

Validity of Phet Simulation Assisted Poe2we Learning Model on Ideal Gas Materials

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Abstract. The purpose of this study was to describe the validity of the POE₂WE model physics learning device assisted by PhET simulation to improve students' critical thinking skills. The learning tools described include the syllabus, lesson plans, LKPD, textbooks and pre-test post-test questions. The research was conducted in class XI SMA Negeri 2 Pasuruan on ideal gases. Descriptive-quantitative data analysis technique by describing and describing the assessment in percentage of agreement. The results showed that the percentage of syllabus validity was 95.75% in the very valid category, the percentage of RPP validity was 96.75% in the very valid category, the LKPD validity was 96.50% in the very valid category, the validity of textbooks was 94.25% with the category is very valid, and the validity of the pre-test post-test is 95.50% with a very valid category. Based on the results of the analysis of the data obtained, it can be stated that the learning device developed is feasible to use with very valid criteria.

Keywords: Validity, Learning Tools, Learning Model, PhET Simulation, Critical Thinking Skills.

1. Introduction

Education is a process of interaction of students with learning resources in an understanding environment as a conscious effort to foster and develop basic human abilities as optimally as possible according to their capacity (Prasiwi and Suliyanah, 2018). Natural Sciences (IPA) subjects are a part of the world of education which plays a role in training students to develop thinking skills and training the behavior or attitudes of students to deal with technological and scientific developments (Haryanti, 2019). One branch of science that studies technological developments is physics. Physics studies natural phenomena in space and time that are often found in everyday life. (Tanti et al., 2016)

Physics is a part of Natural Sciences that studies matters relating to natural phenomena and natural behavior and various forms of symptoms (Pelita, 2011). In essence, learning physics is seen as a product, process, and attitude. This shows that the process and assessment in learning physics must be student-oriented and centered. Good learning is learning that is planned and structured in learning tools. According to Trianto (2012) learning tools are a set of learning resources used by teachers and students in learning activities. The teacher's ability is needed to design meaningful learning activities that are arranged in learning tools. (Salam et al., 2016)(Algiranto et al., 2018) (Scientific-Based Learning on Rotational Dynamics and Rigid Body Equilibrium Materials to Improve Critical Thinking Ability and Verbal Communication of SMA N Setyawan & S Aminah Students, 2017).

Through learning tools, teachers are able to instill skills that are demanded in the 21st century. Critical thinking skills are one of the needs that must be possessed by students in order to face the demands of 21st century skills (Harsono and Suliyanah, 2019). According to Wijaya and Suliyanah (2019) critical thinking is the ability to analyze existing facts then make several ideas and defend these ideas then make comparisons to draw a conclusion to solve existing problems. Therefore, critical thinking skills are skills that must be fulfilled by students.

Critical thinking skills are abilities that are needed by someone in order to be able to deal with various problems faced in social and personal life. Critical thinking skills are a cognitive process of students in systematically and specifically analyzing the problems they face, distinguishing these problems carefully and thoroughly, and identifying and studying information to plan problem-solving strategies (Azizah, 2018). Critical thinking indicators according to Facione (2011) are part of cognitive skills which include interpretation, analysis, evaluation, inference, explanation, and self-regulation. Muna, 2017)

The process of learning physics in the classroom should emphasize giving direct experience to students so they can practice their critical thinking skills (Khotimah and Suliyanah, 2017). One solution to improve critical thinking skills is to apply constructivism learning theory. Constructivism is a learning philosophy based on the premise that reflecting on experience can build and construct knowledge and understanding of the world (Suyono & Hariyanto, 2011). Through constructivism learning, students can be actively involved in finding knowledge through experience (KHOTIMAH, 2017).

One of the learning models that apply constructivism theory is the POE2WE learning model assisted by PhET simulation. Students are required to have a basis for how to make hypotheses and have the ability to test, solve problems, find answers to problems they encounter, express ideas and ideas so that new constructions are obtained (Ambarwati and Suliyanah, 2018). Learning activities in the POE2WE model are by making predictions, then making observations, and making explanations about physics problems (Muna, 2017). (Aminah, 2015).

According to Aminah (2018) before being used in learning activities the learning device should have a valid status. Validity is a measure that shows the level of validity and validity (correctness) of an instrument. An instrument is said to be valid if logically speaking it is in accordance with the contents and aspects expressed (Arikunto, 2010). Therefore, validity is an assessment of a product that is made to show whether or not the product is feasible. The product produced in this study is a learning device. (Maizaliani et al., 2020)

The purpose of this study is to describe the validity of the physics learning device POE2WE learning model assisted by PhET simulation to improve students' critical thinking skills. The learning tools developed consist of syllabus, lesson plans, teaching materials, LKPD, and pre-test post-test questions. (Haryanti et al., 2019).

2. Research Method

The research was conducted at SMA Negeri 2 Pasuruan in the even semester of 2021/2022. The subject of this study was the POE2WE model physics learning device assisted by PhET simulation to improve students' critical thinking skills. Data analysis techniques were analyzed descriptively-quantitatively by describing and explaining the ratings in percentage. The data analysis carried out is the feasibility of the learning device in terms of the aspects of validity and reliability.

The validity used in this study was content validity which was assessed by three expert lecturers from the Department of Physics Education, Nahdlatul Ulama Pasuruan Institute of Technology and Science. The results of the validation show the feasibility of the developed learning tools. The suggestions given by the validator will be revised to produce valid learning tools. (Borich, 2016)(Dola Syamsu et al., 2020)

The learning device is declared valid or feasible if the percentage score is > 61% with the interpretation of the data listed in Table 1.

Table 1. Interpretation Score Criteria

Coeffisient Correlation	Validity Criteria
0% - 20%	Very Less
21% - 40%	Less
41% - 60%	Enough
61% - 80%	Valid
81% - 100%	Very Valid

The reliability of the learning device is based on the percentage level of agreement by the two validators using the percentage of agreement formula (Borich, 1994)

3. Result And Discussion

The validity of the physics learning device POE2WE learning model assisted by PhET simulation includes syllabus validation, learning implementation plans (RPP), student worksheets (LKPD), textbooks and pre-test post-test questions. The results of the validation can be seen in Figure 1.

Based on the graph in Figure 1 it is known that the results of the percentage validity of the syllabus are 95.75% with a very valid category, the percentage validity of lesson plans is 96.75% with a very valid category, the validity of LKPD is 96.50% with a very valid category, the validity of textbooks is 94.25% with a very valid category, and the validity of the pre-test post-test questions is 95.50% with a very valid category. The percentage validity is said to be valid if it is in the range of 61% -80% and is said to be very valid in the range of 81% -100%. The details of each device are as follows.

A. Syllabus Validity Data

The validator's assessment of the syllabus includes aspects of syllabus identity, indicators, learning materials, learning activities, assessment, time allocation and learning resources. The results of the syllabus assessment are presented in Table 3.1 below:

Table 1. Syllabus Validity Results

Assessed Aspects	V1	V2	V3	Average	Category
Syllabus identity	4,00	4,00	4,00	4,00	Very valid
Indicator	4,00	3,50	3,70	3,73	Very valid
Learning materials	3,50	4,00	3,50	3,67	Very valid

Learning activities	3,50	4,00	4,00	3,83	Very valid
Valuation	4,00	4,00	4,00	4,00	Very valid
Time allocation	4,00	4,00	4,00	4,00	Very valid
Learning resources	4,00	3,50	3,33	3,61	Very valid
Final Average Score				3,83	Very valid
Percentage of Agreement				95,75 %	

Detail: V1 = Validator 1; V2 = Validator 2; V3 = Validator 3

Based on the table above, it can be seen that aspects of the achievement of syllabus identity obtain an average aspect score of 4.00. Aspect indicators obtain an average aspect score of 3.75. Aspects of learning materials obtain an average aspect score of 3.67. Aspects of learning activities obtain an average aspect score of 3.83. The assessment and time allocation aspects obtained an average aspect score of 4.00 and the learning resources aspect obtained an average aspect score of 4.00. The average total score of the seven aspects is 3.83 with a very valid validity category.

B. Data Validity of Learning Implementation Plans

The validator's assessment of the RPP includes aspects namely achievement of indicators and learning objectives, materials, steps of learning activities, time, learning methods, and language. The results of the RPP assessment are presented in Table 2 below:

Assessed Aspects	V1	V2	V3	Average	Category
Achievement of learning indicators and objectives	4,00	4,00	4,00	4,00	Very valid
Learning steps	4,00	3,50	3,70	3,73	Very valid
Learning materials	3,50	4,00	3,50	3,67	Very valid
Language	3,50	4,00	4,00	3,83	Very valid
Learning Methods	4,00	4,00	4,00	4,00	Very valid
Time allocation	4,00	4,00	4,00	4,00	Very valid
Final Average Score				3,87	Very valid
Percentage of Agreement				96,75 %	

Detail: V1 = Validator 1; V2 = Validator 2; V3 = Validator 3

Based on the table above, it can be seen that aspects of achievement indicators and learning objectives obtain an average aspect score of 4.00. Aspects of learning materials obtain an average aspect score of 3.67. The aspect of learning steps obtains an average aspect score of 3.73. The time aspect obtained an average aspect score of 4.00. The learning method aspect obtained an average aspect score of 4.00 and the language aspect obtained an average aspect score of 3.83. The average total score of the six aspects is 3.87 with a very valid validity level.

Based on Table 2 above, it can be seen that on average the RPP that has been developed has very valid criteria. In addition, the prepared lesson plans are valid because in terms of format, language, and content they meet or meet the criteria for a good lesson plan (Majid, 2008). However, in the material aspect, the average score is the smallest compared to the other two aspects. This is because improvements still need to be made in terms of writing basic competencies, indicators, learning objectives, and the accuracy between indicators and basic competencies. In addition, it is also necessary to adjust the order of the material with the steps of the guided inquiry model that has been developed, as well as the sequence of preparing lesson plans based on the level of difficulty of the material, starting from the simplest concepts to the most complex concepts. Therefore, the researcher made revisions according to the suggestions from the validator so that it was hoped that after the revision the device would be more able to assist in the learning process.

C. Student Worksheet Validity Data (LKPD)

The validator's assessment of student worksheets includes several aspects, namely aspects of instructions, aspects of the feasibility of the contents of the questions, aspects of language, aspects of questions, brief material and aspects of interest. The results of the assessment are presented in Table 3 below:

Table 3. LKPD Validity

Assessed Specs	V1	V2	V3	Average	Category
Instructions	4,00	4,00	4,00	4,00	Very Valid
The feasibility of the content of the question	4,00	3,50	3,70	3,73	Very Valid
Brief material	3,50	4,00	3,50	3,67	Very Valid
Question	3,50	4,00	3,75	3,75	Very Valid
Language	4,00	4,00	4,00	4,00	Very Valid
Interest	4,00	4,00	4,00	4,00	Very Valid
Final Average Score				3,86	Very Valid
Percentage of Agreement				96,50 %	

Based on the table above, it can be seen that the aspect of achievement of instructions obtains an average aspect score of 4.00. The feasibility aspect of the content of the questions obtained an average aspect score of 3.73. Aspects of brief material obtain an average aspect score of 3.67. The question aspect obtained an average aspect score of 3.75. The language aspect gets an average aspect score of 4.00 and the interest aspect gets an average aspect score of 4.00. The average total score of the six aspects is 3.86 with a very valid validity level.

D. Textbook Validity Data Description

Another learning tool that is validated is the Textbook. Textbook development was carried out based on the results of the researcher's study of: (1) analysis of student characteristics (aiming to determine the level of cognitive development, background knowledge, and socio-cultural background of students); (2) task analysis (used to identify the selected material); (3) analysis of objectives (to determine the fundamental problems encountered in the validation of this PhET Simulation-assisted POE2WE learning tool based on the curriculum developed by the directorate of high school development, relevant learning theories, and future demands). The student textbook which was developed based on some of the considerations above, was then validated by 3 experts with the results shown in Table 4.

Table 4. Textbook Validity

Assessed Aspects	V1	V2	V3	Average score	Category
Analysis of student characteristics	3,50	3,70	3,50	3,57	Very valid
Eligibility of contents	4,00	3,50	3,70	3,73	Very valid
Task analysis	3,50	4,00	3,80	3,77	Very valid
Goal analysis	4,00	4,00	4,00	4,00	Very valid
Final Average Score				3,77	Very valid
Percentage of Agreement				94,25 %	

Based on the table above, it can be seen that the achievement aspect of the analysis of student characteristics obtained an average aspect score of 3.57. The feasibility aspect of the content of the questions obtained an average aspect score of 3.73. The task analysis aspect obtained an average aspect score of 3.77 and the objective analysis aspect obtained an average aspect score of 4.00. The average total score of the six aspects is 3.77 with a very valid validity level.

E. Data Description Validity Pre-test Post-test

The validator's assessment of Student worksheets includes several aspects, namely material aspects, construction aspects, and language aspects. The results of the assessment are presented in Table 3.5 below:

Table 5. Result of Validity Pre-test Post-test

Asspek yang Dinilai	V1	V2	V3	Skor Rata-Rata	Kategori
Materi	3,80	3,70	3,85	3,78	Sangat valid
Konstruksi	4,00	3,70	3,70	3,80	Sangat valid
Bahasa	3,80	4,00	3,80	3,87	Sangat valid
Skor Rata-Rata Akhir				3,82	Sangat valid
Percentage of Agreement				95,50%	

Based on the table above, it can be seen that the aspect of material achievement obtains an average aspect score of 3.78. The language aspect has an average aspect score of 3.87 and the construction aspect has an average aspect score of 3.80. The average total score of the three aspects is 3.82 with a very valid validity level.

4. Conclusion

At this stage the learning tools are in the form of syllabus, lesson plans, textbooks, LKPD and pre-test post-test questions that have been completed in consultation with the supervising lecturer to obtain input and suggestions. Learning tools in the form of syllabus, lesson plans, textbooks, LKPD and pre-test post-test questions which have been corrected according to input and suggestions from the supervisor are then validated by the validator.

The results of the validation of learning tools show that the syllabus, lesson plans, textbooks, worksheets and pre-test post-test questions prepared are feasible to be implemented in schools with revisions according to the suggestions and comments given. The validation results are then followed up with revisions according to the suggestions and comments from the validator. The results of the validation of learning tools are that the syllabus has an average of 95.75%, lesson plans have an average of 96.75%, textbooks have an average of 96.50%, LKPD has an average of 94.25%, and Pretest Posttest has average 95.50%.

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