International Journal of Social Science and Human Research

ISSN (print): 2644-0679, ISSN (online): 2644-0695

Volume 07 Issue 08 August 2024

DOI: 10.47191/ijsshr/v7-i08-93, Impact factor- 7.876

Page No: 6600-6605

Content Validity of Digital E-Module Oriented on Problem Solving in Science Learning on States of Matter and Their Changes Topic

Sulfiana Firman[1], Rahmawati Rahmawati[2], Nurlina Nurlina[3], Rezkawati Saad[4]

[1] Program Studi Magister Pendidikan Dasar, Program Pascasarjana, Universitas Muhammadiyah Makassar, Indonesia

[2,4] Program Studi Pendidikan Fisika, FKIP, Universitas Muhammadiyah Makassar, Indonesia

[3] Program Studi S3-Pendidikan, Program Pascasarjana, Universitas Muhammadiyah Makassar, Indonesia

ABSTRACT: This study aims to analyse the level of validity of digital e-module teaching materials oriented towards problem solving for fifth grade elementary school students on the topic of the state of matter and its changes. The type of research used is development research using the ADDIE model which consists of five stages, namely analysis, design, development, implementation, and evaluation. The validity of the digital e-module was analysed using descriptive statistics. Data collection was carried out through a questionnaire technique using a validation sheet instrument arranged according to a Likert scale. The number of validators used in this study was four experts in the field of education and learning technology. The validity of the problem-solving-oriented digital e-module was assessed based on the construction aspects of the E-Module teaching materials and the material aspects. Furthermore, the expert validation data were analysed using Gregory's theory and equation and categorized into four categories, namely valid, quite valid, less valid and invalid. The results of data analysis on each aspect of the construction of the E-Module teaching materials showed a content validation coefficient value of 0.94 in the high validity category with a percentage of V value obtained of 94%, in the material aspect showed a content validity coefficient value in the valid validity category with a percentage of V of 90%. The average value is in the valid category. Based on the results of the analysis, it can be concluded that the Problem Solving-oriented Digital E-Module is declared valid and feasible to use. The implication of this study is that this problem-solving-oriented digital e-module can be a reference in developing digital e-modules for other themes or topics in science learning at the elementary school level. It can also be developed at different grade levels and subjects.

KEYWORDS: Content validity, Digital E-Module, Problem Solving, ADDIE model, State of Matter and Their Changes Topic.

I. INTRODUCTION

One important aspect of 21st century education is the application of technology to improve learning effectiveness (Thana & Hanipah, 2023). Changes in innovation in the world of education will continue to occur and develop into the current 21st century (Ma'ruf et al., 2021). One of the fields that is developing rapidly is multimedia technology. Multimedia is a concept of technology that is packaged in various texts, sounds, images, and animations that can be modified to make them more interesting, interactive, and have better educational properties (Fatimah et al., 2014). With technology, teachers can design more interesting and relevant teaching for students. Online learning platforms, educational applications, and digital resources provide access to global information and enable students to learn independently.

Teaching materials not only act as a guide for teachers in compiling structured teaching materials, but also as a source of information that provides a foundation for student understanding (Siregar et al., 2022). By including exercises, assignments, and tests, teaching materials help in evaluating the level of student understanding. Teaching materials that are interesting, relevant, and in accordance with student interests also have the potential to increase motivation and learning outcomes (Mahmud, 2023).

E-modules are a form of digital teaching materials that are increasingly dominating in the context of modern education. The existence of e-modules plays an important role in changing the learning paradigm, providing greater accessibility, and facilitating distance learning (Oktaviani, 2021). The main advantage of e-modules is their flexibility, allowing students to learn anytime and anywhere according to their needs and preferences.

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Problem solving is an individual's mental process to identify, analyse, and find solutions to problems faced. It involves steps such as a deep understanding of the problem, gathering information, evaluating various solution options, and implementing actions to solve the problem. Problem solving can involve a variety of skills, including creativity, logic, reasoning, and communication skills (Rahmazatullaili et al., 2017). In the context of science learning, students are invited to understand natural phenomena, apply scientific concepts, and develop skills to analyse and solve problems.

Based on the results of interviews with teachers and analysis of the questionnaire of the needs of grade V students of SD Inpres Perumnas I, it can be concluded that the use of e-modules as teaching materials in the learning process has not been implemented by teachers. Currently, the only learning resource used is the thematic textbook for grade V. This condition causes a lack of variation in the use of teaching materials during the learning process in class. The student needs questionnaire also indicated that 60% of students had difficulty connecting science concepts, 53% of students had difficulty understanding the material if there were no examples, and 83% of students wanted books that could be connected to the internet, could play videos, and were more interesting than thematic books.

Fifth grade students of SD Inpres Perumnas I are proficient in digital literacy. These characteristics include an understanding of the use of technological devices, navigation skills in digital platforms, and basic skills in utilizing online resources. This can be seen from the results of the student needs analysis questionnaire where 26 fifth grade students in this case 100% stated that they were already able to use mobile phones or cell phones to open Google, WhatsApp, YouTube, and other learning applications.

The teaching materials in the form of digital e-modules oriented towards problem solving developed in this study were first validated by several experts/specialists so that the resulting e-modules are suitable for use. Validity aims to measure the validity of the teaching materials developed. Validity is carried out by experts or practitioners who are experts in learning media using a validation questionnaire sheet.

Content validity is determined using expert agreement. A measurement instrument in the form of a test or questionnaire is proven valid if the expert believes that the instrument measures the mastery of the abilities defined in the domain or the psychological construct being measured (Retnawati, 2019). Another way to prove content validity is by using the expert agreement index suggested by Gregory where this index also ranges from 0-1. By creating a contingency table for two experts, with the first category being irrelevant and less relevant becoming the weak relevance category, and the second category for those that are quite relevant and very relevant which are made into a new category of strong relevance. The expert agreement index for content validity is a comparison of the number of items from the two experts with the strong relevance category with the total items (Schraw & Olafson, 2008).

II. METHODE

This research is development research with the ADDIE development model. The ADDIE model is an abbreviation of (Analyse, Design, Develop, Implement, and Evaluate) (Branch, 2009). However, the focus of the study in this paper is descriptive statistical research that aims to describe the level of validation of the content of digital e-modules oriented to problem solving in Natural Science learning. Nieveen et al. (2007) stated that a quality product includes three criteria, namely valid, practical, and effective.

The developed digital e-module was validated by experts and practitioners according to their field of study. Technically, the validation of the digital e-module was carried out by several expert media and material expert validators. Comments, suggestions and input from the validators in the development of the digital e-module will then be followed up to improve the digital e-module. The media aspect was validated by two expert lecturers and the material aspect is validated by one lecturer and one learning expert (learning practitioner).

The instrument used to collect data is a digital e-module validation sheet that aims to obtain suggestions and input from expert validators on the validity of problem-solving-oriented digital e-modules. The expert assessment of the validity of digital e-modules consists of 4 Likert Scales as follows.

Table 1. Categorization of Validation

Score	Categorization of Content Validity
4	Valid
3	Quite valid
2	Less valid
1	Not valid

Retnawati (2017)

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The expert validation data results were analysed to determine the content validation coefficient or Gregory index using the Gregory equation as shown in the equation (Gregory). Before determining the Gregory index, the strong and weak relevance assessments of the two validators were first carried out through a contingency table as shown in Table 2.

Table 2. Contingency Table for Calculating Gregory Index

Matrix 2x2		Validator I	
		Not relevant (Score 1-2)	**Relevant (Score 3-4)**
Validator II	**Not relevant (Score 1-2)**	A	B
	Relevant (Score 3-4)	C	D

Expert Agreement on Content Validity Index is a comparison of the number of entries from both experts in a category with strong relevance for all items. The formula used can be seen as follows.

$$Content\ validity\ coefficient = \frac{D}{A + B + C + D}$$

(Gregory in Retnawati, 2017: 33)

After determining the content validity coefficient, the results are then interpreted into a validator agreement index table as shown in Table 3.

Table 3. Validator Agreement Index

Coefficient	Category of Validity
0,8 - 1,0	High
0,4 - 0,79	Medium
0,00 - 0,39	Fairly

(Gregory in Retnawati, 2017: 33)

The validation format was provided for the validator to provide an assessment of the statement items from each aspect listed in the instrument sheet. Instrumental criteria are declared theoretically valid if the content value coefficient is > 75% (Lawshe, 1975). In addition, the validator's responses were analysed descriptively by taking the score for each aspect and component of the validator. Digital e-modules can be said to be valid and worthy of use or trial if the minimum level of content validity achieved is moderate validity, then revisions need to be made to obtain a level of content validity on valid learning media.

III. RESULT AND DISCUSSION

Data analysis in this study was conducted to answer the problem regarding the validity of digital e-module teaching materials oriented towards problem solving.

A. Validation Results of Digital E-Module Teaching Materials

Tabulation aims to find out the assessment of both experts. The tabulation results related to digital e-module teaching materials are shown in Table 4.

Table 4. Tabulation Results of Digital E-Module Teaching Materials

No	Aspects	Average Score	
		V1	**V2**
1	Display of digital e-module	3	4
2	Content of digital e-module	4	4
3	Benefits of using e-module	4	4
4	The use of digital e-module language	4	4

Note: V1 = Validator 1; V2 = Validator 2

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Table 4 showed that the aspect of the appearance of the digital e-module is at an average of 3 with a fairly valid category, the aspect of the content of the digital e-module is at an average of 4 with a valid category, the aspect of the benefits of the digital e-module is at an average of 4 with a valid category, and the aspect of the use of language in the digital e-module is at an average of 4 with a valid category. It can be concluded that the average acquisition of all aspects of the assessment from the two media experts is 4 with a valid category.

After obtaining the tabulation results from the material experts, the next step was to create a contingency table for the two experts. The contingency results from the two validators are shown in Table 5.

Table 5. Re-categorization contingency of two teaching material expert judgements

Matrix 2x2		Validator I	
		Not relevant (Score 1-2)	Relevant (Score 3-4)
Validator II	Not relevant (Score 1-2)	0	1
	Relevant (Score 3-4)	0	17

Based on the contingency data from Table 5, then determine the validity coefficient using Gregory's content validity formula. The following is the determination of the content validity coefficient with the Gregory equation.

$$Content\ validity\ coeffisient = \frac{D}{A+B+C+D} = \frac{17}{0+1+0+17} = \frac{17}{18} = 0{,}94$$

The content validity coefficient value obtained based on Gregory's formula is 0.94 with a high validity category. This content validity coefficient value shows that the V value is 94%, which means that the assessment results of the two validators have "high agreement" with a content value coefficient greater than 75% or V> 75%. Based on the content validity coefficient value data, it can be concluded that the problem-solving-oriented digital e-module developed in terms of the content of the teaching materials is declared valid and feasible to be tested. Furthermore, strengthening the level of content validity of the digital e-module is carried out by revising the e-module section based on suggestions and input from experts.

B. The Result of Material Validation

The tabulation results to determine the assessments of the two experts can be seen in Table 6.

Table 6. Tabulation results from material expert assessments

No	Aspect of expert judgement	Score Average	
		V1	V2
1	Relevance of the material	4	4
2	Organizing the material	4	4
3	Effects on learning strategies	4	3
4	Sentence structure	3	4

Table 6 shows that the aspect of material relevance is at an average of 4 with a valid category, the aspect of material organization is at an average of 4 with a valid category, the aspect of the effect on learning strategies is at an average of 3 with a fairly valid category, and the aspect of sentence structure is at an average with a fairly valid category. Based on the data in Table 6, it can be concluded that the average acquisition of all aspects of the assessment from the two material experts is 4 with a valid category. After obtaining the tabulation results from the material experts, the next step is to create a contingency table of two experts related to the assessment of the digital e-module material obtained through the provision of a questionnaire. Based on the results of the contingency table from the two experts, it shows that both validators stated that the material in the digital e-module is oriented towards solving problems from the results of the assessment of all aspects is in the value of 0.75 which is the agreement index of the two validators, it is stated that the validity is moderate. The contingency categories of the two validators are shown in Table 7.

Table 7. Re-categorization contingency of two material expert judgements

Matrix 2x2		Validator I	
		Not relevant (Score 1-2)	Relevant (Score 3-4)
Validator II	Not relevant (Score 1-2)	0	1
	Relevant (Score 3-4)	1	18

Table 7 shows that the ratings given by the two validators above can be calculated for validity based on Gregory's content validity formula as follows.

$$Content\ validity\ coeffisient = \frac{D}{A+B+C+D} = \frac{18}{A+1+1+18} = \frac{18}{20} = 0{,}90$$

The results obtained from the assessment of the two material validators were 0.90 with a validity category of high, this indicates that the V value is V> 75%. This means that the results of the assessment of the two validators have "high agreement" with a content value coefficient greater than 75% or V> 75%, so it can be concluded that the results of the intervention measurements carried out are valid. In the material validation process, the two validators provide recommendations to continue to the trial stage.

Validation of problem-solving-oriented digital E-Modules was assessed by 2 media expert validators and 2 material expert validators. There are 2 aspects in the validation of problem-solving-oriented digital e-modules, namely the media design aspect and the material aspect. Based on the analysis of validity and data filling by experts in the field of design, it shows that the Problem-Solving-Oriented Digital E-Modules obtained a validity value of 0.94 with a high validity category agreement index. Meanwhile, the results of the validity analysis of the material field showed that the results of the validity analysis from the two material experts showed that the agreement index value obtained was 0.90 with a high validity category.

The learning media was declared valid after going through the validation stage by the validator. The results of the validation data analysis from the validator showed that the Problem-Solving-Oriented Digital E-Modules were declared very valid and feasible for use in trial activities by considering several suggestions and improvements provided by the validator.

Groundlund & Linn (1990) explained that validity refers to the adequacy and appropriateness of the interpretation made from the assessment, regarding specific use. This opinion is reinforced by Messick's opinion (1996) that validity is an integrated evaluative policy on the extent to which empirical facts and theoretical reasons support the adequacy and appropriateness of inferences and actions based on test scores or instrument scores. Based on this opinion, it can be concluded that validity will show support for empirical facts and theoretical reasons for the interpretation of test scores or instrument scores and is related to the accuracy of the measurement.

In line with this opinion, Arikunto (2018) stated that validity is a measure that shows a level of reliability or validity. Content validity is determined using expert agreement stating that the developed learning media is valid and worthy of being tested.
The findings of this study are in line with the results of Haslinda's research (2017) which revealed that the feasibility of teaching materials reviewed from several elements of expert assessment showed that the developed teaching materials were very feasible or valid to use because their feasibility had been tested through expert tests and trials. Furthermore, research conducted by Nurmala et al. (2019) which showed that the digital pocketbooks developed were very feasible and could be used as learning media in increasing students' interest in learning.

CONCLUSIONS

The results of the study showed that the Problem Solving Oriented Digital E-Module has been declared valid by experts (learning experts and practitioners) and can be used to improve student learning achievement at the Elementary School level. This research product can also be used as a role model in developing digital-based teaching materials for the next stage.

ACKNOWLEDGMENT

We, as a researchers, would like to say thanks to Kemendikbudristekdikti for providing support in terms of research funds in the Master's Thesis Research scheme for the 2024 Fiscal Year so that this research can be carried out properly. Furthermore, the researcher would also like to express his gratitude to the leadership of the LP3M Research Institute, Universitas Muhammadiyah Makassar, who has helped and facilitated us a lot in winning a research grant funded by Kemendikbudristekdikti for the 2024 Fiscal Year.

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