



# Development of Learning Instrument to Increase Student's Physics Concept Mastery Through Conflict Cognitive Approach

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**Abstract:** Physics learning using direct instruction method or speech method did not optimal in increasing concept mastery. This case results in low learning outcomes due to the low mastery of students' physics concepts. The solution to this problem is to develop learning instruments based on a cognitive conflict approach assisted by lesson videos to improve students' mastery of physics concepts as valid and appropriate products for use in learning. The learning tools developed are syllabus, lesson plans, Student's Worksheet, lesson videos and concept mastery assessment instruments. The kind of research is research and development with the 4D method (define, design, develop, disseminate). This research is limited to the development stage, which includes validity testing. The results of this study can be concluded that the learning tools in the category are very valid and reliable. Based on these results, the learning tools developed are suitable for use in learning.

**Keywords:** Learning Instruments; Cognitive Conflict Approach; Lesson video; Concept Mastery.

## Introduction

The purpose of learning Physics is to instill physics concepts correctly so that it can be used to solve problems in everyday life. Physics is a branch of natural science or science. Science consists of collections of knowledge that are arranged systematically. Science can be viewed as a scientific product, process and attitude. Science is seen as a process, namely as a scientific method and as an attitude that includes: honest, open, objective, and critical. Science is seen as a product in the form of concepts, theories, principles and laws (Makhrus & Hadiprayitno, 2012). Physics learning must be directed to do and find out so that it can help students gain a deeper mastery of concepts. In physics learning process, students are required to be directly involved in observing and understanding natural phenomena in the surrounding environment. The purpose of learning physics in everyday life is that students can solve complex problems by applying the knowledge they have (Hartati, 2010).

Prior observations have been carried out at SMA Negeri 1 Gerung in class X. The result show that in learning activities, students are less actively involved in learning and teachers pay less attention to facilities and instrument in learning activities, i.e. the use of learning media that is rarely used in the learning process to help explain subject matter, resulting in low mastery of students' concepts. The solution used for this problem is a cognitive conflict approach assisted by lesson video.

The cognitive conflict approach makes students contradict their conceptions, after that to prove the truth of the concept, students will be directed to conduct experiments or demonstrations. Cognitive conflict approach is an event where students feel that they do not match their knowledge with the surrounding environment (Lee et al., 2001).

In the learning process, teachers usually merely use textbooks in teaching. Advances of science and technology can be used by teachers to create various learning media that will be used in learning activities. Teachers are required to be able to utilize and use

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existing learning media. The media used in this research is lesson video.

Lesson video is one of the media instrument used to convey messages related to the content of study subject. Through this lesson video, it is hoped that it can motivate students to generate interest in learning and their curiosity. Gunawan (2017) states that the use of lesson videos can guide students in understanding subject matter through visualization. The use of video as a media tool in learning activities can guide students to understand the concept of momentum and impulse.

Mastery of concepts is an aspect to measure students' learning outcomes to realize a learning (Sugiana et al, 2017). Makhrus et.al (2020) also states that cognitive conflict approach is able to increasing physics concept of students. The concept is the thinking result of new knowledge that appears in the form of understanding, definition, characteristics, content, nature and so on (Doyan & Sukamantara, 2014). Based on this explanation, the researchers in this study developed learning tools based on a cognitive conflict approach assisted by lesson videos to produce appropriate learning tools to improve students' mastery of physics concepts.

**Method**

The type of this research is research and development with a 4D model (Define, Design, Develop, Disseminate) (Thiagarajan & Semmel, 1974). This development research is limited to the development stage which includes validity testing. The data analysis technique used in this study is equation (1) for validity testing and equation (2) for reliability testing):

Average value of validity score can be calculated with equation 1.

$$NA = \frac{\sum_{i=1}^n v_n}{n} \tag{1}$$

Where, NA is average of validation score,  $v_n$  is validity score given by number n expertise and N is amount of expertise who given the scores.

Based on the NA values obtained, the criteria for assessing the validity of learning devices (Ratumanan & Laurens, 2011) are set in table 1 as follows.

**Table 1.** Criteria for Assessment of the Learning Devices Validity

Score	Criteria	Conclusion
1.00–1.75	Invalid	Revise all
1.76–2.50	Pretty valid	Revision
2.51–3.25	Valid	Appropriate revision suggestion
3.26–4.00	Very valid	No revision needed

This study uses Percentage Agreement (PA) where A is the score given by the first assessor while B is the

score given by the second assessor. A higher rating score will be reduced by a lower rating score. If the percentage of agreement is equal to 75% or more then the instrument can be said to be reliable (Borich, 1994). Percentage Agreement (PA) value can be calculated with Equation 2.

$$(PA) = \left(1 - \frac{A-B}{A+B}\right) 100\% \tag{2}$$

Where A is the higher scorer, while B is the smaller scorer. The larger value (A) is always subtracted from the smaller value (B). If the percentage agreement value is more or equal to 75% then the instrument can be said to be reliable, but if it is less than 75% then it must be tested for clarity and approval from observers.

**Result and Discussion**

Prior step of developing this learning device starts from the definition, including the initial analysis, students' assignment, materials, and analysis of the specification of learning objectives. Based on prior observations and interviews conducted with physics teachers at SMA Negeri 1 Gerung, the results shows that in learning activities students are less actively involved, students' mastery of material still looks low or lacking because of informative learning from the teacher. This can be seen when the teacher gives questions to students from the book.

The next step is designing. The design step aims to prepare learning tools and assessment instruments that can be used to solve problems at the definition step. The learning tools developed include the syllabus, lesson plans, LKPD, lesson videos and assessment instruments for mastery of concepts. The last one is development. This last step aims to obtain the results of learning tools that are suitable for use in learning. First, validation of learning tools is carried out by validators/experts to determine the validity of a product being developed. The following are the results of the feasibility analysis of the developed product.

**Table 2.** Instruments Validation Score (Scale 4)

Product	Lecturer	Teacher
Sylabus	3.63	3.48
Learning Plan	3.55	3.7
Student Worksheet	3.42	3.37
Lesson Video	3.55	3.49
Learning Instrumen	3.56	3.00

**Table 3.** Instruments Realiability Score (%)

Product	Lecturer	Teacher
Sylabus	0.96	0.9
Learning Plan	0.97	0.94
Student Worksheet	0.96	0.95
Lesson Video	0.97	0.877
Learning Instrumen	0.96	0.94

The results of this research are learning instruments with a cognitive conflict approach assisted by lesson videos to improve students' mastery of concepts. This instruments are suitable for use in learning. Research on the development of this learning device uses a 4D model. This research is limited to the development stage, which includes validity testing. This is due to the Covid-19 pandemic that still exists in all regions which causes learning activities in schools to not run as usual, so the operational trial phase cannot be carried out. The

developed product was assessed by six expert validators. Inputs and suggestions from validators are used as the main guide in improving learning tools that are suitable for use during learning activities. Inputs and suggestions from validators are used as the main guide in improving and revising learning tools, so that learning tools are obtained that are suitable for use in learning (Nerita et al, 2018). The following are the results of the products developed.

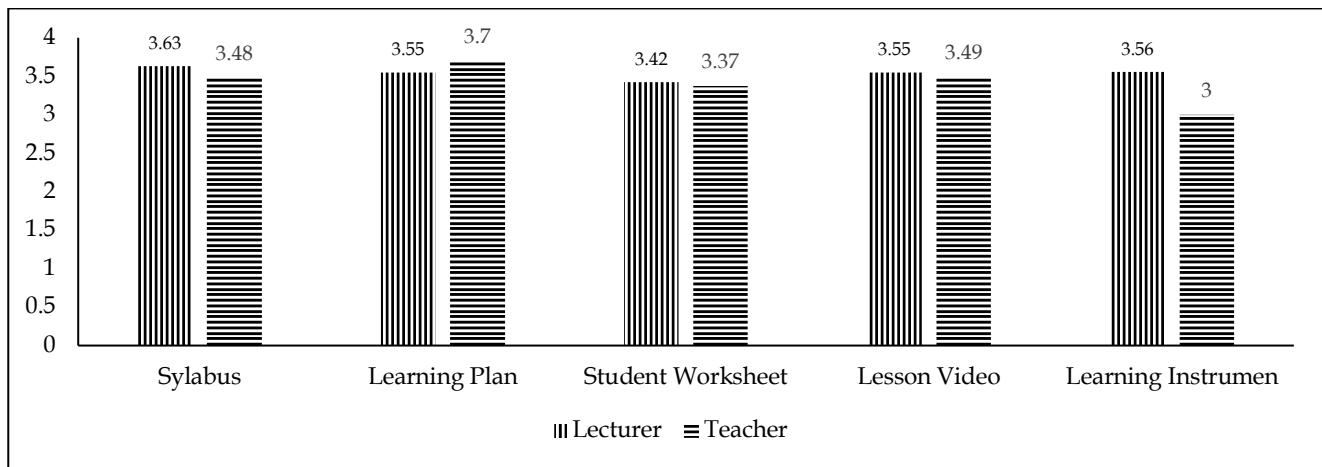


Figure 1. Graphic of Instrument Validation Score

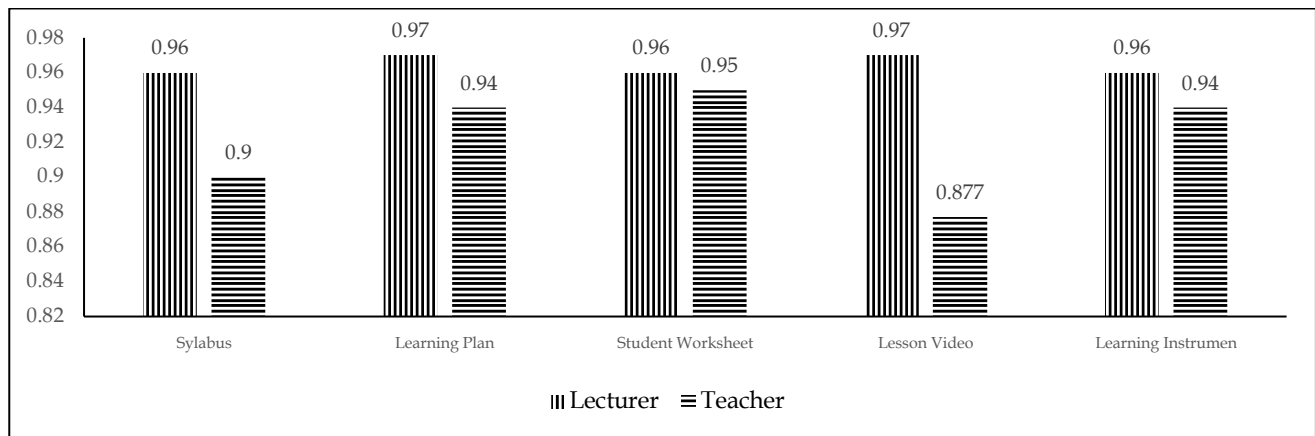


Figure 2. Graphic of Instrument Reliability Score

The syllabus developed by the researcher in this study is in accordance with the cognitive conflict approach and concept mastery. The syntax of the cognitive conflict approach is in accordance with the learning activities and the form of the assessment instrument. Kunandar (2011: 244) syllabus is a design of learning activities that include basic competencies, competency standards, subject matter, learning activities, assessments, indicators of competency achievement, time allocation, and learning resources.

Learning Implementation Plan developed based on the syllabus as a guide in learning activities to achieve Basic Competencies (Rusman, 2017). The components

and sequence of the RPP have been adjusted to Permen No. 22 of 2016. The RPP designed includes KI, KD, learning objectives, competency achievement indicators, learning media, learning activities, learning resources, and assessment techniques in each meeting. There were 3 meetings in the developed RPP. The learning activities in this lesson plan have been adapted to the cognitive conflict approach assisted by lesson videos to improve concept mastery.

The worksheets designed by the researchers in this study have been adapted to the cognitive conflict approach and concept mastery indicators. Sahidu (2017) The Student Worksheet is a guide for students in

learning activities to solve a problem. There are 3 student Worksheet developed in this study. First, the Student Worksheet that is designed contains the student's identity, title, and instructions for working on the questions. Furthermore, Student Worksheet is designed according to the cognitive conflict approach (preliminary phase, conflict phase, and resolution phase).

The video developed by researchers in this study is used as a medium to convey messages or subject matter. This lesson video is designed according to the cognitive conflict approach. Fauzan (2017) state that media in the form of lesson videos has important benefits in learning activities, because it can create a fun learning atmosphere.

The assessment instrument developed by the researcher in this reasearch used a multiple-choice test which was designed according to the indicators of mastery of the concept. This assessment instrument contains 25 multiple choice questions, where in each question there are indicators of mastery of concepts from C1-C6. Sahidu (2016) state that the assessment instrument is a tool used to measure the achievement of learning competencies.

Based on the results of the validity and reliability of the syllabus, lesson plans, student's worksheet, lesson videos and assessment instruments are in the very valid and reliable category. The product developed in this research is suitable for use in learning.

## Conclusion

Based on the results of the research obtained and the discussion, it can be concluded that the learning tools developed in the form of syllabus, Learning Implementation Plans, Student Worksheets, lesson videos and assessment instruments are in the very valid and reliable category. Thus, this learning device is suitable for use in learning

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