with the same criteria will carry out expert validation include (1) material experts, who are experienced in the field of engineering mechanics, namely lecturers who have experience in teaching this course for at least two years, (2) mobile learning experts where people are experienced in learning mobile, namely lecturers from the IT field. The validation stage by experts is included in trials to obtain criticism and suggestions and an assessment of the product.

The analytical technique used to analyze the data from the validation results is calculating the average value. Based on Arikunto (2006), the formula for calculating the average value is as follows.

$$\bar{X} = \frac{\sum x}{n}$$

Explanation:

- \bar{X} = average value
- $\sum x$ = total score of answer
- n = number of validators

The data from the validation results must be strengthened to match a level of qualification criteria that was developed appropriateness. In this study, the rating scale used is 1 to 4, where 1 is the lowest score, and 4 is the highest score. Range determination can be known through the highest score minus the lowest score divided by the highest score.

The trial phase involves students as users of EMB. The subjects of the trial were ten students who had taken an engineering mechanics course. Students were asked to fill out a questionnaire to

provide input (suggestions and comments) of the products developed in this trial. The next stage is the test stage product effectiveness to improve students' digital literacy skills. The effectiveness takes samples that can represent the population. The sample research was taken using a purposive sampling technique, namely the withdrawal of samples based on specific considerations. The research sample is two classes that are taking engineering mechanics courses. The method used to test the effectiveness of teaching material products is a quasi-experimental model Pretest-Posttest Design (Cresswell, 2012).

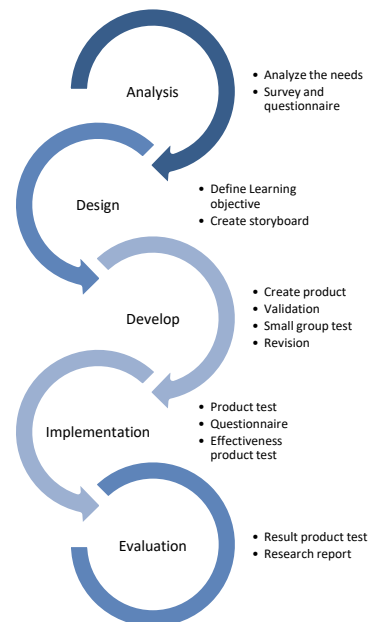


Figure 2. EMB product development

The data analysis technique on the effectiveness of teaching materials was obtained based on the pretest-posttest scores in the experimental and control classes. Pretest-posttest data analyzed to know the ability to understand the concept of physics from the experimental class and the control class were significantly different. Analysis technique Pretest-posttest data use of statistical descriptions of pretest-posttest scores, test homogeneity, and difference test. Statistical descriptions are carried out to know the data of students' pretest-posttest

scores with the lowest and the highest score category. Statistical descriptions are also carried out to find out the average value of pretest-posttest and the standard deviation of the two groups of classes, namely class experiment and control class.

FINDING AND DISCUSSION

The initial stage was carried out in developing EMB in the form of a mobile application. First step was analyze the needs of teaching materials. The needs are based on the field studies conducted through questionnaires and interviews about teaching materials to students. Answers to the questionnaire show that EMB circulating in the market are not appropriate for students' needs until now. The teaching materials used are printed teaching materials that cannot visualize the concept in real terms. Printed teaching materials are too often have a large size and mass. It is reinforced by Chen et al's. (2010) opinion that learning in the classroom has passive tendencies if using a printed textbook.

Students want teaching materials that contain conceptual material and are equipped with practice questions and their discussions. The teaching materials are also expected to be used independently (not necessarily in class) to recall learning. It is because of the allocation of learning in minimal classes. In addition, students also want the teaching materials that are visualize the concept that being studied. Pictures and photos related to phenomena related to the daily life is an example of visualization of course concepts that can attract students' attention. Activities that help students visualize abstract concepts will help the development of conceptual understanding.

The development of 21st-century technology provides alternative learning ways. It could be formed in a multimedia device that can be used as a learning tool. One of the multimedia devices is in the form of a smartphone that can operate multimedia teaching materials. EMB is a

mobile application that combine elements of text, audio, video, animation, and images that are easy and practically used by students independently. The development stage of EMB begins by setting learning objectives and compiling the initial draft of the material taught in PowerPoint slides. The purpose of preparing the initial draft of EMB in the form of PowerPoint slides is to make it easier for developers to compile materials and adjust the navigation of the buttons included in the EMB.



Figure 3. Starting page of EMB

This start page was the first to appear when EMB in a mobile application began to operate. This start page contains identity teaching materials and a button to go to the main page of teaching materials. The start page can be seen in Figure 3.

The main page (homepage) contains the main menus and navigation buttons that support the performance of teaching materials in mobile applications. The menus consist of a menu of teaching materials, practice questions, evaluations, product developers, instructions for use, digital literacy questionnaire and exit button from the application mobile. The main page can be seen in Figure 4.



Figure 4. Menu page of EMB

The EMB page consists of menus of teaching materials that students can select to study. The menu of teaching materials presented, namely: basic understanding statics, internal forces, and placement/support. Contents page teaching materials can be seen in Figure 5. The EMB presented contain material as well as applications in everyday life related to engineering mechanics.



Figure 5. Contents page of EMB

The description of the material is presented next to help students understand engineering mechanics concepts. The description of these concepts is completed drawings and related equations/formulas in engineering mechanics. In this menu of EMB, navigation buttons are provided that make it easy to use. The navigation buttons are arranged in such a way as to facilitate users moving from page one to another page. Students can use the practice questions page to understand more details related to the concept of engineering mechanics. The practice questions of EMB presented contain instructions for solving problems in a detailed and detailed manner.

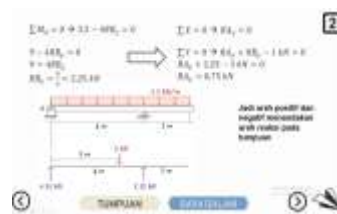


Figure 6. Practice question page of EMB

Students can use the practice questions page to understand more details related to the concept of engineering mechanics. The practice questions presented contain instructions for solving problems in a detailed and detailed manner. Lecturers can use the exam page to measure concept understanding students to the material that has been taught through the mechanics teaching materials techniques in the form of EMB mobile applications. Answers from this exam are uploaded through the site which has been available and will be recorded on google drive. Evaluation menu of EMB is too equipped with instructions and navigation buttons that make it easier for students in answering evaluation questions. The evaluation menu page can be seen in Figure 6.

The data from the media validation are in the form of quantitative and qualitative data. Data on each aspect of the assessment of EMB are calculated through the average analysis technique can be described as in Table 1.

Table 1. Validation Test Result of EMB

Criteria	V1	V2	Average	Grade
Content	3.67	4.00	3.83	Good
Presentation	3.42	3.42	3.42	Good
Language	3.33	3.00	3.16	Good
Layout design	3.00	2.72	2.86	Good enough
Average	3.35	3.28	3.32	Good

V1= first validator

V2= second validator

Based on the table 1, it can be seen that the results of the feasibility of EMB as a whole shows promising results and meet the eligibility criteria with an average value

of 3.32. Comments and suggestions that given by the validator are presented in the Table 2. Comments and suggestions from the validator are considered as revision material. The teaching materials of

engineering mechanics are in the form of mobile applications that are becoming better, more attractive, and worthy of being tested for effectiveness.

Table 2. Validation Result of EMB

	Suggestion	Revision Product
V1	<ul style="list-style-type: none"> There are letters and words that are writing is overwritten. 	<ul style="list-style-type: none"> Improve the writing design as well as the words that befall one another.
V2	<ul style="list-style-type: none"> Some menus have a pictures icon, but to access the menu, we cannot press the icon but must press the menu word label. There is ambiguity between background and buttons functional navigation 	<ul style="list-style-type: none"> Navigation buttons are made with a combination of words and icons. So that users can access the menu by pressing the icon. The background of the application is made to fade by using a plain background.

V1= first validator
 V2= second validator

Based on the comments and suggestions given by the validator, EMB needs to be revised. The suggestion is to improve the design of the writing and the words that override each other, change the application background with a fade effect, and use the plain background one.

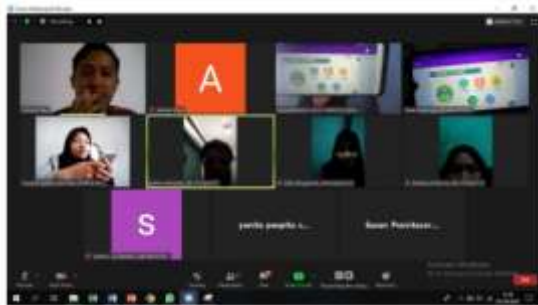


Figure 7. Small Group Testing of EMB

The readability data were taken from 10 students who had taken the Mechanical mechanics course 1. In this readability test, students are asked to provide suggestions and comments after using the EMB.

The stage of testing the effectiveness of EMB is carried out after expert validation tests and limited trials to students. The effectiveness test phase was a pretest-posttest control group design. At the beginning of the lesson, a pretest was carried out in the control class and the class experiment. The implementation of this pretest was carried out in the

experimental class individually online via the edlink LMS. The edlink page is shown in Figure 8. The next step is to treat experimental classes using EMB. EMB can be used to study engineering mechanics via their smartphones. Each of the students can download applications for engineering mechanics teaching materials via the google play store.



Figure 8. The edlink page

At the end of the lesson, a posttest was carried out in the control class and the class experiment. The posttest in the control class was carried out the same as in the activity pretest, was using the edlink LMS. Posttest in the experimental class carried out using the EMB application and google form questionnaire to define students digital literacy. The results of the description of the pretest-posttest value of the ability to understand concepts experimental class students and control class can be seen in Table 3. The result of google form questionnaire to define

students' digital literacy is shown in Table 4.

▪ 47.5% it is hard to understand

Table 3. Statistic Description

Class	N	Pretest average score	Posttest average score	SD
Control	30	33.90	51.10	7.02
Experiment	30	35.34	80.40	5.38

Based on Table 4, the average value of the pretest and posttest data is obtained from the experimental class and the control class. The results of data analysis show that the average posttest value of the experimental class is higher than the posttest value of the class control. It is as a result of giving treatment to the experimental class in the form of EMB implementation.

Table 4. Digital Literacy's Questionnaire Result

Aspect	Result
Always using the internet to search information	<ul style="list-style-type: none"> ▪ 55% internet ▪ 42.5% other
Always using google	<ul style="list-style-type: none"> ▪ 100% using google
Using the internet to study as a new habit during the covid-19 pandemic	<ul style="list-style-type: none"> ▪ 67.5% use internet ▪ 12.5% other
Using the internet or book text to study	<ul style="list-style-type: none"> ▪ 50% using internet ▪ 43% using books ▪ 7% other
Credibility of information	<ul style="list-style-type: none"> ▪ 57.5% aware, check the source of information first ▪ 42.5% not aware
Comparing source of information	<ul style="list-style-type: none"> ▪ 50% compare one source to another to check the validity ▪ 50% didn't compare it
Finding new information/knowledge	<ul style="list-style-type: none"> ▪ 50% easy to understand if they find it using the internet ▪ 50% easy to use books to find the information/knowledge
Symbol and term in internet	<ul style="list-style-type: none"> ▪ 52.5% know well terms on the internet

The Digital Literacy Questionnaire contains questions related to ability digital literacy and its relation to the learning that carried out. Data obtained from digital literacy questionnaires that have been filled out by students, here is the following results.

Table 4 explains that 55% of students stated that they always use the internet as a learning medium and a source of information. In addition, 100% of students use Google as their search engine to search for information related to learning and other things. It is confirmed that the high frequency of accessing content information and social media by students. It also supports the wrong competency in Digital Literacy (Rizal et al., 2020), namely finding and filtering digital information and data.

Meanwhile, 67.5% of students stated they always use the internet as a new habit in studying well before the pandemic and during the online learning period of the COVID-19 pandemic. Also, 50% of students stated that they were more interested in learning with the internet than studying with textbooks. It shows that The internet has entered the joints of life and has become a habit in learning and living. In this category, students can store information obtained from the internet properly, according to digital literacy competence (Rizal et al., 2020).

Table 4 shows that 47.5% of students stated that it was not always observing or tracing sources of information obtained from the internet. Also, 50% of students stated that they always compare the information obtained from the internet with other sources to

obtain accurate information. It indicates that the level of students' digital literacy is low towards new sources of information that are on the internet. Students do not check or check the truth of the source of the information they get. However, when getting some information, selective students try to find accurate information. However, they have to look for information from several sources on the internet. It follows digital literacy competence, which can evaluate information and digital data (Rizal et al., 2020).

The 50% of students stated that it was easier to conclude information obtained from the internet than reading textbooks. Based on Figure 23, 52.5% of students stated that they understand well the terms on the internet that they often encounter. The term includes URL, HTTP, domain, others. It follows the competence of Digital Literacy (Rizal et al., 2020) in terms of interacting with digital technology and being involved in society through digital technology. *Digital literacy* is a life skill that involves the ability to use technology, information, and communication tools and social skills, learning skills, and having attitudes, critical thinking, creativity, and inspiration as digital competencies. The concept of media literacy emerged along with the dominance of the media in human life, which transfers data and information that humans use to carry out their daily lives.

Media literacy as 'the ability to access and process information from any form of transmission.' The definition is then detailed into "... the ability to access, analyze, evaluate and create messages across various contexts (Techataweewan & Presertsin, 2017). The definition on

which media literacy activists and educational planners stand to be integrated into the curriculum aims to create people who can function well in the Information Age. This approach is interpreted as a 'life skills' approach. In a virtual world where the internet has become a new medium that is very important in daily life, understanding and agency of its users are needed because technology is only a tool that does not determine how we should act. It requires a series of understandings and actions by applying various new media literacy or called digital literacy.

CONSLUSIONS

Students' digital literacy is in the quite proficient category. This condition is not regardless of the influence of student habits in using technology which is more often used for online communication and entertainment. The frequency of using digital technology for entertainment purposes is higher compared to use for academic purposes. The hope is that students have good digital literacy and support for successful student academics.

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