

The validity of Teaching Materials Based on Hybrid Learning: The 21st Century Challenge

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Abstract— This study aims to develop calculus teaching materials based on Hybrid Learning. It can be used to prepare students with the 21st-century challenge. This research is expected to help students in facing the learning process in the future. Also, this research aims to help the students to engage in the future need workforce. The target to be achieved in this study is to produce a calculus teaching material based on Hybrid Learning, which satisfies valid, practical, and effective criteria. The method used in this research is the development of instructional materials used for the first time by Plomp, which consists of 5 phases. While the data analysis techniques were carried out by descriptive quantitative and qualitative methods. In this study, the development of teaching materials has been carried out in the form of making a differential calculus video lecture for three meetings. Learning videos developed have met valid criteria, according to the experts. Moreover, the validity criteria came from four experts consisting of 2 lecturers from the mathematics education group and two lecturers from pure mathematics. Validators have stated the validity of learning videos.

Keywords— *Development of Teaching Materials, Hybrid Learning, Differential Calculus, 21st Century Challenge*

I. INTRODUCTION

In the current global era, whether we realize it or not, everything has been connected with technology. It has influenced every aspect of human life, including in the teaching and learning process. If previously, the learning process was carried out conventionally, namely, the teacher and students were in the same room, and the learning process took place, while technology allowed the learning process not to occur in the same room and at the same time. In addition, technology also allows for the formation of virtual classes with the use of learning media that are more varied with the use of technology.

One form of the learning process that is influenced by technology is online-based learning. This learning is known as e-Learning or electronic learning. It is now increasingly recognized as one way to overcome the problem of education, both in developed countries and in developing countries. Many people use different terms with e-learning, but in principle, e-learning is learning that uses electronic services as a tool for help. This word consists of two parts, namely "e", which stands for electronic and "learning", which means learning. Hence, e-Learning can be defined as a learning process by using the services of electronic

devices such as audio, video, or computer equipment or a combination of three of them.

There are four types of E-Learning lectures when viewed from the proportion of face-to-face meetings, namely (1) Traditional Face-to-Face (0% online), (2) Web-Enhanced (1% - 29%), (3) Hybrid (30% - 79%), and (4) Fully Online (80%) as in [1]. In this study, lectures will be conducted in a Hybrid, which means combining online methods with traditional (face-to-face) methods. There is a proportion of the delivery of teaching material that is done online, accompanied by a discussion forum to discuss teaching material that is being discussed. In this type, the number of face-to-face meetings is reduced by online meetings held on the internet.

Based on the description above, the researcher intends to develop differential calculus teaching materials based on Hybrid Learning to prepare students for 21st-century learning. The research questions are: How to develop differential calculus learning materials based on Hybrid Learning to prepare students for 21st-century learning that meets valid, practical, and effective criteria?

II. HYBRID LEARNING

Reference [2] define Hybrid Learning as a combination of various learning media that involves technology, activities, and various ways to create optimal learning programs for special students. The term "combination" means that training led by a teacher is equipped with other electronic formats. In this context, combined learning programs use various forms of e-learning. Meanwhile, [3] define Hybrid Learning as the most logical evolution that develops naturally from a teaching and learning process that is influenced by technological advances. Hybrid Learning has been able to answer the challenges and opportunities for the development of innovations of technology and education.

The primary purpose of hybrid learning is to provide opportunities for a variety of learner characteristics to create independent, sustainable, and lifelong learning patterns so that the essence of learning will be more effective, more efficient, and more attractive. According to [4], there characteristics of hybrid learning are: (a) combines various ways of delivery, teaching models, independent learning offline and online, learning styles, as

well as variety of technology-based media, and (b) the same important role for teacher and parent, the teacher as a facilitator, and the parent as a supporter.

Several steps must be taken so that learning can proceed as planned. The steps that can be taken in preparing for lectures using hybrid learning, as follows: (a) identifying courses to be developed with hybrid learning, for example in this study, researchers chose a differential calculus course, (b) identifying the ability of students who will program courses to be delivered using hybrid learning. One of these abilities is the ability of students to interact with technology, (c) arrange Semester Learning Plan (RPS), which contains the implementation of lectures using hybrid learning, (d) make the content output following the RPS that has been prepared. These contents can be in the form of modules, powerpoints, or learning videos, and (e) by conducting lectures using hybrid learning, students are expected to be able to change their learning in accordance with the changing times and by the demands of learning in the 21st century.

III. 21ST CENTURY LEARNING

The development of technology has changed the teaching and learning processes that exist throughout the world. According to [5], education is now in the age of knowledge with the acceleration to increase extraordinary knowledge. Changes from the industrial age to the knowledge age brought many changes, including in the world of education. The application of digital media and technology has contributed to accelerating the increase in this knowledge period. Teaching and learning processes that exist at this time must be adapted to the needs and demands of the changing times. Teaching materials must be designed to be more authentic through challenges where students can collaborate to create solutions to solve problems.

According to [6], problem-solving is directed to be more towards the core of the question so that students can search for suitable answers and then can also be sought for problem-solving in the context of learning that uses available information resources. According to [7], in the 21st century learning, there were a number of changes including: (1) the smaller world that every place throughout the world was connected by technology and transportation; (2) rapid growth of information and technology services; (3) global economic growth which affects changes in employment and income; (4) emphasizing the management of resources: water, food, and energy; (5) cooperation in handling environmental management; (6) increased security of privacy, security and terrorism; and (7) the economic need to compete in global competition.

Changes in the knowledge period to the industrial age also affect the development of new types of jobs that require qualifications that are not owned by workers in the industry. According to [8], new workers need a formal education to acquire and apply theories of analytical knowledge (analytical knowledge) and require a different approach to work and habits of continuous learning (continuous learning). The new model workers not only

move the types of jobs from the agriculture and household sectors to industry-based jobs but also have to become knowledgeable workers. This new model also affects workers in the education world, such as teachers and lecturers. According to [6], change is needed to prepare themselves to be able to live and work in the age of knowledge (knowledge age), especially in the field of education. Education is part of the development of individuals who can support national development.

This change is a must if you do not want to be crushed by changes in the global era. Partnership for 21st Century Learning develops a 21st-century learning framework that requires students to have skills, knowledge, and abilities in the fields of technology, media, and information, learning and innovation skills, as well as life and career skills. This framework explains the skills, knowledge, and expertise that must be mastered so students can be successful in their lives and work. In line with this, the Ministry of Education and Culture of Republic Indonesia formulates that the future learning paradigm emphasizes the ability of students to find out from various sources, formulate problems, think analytically and collaboratively and collaborate in problem-solving.

Meanwhile, according to [9] learning frameworks of the 21st century are: (a) Critical-Thinking and Problem-Solving Skills, capability of thinking critically, laterally, and systemically, especially in the context of problem solving; (b) Communication and Collaboration Skills, able to communicate and collaborate effectively with various parties; (c) The ability to think critically and problem solving (Critical-Thinking and Problem-Solving Skills), able to think critically, laterally, and systemically, especially in the context of problem solving; (d) Communication and Collaboration Skills, able to communicate and collaborate effectively with various parties; (e) The ability to create and renew (Creativity and Innovation Skills), able to develop their creativity to produce innovative breakthroughs; (f) Information and Communications Technology Literacy, capable of utilizing information and communication technology to improve performance and daily activities; (g) Contextual Learning Skills (Contextual Learning Skills), able to undergo contextual independent learning activities as part of personal development, and (h) Information and media literacy skills, able to understand and use various communication media to convey various ideas and carry out activities collaboration and interaction with various parties.

According to [10], in 21st-century learning, everyone must have critical thinking skills, knowledge, and digital literacy abilities, information literacy, media literacy, and mastering information and communication technology. Several studies on the use of information technology that supports future learning have been carried out in various countries. This fact also underlies researchers to develop differential calculus teaching materials that utilize technology to prepare students for 21st-century learning.

IV. METHOD

Explorative, descriptive research with a qualitative approach is used to describe the validity, practicality, and effectiveness of teaching materials developed on a hybrid learning basis to prepare students for 21st-century learning. The development model of Plomp was used to develop the teaching material of Differential Calculus in the form of learning videos, as in [11].

This model consists of 5 phases: (1) Preliminary investigation, (2) design, (3) realization, (4) test, evaluation, and revision, and (5) implementation. What we had done is phase 1 to phase 4 to get the validity of the teaching material we had developed. There are two lecturers from the education mathematics department and two lecturers from the mathematics department involved to conduct the validity process. For the testing part, we had three 2nd years students who had programmed the Calculus Differential course to give us any suggestion related to the learning videos.

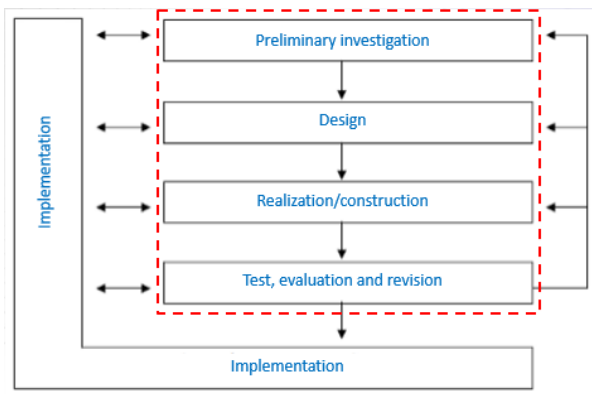


Fig. 1. Development Model of Plomp

V. RESULT AND DISCUSSION

In the first phase of the Plomp model, we pointed out that hybrid learning-based materials are not yet available for differential calculus lecture in the Mathematics Department of Unesa, in which can be used to prepare students in 21st-century learning. We found that the students got much difficult in absolute value, limit function, and calculating the extreme values using the derivative function.

Furthermore, in the design phase, we were designing teaching materials in the form of power points that contain material and exercises. The powerpoint was designed so that it can be used as a basis for making learning videos. In the 3rd phase, we developed differential calculus teaching materials that met valid, practical, and effective criteria. In this study, we developed teaching the material in the form of power points and converted to learning videos that have been uploaded to virtual Unesa classrooms. A smartboard panel was used to produce the learning videos. From the powerpoint file, we build the videos by recording the smartboard screen.

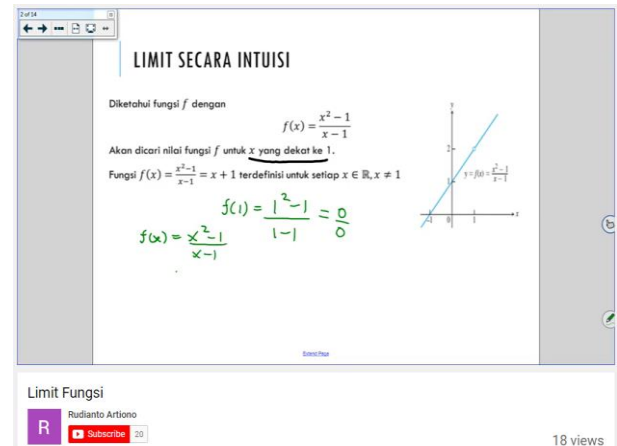


Fig. 2. Screenshot of learning videos on limit function

Based on the results of expert validation, the developed teaching material could be stated to meet the construct validity criteria and can be used with a little revision. Also, according to the results of expert validation, this teaching material met the content validity criteria and can be used with a slight revision.

In the 4th phase, which was conducted to the three 2nd year students, it was found that they have no significant difficulty in understanding the material presented in the video. They stated that the writing and sound contained in the video could be understood clearly. However, they stated that the developed videos cannot replace the lecturer in the classes due to the direction of communication. It can be answered quite easy because the videos were uploaded to the v-learn Unesa, which is facilitating discussion feature in it. The students can post any related question as well as the lecturer give any answer or feedback to the students. The frequent questions asked by students in previous classes were discussed in the videos to prevent any difficulty that may be experienced by students.

The video can assist them in learning the material presented in it because they can repeatedly see the explanation that is conveyed because the video supported with sound, text, and graphics. In addition, in the video, the explanation is already following the RPS that has been prepared previously.

VI. CONCLUSION

Based on the results of validation and limited trials, learning videos that have been made can be implemented in a hybrid learning with minor revisions related to the writing inside.

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REFERENCES

- [1] W. Widagdo, *Pedoman Penyelenggaraan Pembelajaran dengan E-Learning pada Politeknik*, Jakarta: Pusat Pendidikan SDM Kesehatan, 2018.
- [2] J. B. Umoh and E. T. Akpan, "Challenges of Blended E-Learning Tools in Mathematics: Students' Perspectives University of Uyo," *Journal of Education and Learning*, vol. 3, no. 4, pp. 60-70, 2014.
- [3] K. Thorne, *Blended Learning: How to Integrate Online and Traditional Learning*, London: Kagan Page, 2003.
- [4] A. Henrich and S. Sieber, "Blended learning and pure e-learning concepts for information retrieval: experiences and future directions," *Information Retrieval*, vol. 12, pp. 117-147, 2009.
- [5] B. Gates, N. Myhrvold and P. Rinearson, *The Road Ahead*, New York: Viking Penguin, 1996.
- [6] T. Bernie and H. Paul, "WestEd," 1999. [Online]. Available: https://www.wested.org/online_pubs/learning_technology.pdf. [Accessed 11 april 2019].
- [7] T. Bernie and F. Charles, *21st Century Skills: Learning for Life in Our Times*, New Jersey: John Wiley & Sons, 2009.
- [8] P. F. Drucker, "The Age of Social Transformation," *The Atlantic Monthly*, vol. 274, pp. 53-80, November 1994.
- [9] BNSP, *Paradigma Pendidikan nasional Abad 21*, Jakarta: Badan Standar Nasional Pendidikan, 2010.
- [10] M. E. Frydenberg and D. Andone, "Learning for 21st Century Skills," in *IEEE's Internatioanal COnference on Information Society*, London, 2011.
- [11] T. Plomp and N. Nieveen, *Development Research on/in Educational Development*, Netherland: University of Twente, 1997