

# Developing A PBL-Based Interactive Physics CD To Improve Diagram And Mathematics Representation Ability On Simple Harmonic Motion Material

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**Abstract:** This research aims to: (1) develop a Problem-Based Learning (PBL)-based physics interactive CD on simple harmonic material. This research is research and development applying the 4-D model. The field trial subjects included 64 students in SMA Negeri 4 Yogyakarta consisting of 32 students as the experimental class and 32 students as the control class. The results are as follows. First, the PBL-based interactive physics CD on Simple Harmonic Motion material has been developed. Second, the developed PBL based physics interactive CD is declared eligible to be used and belongs to a very good category as indicated by the score of 4.36 from a maximum of 5. Third, the developed PBL based physics interactive CD is declared effective because it can improve the ability of the students of SMA Negeri 4 Yogyakarta to deal with diagram and math representation.

**Index Terms:** interactive CD, PBL, representation of diagram and math.

## 1. INTRODUCTION

THE curriculum in Indonesia has undergone a very fundamental change. In the implementation of the latest curriculum, the learning system is very student-centered and interactive. This means students who really need to be active and independent in the learning process. The reality, until now physics is still considered difficult by students. However, if examined deeper, physics must be a pleasant subject because it is the closest to nature. The results of observations at SMA Negeri 4 Yogyakarta during the physics learning process, the teacher teaches with direct learning method in which the teacher actively explains and students only listen passively. Supposedly, learning should use a problem-based learning approach (PBL). PBL gives students the opportunity to think and look for concepts and solve problems related to the material presented by the teacher. Therefore, PBL has enormous potential to make learning experiences more interesting and meaningful for students. Along with the development of science and technology, currently the learning medium that is often used is computer-based learning media. This development gave rise to a new term to refer to computer-based media, namely interactive learning multimedia. Interactive means there is a reciprocal relationship between the media and media users. Interactive CDs are now more popular because they are very interesting so the learning process is not boring (Siswanto, 2007:38)

## 2 METHOD

### 2.1 Research Design

This research uses a research and development method. The product to be developed in this study is a PBL (Problem Based Learning) physics-based interactive CD to improve the ability of diagram and mathematical representation. The material taken in this study was high school physics class X material, Simple Harmonic Motion. The design used in this research is 4D model development research design according to Sivasailam Thiagarajan (1974:5) consisting of define, design, develop, and disseminate.

### 2.2 Sample

Subjects were 64 students in SMA Negeri 4 Yogyakarta with 32 students as the experimental class and 32 students as the control class. Both are measured through pre-test and post-test.

## 3 RESULT

The product that has been developed is a learning media in the form of physics interactive CD based on problem-based learning (PBL) on Simple Harmonic Motion Material. Media is developed with sections such as cover pages, main menu, Core and Basic Competence, perceptions, learning material, simulations, and interactive practice pages. The language used is Indonesian. This learning media refers to the Indonesia 2013 curriculum. All components designed are then processed using the Adobe Flash Player program and have extension.exe (windows executable) into a whole learning media product.



Pic 1. Display of main menu

The high school physics learning media products produced are interactive physics CDs. In the application, includes KI and KD, learning objectives, subject matter, simulations, and

evaluations. This physics interactive CD learning media is equipped with a Student Worksheet (LKPD) as a guide for students in working on assignments given by the teacher through an interactive CD.

### 3.1 Media Evaluation

The evaluation of physics interactive CD media products was validated by one media expert. The evaluation of the feasibility of all aspects shows that the developed media is declared appropriate.

**TABLE 1**

*RESULT OF THE FEASIBILITY OF THE LEARNING MEDIA*

N.	Evaluation Aspect	Value	Category
1	The Displays of Media	4,25	Very good
2	Text	3,83	Very good
3	Picture	4,30	Very good
4	Animation	4,14	Very good
5	Simulation	4,63	Very good
6	Navigation Icon	5,00	Very good
Average		4,36	Very good

### 3.2 Result of Diagram Representation Ability Test

**TABLE 2**

*RESULT DATA OF DIAGRAM REPRESENTATION ABILITY*

Class	Total of Student	Pretest Avarage	Posttest Avarage	Gain Avarage	Gain Category
Experimental	32	19,4	36,3	0,22	Low
Control	32	12,5	26,9	0,13	Low

Based on the data shown in Table 2, the average pretest score between the control class and the experimental class has a difference that is not so large. The average gain values for the experimental class and the control class are in the low category.

### 3.3 Result of Mathematical Representation Ability Test

**TABLE 3**

*RESULT DATA OF MATHEMATICAL REPRESENTATION ABILITY*

Class	Total of Student	Pretest Avarage	Posttest Avarage	Gain Avarage	Gain Category
Experimental	32	26,2	44,4	0,35	Moderate
Control	32	11,4	46,8	0,25	Low

Based on the data shown in Table 3, the posttest average value between the control class and the experimental class for mathematical abilities has a difference that is not so large. The average gain value for the experimental class is in the moderate category, while the control class is in the low category.

### 3.4 Result of Hypothesis Test

The hypothesis was tested using the MANOVA analysis with the help of the SPSS program. The hypotheses tested are as follows:

- Ho : There is no difference between increasing the ability of diagram and mathematical representation student between the experimental class and the control class.
- Ha : There is difference between increasing the ability of diagram and mathematical representation student between the experimental class and the control class.

The type of MANOVA analysis used is the Hotteling's Trace effect. Decision criteria if the significance value of the test is less than 0.05 then Ho is rejected.

**TABLE 4**  
*MANOVA TEST RESULT*

Effect	Significance	Criteria	Decision
Hotteling's Trace	0,000	Sig<0,05	Ho rejected

Based on the results of the analysis in Table 4, it shows that the significance value of the test 0,000 means less than 0.05 so that Ho is rejected. This shows that the existence of an interactive learning media in the form of an interactive CD is able to create an effective and efficient learning process that is characterized by an increase in the ability of students' mathematical and diagrammatic representations.

## 4 CONCLUSION

PBL-based physics interactive CD media on Simple Harmonic Motion material developed was declared suitable for use in the excellent category with a value of 4.36 out of a maximum value of 5. PBL-based physics interactive CD media on the Simple Harmonic Motion material developed was declared effective because it could improve the ability of diagram and mathematical representation of students of SMA Negeri 4 Yogyakarta.

## REFERENCES

- [1] J. Siswanto, (2011). Compact Disk Online (Cd-O) Sebagai Multimedia Interaktif Pembelajaran Fisika Berbasis Proyek. JP2F, Volume 2 Nomor 1 April 2011.