Digital Literacy based on Multiple Intelligences Integrated with 4C (Critical, Creative, Collaborative and Communication) to Improve Students Learning Outcome

Ira Maria Fran Lumbanbatu[1*], Dian Mayasari[2]

[1] *Universitas Negeri Malang*
[2] *Universitas Musamus*
Corresponding author. Email: Ira.lumbanbatu.fs@um.ac.id

ABSTRACT

The Revolution of industry 4.0 forces the faster change towards education by implementing digital literacy that can create students with 4C soft skills. One of the technology products is e-learning. It supports the virtual learning activity. It also has been the needed part of students and lecturers. This research aims to improve students learning outcomes by applying digital literacy integrated with 4C (Critical, Creative, Collaborative, and Communication). This study is a classroom research method with the subject is students from grade 4 who majored in Mathematics Education in Universitas Musamus. The research design was conducted in three stages: Preliminary Design, Experimental Design, and Retrospective Analysis. The data analysis used in this study is qualitative by analysing the improvement of the teaching and learning process and drawing students' responses towards questionnaires, interviews, and field notes in the observation process. This research shows that the implementation of digital literacy based on multiple intelligence can improve the students' learning outcomes.

Keywords: Digital Literacy, Learning Outcome, Multiple Intelligence.

1. INTRODUCTION

The developed technology helps us support our works in formal and informal situations and is also part of education [1]. Technology has had a definite improvement where it is started with "hardcopy" and now move to "paperless," from the manual book to tablet and from physical interaction (face to face interaction) to the virtual one [2]. Technology starts to dominate education started with administration activity to the teaching and learning process. The old activity of teaching and learning process in class has moved to the virtual one, and the Covid pandemic also has a role in it.

One of the technology products is e-learning. It supports the virtual learning activity. It also has been the needed part of students and lecturers. Specifically, the lecturer tries to provide the material by assuming that all students will have the same needed every student with different learning styles, namely learning style, maturity level, background, knowledge level, learning

achievement, etc. Because of the differences, they need to use e-learning to accommodate the different characteristic problems, and it is called Adaptive eLearning. E-learning used in this case is expected to balance all kinds of students' intelligence [3].

Again, it is emphasized that every student in a class has different bits of intelligence; the bits of intelligence are visual intelligence, mathematic – logic intelligence, linguistics intelligence, spatial intelligence, intrapersonal intelligence, interpersonal intelligence, and naturalistic intelligence [4]. Recently, all the intelligence combinations should be supported by technology comprehension, and it can optimize the students' multiple intelligences [5]. Further, this technology application can be categorized into utilizing the internet in education, which is called digital literacy [6]. It is the main requirement how the teaching and learning process can be work maximal nowadays. Easily, digital literacy is technical knowledge and skill that can be used in long-term situations and can contribute to society. There are

some digital literacy aspects: information literacy, computer literacy, media literacy, communication literacy, visual literacy, and technology literacy. A good comprehension of digital literacy can help students in preparing their selves in their future challenges.

Technology is used in the usage stage in the teaching and learning process, and some lecturers cannot develop the material creatively. Through an interview which was done with the lecturer, the online learning that is used recently is zoom/ Google meet as a replacement of face to face meetings in the classroom, and the material is given through some platforms, namely Google classroom, Edmodo, Schoology, Moodle, etc. [3]. This monotone learning activity makes students get bored and do not understand the material. The lack of understanding of technology can cause the inability of students to make their papers [7].

This research was conducted in Universitas Musamus majored in Mathematics Education in Merauke. Merauke district is one of the remote areas, and it is our main focus because many students lack an understanding of technology. Some factors that can cause the lack of understanding of students; are the students' financial ability, lack of internet access, and of curiosity. The recent activity of teaching and learning based on this research is material given to the students through WhatsApp and collecting the assignment manually. The survey, which is done to 30 respondents who actively join in online learning, shows that 63 % of students feel that the learning activity is monotone. It makes them lazy, contributing to class participation; 30% of students said there is a lack of two-way direction communication. The rest, 7 %, said they could follow the online learning process.

Based on facts in class, two- way direction of learning activity can run well by applying digital literacy in the classroom. Students got anxious with online learning, especially those who cannot operate computers [8]. Moreover, it can be concluded that digital literacy has a huge role; the students can learn effectively [1]. This kind of literacy can also improve the 21 – century competencies, namely Critical Thinking, Problem Solving, Creativity, Communication Skill and the ability to work collaboratively.

Digital literacy will answer the future challenge, and it is also related to pedagogy and education policy [9]. Furthermore, literacy also relates to self-directed learning in producing a paper [7]. In line with that, the practice of technology in the teaching and learning process will positively impact reasoning, communication, problem-solving, and mathematic ability. From all the explanations above, this research was conducted by applying digital literacy based on multiple intelligence integrated with critical, creative, collaborative, and communication to improve students learning outcomes.

Multiple intelligence that is applied in this research is the combination of 4C. The first is critical; it is about how reasoning works, understanding the relationships among concepts and interpreting information. Next is creativity; it focuses on developing the creative idea and implementing it into different knowledge situations. The next one is collaborative; it is about how students can work and be responsible in a team. The last is communication; it is about how the students express their idea by communicating them effectively [10], [11]. This research will describe how the four combinations of this multiple intelligence work together and impact the students' learning outcomes.

2. METHODS

This research used design research to construct a learning process through multiple intelligence integrated with creative, critical, collaborative, and communication. It is a method to develop a solution based on the learning process theory, focusing on its development and validation. It can be meant as a method that purpose to develop Local Instruction Theory where the researcher and lecturer work together to improve the learning outcome. Following are research steps based on design research [12]:

1. Stage 1: Preliminary Design

This stage aims to improve the learning activities steps and design the instrument for evaluating the learning process. The literature review will be done in this step as the derived material, multiple intelligence, and the ability in critical thinking.

In this step, students will be separated based on their intelligence by formulating the purpose of the learning process in technology to improve the learning outcome. Conjecture will be needed as a guidance that will exist and develop in every learning activity, which is flexible and can be revised in every step of experimental design.

2. Stage 2: Experimental Design

A trial in cross-learning was done based on the design that had been constructed. The aim is to analyze and guess the result of students thinking in every intelligence and pilot experiment. Trials of some sample of research subject were done here.

3. Stage 3: Retrospective Analysis

Conjecture in Hypothetical Learning Trajectory compared with the result of the design experiment. The result of the analysis can produce descriptions related to cross-learning in derived learning by using digital literacy integrated with creative, critics, collaborative, and communication.

3. FINDINGS AND DISCUSSION

This research produces a Hypothetical Learning Trajectory design, which consists of cross-learning design in calculus lecture as the derived material of university using digital literacy based on multiple intelligence integrated with creative, critical, collaborative, and communication. The result and discussion will be explained below.

3.1. Preliminary Design

In the first step, the researcher applied digital literacy, focusing on multiple intelligence (critical, creative, collaborative, and communication). The Hypothetical Learning Trajectory design is the most crucial part for constructing students learning activities. The design has a significant role in the learning trajectory where learning planning of material taught can be found there. The learning trajectory that is used in this research is 4C (creative, critical, collaborative, and communication) intelligence by using digital literacy. One thing that has been focused on is the student's understanding of the material and its application.

Figure 1: Learning Trajectory of derived learning in University Level
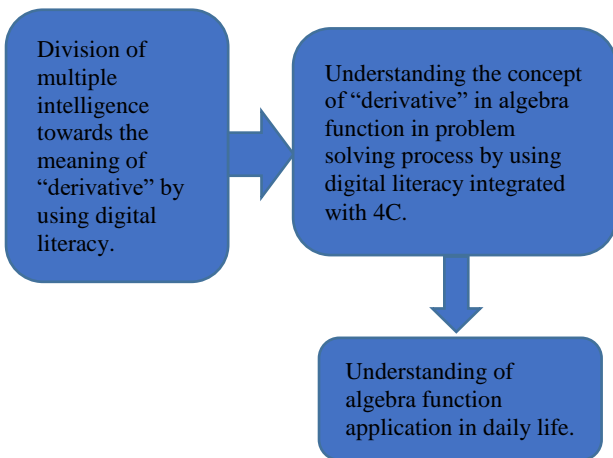
Learning activities were conducted through the learning trajectory, and the result of students' thinking is hypothesized in HLT. This step aims to improve the 4C ability of students and the ability to solve daily problems. The relation among learning path, activities, and achievement that has been designed as HLT can be seen in figure 2.
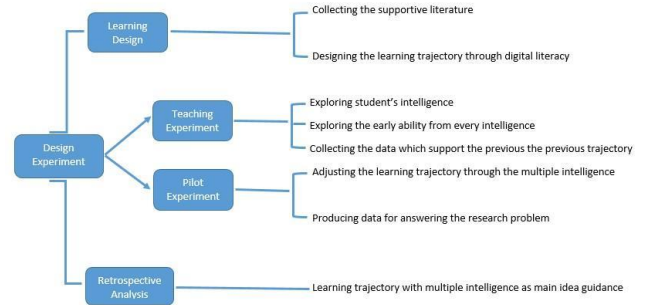

Figure 2. Learning HLT Design

We can see the learning trajectory in calculus through the picture above, and it will be illustrated in the iceberg below.
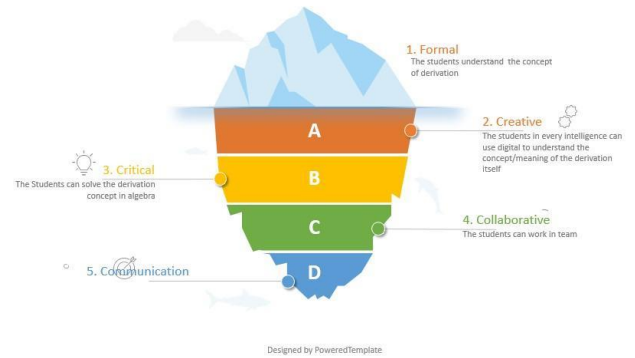

Figure 3. Learning HLT Iceberg

Based on the HLT that has been designed, the learning trajectory in calculus can be found, and the detail can be seen in table 1.

Table 1. Learning derivation conjecture using Digital Literacy integrated with 4C

Steps	Activity Stages	Activities	Conjectures
Formal		The students understand the derivation concept.	1. The students understand the derivation concept 2. The students can solve the derivation problems
Creative	1	Students of every intelligence can use digital literacy	1. Students of every intelligence already familiar with the digital technology 2. Students do not understand yet how to apply digital literacy in learning 3. The students do not know the technology that can be suitable for their own intelligence 4. Students have understood how to use the technology related to derivation material.
Informal	2	The students understand the concept/ meaning of derivation.	1. Students have been familiar with derivation in senior grade because they have learned it before 2. The students in every stage of intelligence have ever learned the derivation material 3. The students in every stage of intelligence have difficulties solving the questions 4. The students understand that the abstract derivation material can use technology.
Critical	3	The students can solve the question of derivation in algebra.	1. The students can implement the character of derivation in daily life 2. The students can solve the problem with some kinds of solving
Collaborative	4	The students can work in team	1. The students work in a team 2. The students solve the problem by doing discussion 3. The students help their friends who do not understand the material
Communication	5	The students can communicate the problem-solving.	The students communicate the problem -solving in written form.

3.2. Experimental Design and Retrospective Analysis

The experiment of the learning trajectory that has been designed is applied to some students. Then, a retrospective analysis was conducted to the result of the experimental learning trajectory, and it can be seen in the design experiment. There are some activities in all activities, namely creative, communication, collaborative, and communication.

3.2.1 Formal

In all bits of intelligence in this step, the students have already understood how to use technology in learning. The students can solve the derivation problem by implementing the early concept that has been received.

3.2.1.1. Creative

Creativities will be demanded in solving the problem. In solving this problem, the students have used a learning management system which is Google classroom. The students solve the problem by their selves and upload it on Google classroom. Derivation material was solved by using the student's early concept.
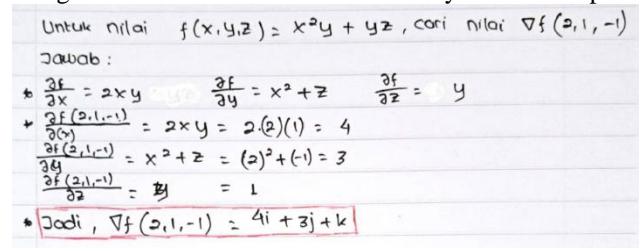

Figure 4. Derivative Solution

The picture above shows the students use the derivation rule solution that has been learned before. It was started by seeking the first derivation of f (x,y,z) on x, the first derivation of f (x,y,z) on y, and the first derivation of f (x,y,z) on z. After all the derivation function has been got, then we will get the last derivation.

3.2.1.2. Informal

The previous derivation material has been learned in Senior High School, and it makes the students have fulfilled the early concept of derivation. Every intelligence in learning has understood the nature of derivation. On this occasion, it can be seen some students' difficulties related to the intelligence itself. The visual linguistics of students can be seen through their ability to remember the words, and it makes them easier

to solve the question based on the previous example given.

Students with logical mathematic intelligence can follow the learning process well and solve the problems using the previous concept given. Students with visual-spatial intelligence tend to understand the problem through pictures visually. It is the opposite of the question-solving in derivation questions. They tend not to solve the problem, and they got confused with the derivative solution of x, y, z in one function. The way they are solving the problem is restricted in one derivation function.

Students with kinesthetic intelligence tend to be active and can solve the derivation problem well. It is different with students with music intelligence, and they tend to be sensitive in sound, which makes them not good enough to solve derivation questions. Students in interpersonal can socialize with their friends so as they tend to work in a team in learning and to solve the question. The last is students with naturalist intelligence; they tend to love nature and animals, so they are less competent in solving mathematic questions.

3.2.1.3. Critical

In this stage, students can apply critical thinking to solve the problems with various ways of solving. For example, in pictures 1 and 2, it can be seen that there is a different way of solving the question. In picture 1, the students finish the problem by directly deriving all the functions, while in picture 2, the students solve the question by derivation one by one.

3.2.1.4. Collaborative

Students were divided into groups in different intelligence through zoom, and it shows how collaborative works. On this occasion, the students will help each other in understanding the material.

3.2.1.5. Communication

Communication is the crucial stage in solving the questions. Good communication will result in a good understanding of the concept. The following is the way communication is applied in solving the question.
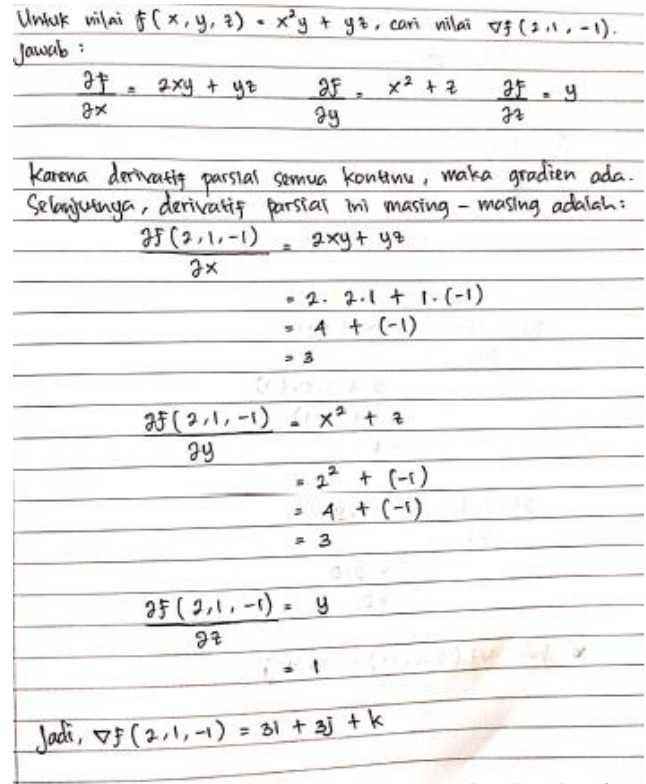

Figure 5 Communication in solving the problem.

In solving the problem, students made some steps. The first step is writing the part of a function that will be derived and solved. Through the picture above, it can be seen that students have understood how to communicate well.

All the explanation above shows us that digital literacy integrated with 4C can ease students from understanding derivation material.

4. SUGGESTIONS AND CONCLUSIONS

This research shows that the learning process by implementing digital literacy can make the students understand the material well. It is caused the learning content is customized with the students' intelligence. Furthermore, this research also creates a learning design integrated with digital literacy with 4C, and it has a crucial role in developing the learning process through digital literacy.

REFERENCES

[1]   C. M. Tang dan L. Y. Chaw, "Digital literacy and effective learning in a blended learning environment," dalam *Proceedings of the European Conference on E-Learning, ECEL*, 2015, vol. 14, pp. 601–610.

[2]   A. Rahmah, "Digital Literacy Learning System for Indonesian Citizen," *Procedia Computer Science*, vol. 72, pp. 94–101, 2015, doi: https://doi.org/10.1016/j.procs.2015.12.109.

[3] K. Hernawati, "E-Learning Adaptif Berbasis Karakteristik Peserta Didik," 2011, pp. 1–10. [Daring]. Tersedia pada: http://eprints.uny.ac.id/7174/1/PM-9 - Kuswari Hernawati.pdf

[4] N. Karamikabir, "Gardner's multiple intelligence and mathematics education," *Procedia - Social and Behavioral Sciences*, vol. 31, pp. 778–781, 2012, doi: https://doi.org/10.1016/j.sbspro.2011.12.140.

[5] H. Toba, "Suatu Tinjauan Mengenai Penerapan Kecerdasan Majemuk pada Pendidikan dan Pelatihan melalui Pemanfaatan Teknologi Informasi dan Komunikasi," dipresentasikan pada Asia Pacific Conference on Arts, Science, Engineering & Technology (ASET), 2017.

[6] D. W. Puspito, "Implementasi Literasi Digital Dalam Gerakan Literasi Sekolah," 2017, vol. 3, pp. 307–308. [Daring]. Tersedia pada: http://indonesia.unnes.ac.id/wp-content/uploads/2017/10/C-D-PROSIDING-KBS_2-UNNES-2-320-415.pdf

[7] M. F. Akbar dan F. D. Anggraeni, "Teknologi Dalam Pendidikan : Literasi Digital dan Self-Directed Learning pada Mahasiswa Skripsi," *Indigenous: Jurnal Ilmiah Psikologi*, vol. 2, no. 1, pp. 28–38, 2017, doi: https://doi.org/10.23917/indigenous.v1i1.4458.

[8] G. P. Yustika dan S. Iswati, "Digital Literacy in Formal Online Education: A Short Review," *Dinamika Pendidikan*, vol. 15, no. 1, pp. 66–76, 2020, doi: https://doi.org/10.15294/dp.v15i1.23779.

[9] C. Lankshear dan M. Knobel, "Digital literacy and digital literacies," *Nordic Journal of Digital Literacy*, pp. 12–24, 2006, doi: https://doi.org/10.1108/EL-05-2015-0076.

[10] Kemendikbud, "Panduan Implementasi Kecakapan Abad 21 Kurikulum 2013 di SMA." Kementerian Pendidikan Dan Kebudayaan, 2017.

[11] B. Sriyanto, "Meningkatkan Keterampilan 4c dengan Literasi Digital di SMP Negeri 1 Sidoharjo," *Jurnal Didaktika Pendidikan Dasar*, vol. 5, no. 1, pp. 125–142, 2021, doi: https://doi.org/10.26811/didaktika.v5i1.291.

[12] I. Risdiyanti dan R. C. I. Prahmana, "Desain Hypothetical Learning Trajectory Dalam Pembelajaran Rotasi Menggunakan Motif Batik Kawung," *Prima: Jurnal Pendidikan Matematika*, vol. 2, no. 1, pp. 19, 2018, doi: https://doi.org/10.31000/prima.v2i1.411.