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A Validity of E-LKPD Based on Problem Based Learning for Improve Critical Thinking Skill

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ABSTRACT

Purpose of the study: This study aims to determine the validity of the developed E-LKPD.

Methodology: The data obtained from the experts were analyzed by considering comments or suggestions using the Content Validity Ratio (CVR) and Content Validity Index (CVI). This E-LKPD product validation sheet was validated by 7 experts, namely 2 lecturers from the Malaysian University of Technology, 2 lecturers from Sriwijaya University, 2 junior high school teachers, and 1 Laboratory Practitioner. This product is validated in the aspects of design, content, Problem Based Learning, and aspects of students' critical thinking skills.

Main Findings: The results of the validity of the E-LKPD conducted by 7 validators are allowed to be used. because the overall value of the E-LKPD aspect (S-CVI / AVE) is 0.95 and falls into the category of a very strong level of validity. while the S-CVI /UA score is 1 so that it can prove this product can be used for teaching materials from teaching and can improve students' thinking skills through the problem-based learning model.

Novelty/Originality of this study: The novelty of this research lies in the validators who validated this E-LKPD so that it can be developed into a better product using CVR and CVI.

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1. INTRODUCTION

In the world of education, the effectiveness of the teaching and learning process is determined by quality teaching materials [1]. Quality teaching materials are teaching materials that adjust to student characteristics, learning materials, and student motivation [2]. However, this cannot be separated from teachers who can teach material with the latest innovations [3], [4]. One innovation that continues to grow in this field is the development of E-Learner Worksheets (E-LKPD). A well-designed E-LKPD can help students develop various competencies, including critical thinking skills and in accordance with the demands of learning in the 21st century [5], [6]. Electronic learner worksheets are one of the media integrated with technology that can attract the attention of students so that they do not feel bored, so they can include images, material, animations, work steps and ways that are different from what is usually done [7], [8].

In the context of science education, critical thinking skills are essential to help students understand scientific concepts well and encourage independent problem solving [9]. One of the problems that is relevant and close to students' daily lives is the problem of cloudy water that can be found in the surrounding environment.

Through the application of this material, students are expected to not only understand mixture separation techniques using filtration, but also be able to identify environmental problems and think critically to find solutions from everyday life [10], [11]. This E-LKPD designed based on PBL provides real problem scenarios to students, encouraging them to think critically in finding solutions through an active learning process. However, in order for this E-LKPD to be effective and right on target, it needs to be validated to ensure the validity of the design, content, application of PBL, and development of students' critical thinking skills. The validation is conducted using the *Content Validity Ratio* (CVR) and *Content Validity Index* (CVI) methods, where experts will evaluate important aspects such as the feasibility of the LKPD design, the accuracy of the material and content, conformity with PBL principles, and the potential for improving critical thinking skills.

Through this validation process, the LKPD will be evaluated and refined based on input from experts, resulting in learning products that are valid, practical, and effective [12]. The validation results are expected to produce EFLs that not only meet scientific standards but are also relevant to student needs, encourage the development of critical thinking skills, and foster real and applicable environmental awareness [3], [13]. Therefore, the validity of this teaching material must be carefully tested to ensure that the E-LKPD is not only relevant to the curriculum but also effective in encouraging the development of students' critical thinking skills [14], [15]. In making problem-based learning-based E-LKPD on filtration material used to train students' critical thinking skills. It is necessary to have validation from experts so that it can be known the suitability of the media before it is developed so that a good problem-based learning-based E-LKPD is obtained and can be used to train students' critical thinking skills. With the above background, the researcher conducted research with the aim of determining the validity of the E-LKPD that was developed.

2. RESEARCH METHOD

This research is a research and development using the Rowntree development model with 3 stages, namely planning, development and evaluation. At the evaluation stage, an expert review was conducted to see the validity level of the product developed. The data obtained from the experts were analyzed by considering comments or suggestions using the Content Validity Ratio (CVR) and Content Validity Index (CVI). This E-LKPD product validation sheet was validated by 7 experts, namely 2 lecturers from the Malaysian University of Technology, 2 lecturers from Sriwijaya University, 2 junior high school teachers, and 1 Laboratory Practitioner. This product is validated in the aspects of design, content, Problem Based Learning, and aspects of students' critical thinking skills. The design aspect is important because an attractive design can increase student motivation and attention [16]. The content aspect helps students build knowledge holistically and can help students understand the material better [17]. The Problem Based Learning aspect is influential in emphasizing students' active involvement in the learning process to use real situations or relevant problems to develop critical, analytical, and collaborative thinking skills [18]. Therefore, the critical thinking aspect can be improved because students are given the opportunity to analyze relevant information, evaluate possible solutions, and formulate arguments to support their choices [19].

Analysis of expert validation results using the Content Validity Ratio (CVR) and Content Validity Index (CVI) with a score of 1 and 0 [20].

Table 1. CVR and CVI score criteria

Criteria	Weight
Yes	1
No	0

Measuring content validity for each item can be seen with CVR and I-CVI scores. Calculating the CVR and I-CVI values can be done using the formula below [21]:

$$CVR = \frac{ne - \frac{N}{2}}{\frac{N}{2}} \qquad \text{…....(1)}$$

$$I - CVI = \frac{ne}{N} \qquad \text{.....(2)}$$

ne : Number of validators who agree
N : Total Validators

Meanwhile, to determine the content validity of the entire product, it is calculated using the CVI formula. Then calculating the CVI value can be with the formula below:

$$CVI = \frac{CVR}{Jumlah\ sub\ pertanyaan} \quad \text{……(3)}$$

The CVI is the average of the CVR scores for all items that met the CVR threshold of 0.78 and was retained for the final instrument. Some suggest a CVI value exceeding 0.70; however, others suggest a CVI value exceeding 0.80 is preferable. In many situations, it is more efficient to report the overall CVI value rather than individual item CVRs. UA (Universal Agreement) indicates that the experts agree with the developed aspects of the product. S-CVI/UA was used to measure the proportion of relevant I-CVI. S-CVI/Ave is used to measure the average I-CVI for all items. PC (Probability of chance agreement), N (Number of experts), and A (Number of experts who consider an item relevant). Kappa values more than 0.74 are superior, 0.60 to 0.74 are good, and 0.40 to 0.59 are acceptable [22].

3. RESULTS AND DISCUSSION

The developed E-LKPD is made to train students' critical thinking skills integrated with problem-based learning.

Table 2. Result of E-LKPD Validation from Content Aspect

No.	Statement	Expert							Ne	CVR	I-CVI	UA	PC
		V1	V2	V3	V4	V5	V6	V7					
1	The materials and activities presented are in accordance with the learning outcomes of the independent curriculum	1	1	1	1	1	1	1	7	1	1	1	0.008
2	Materials and activities presented are in accordance with the learning objectives	1	1	1	1	1	1	1	7	1	1	1	0.008
3	The materials and activities presented can encourage learners to achieve at least 1 of the dimensions of the Pancasila learner profile	1	1	1	1	1	1	1	7	1	1	1	0.008
4	The material presented is in accordance with the concepts that apply in science subjects	1	1	1	1	1	1	1	7	1	1	1	0.008
5	Notations, symbols, icons presented are correct according to the prevalence in science subjects	1	1	1	1	1	0	1	6	0.7	0.86	0	0.055
6	The material presented is factual, which is in accordance with the development of science knowledge	1	1	1	1	1	1	1	7	1	1	1	0.008
7	Selected literature is up-to-date	1	0	1	1	1	1	1	6	0.7	0.86	0	0.055
8	The images, diagrams, illustrations, and videos presented are correct	1	0	1	1	1	1	0	5	0.4	0.71	0	0.164
9	This E-LKPD can be used by all learners with various learning styles	1	1	1	1	1	1	1	7	1	1	1	0.008
10	Each activity (Steps) on this E-LKPD encourages	1	1	1	1	1	1	1	7	1	1	1	0.008

	learners' curiosity												
11	The activities presented provide opportunities for learners to find their own concepts through a problem-based learning process	1	1	1	1	1	1	1	7	1	1	1	0.008
12	The activities presented provide opportunities for learners to express their findings and thoughts.	1	1	1	1	1	1	1	7	1	1	1	0.008
13	The activities presented can train learners to think critically	1	1	1	1	1	1	1	7	1	1	1	0.008
14	Learning outcomes, learning objectives, dimensions of the Pancasila learner profile to be achieved are clearly presented	1	1	1	1	1	1	1	7	1	1	1	0.008
15	Instructions for using the E-LKPD are presented clearly and can be understood by students	1	1	1	1	1	1	1	7	1	1	1	0.008
16	The sentence structure presented is clear and can be understood by learners	1	1	1	1	1	1	1	7	1	1	1	0.008
17	Completeness of identity on images, tables, links, articles, and videos	1	1	1	1	1	1	1	7	1	1	1	0.008
18	Completeness of reference sources (bibliography)	0	0	1	1	1	1	1	5	0.4	0.71	0	0.164
		S-CVI/Ave									0.95		0.03
		S-CVI/UA										1	

Based on table 2 above, statements with a high level of agreement are Statements 1, 2, 3, 4, 6, 10, 11, 12, 13, 14, 15, 16, and 17 are considered good by experts indicated by high CVR, I-CVI, and UA values. These elements are most likely important components of the instructional materials, aligned with the learning objectives and relevant standards. Statements 5, 7, and 8 had lower CVR and I-CVI scores and no universal agreement, indicating that these aspects may need to be refined. This may be done again by reviewing the notations and symbols in this E-LKPD. The E-LKPD could also be revisited on its visual elements, so as to better meet expert criteria and improve instructional quality. This analysis shows that while most of the content was considered valid and important, there is still room for improvement in the areas of notation accuracy, literature updates, and visual elements to ensure the instructional materials meet the high standards of relevance and clarity across the experts' opinions.

In conclusion, most items had high content validity and expert consensus, with only minor adjustments needed for aspects such as completeness of references. The overall S-CVI/Ave value of 0.95 reflects that the instructional materials were considered Valid and relevant by the experts. The overall S-CVI/UA value of 1 reflects that the content of the E-LKPD is valid [23].

Table 3. Result of E-LKPD Validation from Problem Based Learning Aspect

No	Statement	Value							Ne	CVR	CVI	UA	PC
		V1	V2	V3	V4	V5	V6	V7					
1	This E-LKPD explains the learning objectives, explains the logistics required	1	1	1	1	1	1	1	7	1	1	1	0.008

2	This E-LKPD motivates learners to be actively involved in solving the chosen problem	1	1	1	1	1	1	1	7	1	1	1	0.008
3	This E-LKPD helps learners define and organize learning tasks related to the problem	1	1	1	1	1	1	1	7	1	1	1	0.008
4	This E-LKPD encourages students to gather appropriate information, carry out experiments to obtain explanations and problem solving	1	1	1	1	1	1	1	7	1	1	1	0.008
5	These E-LKPDs assist learners in planning and preparing appropriate works such as reports, models and sharing tasks with peers	1	1	1	1	1	1	1	7	1	1	1	0.008
6	This E-LKPD evaluates learning outcomes about the material that has been learned or asks groups to present their work	1	1	1	1	1	1	1	7	1	1	1	0.008
	S-CVI/Ave										1		0.008
	S-CVI/UA											1	

Based on table 3 above, all aspects of Problem Based Learning in this E-LKPD agree that this E-LKPD is valid and relevant for use in learning that emphasizes problems in the environment around students. The S-CVI/Ave (Scale Average Content Validity Index) value is 1, which reflects an overall high level of content validity for the E-LKPD items according to the experts. The S-CVI/UA (Universal Agreement Scale Content Validity Index) value was 1, indicating full agreement across the items from all experts, emphasizing a very high level of validity and consensus [24], [25].

This data reflects a strong consensus among experts that the statements are highly relevant and necessary for e-LPDs. Each statement addresses an important component of the learning process, from clearly explaining the learning objectives to motivating active student engagement, organizing learning tasks, collecting information and conducting experiments. The statements also cover aspects of collaborative work, project planning and assessment of learning outcomes, all of which are essential for a comprehensive learning experience. The low Probability of Chance Agreement (PC = 0.008) across all items indicates that this consensus is unlikely to occur randomly, highlighting that the items have been carefully designed to fulfill aspects that can enhance students' critical thinking skills. In addition, the unanimous high ratings for CVR and CVI indicate that these elements are aligned with the goal to provide a structured framework and support student learning in NPDs [26]. This analysis shows that the E-LKPD is well structured and effectively meets the key elements needed for an interactive and organized learning tool. All components of the E-LKPD have received high validation, underscoring its relevance and potential in supporting student engagement, problem solving, and critical thinking skills.

Table 4. Result of E-LKPD Validation from Critical Thinking Skill Aspect

No	Statement	Value							Ne	CVR	CVI	UA	PC
		V1	V2	V3	V4	V5	V6	V7					
1	The order of presentation of material, questions, and activities is systematic and clear	0	0	1	1	1	1	1	5	0.4	0.71	0	0.164
2	This E-LKPD encourages learners to be able to analyze questions	1	1	1	1	1	1	1	7	1	1	1	0.008
3	This E-LKPD encourages learners to ask and answer questions	1	1	1	1	1	1	1	7	1	1	1	0.008
4	This E-LKPD encourages	1	1	1	0	1	1	1	6	0.7	0.86	0	0.055

	learners to be able to consider whether sources are reliable or not												
5	This E-LKPD facilitates learners to be able to observe, consider observation reports	1	1	1	1	1	0	1	6	0.7	0.86	0	0.055
6	This E-LKPD facilitates learners to be able to perform and consider the results of deduction	1	1	1	1	1	1	1	7	1	1	1	0.008
7	This E-LKPD facilitates learners to perform and consider the results of induction	1	0	1	1	1	1	1	6	0.7	0.86	0	0.055
8	This E-LKPD facilitates learners to be able to make and determine the value of consideration	1	0	1	1	1	1	0	5	0.4	0.71	0	0.164
9	This E-LKPD encourages learners to be able to define, and consider a definition	1	1	1	1	1	1	1	7	1	1	1	0.008
10	This E-LKPD encourages learners to be able to identify assumptions	1	1	1	1	1	1	1	7	1	1	1	0.008
11	This E-LKPD encourages learners to be able to determine an action	1	1	1	1	1	1	1	7	1	1	1	0.008
12	This E-LKPD encourages learners to be able to interact with others	1	1	1	1	1	1	1	7	1	1	1	0.008
	S-CVI/Ave										0.92	1	0.046
	S-CVI/UA												

Based on table 4 above, several aspects of Critical Thinking Skill in this E-LKPD agree that this E-LKPD is valid and relevant for use in students so that it can improve students' critical thinking skills. Some statements that get a round score in CVR and CVI. The low PC scores for these statements strengthen the reliability of this agreement. Statements that focus on higher-order thinking skills, such as analyzing, questioning, defining, identifying assumptions, and determining actions, received strong support, indicating that the NPD effectively addresses critical thinking and interactive elements that are important for student engagement. However, Statements 1, 4, 5, 7, and 8 received lower CVR, CVI, and UA scores, indicating disagreement from the experts. In particular, Statements 1 ("focusing questions") and 8 ("making and determining value judgments") had the lowest scores, suggesting that the items may need to be refined or the experts considered them less important in this context. Overall, the high S-CVI/Ave value of 0.92 indicates that the NLPD is well designed to support learning that is oriented towards critical thinking, questioning, inference, interaction, and action. However, the S-CVI/UA of 0.046 indicates that there is still room for improvement in ensuring universal relevance across all items. Improving clarity or alignment in areas that have a lower level of agreement could further strengthen the LKPD as an educational tool [27], [28].

Table 5. Result of E-LKPD Validation from Design Aspect

No	Statement	Value							Ne	CVR	CVI	UA	PC
		V1	V2	V3	V4	V5	V6	V7					
1	The order of presentation of material, questions, and activities is systematic and clear	1	1	1	1	1	1	1	7	1	1	1	0.008
2	Attractive design appearance	1	1	1	1	1	1	1	7	1	1	1	0.008
3	Display components are neatly organized and consistent	1	1	1	1	1	1	1	7	1	1	1	0.008

4	The overall appearance design of the E-LKPD is in accordance with the material discussed	1	1	1	1	1	1	1	7	1	1	1	0.008
5	The fonts used are standard and attract learners' interest	1	1	1	1	1	0	1	6	0.7	0.86	0	0.055
6	The font size (letter) is proportional so that it can be read clearly	1	1	1	1	1	1	1	7	1	1	1	0.008
7	Proportional layout, text, images and videos	1	0	1	1	1	1	1	6	0.7	0.86	0	0.055
8	The combination of text, images, and colors is appropriate and interests learners	1	0	1	1	1	1	0	5	0.4	0.71	0	0.164
	S-CVI/Ave										0.93		0.039
	S-CVI/UA											1	

Based on table 5 above, it shows that the developed E-LKPD has a very good level of validity, with the S-CVI/Ave value is 0.93 and S-CVI/UA is 1. This value reflects that the majority of validators agree on the relevance and quality of E-LKPD design in supporting learning. Elements such as the order of presentation of materials, attractive design, and suitability with learning materials (*Statements 1-4 and 6*) received universal agreement (UA = 1) and high proportional consensus (PC = 0.008). This indicates that the E-LKPD has met the criteria of being systematic, neat, and attractive to students. However, some design elements require further attention, such as an attractive font type (*Statement 5*), proportional layout of text, images, and videos (*Statement 7*), and a combination of text, images, and colors that attract learners' interest (*Statement 8*). The lower validity scores on these elements (CVR = 0.4-0.7, UA = 0, PC = 0.164) indicate different perceptions among the validators [29]. This may be due to diverse visual preferences or lack of alignment of design elements with learners' expectations.

It is important to note that despite the high overall validity, improvements to the visual aspects are still needed to increase the attractiveness and effectiveness of the E-LKPD in supporting the learning process. More attractive color combinations, layouts, and font selection are expected to improve the user experience. Therefore, revisions to the visual aspects to ensure that the E-LKPD meets the aesthetic criteria are appropriate to the needs of learners.

Table 6. Result of overall aspect

Value	Aspect 1	Aspect 2	Aspect 3	Aspect 4	Average
S-CVI/AVE	0.95	1	0.92	0.93	0.95
S-CVI/UA	1	1	1	1	1

on table 6, The results of the content validity analysis using S-CVI/Ave and S-CVI/UA show that the E-LKPD products used have a very good level of validity and meet high quality standards. The average S-CVI/Ave value of 0.95 illustrates a very strong level of validity for all aspects assessed. Aspect 2 achieved the maximum score of 1, indicating that this aspect is fully valid according to all validators. The lowest score of 0.92 in Aspect 3 is still within the high validity category, although it does indicate the need for improvement in certain areas, such as clarity of description or presentation of content relevant to the learning objectives. Meanwhile, the S-CVI/UA score of 1 on all aspects indicated full agreement among the validators. This result indicates that there were no differences of opinion regarding the validity of the aspects. All validators agreed that product is suitable for use without requiring substantial improvement. Overall, the high mean scores on S-CVI/Ave and full agreement on S-CVI/UA reinforce the validity of E-LKPDs as good teaching materials. This validity ensures that E-LKPDs can be consistent, relevant, and effective teaching materials in supporting the achievement of learning objectives [30].

4. CONCLUSION

The teaching material used in this study is Problem Based Learning based E-LKPD to improve students' critical thinking skills. The results of the Validity test value using CVR and CVI show that this E-LKPD is suitable for use as a learning support. This E-LKPD is included in the relevant category so that it can be useful for teachers and students in the learning process.

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