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

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ABSTRACT
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). Web-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 ≤ 100 | Very Practical   |
| 2  | 60 < x ≤ 80   | Practical        |
| 3  | 40 < x ≤ 60   | Practical Enough |
| 4  | 20 < x ≤ 40   | Less Practical   |
| 5  | 0 < x ≤ 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:

![Diagram showing 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*; students discuss the results of practicum or observations with their group of friends, face to face in class.

6. *Explain*; 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](image-url)
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.

| Aspect         | Assessment Criteria                   | Validation Score of Each Criteria | Validation Score and Criteria |
|----------------|---------------------------------------|-----------------------------------|-------------------------------|
| Programming    | 1. Easiness in menu usage             | 3.2                               | Very Suitable                 |
|                | 2. Efficiency of website usage        | 4                                 |                               |
|                | 3. Easiness in accessing the website address | 3.8                             | Very Suitable                 |
|                | 4. Website content actualization      | 4                                 |                               |

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

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                              | Excellent                     |
|        | 2. There is instruction for doing the discussion activity concerning the result | 4,5                              |                               |
|        | 3. There is instruction to do observation activity       | 5                                 |                               |
|        | 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
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.

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