

# Critical-Thinking Instrument Based on Google Form

*by Evi Yana Dkk.*

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## Critical-Thinking Instrument Based on Google Form: Development on Work and Energy Materials

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## 5 Critical-Thinking Instrument Based on Google Form: Development on Work and Energy Materials

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**Abstract.** Curriculum 2013 requires students to have critical-thinking skills, especially in physics. Preliminary research conducted at several schools found the lack of questioning instruments that require students to have critical-thinking skills and teachers in conducting evaluations still using conventional paper media (paper tests). The purpose of this research is to find out how the characteristics of the instrument about the ability to think critically using Google Form and to find out how the validity and reliability of the items as well as the responses of teachers and students to the instrument about the critical-thinking skills using Google Form. The instrument developed was a multiple-choice grid test that was oriented towards students' critical-thinking skills. The assessment instruments that have been developed in this study are declared valid and reliable as well as the response of teachers and students very well to the question instruments developed.

### 1. Introduction

Education is one of the processes used by teachers to develop students' thinking skills through learning. Along with the development of the globalization era that is happening continuously like today, education has also experienced changes in both the learning methods and the applicable curriculum. In the era of the fourth industrial revolution or better known as the industry 4.0 [1], [2] education became one of the ways used to complement the phenomenon of digital integration in everyday life where humans and machines interact to solve a particular problem. In education access to information is not limited by space and time so the teaching-learning process becomes more dynamic. So that in future education 4.0 can change the use of information to be more practical and digital-based [3].

The support and role of education are expected to be able to increase the competitiveness of a nation amid global competition the increasingly rapid growth of information technology [4]. In the era of digitalization as it is today digitalization can destroy a person's dignity in various ways if it cannot be utilized properly. Therefore, improving the quality of learning and students are required to have a strong character to face the challenges and competition in the era of the industrial revolution 4.0 [5]. There are several effective question instruments to use in the learning process including LOTS (Lower Order Thinking Skill), HOTS (High Order Thinking Skill) [6], Critical-thinking [7], Creative Thinking and Science Literacy [8].

The level of thinking in bloom taxonomy is divided into lower-level thinking abilities and higher-level thinking abilities. Low-level thinking skills consist of remembering, understanding and applying. Whereas the higher-order thinking ability consists of analyzing, evaluating and creating. Higher-order thinking skills are the ability to think critically and think creatively to solve problems in making decisions [6]. The learning process of students must also have critical-thinking skills which are rational thinking that requires the ability to evaluate a statement and identify a reason, for example, the evidence underlying the evaluation [7].

According to Ennis critical-thinking is thinking sensibly and reflective thinking that is focused on deciding what to believe or do [9]. The instrument of critical-thinking in learning is needed by teachers as an evaluation tool to find out whether or not learning in class but, the media used in the evaluation process still uses print media or (paper test) so that the learning process to the evaluation stage is not in accordance with the development of revolution 4.0. Based on the above problems, it is necessary to study the development of the Google Form-based critical-thinking problem instrument, so that the learning process is in line with what is expected by the government in the development of the industrial revolution 4.0.

The instrument serves to reveal a fact in the learning process into a data [10] so that the critical-thinking instrument is a tool used to see achievement in learning because evaluation acts as a feedback for teachers to be able to improve and improve the quality of learning that affects achievement of students' critical-thinking skills [11]. The need for paper in the world of education becomes a major staple in the documentation process. Paper made from wood is one of the main problems of the importance of plants in the world's air security. According to the Indonesian green forum in [12]. 1 tree is 5 years old to produce 1 ream of paper and if an organization consists of 100 people who can save 3 pieces of paper every day, then in a year there are 156 trees saved. So it is necessary to have an environmentally friendly concept (go green) by using technology to reduce the use of paper (paperless).

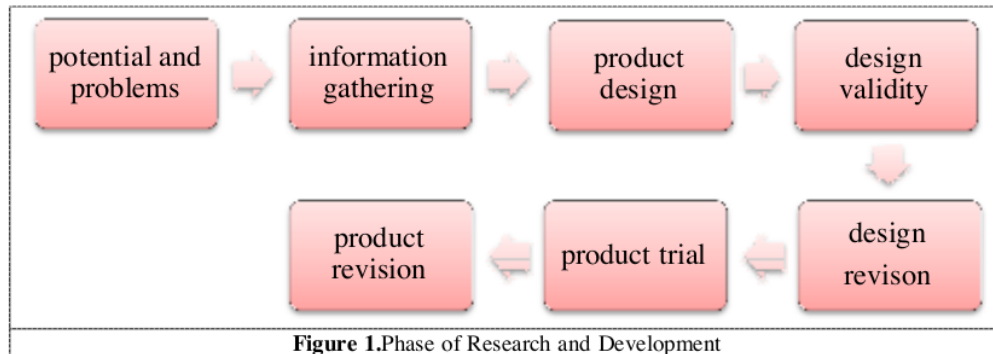
Familiarity with the community of technologies such as computers, smartphones, and tablets. As well as the availability of increasingly inexpensive internet connections should be an opportunity for the utilization of information and communication technology in the implementation of the education system [13]. Google Form or Google Form which is an application/tool from the Google website that is useful to assist teachers in giving quizzes to students easily and efficient way [14]. using Google Forms addresses the problem of inaccuracy by utilizing a single entry point for data, rather than being hand-recorded and retyped in several locations. Finally, its ease of use means that all student workers and staff can easily enter the number of gates at any desired interval, eliminating the need for time-consuming calculations and data entry when statistics are needed [15]. Google Form is an application in the form of form templates or worksheets that can be used independently or together to obtain user information. There are many options for taking surveys online, but I chose to use Google Forms to make this survey because it is free, easy to use, mobile-friendly, and supports a variety of question forms, ranging from multiple-choice, linear scale, and checkboxes for answers and paragraphs short.

The development of critical-thinking tools based on Google Form has an influence on educational development where students are trained to have critical-thinking skills and increase knowledge about Google Form as a medium of evaluation, send surveys and media that can be used to gather information so that the learning process up to the evaluation process is appropriate as expected in the development of the 4.0 revolution era. In accordance with learning in the 21st century where everyone is required to have critical-thinking and master information technology [16], [17].

14

**2. Method**

This type of research is research and development (R&D), namely research on the development of critical-thinking questions using the Google Form. The type of R&D research used in this study refers to the borg and gall method which is adapted according to the needs of researchers while the steps of this research and development can be explained in the following figure:



The design of activities in this study only reached the product revision stage or until the seventh stage. The assessment of instruments for critical-thinking based on Google Forms is based on content validation assessment which includes material experts, media experts, linguists and constructs validators which include validation assessment, reliability test, discriminating index test and difficulty level test. To assess the appropriateness and response of users for the evaluation media that have been made, the measurement scale using the Likert scale is used. Likert scale based on the opinion of Sugiyono (2013) is explained in the table as follows:

**Table 1.** Eligibility Assessment Criteria

Rating Category	Score
Very decent	5
Worthy	4
Decent enough	3
Not feasible	2
Very Inadequate	1

**4 Results And Discussion**

The development of critical-thinking skills assessment instrument, in this case, refers to a model by Borg and Gall as follows:

*3.1 Potential and problems*

Evaluation media used by teachers are only limited to conventional media or paper tests (using paper) and the lack of teacher's knowledge in developing online evaluation media. Information gathering the

collection of information in this study includes searching for information on the internet, journals, and books.

3.2 Product design

At this stage, the researcher designs the design by determining the concept of the instrument to be developed using Google Form. The product that will be produced is an instrument of critical-thinking questions in the form of physics questions, using multiple choice grids on work forms and energy based on Google Form.

3.3 Product Validation

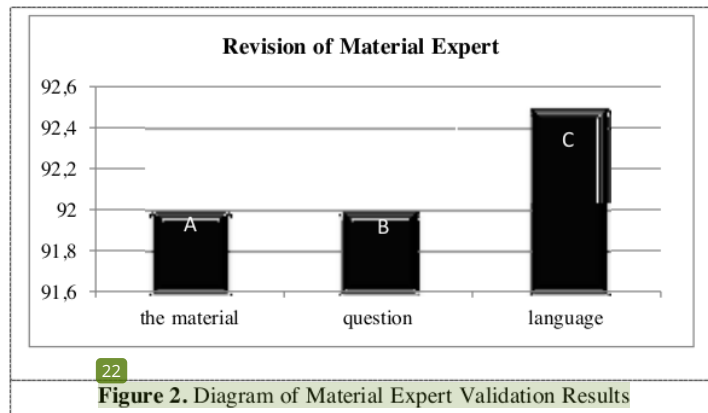
a. Content Validity

1. Material Experts

3

**Table 2.**Results of Material Expert Validation

No	Assessment Aspects	Average score	Percentage	Criteria
1	Theory	3.1	92	Very decent
2	Question	3.1	92	Very decent
3	Language	3.1	92.5	Very decent
Average of all aspects		3.1	92.17	Very decent



22

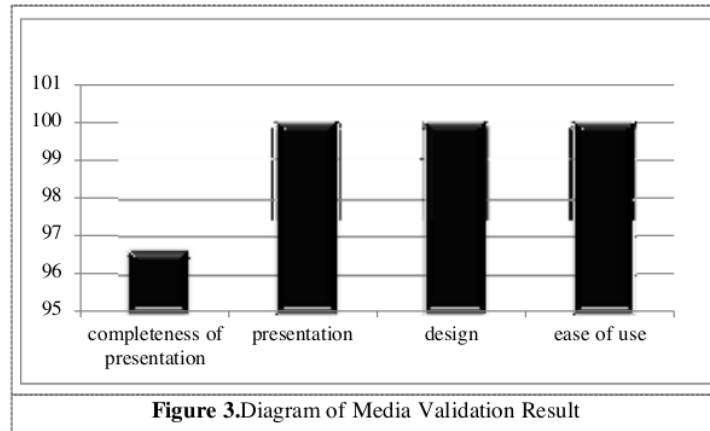
**Figure 2.** Diagram of Material Expert Validation Results

2. Media experts

3

**Table 3**Media Expert Validation Results

No	Assessment Aspects	Average score	Percentage	Criteria
1	Completeness of presentation	3.22	96.67	Very decent
2	Presentation	3.33	100	Very decent
3	The design	3.33	100	Very decent
4	Ease of use	3.33	100	Very decent
Average of all aspects		3.31	99.17	Very decent



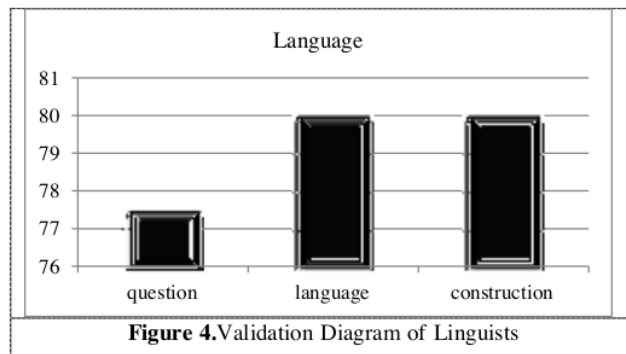
**Figure 3.**Diagram of Media Validation Result

3. Linguists

3

**Table 4.**Results of Linguist Validation

No	Assessment Aspects	Average score	Percentage	Criteria
1	Question	2.58	77.5	Worthy
2	Language	2.66	80	Worthy
3	Construction	2.66	80	Worthy
Average of all aspects		2.63	79.16	Worthy



**Figure 4.**Validation Diagram of Linguists

b. Construct validity

1. Validation

To calculate the validity of the tests in this study using the product-moment correlation formula as follows.

$$r_{xy} = \frac{N\sum XT - (\sum X)(\sum T)}{\sqrt{(N\sum X^2 - (\sum X)^2)(N\sum T^2 - (\sum T)^2)}}$$

The value of  $r_{xy}$  will be compared with the correlation coefficient table of  $r_{xy\text{critical}}$  with the following conditions:

**Table 5.** Validity Test Provisions

$r_{xy}$	Criteria
$r > r_{xy\text{critical}}$	Valid
$r_{xy\text{hitung}} < r_{xy\text{critical}}$	Invalid

Of the 30 questions developed in the validity test, there were 24 valid questions and 6 invalid questions.

## 2. Reliability

From 24 valid questions, the reliability of the test was then tested using the Kuder and Richardson method, namely by using the Alpha formula as follows.

$$r_{11} = \left( \frac{n}{n-1} \right) \left( 1 - \frac{ZS^2}{St^2} \right)$$

Reliability data obtained from 24 questions of 0.845933 so it can be said to be a reliable question with very high criteria.

## 3. Discriminating Index Tests

Discriminating index test can be measured using the following formula.

$$D = \frac{Ba}{Ja} - \frac{Bb}{Jb}$$

The results of the calculation of the Discriminating Index interval tests can be seen in chapter 3, obtained questions that have enough discriminating index there are 4 questions and good power difference there are 20 questions.

## 4. Difficulty Level Test

Test the level of difficulty on the questions to find out whether or not the items of the learning outcomes test items are used (Sudjiono, 2012). In this study to test the level of difficulty, use the following formula:

$$P = \frac{B}{JS}$$

The results of the analysis of the difficulty level of each item obtained calculation results indicate that of the 24 questions tested were classified in the easy category consisting of 18 items and enough 6 items.



3.4 Product Revision

The development of a critical-thinking instrument based on Google Forms has been validated by expert validators, therefore the next stage of design improvement is by the criticisms and suggestions given by expert validators.

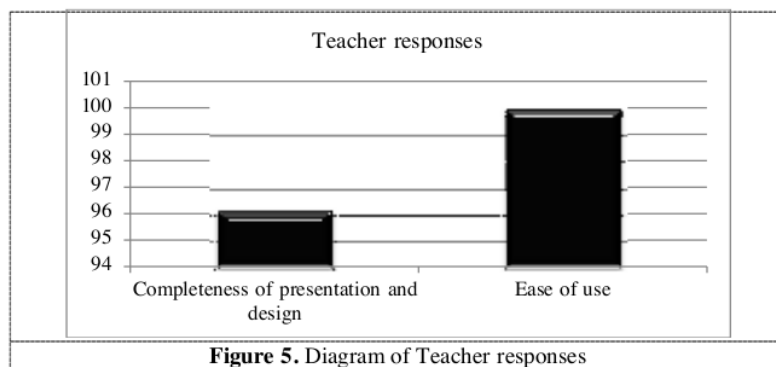
3.5 Product Trials

The product is tested to find out the distribution of the values obtained and the responses of teachers and students to the questions made.

a. Teacher Response

**Table 6. Teacher Responses**

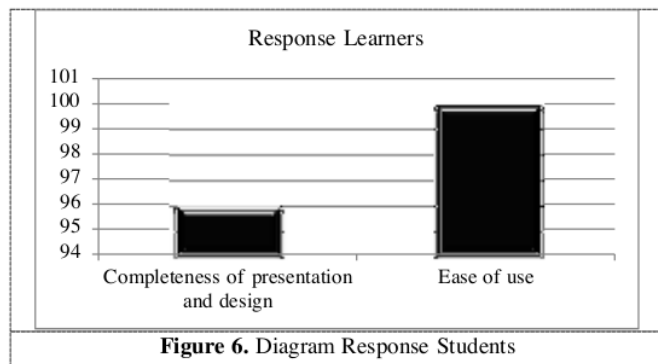
No	Assessment Aspects	Average score	Percentage	Criteria
1	Completeness of presentation and design	4,8	96.19	Very good
2	Ease of use	3.33	100	Very good
Average of all aspects		4.07	98.09	Very good



b. Students' Response

**Table 7. Students' Responses**

No	Assessment Aspects	Average score	Percentage	Criteria
1	Completeness of presentation and design	8	96	Very good
2	Ease of use	8.33	100	Very good
Average of all aspects		8.16	98	Very good



**Figure 6.** Diagram Response Students

The response results obtained from teachers and students are very good, it is seen in the table above. However, the preparation of these critical-thinking skills assessment instrument products has limitations, including the use of critical-thinking indicators and problem-solving, not using all indicators but only indicators that are appropriate to the research, and the type of instrument developed is a multiple-choice instrument.

### 3.6 Product Revision

The results of improvements to the revision are the final product of the Google Form evaluation media and the matter of the ability to think critically physics on work and energy materials. The media has been tested for both feasibility and usage, so the Google Form evaluation media and the matter of the critical-thinking abilities of physics on work material and energy are very appropriate as evaluation media that can help in evaluating X grade high school students.

There are several instruments development about critical-thinking skills in several subjects that have been done including mathematics [7], [19], chemistry [18], physics in the material elasticity and Hooke law [19] and the development of Google Form media that has been carried out, among others, [20] developing a four-tier diagnostic test using Google Forms and developing a diagnostic test using Google Forms to uncover students' misconceptions.

The difference found in the research that researchers are doing now with previous research is that there is material that is developed that is on work and energy materials and the instrument developed is an instrument of critical-thinking. So this research has an impact on the development of education in which students are trained to have to have critical-thinking skills and increase knowledge about Google Form as a medium of evaluation.

## 4. Conclusion

The characteristics possessed by the development of the instrument of critical-thinking based questions namely the questions in the form of multiple-choice grids are easy to use, scoring can be seen directly after the students send answers so that teachers can easily make judgments, reasonable questions contained in the Google Form but the students just need to match between answers to questions and reasoning and development of critical-thinking questions in the form of online test using Google Form, the response is "very feasible", the assessment is carried out by expert validators and users (teachers and students).

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