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Electronic Assessment of Momentum and Impulse Materials is Practical: In Assessing Students' Critical Thinking Skills?

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ABSTRACT

The problem of low critical thinking skills in physics learning and the unavailability of assessments that assess students' critical thinking skills, especially in momentum and impulse material. The use of technology that has not been maximized in learning. One solution to some of these problems is to develop electronic assessments to assess students' critical thinking skills on momentum and impulse materials. This study aims to analyze the practicality of electronic assessment products to assess critical thinking skills on momentum and impulse materials. This research uses the Plomp model. This research reports the development stage in the Plomp model, namely at the one to one and small group practicality test stages. This research instrument is in the form of a practicality questionnaire which is analyzed by percentage technique. The results of the practicality test of the electronic assessment product obtained an average percentage of 89.48 with very practical criteria. Electronic assessment to assess students' critical thinking skills on momentum and impulse material is declared practical for students from the aspects of convenience, attractiveness, efficiency and benefits so that it is feasible to use.

Keywords: Electronic Assessment, Critical Thinking Skills, Practicality

I. INTRODUCTION

Currently, education in Indonesia has entered the 21st century which is characterized by the rapid development of technology and knowledge and has become an important thing in nation building. In this 21st century, requires the Indonesian nation to face challenges that require an increase in the quality of human resources to compete. There are four abilities that must be possessed in the 21st century, namely critical thinking skills, creative and innovative thinking skills, communication skills, and collaboration skills, or commonly known as 4C skills [1]. Among the many skills needed in the 21st century, critical thinking is one of the skills that students need to master in order to face life's obstacles and difficulties. [2]. Critical thinking is very important because it supports learners in analyzing information, solving problems, and making rational decisions in everyday life and the future world of work [3]. In this regard, educators play an important role in cultivating critical thinking skills in students by implementing holistic learning strategies that are student centered. [4].

Critical thinking skills are thinking skills that involve cognitive processes and invite students to think according to their abilities or think reflectively about problems [5]. Critical thinking skills are the ability to process and evaluate information objectively, and reach the right and effective decision [6]. Based on the opinions of experts, it can be concluded that the ability to think critically is the ability of the cognitive process in processing information objectively and making the right decision . The indicators of critical thinking of students are: (1) Providing simple explanations (elementary clarification), including: focusing questions, analyzing arguments, asking and answering questions that require explanation or challenge; (2) Building basic skills (basic support), including: considering the credibility of sources and making observational considerations; (3) Drawing conclusions (inference), including: compiling and considering deduction, compiling and considering induction, compiling decisions and considering the results; (4) Providing advanced clarification, including: identifying terms and considering definitions, identifying assumptions. (5) Organizing strategies and tactics, including: determining an action and interacting with others [7].

Although the urgency of critical thinking has been recognized, the reality is that students' critical thinking skills in physics materials, especially in momentum and impulse materials, are still relatively low. Research

shows that more than half of students find this material difficult to understand, which has an impact on their low learning outcomes and critical thinking skills [8]. Aspects of critical thinking such as reasoning, analysis, and inference are still not optimally mastered by students on the material [9]. One of the main obstacles in developing critical thinking skills is the limitation of assessment instruments that specifically and effectively measure these abilities in Momentum and Impulse material [10].

Based on the results of researchers' observations, it is known that many students still have low critical thinking skills. This is supported by the results of interviews conducted at SMAN 1 Banuhampu which show that there is no assessment that specifically assesses students' critical thinking abilities on momentum and impulse material. In other words, there are only 3 indicators used by physics teachers, namely providing simple explanations, building basic abilities and drawing simple conclusions. The test instrument consists of questions that are still at cognitive level C1-C4, which should be for critical thinking questions starting from C4-C6. In addition, there are still some teachers who do not make special instruments due to lack of time. The application of technology in learning process activities is also still lacking.

As a solution, electronic assessment is one of the technological aids that can be used to help assess students' critical thinking skills. This electronic assessment on momentum and impulse material is integrated through wizer me with the help of a google site that can be accessed easily by students via smartphone. Wizer.me has a simple interface and is easily understood by both teachers and students, so it does not require special technical understanding to operate it. This makes the process of creating and filling out questions faster and more efficient than conventional assessment methods. The platform provides various question types such as multiple choice, essay, matching, puzzle, and complex multiple choice. This variety allows teachers to create assessments that are more interesting and able to accommodate various indicators of critical thinking skills [11]. In addition, this electronic assessment was made with complete critical thinking ability indicators based on the opinion of Ennis (2013) and is at cognitive level C4-C6.

Therefore, it is important to conduct research on the development of electronic assessments to assess critical thinking skills on momentum and impulse material. Several studies have been conducted to develop critical thinking assessments [12]; [13], both in conventional form [14] and in electronic form [15]. The electronic assessment on momentum and impulse material used in this study needs to be tested for practicality through one to one and small groups, so that the products obtained are of higher quality. Practicality is a key aspect in the development of electronic assessments. A practical instrument must be easy to use by teachers and students, efficient in implementation, and able to provide valid and reliable assessment results in a relatively short time. Practicality also includes ease of access, flexibility in presenting questions, and integration with technology-based learning systems [16]. Practical instruments can increase student learning motivation, learning effectiveness, and teacher work efficiency in conducting assessments [17]. Thus, the practicality test is important to see the quality of the product in ease, attractiveness, usefulness and time efficiency for users, namely students.

This study aims to analyze the practicality of electronic assessment products to assess critical thinking skills on momentum and impulse material, with the research question being “how is the practicality of electronic assessments to assess students' critical thinking skills on momentum and impulse material?”

II. METODE

The research conducted was designed based on the Plomp development model. Plomp's development model has three stages, namely: (1) preliminary research, at this stage a needs analysis and literature study are carried out, (2) the prototyping stage, at this stage design, product design, evaluation and revision are carried out, (3) the assessment stage, at this stage a field trial is carried out to obtain questions that are valid and feasible to use [18]. In this study, it is limited to the development stage, namely practicality which consists of one to one and small group

The one to one practicality test analysis was conducted on three students with high, medium and low abilities from class XI Physics 3 at SMAN 1 Banuhampu. In addition to students in this one to one test, researchers involved three physics teachers at SMAN 1 Banuhampu as well. Then after the one to one test was carried out on students and teachers, researchers conducted a small group test analysis. The small group analysis was conducted on nine students with low, medium and high abilities from class XI Physics 2 at SMAN 1 Banuhampu.

The instrument in this study is a questionnaire sheet for the practicality test which includes practicality in terms of ease of use, attractiveness, efficiency, and benefits. The practicality test assessment questionnaire was prepared based on a Likert scale of 1 to 5 with a score category of 1 indicating strongly disagree and a score of 5

indicating strongly agree criteria [19]. The data obtained from the practicality test results were analyzed with the following mathematical equation :

$$P = \frac{f}{N} x\ 100 \qquad (1)$$

$Information$:

P = Final grade

f = Score acquisition

N = Maximum score

Practicality assessment is determined based on the score interpretation criteria obtained based on the percentage of the final score of product practicality such as Table 1 [20].

Table 1. Product Practicality Criteria

Percentage (%)	Criteria
0 – 20	Not Practical
21 - 40	Less Practical
41 – 60	Practical enough
61 – 80	Practical
81 - 100	Very Practical

The product is declared practical and feasible to use if the assessment is in the criteria of quite practical, practical and very practical.

III. RESULTS AND DISCUSSION

Results

Based on the research conducted, the research results from the development stage were identified, which included one to one and small group practicality tests..

One to one

First, at the one to one practicality test stage for three students with low, medium and high abilities. The product practicality instrument consists of four aspects, namely convenience, attractiveness, efficiency, and benefits. Based on the assessment instrument used, it can be analyzed the assessment results for the four aspects of the assessment of the three types of assessments that the researchers developed. The assessment consists of four aspects with a total of 26 indicators consisting of 8 indicators on the aspect of convenience, 8 indicators on the aspect of attractiveness, 4 indicators on the aspect of efficiency and 6 indicators on the aspect of the benefits of the product developed in each type of assesment. The results of the practicality assesment by sstudents are:

Table 2. Results of One to One Practicality Test Analysis students

Aspects	Value	Criteria
Ease	80	Practical
Attractiveness	81,7	Practical
Efficiency	76,6	Practical
Benefits	77,8	Practical
Average	**79,02**	**Practical**

Second, at the stage of one to one practicality test on teachers totaling three physics teachers. The results of the practicality assessment by teachers are as follows:

Table 3. Results of One to One Teacher Practicality Test Analysis

Aspects	Value	Criteria
Ease	97,5	Very Practical
Attractiveness	95	Very Practical
Efficiency	98,3	Very Practical
Benefits	97,8	Very Practical
Average	**97,15**	**Very Practical**

Small Group

At the Small Group practicality test stage for nine students with low, medium and high abilities. The product practicality instrument consists of four aspects, namely convenience, attractiveness, efficiency, and benefits. Based on the assessment instrument used, it can be analyzed the assessment results for the four aspects of the assessment of the three types of assessments that the researchers developed. The assessment consists of four aspects with a total of 26 indicators consisting of 8 indicators on the aspect of convenience, 8 indicators on the aspect of attractiveness, 4 indicators on the aspect of efficiency and 6 indicators on the aspect of the benefits of the products developed in each type of assessment. The results of the practicality assessment by students are:

Table 4. Results of Small Group Practicality Test Analysis

Aspects	Value	Criteria
Ease	88,4	Very Practical
Attractiveness	94,4	Very Practical
Efficiency	92,2	Very Practical
Benefits	94,1	Very Practical
Average	**92,28**	**Very Practical**

Based on the data from the validity analysis for the four aspects of assessment with three types of assessments from each practicality test, the average graph of practicality results for each type of practicality test is obtained as follows:

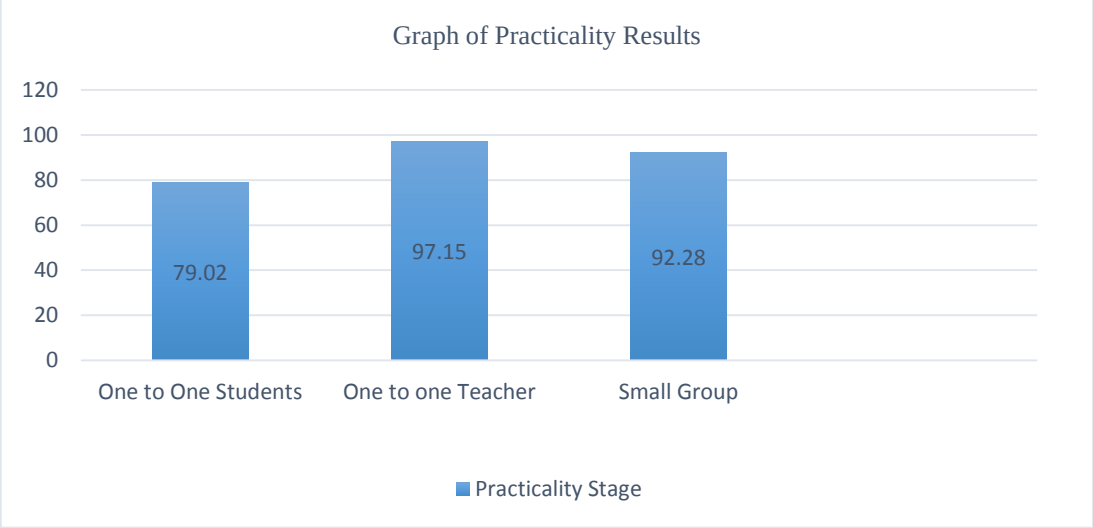

Fig. 1. Average Practicality Test Results

Based on Figure 1, it can be explained that the average value of each type of practicality trial is 79.02 for one to one students, 97.15 for one to one teachers and 92.28 for small group trials with the average value of all types of practicality trials is 89.48. From these results it can be stated that overall the type of electronic assessment is practical and is in the very practical category. Thus, electronic assessment to assess students' critical thinking skills on momentum and impulse material can be used to assess students' critical thinking skills.

Discussion

The electronic assessment in this study was developed to assess students' critical thinking skills on momentum and impulse material. In this discussion, the results of the research that has been carried out for the entire study will be discussed. The following is a description of the discussion. Based on the results of the

practicality test of the three types of trials, it was found that the electronic assessment was very practical to use to assess students' critical thinking skills with an overall average score of 89.48 in terms of the following aspects.

First, the convenience aspect which consists of eight indicators. All indicators in this component are highly practical because the instructions for filling out and using the momentum and impulse assessment presented are easy for students to understand and use. The ease of access and operation is the main reason for the high positive responses from teachers and students [15].

Second, the attractiveness aspect consists of eight indicators. All indicators were categorized as very practical. This is because the design made on the assessment has events related to momentum and impulse that are contextual in everyday life. Furthermore, the appearance of the assessment content is attractive because it is arranged neatly and sequentially. Then this is in line with the display color and illustration of images or videos in the assessment is proportional so that it is interesting to read [21].

Third, the efficiency aspect which consists of four indicators in it with all indicators categorized as very practical. This is because filling in answers, feedback and correction or assessment can be done automatically and quickly. This efficiency is very helpful for teachers in managing time and energy. The results of this study are in line with the use of digital applications for learning assessment that accelerate the process of assessing and reporting results [22]. Then about the implementation of android-based applications for end-of-semester assessments that make it easier for teachers in the process of managing questions, conducting exams, and automatically correcting and recapitulating scores [23].

Fourth, the benefits aspect consists of six indicators. In this benefit aspect, all indicators are very practical. This is because the electronic assessment contains contextual questions that can be used to assess critical thinking skills. Then this electronic assessment can be reused to make similar assessments at different times. This critical thinking skills instrument in physics can be used for physics learning programs as well as to measure the critical thinking skills of students in schools [24]. Furthermore, the benefits of electronic assessment in physics learning, especially to measure critical thinking skills and can be used as an alternative and reference assessment for physics teachers because this assessment instrument is effective in improving students' critical thinking skills [25] .

IV. CONCLUSION

Electronic assessment of critical thinking on momentum and impulse material is an assessment consisting of five aspects of critical thinking in one discourse with each aspect represented by critical thinking indicators. This electronic assessment assessment was developed using wizer me media with the help of google sites that can be accessed via smartphones in html format. This electronic assessment is made to assess the critical thinking skills of grade XI students on momentum and impulse material.

The results of practicality show that the electronic assessment of critical thinking on momentum and impulse material is categorized as very practical in terms of convenience, attractiveness, efficiency and benefits with an average value of the three types of assessments is 89.48. This shows that the developed electronic assessment is feasible to use to assess students' critical thinking skills on momentum and impulse material. Therefore, further research on the practicality and effectiveness of this electronic assessment is highly expected. This electronic assessment can also be developed on other physics materials to assess students' critical thinking skills.

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