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VALIDITY OF SCIENCE LEARNING DEVICES WITH *CASE-BASED LEARNING* MODEL ASSISTED BY PHET MEDIA

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Abstract
The purpose of this study is to test the level of validity of developing learning devices with the CBL model assisted by PhET media. The method used is the research and development method. The results of the initial study show that the critical thinking ability of students at Waru Barat 4 State Elementary School in Pamekasan in science subjects is still low, as evidenced by students' difficulty in analyzing. HOTS questions are given by teachers because the learning activities carried out at school tend to be rote learning. Therefore, the researcher developed a CBL learning tool with the help of PhET media which includes lesson plans, teaching modules, student activity sheets, assessment sheets, and textbooks that can improve students' critical thinking skills. The purpose of this study was to obtain a valid learning tool. Based on the results of the validity test conducted with three education experts, it was found that the learning tool developed met the valid category so that it could be implemented to improve the critical thinking skills of elementary school students.
Keywords: Validity of Learning Devices, Case Based Learning Model, PhET Media

Abstrak
Tujuan peneitian ini adalah untuk menguji tingkat ke validitan develop learning devices with the CBL model assisted by PhET media. metode yang digunakan yakni metode penelitian dan pengembangan. adapun hasil studi awal menunjukkan bahwa kemampuan berpikir kritis siswa Sekolah Dasar Negeri Waru Barat 4 Pamekasan pada mata pelajaran IPA masih rendah, dibuktikan dengan siswa kesulitan menganalisis soal HOTS yang diberikan guru karena kegiatan pembelajaran yang dilakukan di sekolah cenderung bersifat hafalan. Oleh karena itu, peneliti mengembangkan perangkat pembelajaran CBL berbantuan media PhET yang meliputi RPP, Modul Ajar, Lembar Kegiatan Peserta Didik (LKPD), Lembar Penilaian dan Buku Ajar yang dapat meningkatkan kemampuan berpikir kritis peserta didik. Tujuan dari penelitian ini adalah untuk memperoleh perangkat pembelajaran yang valid. Berdasarkan hasil uji validitas yang telah dilakukan dengan 3 orang ahli pendidikan diperoleh bahwa perangkat pembelajaran yang dikembangkan memenuhi kategori valid sehingga dapat diimplementasikan untuk meningkatkan kemampuan berpikir kritis siswa sekolah dasar.
***Kata kunci**: Validitas Perangkat Pembelajaran, Model Pembelajaran Berbasis Kasus, Media PhET*

INTRODUCTION

The 21st-century learning approach is designed to assess learning achievement, including aspects of knowledge that include critical thinking skills (Muhali, 2019). Critical thinking is a must for students to face the complexity of life in the future because the ability of a

thinker to account for the student's thinking includes cognitive competence. (Sari, Damayanti, Handayani, & Nurokhman, 2021). One of the learning activities that involves critical thinking aspects in finding concepts and theories of lessons is science/science and technology learning. Science and technology learning, especially at the elementary school level, is a group of subjects that must be applied to students to introduce, respond to, and appreciate science and technology. In addition, another goal is to instill critical, creative, and independent scientific thinking and behavior. (Permendiknas, 2006). This is also per what is expected in the independent curriculum, is that science/science learning must train critical, analytical thinking skills, the ability to conclude, and foster curiosity and scientific principles (Kemendikbud, 2022). Other studies note that critical thinking skills are considered one of the most important aspects of thinking to be integrated into learning activities. Therefore, it is advisable to include these skills in the curriculum and learning approaches and make them a must at all levels of education (Alsaleh, 2020).

Based on the results of observations that have been conducted at one of the elementary school levels in Pamekasan Regency, students' critical thinking skills are still relatively low. This problem is evidenced by the presence of students who still have difficulty conveying their ideas and understanding science material, in addition, students are weak in analyzing HOTS (*Higher Order Thinking Skill) questions* given by teachers, and students are still unable to take responsibility for their answers so they still depend on the teacher to answer questions. The low results of the analysis of students' critical thinking skills are caused by learning activities that tend to memorize and teachers do not implement learning activities that can train critical thinking skills, so students do not understand the importance of having critical thinking skills. This is relevant to previous studies that reported that students' critical thinking skills are still underdeveloped or still low as evidenced by the value of the results of the analysis of students' answers to HOTS questions that do not meet the critical thinking indicators (Nuryanti, Zubaudah, & Diantoro, 2018). Other studies also suggest that the low critical thinking skills of students are caused by the learning process that is less effective in developing interests, talents, and potential in students. (Anisa, Ipungkarti, & Saffanah, 2021). In addition, other researchers also stated that the cause of low critical thinking skills is because students are not yet familiar with indicators of critical thinking skills and the learning applied does not empower students' ability to think critically (Agnafia, 2019). Patonah in 2014 also revealed that science learning applied in schools tends to memorize rather than develop thinking skills so students find it difficult to think critically (Patonah, 2014).

Efforts that can be made to overcome the problem of low critical thinking skills of students include implementing the *Case Based Learning* (CBL) model. CBL Model or case-based learning is project-based and problem-based learning that requires students to solve clinical cases to understand learning concepts (Dewi & Hamid, 2015). Through CBL, students can be guided to understand concepts concretely, improve analytical skills, develop problem-solving skills, and practice applying theories in relevant contexts (Salsabila & Nofrion, 2023). Through CBL learning, students are invited to analyze the

relationship between the theories they have understood and the phenomena that occur in everyday life (Mutmainnah & Pitoyo, 2019). The application of the CBL model by teachers in learning allows students to overcome and find solutions to investigation cases (Fa'izah & Wulandari, 2023). The characteristics of the CBL learning model are very appropriate when applied in a science learning process that can improve students' thinking skills, especially at the elementary school level.

In this study, CBL learning is combined with the use of technology-based learning media, namely *Physics Education Technology* (PhET). This is because critical thinking skills in science subjects for elementary school students will be more difficult to apply without the support of learning media that are the content. (Nefrita, 2019). To improve students' critical and creative thinking skills, technology-based activities can be applied in the form of simulation media. By utilizing technology, students' understanding of scientific concepts becomes more real because they can practice and directly understand the material being studied. In addition, the use of technology can increase learning motivation because they can build their knowledge related to the concepts that have been understood (Nefrita, 2019). Yusuf & Widiyaningsih in their research stated that learning assisted by PhET media can improve students' *higher-order thinking Skills*, including critical thinking skills. Learning supported by (Yusuf & Widyaningsih, 2024) PhET-based media is more effective in improving students' science process skills, compared to conventional learning (Haryadi & Pujiastuti, 2019). This study combines the CBL model with the help of PhET media because science and technology are interrelated. PhEt provides a simulation of science concepts and can be used directly by students. The use of PhET provides a representation of various scientific concepts so that what is invisible becomes visible, can make it easier for students to conduct experiments, and is fun to do, especially for elementary school students (Inayah & Masruroh, 2021).

METHOD

The method used in this study was the research and development method to develop a learning tool with the CBL model using PhET media, with a focus on training the critical thinking skills of fourth-grade elementary school students in science subjects. The tools developed following the independent curriculum include lesson plans, teaching modules, student activity sheets, assessment sheets, and student textbooks. The CBL learning tools with the help of PhET media were validated by 3 education experts who provided input on the learning tools that had been compiled. The instrument developed in this study is a learning tool validation instrument that aims to determine the validity of CBL learning tools. The reliability calculation of the CBL learning model validation sheet instrument is based on the statistical analysis results of the percentage of agreement (R) (Borich, 1994). The learning tool is said to be valid if it meets the following criteria:

Table. Criteria for Learning Device Validation Assessment

SCORE INTERVAL	ASSESSMENT CATEGORY	INFORMATION
3.6 ≤P ≤4	Very Valid	Can be used without revision
2.6 ≤P ≤3.5	Valid	Could use some revision
1.6 ≤P ≤2.5	Less Valid	Can be used with multiple revisions
1 ≤P ≤1.5	Invalid	Not yet usable and still requires consultation

(Ratunaman & Laurens, 2006)

RESULTS AND DISCUSSION

Scientific-based learning tools that have been developed are said to be valid if they show a need, are state-*of-the-art* , have a strong theoretical basis, and there is consistency between model components. The ATP (Learning Objective Flow) developed is oriented towards the Independent Curriculum with the material of **Style Around Us** . The validation results from three validators are shown in Table 2 below:

Table. Learning Objective Flow Validation Results

NO	COMPONENTS/INDICATORS	EVALUATION			AVERAGE	CATEGORY
		V1	V 2	V 3		
I.	**IDENTITY**					
1.	ATP load Name school, Name eye lesson, class/phase	4	4	4	4 ,00	**V**
II.	**ACHIEVEMENTS LEARNING**					
2.	Contains learning outcomes comprehensively complete in accordance with decision head BSKAP number. 008/KR/2022	4	4	4	4.00	**SV**
III.	**OBJECTIVE LEARNING**					
3	Objective learning load competence attitude, knowledge, And skills load content in accordance with achievement learning.	3	3	4	3, 33	**SV**
IV.	**ALLOCATION TIME**					
4	Load allocation time with amount equal to the number of hours intracurricular per year.	4	4	4	4.00	**SV**
V.	**MATERIAL LEARNING**					
5	Load material learning Which essential according to achievement learning.	4	4	4	4.00	**SV**
VI.	**ETC**					

6	Loading learning methods/models assessment that can be evaluate attitude, knowledge, And skills. Learning resources glossary.	3	4	4	3, 67	**V**
AMOUNT		**22**	**2 3**	**24**	**23**	
AVERAGE		**3, 67**	**3, 83**	**4.00**	**3, 83**	**SV**
PERCENTAGE OF AGREEMENT		**88.27%**				

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

SV = Very Valid; V = Valid

Based on the validation data above, it shows that the Learning Objective Flow (ATP) developed is categorized as very valid with an average value of 3.83 and *a Percentage of Agreement* or conformity between validators 1, 2 and 3 of 88.27%. The results of the validation of the teaching module that has been developed are shown in Table 3 below:

Table. Results of Teaching Module Validation

NO	COMPONENTS/INDICATORS	EVALUATION			AVERAGE	CATEGORY
		V1	V 2	V 3		
I.	**IDENTITY**					
1	Load Name school, Name eye lesson, class/phase.	4	4	4	4.00	**SV**
II.	**OBJECTIVES LEARNING**					
2	Load objective learning in accordance with ATP	4	4	4	4.00	**SV**
III.	**ACTIVITY LEARNING**					
3	**A. Introduction** Contains activities for to condition student so that Ready follow learning, including existence question lighter.	4	3	4	3 ,67	**V**
4	**B. Core activities** Learning Activities pay attention to readiness, interest, and student learning character (differentiated learning) student-centered learning by using the method or model that stimulates students to have skills high thinking (HOTS and 4C). develop literacy and numeracy, strengthen student profile Pancasila.	3	3	3	3, 00	**V**
5	**C. Activity Closing** There is activity reflection by	4	4	4	4.00	**SV**

	student And Teacher.					
IV.	**ASSESSMENT**					
6	There is activity assessment beginning, assessment formative, assessment summative activity assessment load competence attitude, knowledge And skills. There is activity remedial And enrichment.	3	3	4	3, 33	**V**
V.	**ATTACHMENTS**					
7	Contains learning materials and examples of remedial and assessment enrichment.	4	4	4	4.00	**SV**
AMOUNT		**24**	**25**	**2 7**	**25.3 3**	
AVERAGE		**3.42**	**3, 5**	**4.00**	**3.85**	**SV**
PERCENTAGE OF AGREEMENT				**92.18%**		

Based on the validation data of the developed Teaching Module, an average value of 3.85 was obtained, which means that the developed teaching module has a very valid category so that it can be used in the science learning process. Likewise, the suitability value or *Percentage of Agreement* between the three validators shows a value of 92.18% appropriate. The validation results of the LKPD that has been developed are shown in Table 4 below:

Table. Results of Validation of Student Activity Sheets

NO	COMPONENTS/INDICATORS	EVALUATION			AVERAGE	CATEGORY
		V1	V2	V3		
I.	**PRESENTATION**					
1	Clarity news material	4	4	4	4.00	**SV**
2	Arrangement illustration/picture	4	4	3	3.67	**SV**
3	Arrangement order location	4	3	3	3, 33	**V**
II.	**LANGUAGE**					
1	Compliance Languageused with EYD	4	4	4	4.00	**SV**
2	Simplicitystructure sentence	4	3	4	3.66	**SV**
3	Clarity instructionsand directions	3	3	4	3.33	**SV**
4	Sentence question Nomeaningful double	3	4	4	3.67	**SV**
5	Characteristic Communicative Language Which Used	4	4	4	4.00	**V**
III.	**CONTENTS**					
1	Compliance with indicator achievement	4	3	3	3.33	**SV**

	results Study					
2	Truth of content/material support clarity of material	4	4	4	4.00	**SV**
3	Compliance Worksheetwith need participant educate	3	3	4	3.33	**SV**
4	Eligibility asdevice learning	3	4	3	3.33	**SV**
IV.	**DESIGN WORKSHEET**					
1	Appearance order locationon the cover of LKPD (title, illustration, logo,etc.) is arranged in a way harmonious	3	4	4	3.67	**V**
2	The letter used interesting and easy-read	3	4	4	3.67	**SV**
3	The placement order location(title, illustration) on every page consistent	4	3	4	3.67	**SV**
4	No use too Lots typeletter	4	4	4	4.00	**SV**
5	Color And order location harmonious and to clarify the function	4	4	4	4.00	**SV**
6	Picture Which served interesting Andsupport clarity material	4	4	3	3.67	**SV**
AMOUNT		**66**	**66**	**67**	**66.64**	
AVERAGE		**3.67**	**4.00**	**3.78**	**3.70**	**V**
PERCENTAGE OF AGREEMENT		**95.7%**				

The validation results data of the Student Activity Sheet (LKPD) that has been developed obtained an average of 3.70 with a very valid category. The conformity value between the three validators is 95.7%. The results of the validation of the student learning outcome assessment sheet are shown in Table 5 below:

Table. Validation Results of Student Learning Outcome Assessment Sheets

NO	**COMPONENTS/INDICATORS**	**EVALUATION**			**AVERAGE**	**CATEGORY**
		V1	**V2**	**V3**		
I.	**CLARITY**					
1	Clarity of each question item	4	4	4	4.00	**SV**
2	Clarity of instructions for filling in questions	3	3	4	3, 33	**V**
II.	**ACCURACY OF CONTENT**					
1	Language appropriateness to the developmental level of autistic children	4	4	4	4.00	**SV**
2	Accuracy of question form with KIKD	3	4	4	3.67	**SV**
III.	**RELEVANCE**					

1	Questions related to the material	4	3	4	3.67	**SV**
IV.	**VALIDITY OF CONTENT**					
1	Level of truth of the item	4	3	4	3, 67	**V**
V.	**NO BIAS**					
1	The question item contains one complete idea	4	4	4	4.00	**SV**
2	The words used do not have a ouble meaning	3	4	3	3.33	**SV**
VI.	**LANGUAGE ACCURACY**					
1	The language used is easy to understand	4	4	4	4.00	**SV**
2	The language used is effective	4	4	4	4.00	**SV**
3	Writing according to EYD	4	4	4	4.00	**SV**
AMOUNT		**41**	**41**	**4 3**	**41.6 7**	
AVERAGE		**3, 72**	**3.72**	**3.90**	**3, 78**	**V**
PERCENTAGE OF AGREEMENT				**93.9%**		

The validation data of the *Pretest* and *Posttest Assessment Sheets* show a valid category with an average of 3.78. Meanwhile, the conformity value between the three validators is 93.9%. The observation sheet of learning activities was observed when students were making presentations and discussing the results of the experimental activities. The results of the validation of the observation sheet of learning activities during the presentation are shown in Table 6 below:

Table. Results of Validation of Learning Activity Observation Sheets during Presentation

NO	COMPONENTS/INDICATORS	EVALUATION			AVERAGE	CATEGORY
		V1	V2	V3		
1	Use of Language	4	4	4	4.00	**SV**
2	Clarity of Delivery	3	4	4	3.67	**SV**
3	Communicative	3	3	4	3.33	**V**
	Truth of Concept	4	4	4	4.00	**SV**
AMOUNT		**14**	**15**	**16**	**15**	
AVERAGE		**3.50**	**3.75**	**4.00**	**3.75**	**SV**
PERCENTAGE OF AGREEMENT				**93.33%**		

The results of the validation of the observation sheet for learning activities during the discussion are shown in Table 7 below:

Table. Results of Validation of Observation Sheets for Learning Activities during Discussion

NO	COMPONENTS/INDICATORS	EVALUATION			AVERAGE	CATEGORY
		V1	V2	V3		
1	Listen	4	4	4	4.00	**SV**

2	Non-verbal communication (eye contact, body language, posture, facial expressions, voice)	3	3	4	3.33	**V**
3	Participation (conveying ideas, feelings, thoughts)	3	3	4	3.33	**V**
AMOUNT		**10**	**10**	**4**	**10.66**	
AVERAGE		**3.33**	**3.33**	**4.00**	**3.55**	**SV**
PERCENTAGE OF AGREEMENT		**90.86%**				

The validation data of the Learning Activity Observation Sheet when students were conducting discussions and presentations were categorized as very valid with an average of 3.75 for discussion activities and 3.55 for presentation activities. The suitability values of the three validators were 93.33% and 90.86% respectively. Student Textbooks are handbooks used by students in learning activities. The student books developed in this study contain science subjects for elementary school students including chapter 3 material on Forces Around Us. The validation results of the Student Textbooks are shown in Table 8 below:

Table. Results of Student Textbook Validation

NO	COMPONENTS/INDICATORS	EVALUATION			AVERAGE	CATEGORY
		V1	V2	V3		
I.	**CONSTRUCTION FEASIBILITY**					
1	The breadth of material is following SK and KD	3	4	4	3, 67	**SV**
2	The depth of the material is under SK and KD	4	3	3	3.33	**SV**
3	The truth of the material presented is the truth of facts, concepts, theories, and principles.	3	4	4	3.67	**SV**
4	The content of the material presented is up-to-date per scientific developments.	3	4	4	3.67	**SV**
5	Suitability of illustrations to the material presented	4	3	3	3.33	**SV**
6	Feature updates	3	4	3	3.33	**V**
II.	**PRESENTATION ELIGIBILITY**					
1	Sequence of concept presentation	3	4	4	3.67	**SV**
2	Integrating interrelated concepts	4	4	4	4.00	**SV**
3	Consistency of the writing system	3	3	4	3.33	**SV**
4	Attractive presentation	4	4	4	4.00	**SV**
5	Presenting concrete examples from the environment	3	4	4	3.67	**SV**
III.	**LANGUAGE ELIGIBILITY**					
1	Suitability to the level of student development	4	3	4	3.67	**SV**
2	Good and correct use of Indonesian	4	3	4	3.67	**SV**

3	Correctness of sentence structure	4	4	4	4.00	**SV**
AMOUNT		**49**	**5 3**	**50**	**54.34**	
AVERAGE		**3, 50**	**3.78**	**3.92**	**3, 64**	**V**
PERCENTAGE OF AGREEMENT				**96.24%**		

Based on the validation data above, it shows that the Learning Objective Flow (ATP) developed is categorized as very valid with an average value of 3.83 and *a Percentage of Agreement* or suitability between validators 1, 2, and 3 of 88.27%. Based on the validation data of the Teaching Module that has been developed, an average value of 3.85 was obtained, which means that the teaching module that has been developed has a very valid category so that it can be used in the science learning process. Likewise, the suitability value or *Percentage of Agreement* between the three validators shows a value of 92.18% appropriate. The validation data of the Student Activity Sheet (LKPD) that has been developed obtained an average of 3.70 with a valid category. The suitability value between the three validators is 95.7%. The validation data of the *Pretest* and *Posttest Assessment Sheets* show a valid category with an average of 3.78. While the suitability value between the three validators is 93.9%. Validation result data of Assessment Sheet Validation result data of the developed textbook obtained an average of 3.88 with a very valid category. The suitability value between the three validators was 96.24. Thus, it can be concluded that the Case Based Learning model learning device assisted by PhET media to improve critical thinking skills obtained a valid category which means it can be implemented for science learning activities in elementary schools.

CBL involves students in the process of acquiring problem-solving skills that link learning concepts to real-world contexts. Thus, this learning involves cognitive aspects that encourage students to think critically and improve their communication skills (Norawati & Puspitasari, 2022). Other studies have shown that CBL can make students active in finding new ideas when faced with a case so that students are actively motivated in learning activities. (Ariyanto & Fauziah, 2020). Through the application of the CBL learning model, students can develop the ability to find concrete solutions, improve communication skills, and have the ability to find literature sources that are relevant to their ideas and reasoning abilities (Lina & Wulandari, 2023). It is important to investigate critical thinking skills because this is an ability that students need to face various challenges in the future, including making personal and social decisions in life. (Sari, Syarifah, Damayanti, Handayani, & Nurokhman, 2021). Students need to be trained in critical thinking skills to be able to build quality thinking so that they can achieve learning goals and have an impact on everyday life. Other researchers also stated that science learning in the independent curriculum is carried out by involving students in designing experimental activities so that they can train scientific thinking skills (Ariani, 2023). Critical thinking as a whole involves mental operations so that learning can be more meaningful for students (Syafitri, Armanto, & Rahmadani, 2021). In addition, previous research also suggests that critical thinking needs to be assessed by teachers because it involves a series of cognitive processes and mental skills such as interpretation, evaluation, intervention, explanation and self-regulation (Behar & Niu, 2011). This

contrasts with the views of other researchers who indicate that the lack of critical thinking skills in students, among other things, comes from a lack of enthusiasm for learning (Amalia, Rini, & Amaliyah, 2021).

To train critical thinking skills that can increase students' learning motivation, a technology-based learning process can be applied. (Alsaleh, 2020). Learning that uses technology, such as PhET media, can be applied in various learning models. One of the effective learning models for developing thinking skills critical is model learning Case Based Learning (CBL). To train critical thinking skills that can increase students' learning motivation, a technology-based learning process can be applied. (Alsaleh, 2020). Learning that uses technology, such as PhET media, can be applied in various learning models. One of the effective learning models for developing thinking skills critical is model learning Case Based Learning (CBL). PhET which is combined with the CBL model can be used by students to obtain data and facts like in the actual laboratory so that it is easier for Teachers to do science experiment activities without having to bring equipment for experimental activities (Haryadi & Pujiastuti, 2019). This can increase students' learning motivation and train students' problem-solving abilities, especially in science learning. (Susilawati, Yusrizal, Halim, Syukri, Khaldun, & Susanna, 2022). The use of PhET is considered effective as a learning aid to improve students' understanding of concepts through practical activities (Inayah & Masruroh, 2021). Students' *Higher Order Thinking Skills (HOTS)* can be improved by implementing PhET media so that it can be an opportunity for teachers to encourage students to achieve learning goals (Yusuf & Widyaningsih, 2024). PhET technology as an alternative media for practical activities effectively encourages productive exploration of authentic scientific phenomena. And give the animation that is credible For guide process think student. (Wieman, Adams, Loeblein, & Perkins, 2010). Nefrita (2019) also reported that learning assisted by PhET media showed more significant results than without learning media.

CONCLUSION

Validity tests that have been carried out on various learning tools, including Learning Objective Flow (ATP), Teaching Modules, Student Activity Sheets (LKPD), Assessment Sheets, and Textbooks, show that the tools developed meet the valid category. Based on the results of the analysis involving three expert validators, the tool obtained an average agreement score (Percentage of Agreement) of 92.92%. This percentage indicates that the learning tool that has been developed has met the required validity standards and can be used in the learning process. One of the main advantages of this tool is the application of the Case-Based Learning (CBL) model combined with PhET media. The CBL model allows students to learn through real cases, so that they can develop critical thinking skills better. In science learning at the primary school level, this approach is very relevant because it trains students to analyse problems, look for solutions, and connect theory with phenomena that they encounter on a daily basis. Meanwhile, the use of PhET as a technology-based learning medium provides opportunities for students to conduct simulations and experiments interactively, which in turn can improve their understanding of scientific concepts. With high validity results, this CBL and PhET-based learning tool

can be applied in teaching and learning activities to improve the critical thinking skills of elementary school students. The success of this tool also shows that the combination of case-based learning and technology can be an effective solution in improving the quality of science learning. Therefore, it is hoped that the implementation of this tool can help create a more interactive, meaningful, and challenging learning experience for students, as well as encourage them to become active and independent learners.

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