Advances in Social Science, Education and Humanities Research, volume 619
Proceedings of the 2nd International Conference on Innovation in Education and Pedagogy (ICIEP 2020)

Constructing Microlearning Design for Mathematics Learning in School

Agusmanto JB Hutauruk[1,*], Adi S Situmorang[2], Parlindungan Sitorus[3]

[1] *Mathematics Education, Universitas HKBP Nommensen*
[2] *Mathematics Education, Universitas HKBP Nommensen*
[3] *Physics Education, Universitas HKBP Nommensen*
[*]*Corresponding author. Email: a7hutauruk@uhn.ac.id*

ABSTRACT
Learning at this time should be upgraded according to technological and cultural development. E-learning by utilizing learning technology must also be adapted in mathematics learning. Microlearning as a learning method can be used in mathematics learning in school. Microlearning design must first be constructed to maximize the expected achievement of mathematics learning outcomes. This literature study is aims to design a way of constructing a microlearning design for mathematics learning in schools. By using the ADDIE instructional learning design model, a way of constructing a micro learning design for mathematics learning is formed which consists of five main stages. From these results, further research to build a microlearning design for mathematics learning can be developed.

Keywords: *Microlearning, Learning Design, Mathematics Learning.*

1. INTRODUCTION

The pandemic situation due to the spread of the Covid-19 virus has changed the world of education and the learning process that has been running so far. The existing circumstances force changes in the learning process, of course it will cause many challenges and obstacles that are faced by both teachers and students. Learning mathematics is certainly a part of learning that is required to be able to face obstacles, challenges and problems in the learning process. Problems that arise in the process of changing and adjusting mathematics learning certainly cause inconvenience, but on the other hand, it is one of the things that encourages innovation in learning [1].

Microlearning design is a learning design that divides the scope of learning into several smaller partitions, so that the information provided in the learning process can be maximally studied and the learning process becomes simpler [2][3][4]. One topic or whole material in mathematics learning is partitioned according to categories or characteristics that are compatible with each other, so that each small partition can be studied and does not miss as a complete unit of material or previous topics [5][6].

Providing long content or subject topics to be studied by students at once will cause minimal interaction between learning information and learners, and will also exceed the capacity of students' working memory which ultimately leads to instability in the learning process [2]. With microlearning, students are given the opportunity to more easily absorb and store information obtained from the learning process. In addition, learning activities are also easier to manage and lesson topics can be easier to understand [3].

Microlearning can be applied to mathematics learning, where problems and obstacles that arise in learning mathematics can be minimized so that they are easier to solve and deal with. The concept of Microlearning can be used in school learning to maximize learning outcomes, with a simpler but more precise learning design [7][8][9]. Microlearning learning design is also expected to be able to support the Merdeka Belajar program initiated by the Indonesian Ministry of Education and Culture team. One aspect that becomes the focus of the Merdeka Belajar program is innovating in the learning planning process so that the learning process can be maximized both in terms of learning outcomes and the quality of graduates / learners [10][11].

The application of microlearning design for mathematics learning in schools requires thorough preparation. One of the basic needs is to first construct

the learning design. The term learning design refers to a set of activities to design and develop learning activities to achieve certain learning objectives by paying attention to the factors that affect the success of the learning [12]. Learning design is more than just planning the learning process but is also related to problems that arise in learning experienced by learners, identifying the root of the problem, considering various possible solutions to overcome these problems, and implementing these solutions in ways designed to minimize other unexpected consequences.

Learning design skills are one of the abilities forming the pedagogical competence of an educator, the teacher must be able to design learning to achieve learning objectives by paying attention to various factors that affect the learning process, such as the characteristics and development of students, the characteristics of teaching materials, learning culture, and so on. Building a construction or microlearning design must also be able to answer learning challenges, where at this time learning is dominated by face-to-face learning. The construction of the micro learning design is made in such a way that it is able to answer the challenges of online learning and use various LMS applications in the learning process at school.

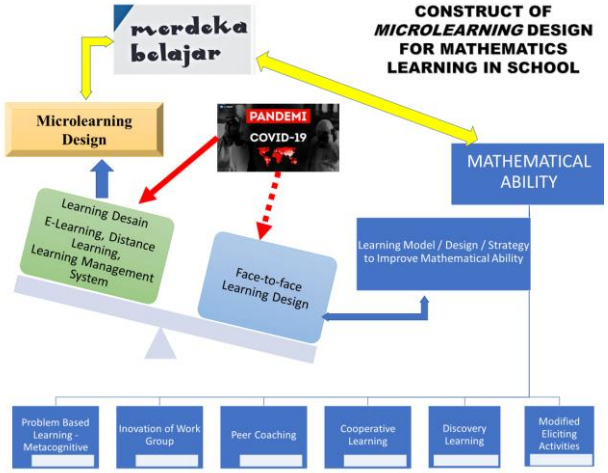

Figure 1 Building Microlearning Design

2. METHODS OF CONSTRUCTING MICROLEARNING DESIGN

The research was developed through three stages. In the first stage, a study is conducted on the theoretical basics of microlearning as a learning design for learning mathematics. This study aims to identify and recognize the components in microlearning design. In stage two the components of the micro learning design are determined and used as a reference for constructing the learning design. This paper is still limited to this second stage. With the formation of the microlearning design construction, it can be continued in the third stage. The microlearning design that has been formed is then reviewed and validated by learning design experts. The result is a microlearning design construct that can be implemented in mathematics learning in the field.

Microlearning design construction was built with a literature study, based on the ADDIE model instructional design [12]. Microlearning design for mathematics learning must first be constructed [13] so that the application of learning can run optimally. The construction of Microlearning Learning Designs can be designed using the ADDIE model of instructional design [14][15] depicted in the following diagram.

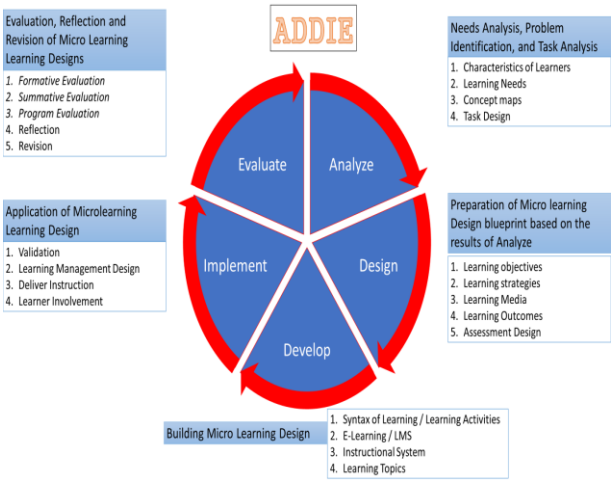

Figure 2 ADDIE instructional model for Microlearning Design.

3. RESULT AND DISCUSSION

The microlearning design construction is arranged according to the ADDIE model instructional design. By using the ADDIE learning design, it is hoped that the microlearning design can be optimally arranged and then applied in mathematics learning.

The first stage in ADDIE design is Analyze. The analysis stage is the first flow with instructional activities of needs analysis, problem identification and task analysis. Needs analysis is the first stage that must be carried out in designing or constructing microlearning learning designs in mathematics learning. Needs analysis consists of identifying learner characteristics, learning needs, concept maps and task designs for learning participants.

Characteristics of learners are an identification of the state of the teacher, students and the learning environment. Analysis of learner characteristics becomes one of the references that will later be used in the next learning construction stage. The characteristics of learners explain how the initial mathematical abilities of students who will participate in mathematics learning, how the learning tendencies and learning

habits of students, how the teacher's habit patterns in teaching mathematics, and how the learning environment is able to support or not support the ongoing or future learning process. Based on the characteristics of learners, learning needs can be mapped. What learning needs already exist and what learning needs still have to be fulfilled will certainly be one of the determining factors in designing learning. With the characteristics and identification of learning needs, then a learning design concept map can be prepared. This concept map is a flow that explains the learning design format to be compiled. The concept map also shows the task design of each learning participant, namely student assignments and teacher assignments that need to be constructed in the microlearning learning design.

The second stage in ADDIE design is Design. The design stage is an activity to formulate a microlearning design blueprint based on the analyze results. Instructional Design activities include identifying and setting learning objectives, designing learning strategies, determining learning media to be used, determining targeted learning outcomes, and designing assessments that will be used to measure learning success. Learning objectives are arranged according to the learning objectives contained in the existing learning curriculum. The learning strategy in microlearning design is structured so that learning can run online using existing e-learning applications. The learning media that will be used are determined by paying attention to the planned learning strategies, as well as the selection of online learning media that are available or that can be accessed and used by students and teachers. Learning outcomes are targets that must be achieved by students after participating in learning with microlearning learning designs. Assessment is a measuring tool that is based on indicators of previous learning outcomes, which aim to measure whether the learning process with microlearning learning designs runs optimally, and measure learning outcomes that have been previously targeted.

The third stage in ADDIE design is Develop. The develop stage is an instructional activity to build a microlearning design component consisting of syntax / learning activities, e-learning / LMS applications that will be used, an instructional system that will become a microlearning learning guide, and partitions of mathematics subject topics that will be studied by students. At this stage, it is necessary to conduct a Focus Group Discussion (FGD) to build a microlearning learning design. The FGD participants are experts in their respective fields who have mastered the mathematics learning design. FGD participants who were invited to build microlearning learning designs included experts in the field of mathematics learning design, experts in mathematics learning media, design research methodologists, and experts in mathematics materials. The subject matter of the discussion in this FGD consisted of how the arrangement of learning steps/ syntax microlearning, which is partitioned into two parts, namely student activities and teacher activities.

Another focus of the FGD is what e-learning media or applications are suitable for use in relation to the learning material students will study. The e-learning application to be used must comply with the Learning Management System (LMS) rules. Then the focus of the next FGD is on how to arrange the instructional system which will become a guide for microlearning learning. The learning syntax and the LMS media used need to be arranged in a learning instructional system so that it can be implemented optimally by teachers and students. The focus of the last FGD discussion was the partition of the topic or material for learning mathematics to be studied. As previously explained, basically the microlearning learning design is learning by dividing one lesson topic into several smaller partitions so that it can be studied in more depth and in more detail. The arrangement of this learning partition must pay attention to the suitability of the material and the continuity of one material partition with other material partitions, so that the outline of the topic / subject matter remains in place.

The fourth stage in the ADDIE design is Implement. At this stage, the microlearning learning design that has been prepared will be implemented or applied in mathematics learning. The design that was previously built in the previous stage was then applied or implemented in mathematics learning in the field. The instructional stages that are carried out include the validation of learning design activities. This validation aims to ensure that the learning design that has been built before is suitable for use. Validation is carried out in a micro field, with a limited number of learning participants. After the validation is carried out, then next is to carry out the learning management with the microlearning learning design, ensure the running of the deliver instructions that have been prepared and ensure learner involvement in the learning process.

The final stage in ADDIE design is Evaluate. The evaluate stage is a series of evaluation activities, reflection and revision of the microlearning learning design based on the results of the implementation stages that have previously been implemented. The instructional evaluate stage is carried out by formative evaluation, summative evaluation, program evaluation, reflection and revision. This evaluation activity aims to measure whether the implementation of the learning design has been running optimally, to reflect aims to measure deficiencies in the learning steps that are already running, and to make revisions that aim to correct existing mistakes and complement deficiencies in the microlearning learning design. The results of this revision can then be used again in the field according to

the previous ADDIE sequence, so that in the end it will produce the best microlearning design construction.

4. CONCLUSION

Constructing a microlearning design can be done with the ADDIE model of instructional design, which consists of the Analyze, Design, Develop, Implement and Evaluate partitions. By building a learning design construction, it is hoped that a maximum microlearning learning design will be built that can be used in mathematics learning. The way of constructing a micro learning design in this paper is limited to learning mathematics in schools and has not been implemented in the field. For further research, the micro learning design that has been built will be implemented in the field to get reflection and revision of the learning design.

REFERENCES

[1] D. I. Sihombing and R. M. Simanjuntak, "Dampak Covid 19 dalam Mengubah Cara Mendidik Generasi Mendatang : Studi Kasus," *Sepren J. Math. Educ. Appl.*, vol. 2, no. 1, pp. 68–76, 2020.

[2] L. Giurgiu, "Microlearning an Evolving Elearning Trend," *Sci. Bull.*, vol. 22, no. 1, pp. 18–23, 2017, doi: 10.1515/bsaft-2017-0003.

[3] M. A. Job and H. S. Ogalo, "Micro Learning As Innovative Process of Knowledge Strategy," *Int. J. Sci. Technol. Res.*, vol. 1, no. 11, pp. 92–96, 2012.

[4] A. Fox, "Microlearning for effective performance management," *Talent Dev.*, vol. 70, no. 4, 2016.

[5] O. Jomah, A. K. Masoud, X. P. Kishore, and S. Aurelia, "Micro Learning: A Modernized Education System," *BRAIN. Broad Res. Artif. Intell. Neurosci.*, vol. 7, no. 1, pp. 103–110, 2016, [Online]. Available: https://www.edusoft.ro/brain/index.php/brain/article/view/582/627.

[6] J. Skalka and M. Drlik, "Automated assessment and microlearning units as predictors of at-risk students and students' outcomes in the introductory programming courses," *Appl. Sci.*, vol. 10, no. 13, 2020, doi: 10.3390/app10134566.

[7] E. Surahman *et al.*, "Pelatihan Micro Learning Object Berbasis TPACK bagi Guru-Guru SMA di Garut," *Abdimas Pedagog. J. Ilm. Pengabdi. Kpd. Masy.*, vol. 3, no. 1, p. 1, 2020, doi: 10.17977/um050v3i1p1-14.

[8] G. Sirwan Mohammed, K. Wakil, and S. Sirwan Nawroly, "The Effectiveness of Microlearning to Improve Students' Learning Ability," *Int. J. Educ. Res. Rev.*, vol. 3, no. 3, pp. 32–38, 2018, doi: 10.24331/ijere.415824.

[9] J. Skalka and M. Drlík, "Conceptual framework of microlearning-based training mobile application for improving programming skills," *Adv. Intell. Syst. Comput.*, vol. 725, no. February, pp. 213–224, 2017, doi: 10.1007/978-3-319-75175-7_22.

[10] Kementerian Pendidikan dan Kebudayaan, "Pokok-pokok Kebijakan Merdeka Belajar. Pemaparan pada Rapat Koordinasi dengan Kepala Dinas Pendidikan Seluruh Indonesia.," 2019.

[11] M. Yamin and S. Syahrir, "Pembangunan Pendidikan Merdeka Belajar (Telaah Metode Pembelajaran)," *J. Ilm. Mandala Educ.*, vol. 6, no. 1, pp. 126–136, 2020, doi: 10.36312/jime.v6i1.1121.

[12] S. Putrawangsa, *Desain Pembelajaran: Design Research sebagai Pendekatan Desain Pembelajaran*, no. November. Mataram: CV. Reka Karya Amerta, 2018.

[13] T. Plomp and N. Nieveen, *An Introduction to Educational Design Research.* Netherland: SLO, 2010.

[14] N. Aldoobie, "ADDIE Model," *Am. Int. J. Contemp. Res.*, vol. 5, no. 6, 20156.

[15] "ADDIE." http://raleighway.com/addie/.