Hybrid Learning as an Alternative for Learning to Improve Students' Physics and Digital Literacy Competencies on The Topic of Fluid Physics

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Abstract:- Innovative learning is very necessary in the realization of graduate competencies. The learning process is required to be able to construct student knowledge and skills. Learning is currently designed to achieve 21st Century competence. Educators and education produced by LPTK must not only master material content but must also be digitally literate, master teaching methodologies with digital systems, and they are prepared to face the industrial era 4.0. Efforts that are considered capable of overcoming these problems and improving students' digital literacy and scientific competences are the development of Hybrid-Learning Management System learning in the lecture process. This research is a development research that aims to produce fluid physics learning through learning Hybrid-Learning Management Systems. This research development stage refers to the development research model of Wademan and McKenney. The subjects of this research trial were 58 students programming basic physics courses for the academic year 2019/2020. Analysis of research data was analyzed descriptively and qualitatively. The results showed that learning fluid physics through learning Hybrid-Learning Management System that was developed has met the validity criteria in the valid category, practicality criteria in the very good category, and effectiveness criteria in the medium category. Based on the results of the study, it was concluded that the learning of fluid physics through learning Hybrid-Learning Management Systems developed was declared feasible.

Keywords:- *Hybrid Learning, Physics Competence, Fluid.*

I. INTRODUCTION

Basically, each region has local characteristics or wisdom that can be raised in the learning process / lecture, either as a learning resource, or as an object of problems that can increase learning motivation due to the relevance of the material they are learning with the daily environment. The province of South Kalimantan, which has almost all kinds of wetlands, certainly provides opportunities for educators who want to develop lessons that are adapted to the wetland environment. Integrating wetland problems in the learning process will also add insight to the local wisdom of students on the wetland environment around them. Fluid physics can be related to wetland conditions in South Kalimantan. In learning fluid physics, wetland utilization can be used as the object of the problem. Integrating fluid material and wetland problems such as the concept of hydrostatic pressure can be related to the deep pressure of the house building process using galam wood, the lifting force of the search substance in the concept of a boat float in a river and various other events in wetlands that can be raised in the learning process. This of course will be more interesting and better when compared to giving textual problems that exist in books.

Learning at this time apart from having to be carried out contextually/ in accordance with environmental conditions, it is also necessary to integrate 21st century skills, for that the government is developing the Indonesian National Curriculum Framework so that students achieve the competency standards of graduates. Initial observations of physics lectures show that the teaching method has been conventional, namely lecturers delivering material, followed by information on formulas, and sample questions, therefore it is necessary to apply an innovative method that is relevant to the demands of the times.

Today's education is dominated by a technology-conscious generation. The internet as the dominant technology to support the system as a medium of communication, delivery material, and various other online activities has become a part of the life of the current generation[1]. E-learning has become the backbone for distance education in the world. Almost all universities in the world today have implemented e-learning in lecture activities, because in fact it is almost impossible for every student to survive in college without having basic skills and knowledge of digital literacy[2]. Despite its various shortcomings, the traditional teaching model provides a much needed human touch in the teaching and learning process. The traditional approach helps in developing a strong life value system. Social skills such as cooperation, sharing, expression and respect for the views of others are easier to develop using traditional teaching[3].

Research by Kurniawati & Baroroh reveals that the level of individual competence of students in literacy digital media is still at the basic level[4]. Another study by Kahar states that the level of digital literacy of students is moderate on the indicator of the percentage of reading books via the internet (58%) and is classified as very low on the indicator

of the ability to distinguish between valid or invalid sources (8%)[5].

Based on the research above, it is concluded that digital literacy among students has not shown maximum results. A lecture system is needed that can train and accustom students to improving digital literacy skills. LPTK as an institution for producing teacher candidates is currently one of the prima donna majors for prospective students in Indonesia. Referring to Article 10 (1) of Law Number 14 of 2005 concerning Teachers and Lecturers, a teacher must have pedagogical competence, personality competence, social competence and professional competence. The LPTK as a printing institution for teaching staff is required to be able to prepare competent prospective teachers. The traditional learning process that is generally applied is deemed unable to meet the competency standards as mandated by the Teacher and Lecturer Regulation.

Teachers produced by the LPTKs must not only master material content but must also be digitally literate, master learning with digital systems, and they are prepared to face the current 4.0 industrial era. One of the efforts that are considered capable of overcoming these problems and improving digital literacy and increasing student scientific competence is the development of learning Hybrid Learning using the Learning Management System. Hybrid learning which emphasizes a combination of face-to-face and online teaching in a comfortable and practical hybrid classroom. Blended learning is recognized as a trending strategy at this time and benefits students because of the mixture of advantages of online and face-to-face activities that will have a big role in the future[6]. Research on the development of Hybrid Learning using the Learning Management System, in addition to supporting digital literacy and improving student scientific competence, will also support the development of lecture quality, lecturer competence, quality of higher education curriculum, and learning models / methods.

Therefore, this research plan, entitled "Development of Wetland Problem Oriented Fluid Physics Learning Using a Hybrid-Learning Management System to Improve Student's Digital Literacy and Scientific Competencies" will contribute to produce a wetland-based fluid physics learning design using hybrid-learning management system to improve digital literacy skills and competency skills of prospective teacher students.

Various efforts and learning alternatives are implemented in order to improve the quality of education from all aspects. Indonesia needs to implement the concept of education with various activities, varied programs to create student development[7]. In Law Number 20 of 2003 concerning the National Education System and Government Regulation Number 19 of 2005, namely to support the learning process, information and communication technology (ICT) can be used. The use of ICT in education today must be fulfilled in order to create a generation with global competitiveness. Therefore, education staff, both teachers and lecturers in today's digital era, are highly required to master ICT.

Hybrid learning is a learning approach that combines face-to-face lecture activities with online learning to combine the advantages of the two methods[8]. In implementing hybrid learning, an application is needed, namely a learning management system (LMS). LMS is an application used to manage online learning which includes several aspects, namely material, placement, management, and assessment.

The advantages of hybrid learning from the results of research conducted by Akkoyunlu and Yılmaz-Soylu, show that the implementation of hybrid learning helps to follow learning easily, learning can be accessed anywhere, using online discussion forums easily, can easily share thoughts and experiences with friends, support and help strengthen what has been obtained in class, modules uploaded on e-learning meet student needs, evaluation criteria with e-learning guide students in building projects, evaluation criteria are clear and understandable, a learning system is very effective , and students can learn at their own pace [9]. Three general goals for the adoption of hybrid learning: improved pedagogy, increased access and flexibility, and increased cost-effectiveness and resource use[10;11].

Lectures are currently designed to achieve 21st Century competencies, one of which is digital literacy[12] So that students' digital literacy skills develop, the integration of ICT in learning needs to be done. Increasing students' digital literacy competencies can be done by integrating ICT in the learning process[13]. Digital literacy is one of the components in media literacy skills, namely the proficiency of using computers, the internet, and other digital devices. Digital literacy refers to efforts to recognize, search for, understand, assess and analyze and use digital technology. Digital literacy is the interest, attitude and ability of individuals to use digital technology and communication tools to access, manage, integrate, analyze and evaluate information, build new knowledge, create and communicate with others in order to participate effectively in society. Research conducted by Azmi at Qatar University shows that the skill of searching for information in databases is considered by students as one of the important skills that students must possess. However, online skills, including searching for information on the internet, may differ among students[14].

The Regulation of the Republic of Indonesia Number 14 of 2005 concerning Teachers and Lecturers states that competence is a set of knowledge, skills, and behaviors that must be possessed, lived in, and controlled by teachers or lecturers in carrying out professional duties. In Article 10 (1) of Law Number 14 of 2005 concerning Teachers and Lecturers, a teacher must have pedagogical competence, personal competence, social competence and professional competence. Pedagogic competencies include teacher understanding of students, design and implementation of learning, evaluation of learning outcomes, and development of students to actualize their various potentials. Personality competence is a personal ability that reflects a stable, stable, mature, wise and dignified personality, becomes an example for students, and has noble character. Social competence is the teacher's ability to communicate and socialize effectively with students, fellow educators, education staff, parents /

guardians of students, and the surrounding community. Professional competence is the mastery of learning material broadly and deeply, which includes mastery of subject curriculum materials in schools and scientific substances that cover the material, as well as mastery of scientific structure and methodology.

The LPTK as an institution for producing teaching staff is required to be able to prepare prospective teachers who have pedagogical competence, personality competence, social competence and professional competence. In the lecture process, it must be able to foster the four competencies that prospective teachers must have, and are also relevant to the digital era or the era of the industrial revolution 4.0.

Physics scientific competence is part of the professional competences that prospective physics teacher students must possess. Physics scientific competence is a set of abilities and or a combination of knowledge, skills, values, interests and attitudes that are reflected in the habit of thinking and acting in overcoming the problems at hand.

The basic competencies of students that are expected to be possessed by students / graduates from the physics education study program as prospective teachers include: having sufficient knowledge and understanding of facts, concepts, principles and basic theories of physics, having the ability to formulate / reasoning mathematical symptoms of physics, have the ability to explain the physical meaning of various mathematical formulations on physical phenomena, have the ability to apply physics formulas based on data / observations, have the ability to design and conduct physics experiments, and be able to apply physics and / or explain the symptoms of physical events in everyday life.

II. METHOD

This research is a development research that refers to the design of Wademan and McKenney's research model with the steps of problem identification, identification of tentative products and design principles, tentative products and theories, prototyping and assessment of preliminary products and theories, problem resolution-advancing theory[15]. The product developed is hybrid learning in physics learning on the topic of fluids in the fundamental physics course.

The test subjects of this research product were students of the physics education study program at Lambung Mangkurat University who programmed the fundamental physics courses for the 2019/2020 school year, totaling 58 studenss. The research instruments used include: validity assessment sheets, observation sheets, physics competency test instruments, and digital literacy skills observation instruments.

To see the quality of the validity of teaching materials, validity assessment was carried out by two validators using a validation sheet, and to see the practicality of teaching materials, the implementation of teaching materials was assessed by two observers using the observation sheet for the lessong plan. Analysis of the quality of the validity of

teaching materials after the assessment of two validators and the practicality of teaching materials after assessment of two observers used Percentage of Agreement Analysis (R) to assess interobserver agreement[16]:

$$R = \left[1 - \left\{\frac{A-B}{A+B}\right\}\right] \times 100\%$$

With:

R: reliability / practicality reliability coefficient
A: highest score from validator / observer
B: lowest score from validator / observer

Pretest and posttest were conducted to see the effectiveness of strategies in improving students' physics learning outcomes and using normalized gain score analysis. Normalized gain score analysis is based on the formula:

$$\langle g \rangle = \left(\frac{\%\langle S_f \rangle - \%\langle S_i \rangle}{100\% - \%\langle S_i \rangle}\right)$$

with:
$\langle g \rangle =$ Normalized gain
$\langle S_f \rangle =$ Pre-test value
$\langle S_i \rangle =$ Post-test value

The data obtained in the implementation stage are consulted in Table 1 to see the effect of teaching materials developed during learning on improving student physics learning outcomes.

Table 1. Reference Gain Value

Scale	Criteria
(<g>) > 0.7	*High-g*
0.7 > (<g>) > 0.3	*Medium-g*
(<g>) < 0.3	*Low-g*

III. DISCUSSION

The development of fluid physics learning oriented to wetland problems through hybrid learning that has been developed, validated and tested in class to determine its feasibility. The following are the results of the development of learning and the results of class trials and their discussion.

Learning development with the characteristics of fluid material using hybrid learning, is the development of the stages of implementing fluid physics learning by organizing learning activities/ processes using the learning management system assistance. In the stages that are validated, all printed learning devices are transferred on an online basis, be it lesson plans, teaching materials, student worksheets, and evaluation sheets.

The transfer of printed resources to online makes learning designs more flexible and controlled in the system. The lesson plan is outlined in all stages of the implementation of learning which includes the motivation-perception stage, the material discussion stage, the training and discussion stages for each topic, the confirmation stage, and the evaluation stage. Likewise, teaching materials which are

generally printed in nature have been transferred to pdf files. This can be seen at the material and discussion stages, where students will be given a link to the teaching material file then they are downloaded. Giving files in the form of soft files makes it easier for students to find information to answer the problems/ assignments given.

The transfer of printed Student Worksheets to online is specifically described at the training and discussion stages. At the training and discussion stages, students are directed to the Exercise and Discussion form which requires all students to show answers to problems online. With this method, all students fill out the answers on the form provided with a predetermined time. Student activities can be monitored in the process of filling in answers as well as their work results.

In the evaluation stage, namely by carrying out the post-test stage, learning outcome instruments which are usually printed are also transferred in the form of an online competency test form. With the online form, students can immediately see the results of their work after submitting their answers. This is certainly more practical and efficient in the use of resources and time.

Fluid Physics Learning through developed hybrid learning was tested on students of the FKIP ULM Physics Education Study Program who programmed the Fundamental Physics subject for the 2019/2020 academic year. To find out the practicality of learning fluid physics with hybrid learning, it can be seen in the implementation of learning which was carried out in two meetings, namely the first meeting on Archimedes' law material and the second meeting on Pascal's law material. The overall data from these observations are attached.

Based on the implementation of learning from the two meetings, it was found that at the first meeting the average score was 3.65 for the very good category and the second meeting the average score was 3.83 for the very good category. The mean score for the implementation of the lesson plan during the two meetings was 3.74 in the very good category with the reliability of 0.94 in the high category.

The effectiveness of fluid physics learning using developed hybrid learning can be seen through the results of student competency tests measured from the pretest and posttests and students' scientific literacy skills during the learning process. The results of the student's fluid concept competency test showed that the average score obtained by students in the pre-test was 41.29 to 60.82 in the post-test, from a score of 100 that might be achieved by students. The maximum score obtained by students for the pre-test is 75.00 while the maximum score for the post-test is 92.50.

One of the indicators of learning effectiveness can be seen in the results of the n-gain analysis of the pre-test and post-test scores of the fluid physics competency test. The results of the n-gain score analysis show that the average n-gain score for fluid physics competence is 0.32. The n-gain score indicates that the effectiveness is in the medium category.

The results of the analysis of students' digital literacy skills include indicators, namely accessing digital information, searching for information digitally, managing information, analyzing information, and evaluating information. Based on the results of the analysis of students' digital literacy skills, it was found that at the first meeting for the skills to access digital information was at a score of 72.5, looking for information digitally was at a score of 60.3, managing information was at a score of 56.9, analyzing information was at a score 53.4, and evaluating the information is at a score of 53.4. At the second meeting, it was found that the skills to access digital information were at a score of 100.0, looking for digital information was at a score of 86.2, managing information was at a score of 87.1, analyzing information was at a score of 67.2, and evaluating information was at score 65.5.

The effectiveness of learning which is also an indicator can be seen in the results of the n-gain analysis of the first and second meeting scores of students' digital literacy skills. The results of the n-gain score analysis showed that the average n-gain score for students' digital literacy skills was 0.51. The n-gain score indicates that the effectiveness is in the medium category.

The discussion of the results of this study was conducted to determine the feasibility of the developed learning. This discussion includes the feasibility of learning developed, such as validity, practicality and effectiveness of learning through hybrid learning.

The results of the assessment of the validity of fluid physics learning based on hybrid learning which include aspects of format and display assessment, in this aspect what is assessed is the suitability of the format/ display used, the numbering system, the appropriate type and size of letters, and the suitability of space/ layout. The overall mean validity score for format and display was 3.63 in the very valid category.

In the language and image aspects assessed in this aspect is to use language in accordance with the correct Indonesian language rules, use simple language, use terms (words) that are easy to understand, command sentences do not cause multiple interpretations, images are displayed contextually, the picture quality is clear, and the video shown is motivational, the video quality is clear. The overall average validity score for the language and image aspects is 3.69 in the very valid category.

In the aspect of rationality of learning assessed in this aspect is in accordance with the competence of higher education graduates, in accordance with KKNI, in accordance with course objectives, and in accordance with 21st century skills. The overall average validity score for the rationality aspect of learning is 3.75 in the category very valid. Likewise for the aspects of the learning stages that are assessed in this aspect, the learning stages can achieve learning objectives, the learning stages support digital literacy, the learning stages are logical and can be implemented, and the learning stages contain clearly learning activities. The overall average

validity score for the aspects of the learning stages is 3.75 in the very valid category.

In the completeness of the hybrid learning support system assessed in this aspect, the included teaching material has been uploaded, the included teaching material is in accordance with the learning topic, the teaching material that is included supports the achievement of learning objectives, MFI is done online, MFI can support the achievement of learning objectives, LKM can support digital literacy, LKM directs students actively in learning, LKM activities can support students understand fluid physics, LKM answers can be stored in the online system, assessment sheets can be done online, and assessment sheets according to the learning objectives. The overall average validity score for the completeness aspect of the hybrid learning support system is 3.71 in the very valid category.

In the social system aspect and the principle of reaction assessed in this aspect, the pattern of relationships between lecturers and students is clear, the pattern of relationships between lecturers and students shows lecturers as motivators, patterns of relationships between lecturers and students show lecturers as guides / facilitators, patterns of relationships between lecturers and students show lecturers as evaluators, patterns of relationships between lecturers and students show student-centered learning, patterns of relationships provide opportunities for students to interact with other students, and patterns of relationships provide opportunities for students to interact with lecturers. The overall mean validity score for aspects of the social system and reaction principle is 3.50 in the very valid category.

In the aspect of ease of use assessed in this aspect is the ease of access for lecturers and students, and ease of use of features in the learning system. The overall average validity score for the ease of use aspect is 3.75 in the very valid category. The last aspect that is assessed for its validity is the aspect of estimating the time allocation. In this aspect, what is assessed is the allocation of time for all activities, and the allocation of time for each learning stage. The overall average validity score for the estimation aspect of the time allocation is 3.75 in the very valid category.

The practicality of learning is seen from the steps of learning activities which consist of an introduction, a core, and a closing. In this study, two meetings were conducted with the time allocation for each meeting was 3×50 minutes. It can be seen that the implementation of the two meetings consists of the first meeting, and the second, the overall average of the meetings is 3.74 in the very good category with a reliability of 0.94 in the high category. So it can be concluded that learning fluid physics using hybrid learning is carried out very well. The importance of the successful implementation of a lesson certainly greatly impacts this research. So that the learning process is not only limited to the process of knowledge transmission, but also the success of class management by teachers who run it using an online system.

Whether the learning process is effective or not can be seen in the results of student competency tests measured from the pre-test and post-test and students' scientific literacy skills during the learning process. In the gain test, there are three categories, namely low, medium, and high. Based on the calculations for the results of the fluid physics competency test using the gain test that the average n-gain score obtained was 0.32 in the moderate category and for the results of the n-gain analysis the scores of the first and second meetings of students' digital literacy skills showed that it was obtained. The n-gain average score for students' digital literacy skills was 0.51. The n-gain score indicates that the effectiveness is in the medium category. The medium category obtained on the two assessed effectiveness indicators shows that fluid physics learning using hybrid learning is effective in the medium category.

IV. CONCLUSION

Based on the results of research and discussion, it can be concluded that the learning of fluid physics oriented to wetland problems using a hybrid-learning management system to improve digital literacy and physics scientific competences of students has met the appropriate criteria.

REFERENCES

[1]. Surjono, H.D., Muhtadi, A. & Wahyuni, D. (2017). The Implementation of Blended Learning in Multimedia Courses for Undergraduate Students in Indonesia. *International Journal of Information and Education Technology, 5* (10). 783-786.

[2]. Adeoye, A. A., & Adeoye, B. J. (2017). Digital Literacy Skills of Undergraduate Students in Nigeria Universities. *Library Library Philosophy and Practice (e-journal) University of Nebraska – Lincoln.*

[3]. Lalima & Dangwal, K.L. (2017). Blended learning: an innovative approach. *Universal Journal of Educational Research*, 5(1), 129-136.

[4]. Kurniawati, J., & Baroroh, S. (2016). Literasi Media Digital Mahasiswa Universitas Muhammadiyah Bengkulu. *Jurnal Komunikator*, 8(2), 51-66.

[5]. Kahar, A. P. (2018). Analisis Literasi Digital Mahasiswa Calon Guru Biologi Melalui Proyek Video Amatir Berbasis Potensi Lokal Pada Mata Kuliah Ekologi Tumbuhan. *Pedagogi Hayati*, 2(1), 1-13.

[6]. Vernadakis, N., Giannousi, M., Derri, V., Michalopoulos, M., & Kioumourtzoglou, E. (2012). The impact of blended and traditional instruction in students' performance. *Procedia Technology*, 1, 439-443

[7]. Dwiharja, L. M. (2015). Memanfaatkan Edmodo Sebagai Media Pembelajaran Akuntansi. In *Prosiding Seminar Nasional UNY 19 Mei 2015* (Vol. 9).

[8]. Sriwartini, Dani, . (2015). Strategi Meningkatkan Hasil Belajar Akuntansi Melalui Blended Learning Berbasis Edmodo Social Networking. *Prosiding Seminar Nasional Pendidikan Akuntansi dan Keuangan*, 167-177.

[9]. Akkoyunlu, B., & Yılmaz-Soylu, M. (2008). Development of a Scale on Learners' Views on Blended Learning and Its Implementation Process. *Internet and Higher Education, 11*(1), 26–32.

[10]. Graham, C. R., Allen, S., & D, U. (2005). Benefits and challenges of blended learning environments. In M. Khosrow-Pour, *Encyclopedia of Information Science and Technology* (pp. 253–259).

[11]. Porter, W., Graham, C. R., Spring, K. A., & Welch, K. R. (2014). Blended Learning in Higher Education: Institutional Adoption and Implementation. *Computers & Education, 75*, 185–195.

[12]. Partnership for 21st Century Skills. (2009). *21st Century Skills Assessment.* USA.

[13]. Yilmaz, M. B., & Orhan, F. (2010). High School Students Educational Usage of Internet and Their Learning Approaches. *World Journal on Education Tecnology,* 2(2), 100-112.

[14]. Azmi, H. (2006). Teaching Information Literacy Skills: A case study of the QU core program in Qatar University. *Innovation in Teaching and Learning in Information and Computer Sciences*, 5(4), 1-20

[15]. Plomp, T. 2010. Educational Design Research: An Indtroduction. In T Plomp and Nieven (Eds), *An Introduction to Educational Design Reserarch* (pp. 9-35). Enschede: SLO, Netherlands Institute for Curriculum Development.

[16]. Borich, G.D. 1994. *Obersvation Skills for Effective Teaching.* New York: Macmillian Publishing Company.