Journal of Educational Sciences

PDEODE-WEB-BASED Blended Learning As 21st Century Learning Development Solutions

Zulfarina*, Tuti Mailani, Wan Syafii

Biology Education, Universitas Riau. Pekanbaru, 28291. Indonesia

ARTICLE INFO

A B S T R A C T

The purposes of this study are to develop a PDEODE-WEB based Blended Learning model, and determine the quality of the developed PDEODE-WEB based Blended Learning model on digestive system material in terms of validity, practicality, and effectiveness. This study employed a 4D development research (R&D) which consists of Define, Design, Development, and Disseminate. The results showed that the validation of material and media experts for content validation was 3 with very important categories. Analysis from a learning expert for the construction validation category obtained 4.03 with the very good category. The results of the limited trial obtained a score of 81.47 in the good category and the practicality test obtained 90.6 which could be categorized as very practical. The effectiveness test was carried out obtained the N-Gain of 0.6 with the medium category. The PDEODE-WEB Blended Learning model that was developed meets the criteria of validity, practicality, and effectiveness as a solution for the development of learning in the 21st century.

1. Introduction

In the 21st century, science has developed rapidly, where the main technology that is the basis of which is computers through the internet network. The internet is used as one of the learning resources without the boundaries of space and time. Thus, the impact of this development is to change the traditional learning approach towards future learning which is called the learning age of knowledge, that people can learn anytime and anywhere as reported by Istiningsih & Hasbullah (2015).

The 21st century learning paradigm implies that a teacher must be capable of using digital technology, suitable means of communication, and/or networks to access, manage, integrate, evaluate, and create information which functions in the

learning process (Solihudin, 2018). This is in accordance with The Regulation of Minister of Education and Culture Number 22 Year 2016 about the standard of primary and secondary education processes. The use of information and communication technology is one of contents in the process standard which functions to increase the learning efficiency and effectiveness. Based on the description above, the teachers are expected to be capable of applying the information and communication technology in an integrated, systematic, and effective way in line with the conditions and situations, including being able to use technology as learning resource and learning media.

Digital-based learning such as online learning has been designed and developed by many education practitioners. However, other forms of learning are still required such face to face learning. The combination of both of them, online and face-to-face learning, is known as Blended Learning (Abdullah, 2018).

In other words, blended learning is a combination of various forms of learning instruments such as real-time software, online web-based learning programs, and other applications which support the learning environment and knowledge management system. This is in line with Abdullah (2018) who confirms that blended learning is a combination of online, face-to-face, and independent learning guided by a mentor, teacher, or lecturer structurally.

Blended learning is a combination of face-to-face learning systems with e-learning that can be used by anyone, anywhere, anytime (Sudarman, 2014). Blended learning has benefits in learning including the success of achieving learning objectives, changing teacher-centered learning patterns to being student-centered, balancing student independence in learning, and motivating students to discipline themselves in learning (Hima, 2015). Blended Learning can improve critical thinking skills (Joanna, 2012), best practices, strategies, models, and course design principles (Moskal, et al., 2013), problem-solving abilities (Mulyono, et al, 2015), and creating an effective learning environment (Wardani, 2019).

Nowadays, there is more convenience of technology media. Thus, there are many media choices that can be used, one of which can accommodate the needs of any time, anywhere, and real-time monitoring in using website-based media (online). We-based learning media can be accessed anywhere and anytime by using computer or smartphone as long as there is internet connection. Not only that, web-based learning media also contains text, images, videos, and direct communication which make it more interesting for the learners(Utama, 2011). There are some benefits of web-based learning such as: (1) the access is available anywhere and anytime around the world; (2) Per-student equipment cost is affordable; (3) Student tracking is made easy; (4) Possible "Learning object" architecture supporting on-demand personalized learning; (5) The content is up to date (learning materials can be updated more easily) (Titin and Panjaitan, 2016).

The 2013 curriculum adheres to the basic view that knowledge cannot just be transferred from teachers to students. Learning using the 2013 curriculum has to

provide opportunities for students to seek, process, construct, and use knowledge in their cognitive processes. Therefore, in the 2013 curriculum, the learning process carried out not only transfers the knowledge possessed by the teacher to students directly through lectures, but also guides students to actively look for, process, and construct knowledge. Teachers are required to make learning more interesting and innovative to foster students' enthusiasm for learning. This learning is expected to encourage students to be able to learn optimally both in individual learning and in the learning process in the classroom (Titin and Panjaitan, 2016). Yuliandari & Wahjudi (2014) stated that one of the efforts that teachers can make to achieve interesting and innovative learning is by using models in the teaching and learning process.

PDEODE is one of learning models in education. It stands for Predict-Discuss-Explain-Observe-Discuss-Explain. According to Wulandari, et. al., (2018), it can train students to build scientific concepts. In this model, the students obtain the chance to express their prior knowledge related to the learning materials, the cooperation among students during the discussion, exchanging opinions, and so on, also to show a conceptual change in the knowledge owned by students. The conceptual change that occurs is a change in the initial concept held by students with new knowledge that is proven to be true through demonstrations or experiments. The PDEODE learning model trains students to predict, discuss, explain, observe, discuss the results of observations, and explain it again (Dipalaya, et al., 2016).

Based on the problems explored above, the researchers can develop PDEODE-WEB-based Blended learning for Senior High School level because PDEODE alone is not sufficient for conducting the learning which supports 21st century skills. Therefore, PDEODE model developed must be integrated on the web namely at the Predict and Discuss 1 stage that is carried out online meanwhile the Explain stage, observer, Discuss 2, and Explain 2 are conducted offline to generate blended learning and to be a solution for the 21st Century learning development. The purpose of this study is to develop a PDEODE-WEB based Blended Learning model and to determine the quality of it on digestive system material from the aspects of validity, practicality, and effectiveness.

2. Methodology

This study employed the type of research and development (R&D). The development model used was an adaptation of the 4D development model to design a learning system. According to Ruhama (2017), the stages carried out in the 4D research model are Define, Design, Develop, and Disseminate. The results of the model design that have been feasible to be tested on students in the learning process were then taken pretest and posttest data from the learning outcomes with the developed model. The data were analyzed with the gain score formula which was then matched with the criteria in Table 1 to see its practicality aspect.

Table 1. Practicality Aspect

No	Score%	Criteria
1	$80 < x \leq 100$	Very Practical
2	$60 < x \leq 80$	Practical
3	$40 < x \leq 60$	Practical Enough
4	$20 < x \leq 40$	Less Practical
5	$0 < x \leq 20$	Not Practical

(Adapted from Riduwan, 2009)

3. Results and Discussion

The process of designing a PDEODE-WEB based learning model was carried out by making a design presented in Figure 1:
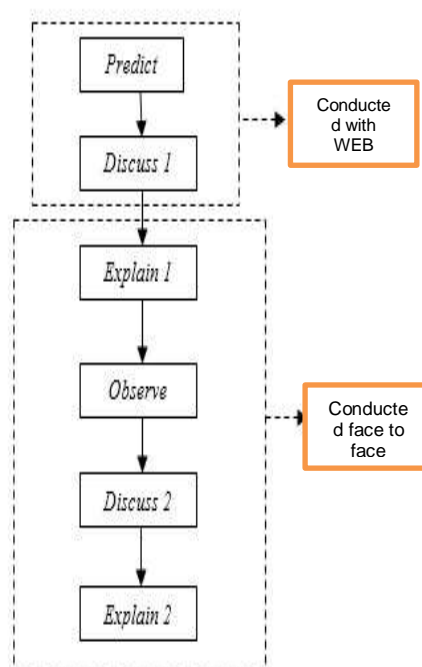

Figure 1. Stages of implementing PDEODE-WEB in Blended Learning

In general, the implementation stages were as follows (Modified from Ekawati, 2018):

1. *Predict*; the teacher provides problems (questions) on a web application, then students predict problem-solving to an event.
2. *Discuss* 1; students discuss in their respective groups with e-learning on the web related to the prediction of initial solutions to problems (questions) given by the teacher.
3. *Explain* 1; this activity is carried out face-to-face, where students expressed group opinions based on the first group discussion on the web.

4. *Observe*; this activity is carried out face-to-face. Students carry out practicum or observations in the laboratory following the problems given by the teacher to observe possible events that might be used in drawing conclusions. The teacher guides students to make relevant observations using the right concept.
5. *Discuss* 2; students discuss the results of practicum or observations with their group of friends, face to face in class.
6. *Explain* 2; students make presentations in front of the class for each group based on the evaluation questions (posttest) to find out the students' learning achievement towards understanding the concept.

The PDEODE-WEB that was produced has several advantages. For example, students can get material files by downloading them. Thus, students can read and study material anywhere and anytime. Moreover, students can independently work on the predict sheet to practice their analytical skills on the problems given. Besides, students can carry out discussion activities with the chat group feature that has been provided to answer the discussion sheet. Finally, students can take quizzes within the specified time limit and can also immediately see the results or grades of the quizzes they are working on along with reviews and explanations of the quizzes that have been done.

PDEODE-WEB display can be seen in the following Figure 2:

Figure 2. Display of PDEODE-WEB based Blended Learning

Based on the results of the validity test conducted by the material and learning media expert, the content validation including aspects of programming, functionality, appearance, learning, material, and language, obtained the CVR score of 3 which is categorized as very important criteria. The analysis of the results of the validation on the programming aspect can be seen in Table 2 below.

Table 2. Content Validation Score on Programming Basic Competency Number 3.7 Digestive System

Aspect	Assessment Criteria	Validation Score of Each Criteria	Validation Score and The Category
Programming	1. Easiness in menu usage	3,2	
	2. Efficiency of website usage	4	3,75
	3. Easiness in accessing the website address	3,8	Very Suitable
	4. Website content actualization	4	

Based on the results of the validity test conducted by the pedagogic experts for construct validation. Material aspects included lesson plans, student worksheets, questions, functions and benefits, and equipment engineering. The average score was 4.03 categorized as very good. The analysis of the results of the validation on the student worksheet aspect can be seen in Table 3 below.

Table 3. Construct Validation Scores on Student Worksheet Aspect

Aspect	Assessment Criteria	Validation Score of Each Criteria	Validation Score and Criteria
LKPD	1. The syntax of PDEODE_WEB development clearly seen in LKPD	4,5	
	2. There is instruction for doing the discussion activity concerning the result	4,5	4,5
	3. There is instruction to do observation activity	5	Excellent
	4. There is assessment of critical thinking skill	4	

The teacher response questionnaire was given when the try-out was carried out in the classroom. The results of the teacher response questionnaire in the try-out showed that the response to the PDEODE-WEB based Blended Learning model as a 21st Century learning development model was 90.6%, which is categorized as "very practical." The results of the teacher response questionnaire regarding the use of the PDEODE-WEB based Blended Learning model can be seen in Table 4 below.

Table 4. Average Practicality

No	Assessment Criteria	Statement Type	The Highest Score	Total Score
1	The purpose and indicator	Positive	1	1
2	Steps	Positive	1	1
3	Assessment Instruction	Positive	1	0
4	Time Allocation	Positive	1	1
5	Competence Achievement	Positive	1	1
6	Improve the critical thinking skill	Positive	1	1
7	Get use to independent learning	Positive	1	1
8	Encourage curiosity	Positive	1	1
9	Attractive	Positive	1	1
10	Trigger critical thinking	Positive	1	1
11	Systematic	Positive	1	1
12	Discussion	Positive	1	1
13	In accordance with EYD	Positive	1	1
14	The language can be understood	Positive	1	1
15	Attractive PDEODE-WEB	Positive	1	1
16	Consecutive	Positive	1	0
17	Improve intensity	Positive	1	1
18	Could be used anytime	Positive	1	1
19	Interesting questions	Positive	1	1
20	Give experience	Positive	1	1
21	KBK Based Questions	Positive	1	1
22	Questions in accordance with the purpose	Positive	1	1
23	Questions in accordance with EYD	Positive	1	1
24	Clear Questions	Positive	1	1
25	Enthusiastic	Positive	1	1
26	Motivation	Positive	1	1
27	Fun	Positive	1	1
28	The model is easy to be implemented	Positive	1	1
29	The device could be used easily	Positive	1	1
30	The evaluation is easy to use	Positive	1	1
31	Model Implementation	Positive	1	0
32	Time	Positive	1	1
	Amount		**32**	**29**
	Total Score		**90,6 (Very Practical)**	

Analysis of critical thinking skills for effectiveness test was done by testing the gain score. The gain score test used the pretest average data of 0.6 and the posttest average data of 0.6. processed pretest and posttest data were obtained from the tryout in the classroom. The gain score test was carried out to determine the effectiveness of the learning model being developed. The gain score test results obtained were 0.6 in the moderate category.

In general, this model focused more on the student learning process. Thus, students have more space to explore their thinking, interacting, and problem-solving skills. The objective of this study is to support the Government Regulation No. 19 of 2005 concerning national education standards which states that the learning process in educational units is organized in an integrated, interactive, inspirational, fun, and challenging that motivate students to participate actively for it provides sufficient space for the initiative, creativity, and independence according to the talents, interests, and physical and psychological development of the students. Furthermore, according to Mahmudi (2006), student-centered collaborative learning facilitates the achievement of learning objectives, trains cooperation and communication skills, generates creative ideas, thinks critically about a problem, and finds out solutions to these problems.

The second validation was the validation of learning instruments. In this validity test, the overall percentage score was up to 4.03 in the very good category. The aspect with the highest score was the lesson plan aspect which got a percentage of 4.75 in the very good category.

The learning scenario arranged in the lesson plan is a syntax sequence of the PDEODE-WEB based Blended Learning model which is detailed into two activities, namely student activities and teacher activities which are all systematically arranged and as much as possible using clear and straightforward instructions to make it easier for users or lesson plan readers to understand and carry out the learning design according to the order that has been made.

The results of the gain score analysis of the trial class obtained a percentage of 0.6. this result is classified as a moderate category. Furthermore, the results of previous studies conducted by Ali & Setiani (2018) and Rahuma & Ananda (2019) suggested that the use of a well-directed learning model can have a better effect on student learning outcomes.

4. Conclusion

Based on the description above, it is concluded that the design stage of the PDEODE-WEB based Blended Learning model began with analyzing student learning needs, compiling the learning model syntax, and adjusting the instructions used to make it easier to use the model. Furthermore, the PDEODE-WEB based Blended Learning model that was developed meets the criteria of being valid, practical, and effective as a 21st-century learning development solution.

Suggestions

First, the PDEODE-WEB based Blended Learning model developed has been tested for its validity and effectiveness. Thus, it is recommended that teachers use this learning model as an alternative to the relevant learning model. Second, the

PDEODE-WEB based Blended Learning model is still rarely applied in schools. Thus, teachers can learn it.

References

Ali, M., & Setiani, D. D. (2018). The Effect of Discovery Learning Model on Students' Learning Result in Fungus Concept. *Bioedusiana, 3(2)*, 59-63.

Dipalaya, T., Susilo, H., & Corebima, A. D. (2016). The Effect Of PDEODE(predict-discuss-explain-observe-discuss-explain)   Learning Strategy In The Different Academic Abilities On Students' Critical Thinking Skills In Senior High School. *European Journal of Education Studies, 2(5),* 112-125.

Ekawati, N. E.(2018).   Application of Blanded Learning with Edmodo Application based on PDEODE Learning Strategy to Increase Student Learning Achievement. *Jurnal Ilmiah Pendidikan MIPA. 8(1),* 27-32.

Hima, L. R. (2015). The Effect of Blended Learning on Students Motivation in Relation and Function Material. *Scientific Journal of Mathematics Education*, *2(1),* 36-42.

Istiningsih, S & Hasbullah. (2015). Blended Learning, Trend Strategy of Future Learning. *Element Journal 1(1)*, 49-56.

Joanna, P. (2012), Use of Blended Learning To Enhance The Student Learning Experience And Engagement In Property Education*, Property management*, *30(2),* 129-156.

Ministry of Education Republic of Indonesia. (2016). No. 11. Year 2016. Content Standard of Elementary and High School Education Which Contains Competence Level and Core Competence In accordance With the Level and Type of Certain Education. Jakarta: Kemendikbud.

Rahuma, A., & Ananda, A. (2019). The Effect of Using Cooperative Learning Model Type of Examples Non Examples and Motivation Toward Student Learning Outcomes. *JPPI (Journal of Educational Research Indonesia), 4(2),* 117-121.

Mahmudi.(2006). The Implementation of ARCS Learning Model on Statistics Material in Grade XI of State Senior High School 2 RSBI Banda Aceh. *Journal of Opportunity, 2(1),* 13-18.

Moskal.P, Dziuban. C, Hartman, J. (2013). Blended learning: A dangerous idea? *Internet and Higher Education*,*18(1),* 15-23.

Mulyono, Sulistiyoningsih, S, Kartono. (2015). PBL With Adiwiyata Nuance With Blended Learning to Improve The Ability of Problem Solving and Caring Environment Character. *Unnes Journal of Mathematics Education Research*,*4 (2).*

Riduwan. (2009). *Basics of Statistics*. Bandung: Alfabeta.

Ruhama, D. M, & Setyoko.(2017). Developing Website Based Blended Learning at Biology Education Study Program University of Samudra. *Journal of Biology Education 6(3),* 346-350.

Solihudin. (2018). Developing Web Based e-Module to Improve Competence Achievement of Physics Knowledge on Static and Dynamic Electricity Materia in Senior High Schoo. *Journal of Physics Education Media, 3(2),*

51-61.

Sudarman, S., & Mulawarman, U. (2018). The Effect of Blended Learning Strategy on Learning Achievement of Concept and Procedure on Students who Have Self Regulated Learning. *Journal of Education and Learning*, *21(1)*.

Titin. E,S & Panjaitan. R.G. (2016). Developing E-Comic Billingual Media Channel Sub Material and Digestive Glands. *Unnes Science Education Journal, 5(3)*.

Utama, Y. (2011). Web Based Information System. *Journal of Information System (JSI), 3(2)*, 359-370.

Wardani, D.N, Anselmus J.E. Toenlioe, Agus W. (2019). Daya Tarik Pembelajaran Di Era 21 Dengan Blended Learning. *JKTP*,*1(1)*.

Wulandari. (2018). Developing Quality Mathematics Learning Media ICT Based. In *National Seminar of Graduate Program X- ITS UNESA, Surabaya.*

Yuliandari, S., & Wahyudi, E. (2014). Developing Interactive Multimedia Based Learning Media for Economic Subject Material Adjustment Journal of Service Company. *Journal of Accounting Education (JPAK), 2(2).*