ANALYSIS OF STEM-CP-BASED DIGITAL MODULE DEVELOPMENT IN FLIPPED LEARNING TO IMPROVE THE INDEPENDENT LEARNING OF ELEMENTARY SCHOOL TEACHER EDUCATION STUDENTS AT UNIVERSITAS NEGERI PADANG

Atika Ulya Akmal [1], Ari Kiswanto Kenedi [2], and Yeni Erita [3]

[1]Universitas Negeri Padang
atikaulyaakmal@fip.unp.ac.id
[2] Universitas Negeri Padang
arykenedi@unsam.ac.id
[3] Universitas Negeri Padang
yenierita@fip.unp.ac.id

ABSTRACT

This research is motivated by the development of STEM-based digital modules for elementary school teacher education students that are suitable for use in increasing learning independence. The purpose of this study was to determine the effect of using STEM-based digital modules on the learning independence of elementary school teacher education students. This research is an experimental research. The number of samples used in this study were 60 people. This study uses a self-learning questionnaire which is analyzed by calculating the normality test, homogeneity test, T test, influence test between variables and N-Gain calculations. The results of the study stated that T count > T table, namely 4.18> 1, 69 so that it is stated that the use of STEM-based digital modules has an effect on increasing student learning independence. The implications of this research can be used as a basis for increasing student learning independence.

Keywords: *digital module, STEM, technology, independent learning.*

PRELIMINARY

The Covid-19 pandemic is still developing in Indonesia [1]. Even though the Covid-19 pandemic has been going on for two years, the progress is still there. This can be seen from the data from the Covid-19 task force which states that in some areas the number of cases of Covid-19 is still high. This remains the shared responsibility of each element so that the development of the corona virus can be minimized. The Covid-19 pandemic has resulted in a change in people's mindset and behavior which has had an impact on religious, cultural, social, economic and even educational aspects. In the educational aspect, educational institutions are required to organize a learning process that reduces the face-to-face learning process in schools [2].

This circular letter is the basis for educational institutions to carry out online learning processes. Online learning is a learning process that is carried out online. In online learning, learning resources are needed that are managed online by the teacher [3]. Online learning also facilitates students and teachers to discuss, consult and provide assignments online through the online learning platform used [4]. This implies that the online learning process requires student learning independence at home because teachers cannot accompany students directly in the learning process. In online learning students are required to learn and understand their own learning. Students are required to be able to complete tasks

by actively finding reference sources that are able to answer problems [5]. This student process is called independent learning.

Learning independence is the ability possessed by students to be able to control cognitive aspects, monitor, formulate and motivate students to be able to learn independently. Learning independence is characterized by the responsibility that students have in designing, implementing and evaluating learning that they do independently [6]. It is this learning independence that greatly influences the online learning process, including the online learning process in tertiary institutions.

During the Covid-19 pandemic, many tertiary institutions implemented an online learning process, including the elementary school teacher education study program (PGSD) [7]. This aims to reduce the spread of the corona virus. The implementation of online learning at PGSD also requires learning independence for PGSD students so that online learning can be implemented optimally. PGSD students are students who are prepared to become elementary school teacher candidates so that PGSD students must be able to achieve the learning objectives that have been set even though they are implemented online [8]. Therefore, it is necessary to have high learning independence for PGSD students so that each series of online learning processes can be carried out properly.

Learning independence is a key factor for success in achieving online learning goals [9]. Students must be able to maximize independent learning in order to understand the material presented in the learning process. However, based on the initial analysis that the researchers did, it was found that student learning independence was low. This is evidenced by the results of preliminary research which stated that the average score of student learning independence was 52.78 in the low category. This proves that student learning independence is still not optimal during the Covid-19 pandemic. Therefore we need an effort that can increase the independence of student learning.

One of the efforts that can be made to increase student learning independence is to use digital modules. Digital modules are teaching materials that are appropriate to the era of the industrial revolution 4.0 and are appropriate for use during the Covid-19 pandemic [10]. This is because the use of digital modules can be accessed via computers or smartphones anywhere and anytime so students can easily access information related to learning [11]. Therefore, in previous research, a STEM-based digital module was developed with the aim of increasing student learning independence. The digital module has been assessed by experts and declared fit for use. However, further research is needed to determine the effectiveness of these digital modules in increasing student learning independence.

1. INTRODUCTION

The first stage of the Module STEM-CP-based Digital on Flipped Learning is the stage of analyzing (analyse) which aims to find gaps between expectationsand reality. The stages are as follows: 1) find problems between reality and expectations, 2) conduct a review of development goals, 3) identify development goals, 4) study the required components, 5) formulate a delivery system

2. RESEARCH METHODOLOGY

This research was conducted at the Department of Elementary School Teacher Education, Padang State University. This research is researchmix method using the ADDIE model.The research design uses a pretest-posttest. The population of this study were all students majoring in PGSD, Padang State University. This study used a purposive sampling technique so that 30 AT 01 students were selected as

the class that was given treatment using digital modules and AT 02 class as many as 30 people as a class with conventional learning.

The independent variable in this study is a STEM-based digital module and the dependent variable is student learning independence. The research instrument used a questionnaire with a Likert scale. The data analysis technique used the normality test, the two variants similarity test and the hypothesis test which consisted of the two average difference test, the effect test between variables and the normalized gain test.

3. RELATED RESEARCH/LITERATURE REVIEW

Research related to STEM-CP was conducted by Oktaviani et al who studied the development of STEM-CP teaching materials for students SENIOR HIGH SCHOOL. The results of the study stated that teaching materials had been developed STEM-CP in learning biology for high school students who are valid and able improve students' critical thinking skills [12]. Research conducted by Fadilah examines the application of STEM-CP in high school. Research result states that students who study with STEM-CP experience increasing learning outcomes, especially in the process of solving problems [13]. Research conducted by Hasanah et al states that application STEM-CP textbooks are able to increase collaboration, participation and critical thinking skills of high school students [14].

Research examining flipped learning was carried out by Karabulut-Ilgu who studied flipped learning for engineering students. The results of the study stated that flipped learning was suitable to be applied to engineering student learning process due to flipped learning prepare students to understand prior learning carry out the tasks given [15]. Research conducted by Brewer et al who studied the impact of filipped learning on the lecture process student. The results of the study stated that flipped learning was appropriate to use in lectures because it can increase student understanding [16]. Research conducted by Thomas et al examines readiness early year students in carrying out the flipped learning process [17]. Results research states that the use of flipped learning in the student learning process has a positive impact on improving student learning activity. Research conducted by Jee et al examines the development of lectures for college students [18]. The results of the research stated that a flipped process had been developed learning that can improve the quality of learning mathematics student in college.

4. RESULTS AND DISCUSSION

The stages of analysis in the development of STEM-CP-based Digital Modules in Flipped Learning consist of three stages, namely needs analysis, analysis of student characteristics, and material analysis.

a. Needs Analysis

Based on SE Chancellor of UNP number 5180/UN35/EP/2022 regarding activities January-July 2022 semester lectures in the framework of vigilance The Covid-19 pandemic and Minister of Home Affairs Instruction number 11 of 2022 concerning the implementation of level III PPKM in Padang City and increasing the community UNP academics who are exposed to Covid-19 will have face-to-face lectures carried out online except for practicum lectures including lectures at PGSD UNP.

In the 2021 PDP research, researchers have implemented a process flipped learning. However, it was found that the material presented was an obstacle still using material at face-to-face meetings so that on learning process

many students feel confused in understanding the material. So the need for innovation that develops the material lectures that are in accordance with the flipped learning process. One of them is developing digital modules. The use of aligned digital modules with the 4.0 era and the conditions of the covid-19 pandemic. Many researches states that the use of digital modules can improve quality learning, especially in learning during the covid-19 pandemic.

Learning during a pandemic also requires independence student. Students must be able to take responsibility for the process learning [10]. Learning independence is important because of many students ignore the online learning period lectures. So that efforts are needed to increase independence student study. Therefore researchers want to develop a module digital in the flipped learning process that can increase independence student study. This digital module was developed with integration STEM-CP approach. STEM-CP is a learning process that combines the concepts of science, technology, engineering and deep mathematics learning process and relate it to real problems student. STEM-CP is learning in harmony with the era 4.0 because it combines the concept of technology. Apart from that STEM-CP as well presents environmental problems as the basis of learning so it is right to be integrated in this digital module.

b. Analysis of Student Characteristics

Having found the main foundation for the development of digital-based modules STEM, then an assessment of the characteristics is carried out student. Based on the survey conducted, it was found that as many as 100% of students have smartphones and laptops, as much as 100% students master the UNP e-learning LMS, and as much as 100% bias operate the Microsoft word application so that it can be concluded that PGSD students have the characteristics of being able to master technology associated with digital modules.

c. Material Analysis

The material analysis to be developed is:

Image 1. concept material to be developed In this development

The material to be developed is a concept measurement of quantities, kinematics of straight motion, forces and the effect of forces on motion, types of simple machines, various types of energy, heat, heat transfer, effect of heat on objects and electricity.

5. CONCLUSION

The results of the study obtained a calculated T value of 4.18 with T table getting a score of 1.69. This proves that t count > t table so that it can be criterion that the average student learning independence in the experimental class is greater than that in the control class. The final results of the study state that STEM-based digital modules have an effective influence in increasing the learning independence of PGSD students.

REFERENCE

1. Eliyasni, Rifda; Kenedi, Ary Kiswanto; Sayer, Inaad Mutlib. Blended Learning and Project Based Learning: The Method to Improve Students' Higher Order Thinking Skill (HOTS). *Jurnal Iqra': Kajian Ilmu Pendidikan*, 2019, 4.2: 231-248.
2. Lo, Chung Kwan; Hew, Khe Foon. A critical review of flipped classroom challenges in K-12 education: Possible solutions and recommendations for future research. *Research and practice in technology enhanced learning*, 2017, 12.1: 1-22.
3. Awidi, Isaiah T.; Paynter, Mark. The impact of a flipped classroom approach on student learning experience*. Computers & Education*, 2019, 128: 269-283.
4. Akmal, Atika Ulya and Hilmi, Lafziatul, Penerapan Inovasi Vlog Berbasis Flipped ClassroomMethod Pada Matakuliah Konsep Dasar Fisika Dasar SD Di Jurusan PGSD FIP UNP, UNP, 2021.
5. Herpika, Felya; Mawardi, Mawardi. Validity of the flipped classroom learning system based on guided inquiry on molecular forms using augmented reality for class X SMA/MA students. *International Journal of Progressive Sciences and Technologies*, 2021, 27.1: 232-236.
6. Suppan, Mélanie, et al. Teaching adequate prehospital use of personal protective equipment during the COVID-19 pandemic: development of a gamified e-learning module. *JMIR Serious Games*, 2020, 8.2:e20173.
7. Mulyadi, Mulyadi; Atmazaki, Atmazaki; Syahrul, R. The Development of Interactive Multimedia E-Module on Indonesia Language Course. In: *1st International Conference on Innovation in Education (ICoIE 2018)*. Atlantis Press, 2019. p. 291-295.
8. Rahmatsyah, S.; Dwiningsih, Kusumawati. Development of interactive E-Module on the periodic system materials as an online learning media. *Jurnal Penelitian Pendidikan IPA,* 2021, 7.2: 255-261.
9. Aprilia, Irma; Suryadarma, I. Gusti Putu. E-module of mangrove ecosystem (emme): development, validation and effectiveness in improving students' self-regulated. *Biosfer: Jurnal Pendidikan Biologi*, 2020, 13.1: 114-129.
10. De Witt, Christian Schroeder, et al. Is independent learning all you need in the starcraft multi-agent challenge?. *arXiv preprintarXiv:2011.09533*, 2020.
11. Lau, Eva Yi Hung; Li, Jian-Bin; Lee, Kerry. Online learning and parent satisfaction during covid-19: Child competence in independent learning as a moderator. *Early Education and Development*, 2021, 32.6: 830-842.
12. Oktaviani, I. M., et al. STEM-CP (Sains, Technology, Engineering Mathematics, And Contextual Problem)-Based Biology Textbook on Food Digestion System in High School. *Pancaran Pendidikan*, 2020, 9.1.
13. Fadilah, Umi. Implementasi Stem-Cp Pada Pelajaran Biologi Melalui Pembuatan Teknologi Filter Emisi Untuk Membentuk Siswa Milenial Unggul. *Madaris: Jurnal Guru Inovatif*, 2020, 1.2: 93-107.

14. Hasanah, N., et al. STEM-CP (Science, Technology, Engineering, Mathematics, and Contextual Problem) Based Colloid Textbook to Increase Creative Thinking Skill for Chemistry Learning in Senior High School. *Pancaran Pendidikan*, 2020, 9.1.
15. Karabulut-Ilgu, Aliye; Jaramillo Cherrez, Nadia; Jahren, Charles T. A systematic review of research on the flipped learning method in engineering education. *British Journal of Educational Technology*, 2018, 49.3: 398-411.
16. Brewer, Robin; Movahedazarhouligh, Sara. Successful stories and conflicts: A literature review on the effectiveness of flipped learning in higher education. *Journal of Computer Assisted Learning*, 2018, 34.4: 409-416.
17. Tomas, Louisa, et al. Are first year students ready for a flipped classroom? A case for a flipped learning continuum. International *Journal of Educational Technology in Higher Education*, 2019, 16.1: 1-22.
18. Lee, Jihyun; Lim, Cheolil; Kim, Hyeonsu. Development of an instructional design model for flipped learning in higher education*. Educational Technology Research and Development*, 2017, 65.2: 427-453.