Development of Online Learning Resource for Accelerated Linear Motion Material with the Problem Based Learning (PBL) Model During the COVID-19 Pandemic

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Abstract. Coronavirus Disease or COVID-19 causes a serious affect in different divisions of life, including in education. At the present time, exercises at school have been incidentally suspended, but learning must proceed to be carried out to give what students need. The solution offered in dealing with the current pandemic is by doing online learning. However, the conditions in the field of teachers were not ready for online learning, it was found that the percentage of availability of online learning resources at Public Vocational School 53 Jakarta was only 44%. Therefore, this study aims to develop Edmodo application and Zoom-based online learning resource with problem-based learning (PBL) models on accelerated linear motion material. This type of research is an educational research and development with the ADDIE model (analysis, design, development, implementation, and evaluation). Assessment of online learning resource was carried out by physics, material experts, learning experts and media experts. Testing was carried out at Public Vocational School 53 Jakarta by 35 class X students and filling out the teacher response questionnaire. The result of this research is an online learning resource using the PBL model on accelerated linear motion material (GLBB). The online learning resource which developed include the Learning Implementation Plan (RPP), Student Worksheets (LKS), and Handout. The result of the media feasibility validation test were obtained 98%, for the feasibility of physics, material obtained 81%, and the feasibility of learning physics was obtained 86%. From the results of the feasibility test with the teacher, it was obtained 94%. Based on the interpretation of the Likert scale, online learning resource is categorized as "very good". So, it can be concluded that the online learning resources that has been developed is suitable for use in learning physics at Public Vocational School.

1. Introduction
The Corona Virus (COVID-19) disease caused a serious disturbance in different socio-economic areas. The education sector also experienced critical disturbances. Schools and colleges have been closed, either broadly or locally in a few nations influenced by COVID-19 [1].

Online learning must be supported by fitting classroom plan and conveyance strategies so that online learning can empower students to reflect on their convictions; give a secure environment for talking about various viewpoints; guide them to explore, validate and broaden new points of view; and support them to develop new roles [2]. In addition, access is the key word for optimal online learning. Lembani, et al (2019) said that open remote learning increases opportunities for access to education because of the availability of...
online material. However, this condition is greatly influenced by various variables such as age, access to computers and the internet, as well as the digital divide. Facilitating adequate access, for example, is one of the most basic things in supporting the smooth running of open distance learning [3].

In responding to the COVID-19 circumstance, the teacher must be able to encourage students to provide material and indeed the evaluation system. Online learning utilizes technology, where students attempt to manage with different assignments and make choices at a time. However, in reality, within the field, instructors are not prepared to do online learning. Based on the results of the needs analysis conducted at Public Vocational School 53 Jakarta, it was found that the availability of online learning resource was only 44%. Therefore, we need an online learning resource designed to respond to the COVID-19 situation.

Learning resources are a set of tools that support the success of a lesson that has been arranged already to be used within the learning process. The learning resources comprise a syllabus, lesson plans, teaching materials, and assessment instruments. The usage of high school material science learning within the 2013 curriculum requires learning gadgets in understanding the characteristics of scientific/scientific learning [4]. During the online learning process, various platforms can be utilized effectively such as learning applications, learning websites, or learning management systems (LMS). Edmodo can be used to share learning materials, give assignments, and make assessments. The Zoom application can also be used to conduct video conferences to monitor learning activities legitimately.

Edmodo is a learning platform which is free and secure. Edmodo is accessible at www.edmodo.com [5]. Edmodo’s interface is just like social media that permits teachers to make a class, and anyone with the class code can join the class. At the class, the teacher can give some materials, assignments, etc. Students can also view the materials that the teacher gave, and submit their assignments and view the teacher’s feedback, notes and advice. [6] [7]. Edmodo is also one of the top 25 website in “Social Networking” Category by the American Affiliation of School Custodians in 2011 [8].

The development of physics tools certainly cannot be separated from the learning model used. However, the reality shows that so far most educators have used conventional learning models and many are dominated by educators. Circumstances like this tend to be boring and will ultimately affect the learning outcomes of students. One strategy that is suitable for increasing the motivation of students to learn more effectively is to carry out variations in learning, namely by implementing physics learning with a problem-based learning model (PBL). One of the learning strategies that are seen as in line with the standards of the scientific approach is Problem Based Learning (PBL). PBL is an approach that gives the students any problems or issues that need to be solved and supposes them to find solutions to the real-world problem by applying their knowledge and skills as the learning process. [9].

Learning resources are all things needed to be used by the teacher to carry out the learning process. Teaching materials are all types of material that teachers use to assist them in carrying out learning activities. The learning resource developed include lesson plans, basic physics textbooks, student worksheets, and student learning outcomes tests.

The problem-based learning (PBL) model is based on many issues that require true examination, namely investigations that require solutions for real problems. PBL is a learning method that the relevant problem is presented early within the instruction cycle and is utilized to provide setting and motivation for the learning that takes after [10]. The PBL model has a syntax consisting of five stages of learning: 1) organizing students into problems, 2) organizing students to learn, 3) helping groups and independent investigations, 4) developing and presenting works and exhibitions, 5) analyzing and evaluating the problem solving process [11].

One of the sub-concepts discussed in this basic competency are accelerated linear motion. Accelerated linear motion (GLBB) is a motion whose path is straight and its speed changes in an orderly/patterned manner.

2. Method
The purpose of this study was to develop edmodo and zoom-based online learning resource with problem-based learning models on accelerated linear motion material suitable for use in physics learning. The learning resources that have been developed in this study are Learning Implementation Plan (RPP) that
integrates Edmodo and Zoom, handouts, Student worksheet (LKS). This type of research is an educational research and development with the ADDIE model (analysis, design, development, implementation, and evaluation). A lot of teaching designers have adopted the ADDIE model [12] as a standard model for education with technology based. ADDIE is a plan that presents an arrangement of five stages that construct effective education and training [13].

3. Results and Discussion
Based on the steps of the ADDIE model, the results of the following research procedures are as follows:

3.1 Analysis
The analysis stage in this research includes needs analysis, curriculum analysis, and analysis of the characteristics of students. The analysis of conditions in the field is needed, to find out whether online learning can be applied. A needs analysis has been done at Public Vocational School 53 Jakarta to determine the quantity of students who have used the internet or online learning to study. It was found that as many as 74.3% of students had used the internet or online learning to independently study the physics subject matter. Some of the platforms that are often used by students include the Ruang Guru, Zenius, YouTube, Google Classroom, and Brainly. In line with the results of the needs analysis, online learning is one of the right solutions for learning during the COVID-19 period.

![Figure 1](image1.png)

**Figure 1** Percentage of Online Learning Resource Availability.

The material of accelerated linear motion is one of the materials that students find difficult to understand, if the teacher does not use the right learning resource. This can be seen from the results of the student's conceptual achievement needs analysis of linear motion material only 49%. The low achievement of students' concepts is caused by inadequate linear motion learning resource. It was found that the availability of linear motion learning devices in Public Vocational School 53 Jakarta was 59%. Based on the description that has been given, this study aims to develop edmodo and zoom-based online learning resource with problem-based learning models on linear motion material. This is supported by needs analysis, in which 95% agree to need online learning resources, accelerated linear motion material.

![Figure 2](image2.png)

**Figure 2** Percentage of Needs for Online Learning for Linear Motion Materials content.
3.2 Design
At this stage, the preparation of online learning resource, reference collection, and instrument preparation is carried out.

3.3 Development
The development of online learning resource is carried out based on the design in the previous stage. The following is an explanation of the results obtained at the development stage.

a. Development of a Learning Implementation Plan (RPP)
b. Development of Student Worksheets (LKS)
c. Handout Development
d. Validation
Furthermore, the learning device is validated by 6 validators, 2 each for each learning expert, media, and material.
e. Revision
Then the revisions were made according to the validator's suggestions and input.

This research produces an online learning resource using the PBL model on accelerated linear motion material. The online learning resource developed include lesson plans, worksheets, and handouts. The Learning Implementation Plan (RPP) that integrates Edmodo and Zoom, handouts, Student worksheet (LKS), and Edmodo that have been developed can be seen at: https://drive.google.com/file/d/1R_gEEr3JFUjDluyvQjv1sk1049RTT8Km6/view?usp=sharing

3.4 Implementations
At this stage, several activities were carried out, namely testing the learning resource and filling out the teacher and student response questionnaires. Learning resource that has been validated and revised are then tested. The trial of learning devices was carried out at Public Vocational School 53 Jakarta by 35 Automotive Light Vehicle Engineering (TKRO) class X students on June 30, 2020.

3.5 Evaluation
The last stage in the development of learning resource is evaluated. During the trial process, there were several suggestions from students and teachers that were used as suggestions for improvement or revision of stage II.

Instruments for collecting data include: (1) a questionnaire to analyze the needs of teachers and students, (2) a validated questionnaire for material, media, and learning experts, (3) a field trial questionnaire for teachers and students. The data in this study were obtained by non-test. Quantitative data were obtained from the results of the assessment of lesson plans, worksheets, and handouts by the material, media, and learning validators, as well as the results of the teacher and student field trial questionnaire assessments.

Furthermore, the learning resource that have been developed are validated by 6 validators, 2 each for each learning, media, and material expert. The media expert validation test aims to determine the feasibility of the media on based online learning resource edmodo and zoom with a learning model problem based learning for accelerated linear motion material that has been developed. The assessment is given through the media expert validation test sheet. This validation test sheet contains 23 questions from four aspects, namely (1) Components of Learning Activities in Edmodo Web which consists of 5 question items, (2) Components of worksheets consisting of 7 questions, (3) Handout components consisting of 8 questions, and (4) Video/Animation Components and Phet which consists of 3 questions. The following table of data is obtained from the results of the validation test by media experts:
Table 1. Validation Test Results by Media Experts

| No. | Measured Aspects                                      | Percentage Achievements | Interpretation |
|-----|-------------------------------------------------------|--------------------------|---------------|
| 1.  | Components of Learning Activities in Edmodo Web        | 98%                      | Very good     |
| 2.  | Components of Worksheets                              | 97.14%                   | Very good     |
| 3.  | Handout Components                                    | 96.25%                   | Very good     |
| 4.  | Component Video / Animation and Phet                  | 100%                     | Very good     |
|     | Average of all Measured Aspects                       | 98%                      | Very good     |

The following is a picture of the percentage of achievement of validation results by media experts:

![Figure 3 Validation Test Results by Media Experts.](image)

Based on the results of the media feasibility validation test, the average percentage of achievement in all aspects was 98%. Based on scale interpretation Likert, these results indicate that the online learning resource created is very good for use in learning physics.

The physics, material expert validation test aims to determine the feasibility of the material on the based online learning resource edmodo and zoom with a learning model problem based learning for accelerated linear motion material that has been developed. The assessment is given through the physics material expert validation test sheet. This validation test sheet contains 21 questions from four aspects, namely (1) Suitability of the Handout Component with the Physics, Material which consists of 9 questions, (2) The suitability of the material in the Handout which consists of 4 questions, (3) the suitability of the material on the video / Animation which consists of 5 questions, and (4) Language of Writing Material which consists of 3 questions. The following table of data is obtained from the results of the validation test by material physics experts:

Table 2. Validation Test Results by Material Experts

| No. | Measured Aspects                                      | Percentage Achievements | Interpretation |
|-----|-------------------------------------------------------|--------------------------|---------------|
| 1.  | Suitability of the Handout Components with the Physics| 81.11%                   | Very Good     |
| 2.  | Material in the Handout                               | 77.5%                    | Good          |
| 3.  | Suitability of the material on the video / animation  | 82%                      | Very Good     |
| 4.  | Use of language in writing                            | 83.33%                   | Very Good     |
|     | Average of all Measured Aspects                       | 81%                      | Very Good     |
Based on the results of the feasibility validation test of the physical material, the average percentage of the overall aspects of the achievement is 81%. Based on scale interpretation Likert, these results indicate that the online learning resource developed is very good for use in learning physics.

The learning expert validation test aims to determine the feasibility of learning on based online learning resource edmodo and zoom with a learning model problem based learning for accelerated linear motion material that has been developed. The assessment is given through the learning expert validation test sheet. This validation test sheet contains 20 questions from five aspects, namely (1) Characteristics of the RPP, which consists of 5 questions, (2) Stages of PBL, which consists of 5 questions, (3) Characteristics of the Handout which consists of 3 questions, (4) Learning Assessment which consists of 4 questions and (5) Characteristics of worksheets consisting of 3 questions. The following table of data is obtained from the results of the validation test by learning experts.

| No. | Measured Aspects                  | Percentage Achievements | Interpretation |
|-----|-----------------------------------|-------------------------|----------------|
| 1.  | RPP Characteristics               | 90%                     | Very Good      |
| 2.  | PBL Phases                        | 84%                     | Very Good      |
| 3.  | Handout Characteristics           | 90%                     | Very Good      |
| 4.  | Learning Assessment               | 77.5%                   | Good           |
| 5.  | Characteristics of worksheets     | 90%                     | Very Good      |
| **Average of all Measured Aspects** | **86%**                 | **Very Good**          |

The following is a histogram, image of the percentage of achievement of validation results by learning experts:
Based on the results of the feasibility validation test for learning physics, the average percentage of achievement in all aspects is 86%. Based on scale interpretation Likert, these results indicate that the online learning resource developed is very good for use in learning physics.

Learning devices that have been validated by experts and revised are then tested for learning devices and filling out teacher response questionnaires. This test sheet for teachers contains 17 questions from four aspects, namely (1) Characteristics of the lesson plan which consists of 5 questions, (2) Components of Learning Activities in Edmodo Web which consists of 5 questions, (3) Language of Writing Material which consists of from 3 questions, and (4) Learning Assessment which consists of 4 questions. The following table of data is obtained from the results of the validation test by the teacher:

| No. | Measured Aspects                                           | Percentage Achievements | Interpretation |
|-----|------------------------------------------------------------|-------------------------|----------------|
| 1.  | RPP characteristics                                        | 92%                     | Very good      |
| 2.  | Components of Learning Activities in Edmodo Web            | 96%                     | Very good      |
| 3.  | Use of language in writing                                | 93.33%                  | Very good      |
| 4.  | Learning Assessment                                        | 93.33%                  | Very good      |
|     | **Average of all Measured Aspects**                       | **94%**                 | **Very Good**  |

The following is a histogram, image of the percentage of teacher validation results:

Based on the results of the feasibility validation test with the teacher, an average percentage of the achievement of all aspects was 94%. Based on scale interpretation Likert, these results indicate that the online learning resource developed is very good for use in learning physics.
4. Conclusion
The conclusion of this research is the Edmodo application and Zoom-based online learning resource with problem-based learning (PBL) models on the material of accelerated linear motion developed has met the criteria very well and is suitable for use in learning physics.

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