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Validity Analysis of Joyful Learning Integrated Measurement E-Module for Student Knowledge and Creative Thinking

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ABSTRACT

This study aims to analyze the validity of digital teaching materials for integrated joyful learning measurement in facilitating students' knowledge and creative thinking skills. The method used is Research and Development (R&D) with the Hannafin and Peck model. Validity is assessed by three validators based on aspects of material, learning design, visual communication, software utilization, integration of joyful learning, and knowledge and creative thinking abilities. The results of the study showed an average validity score of 0.88 which is categorized as highly valid, so that the teaching materials are declared feasible and in accordance with the Merdeka Curriculum and 21st-century learning. This study contributes to the development of innovative and effective physics learning media in supporting interactive and meaningful learning.

Keywords: Validity, Digital Teaching Materials, Measurement, Joyful Learning, Creative Thinking

I. INTRODUCTION

Education plays a fundamental role in developing human potential and preparing learners to face the challenges of an increasingly complex world. The Indonesian National Education System Law emphasizes that education must foster not only knowledge, but also character, skills, and higher-order thinking abilities. In response to rapid global changes, learning in the 21st century is required to shift from teacher-centered practices toward student-centered, active, and meaningful learning experiences that empower learners to construct knowledge independently [1][2].

Twenty first century learning highlights the importance of critical thinking, creativity, collaboration, and communication skills. Among these competencies, creative thinking is particularly essential because it enables students to generate original ideas, explore multiple solution strategies, and approach problems from diverse perspectives [3][4]. In physics education, creative thinking supports students in understanding abstract concepts, interpreting phenomena, and solving contextual problems scientifically. Therefore, learning activities should be designed not only to transmit knowledge but also to stimulate students' higher-order thinking processes [5].

The rapid development of information and communication technology (ICT) has further strengthened the transformation of learning practices. Technology enables flexible, interactive, and multimodal learning environments where students can access learning resources beyond classroom boundaries [6]. Digital teaching materials, in particular, offer opportunities to integrate text, images, simulations, videos, and interactive tasks in ways that support deeper conceptual understanding and engagement [7]. However, effective technology integration requires not only digital tools, but also pedagogical approaches that ensure learning remains meaningful and learner-centered [8].

The implementation of the Independent Curriculum in Indonesia reinforces the need for flexible, differentiated, and student-oriented learning. Teachers are encouraged to design teaching materials that align with students' characteristics, interests, and learning needs while promoting active participation and independent learning [9][10]. Despite these expectations, classroom realities often show a mismatch between curriculum

ideals and instructional practice. Physics learning in many schools still relies on conventional materials that are text-dominated, minimally interactive, and less supportive of higher-order thinking development [11].

Preliminary studies conducted at SMAN 1 Tilatang Kamang reveal a significant gap between expected competencies and actual student performance. Students' knowledge mastery in measurement topics remains below the minimum competency criteria, and their creative thinking skills measured through indicators of fluency, flexibility, originality, and elaboration show a low average score of 39.2. These findings indicate that students have limited opportunities to engage in learning activities that challenge them to think creatively and explore ideas independently. This condition is compounded by the limited availability of digital teaching materials that are interactive, visually engaging, and specifically designed to foster creative thinking [12][13].

These problems highlight the need for instructional innovation through the development of digital teaching materials that are aligned with 21st-century learning principles and capable of creating engaging learning experiences. One promising approach is joyful learning, which emphasizes enjoyable, meaningful, and student-active learning environments. Joyful learning connects learning content with real-life contexts, involves multiple senses, and creates a positive emotional atmosphere that enhances motivation and engagement [14]. When combined with digital media, this approach has the potential to reduce learning anxiety, increase participation, and stimulate creativity [15].

In developing digital teaching materials, validity is a crucial initial step to ensure that the product is conceptually accurate, pedagogically appropriate, visually effective, and technically functional before being implemented in classrooms [16]. Valid teaching materials are more likely to support learning objectives and provide meaningful learning experiences for students.

Based on the background described above, this study focuses on the development and validation of a joyful learning integrated digital measurement E-Module designed to facilitate students' knowledge and creative thinking skills.

II. METHOD

This study uses the Research and Development (R&D) method with the Hannafin and Peck development model because this model has a systematic, simple, and appropriate flow for the development of digital teaching materials. The Hannafin and Peck model emphasizes the integration of needs analysis, design, and continuous product development so that the resulting product truly meets learning needs. This model consists of three main stages, namely needs assessment, design phase, and development and implementation. The selection of this model allows researchers to comprehensively identify learning problems before designing and developing teaching materials.

During the needs assessment stage, an analysis was conducted on the creative thinking skills of students, student learning outcomes, measurement materials, and the condition of teaching materials available at the school, particularly at SMAN 1 Tilatang Kamang. Next, the digital teaching materials that had been designed were validated by physics lecturers from the Faculty of Mathematics and Natural Sciences, Padang State University. The validity test covered aspects of material substance, learning design, visual communication, software utilization, joyful learning integration, and knowledge and creative thinking abilities. This validation stage aimed to ensure that the teaching materials developed were of good quality and suitable for use in learning, as illustrated in Figure 1.

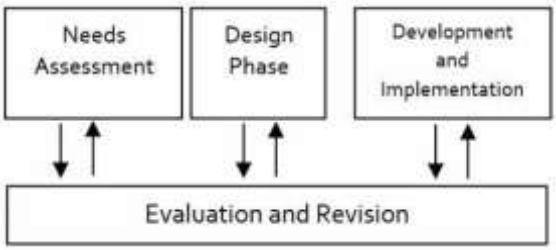

Fig. 1. Hannafin and Peck's research scheme

The validity assessment of the instructional materials in this study employs a Likert scale as the measurement instrument. This scale is utilized to quantify respondents' attitudes, opinions, or perceptions regarding specific evaluative statements. Product evaluation is conducted using a scoring range of 1 to 5, as presented in Table 1, where each score indicates the level of appropriateness or validity of the components being

assessed. The use of a Likert scale enables the acquisition of measurable and objective data to determine the empirical feasibility of the developed materials.

Table 1. Likert Scale Assessment Criteria

Likert	Category
1	Strongly Disagree
2	Disagree
3	Undecided
4	Agree
5	Strongly Agree

(Source: Ref[17])

The data obtained were analyzed using the validity index proposed by Aiken. The scale used was 1 to 5, with three validators. Aiken's formula used was equation 1:

$$V = \frac{\Sigma s}{n(c-1)} \qquad (1)$$

$$s = r - l_0$$

Description:
V = Assessor agreement index
I0 = Lowest validity rating
c = Highest validity rating
r = Score given by assessors
n = Number of Assessors

After obtaining the assesor agreement index, the index value category is determined. The results of the category decision based on the Aiken V Index are shown in Table 2.

Table 2. Validity Criteria for Digital Teaching Materials

Percentage (%)	Criteria
V>0.8	Very Valid
0.4≤V≤0.8	Valid
V<0.4	Less Valid

(Source: Ref[18])

The validity level of the digital teaching materials is categorized based on the calculated V index values. Materials achieving a coefficient greater than 0.8 (V > 0.8) are classified as Very Valid. Coefficients ranging between 0.4 and 0.8 (0.4≤V≤0.8) indicate a Valid category. Conversely, any value falling below 0.4 (V < 0.4) is deemed Less Valid.

III. RESULTS AND DISCUSSION

Results

After the product was developed, formative evaluation was conducted through a validity test. At this stage, the aspects evaluated included the material substance, learning design, visual communication display, software utilization, integration of joyful learning, knowledge and creative thinking skills. The validation results showed that the developed digital teaching materials were valid. The first aspect evaluated was the material substance. This aspect includes four assessment indicators: truth, depth, and currentness. Based on the analysis, the results for each indicator are shown in Table 3.

Table 3. Validation Results for the Material Substance Aspect

Assessed Indicators	V	Average	Category
Truth	0,83	0,855	Very Valid

Depth	0,81
Timeliness	0,95
Readability	0,83

Based on Table 3, the validation results on the substance aspect show that all indicators are in the Very Valid category. The truth indicator obtained a V value of 0.83, which indicates that the material is in accordance with scientific concepts. The depth indicator obtained a V value of 0.81, which indicates that the depth of the material is adequate and relevant to the students' level of understanding. Furthermore, the timeliness indicator received the highest score of 0.95, indicating that the material presented is up-to-date and in line with curriculum developments. Meanwhile, the readability indicator received a V score of 0.83, indicating that the language and presentation of the material are easy for students to understand. Overall, the average score of 0.855 confirms that the substance of the material in the teaching materials is in the Very Valid category and is suitable for use in the learning process without requiring substantial revision.The second phase of evaluation addressed instructional design, encompassing 11 indicators ranging from the title and introduction to student worksheets, evaluation tools, and references. The analytical results for each of these indicators are detailed in Table 4.

Table 4. Validation Results for the Learning Design Aspect

Assessed Indicators	V	Average	Category
Title	1,00	0,93	Very Valid
Introduction	0,91		
Learning Instructions	1,00		
E-Module Identity	0,91		
Learning Outcomes	1,00		
Learning Materials	0,83		
Student Worksheets	0,91		
Practice Questions	0,83		
Evaluation	0,83		
Glossary	1,00		
Bibliography	1,00		

Based on Table 4, the validation results on the learning design aspect show that all indicators are in the Very Valid category with an average score of 0.93. The indicators of title, learning instructions, learning outcomes, glossary, and bibliography each received a V score of 1.00, indicating that these components have been compiled very well, clearly, and in accordance with the learning objectives. The indicators introduction, E-Module identity, and student worksheets received a V score of 0.91, indicating that the introduction, module identity, and student worksheets have been designed systematically and are easy to understand. Meanwhile, the learning materials, practice questions, and evaluation indicators received a V score of 0.83, which is still considered highly valid and indicates that the materials, exercises, and evaluations are relevant and support the achievement of competencies. Overall, the average score of 0.93 confirms that the learning design in the E-Module has met excellent eligibility criteria and is ready to be used in the learning process without requiring significant revisions.

The third aspect of the evaluation pertains to visual communication design, encompassing seven assessment indicators: navigation, typography, media elements, color schemes, animations, and layout. The analytical results for each indicator are presented in detail in Table 5.

Table 5. Validation Results for Visual Communication Display Aspects

Assessed Indicators	V	Average	Category
Navigation	0,91	0,90	Very Valid
Typography	0,83		
Media (images, videos, audio)	0,91		
Colors	1,00		

Animation	0,83		
Layout	0,91		

Based on Table 5, the validation results on the visual communication aspect show that all indicators are in the Very Valid category with an average score of 0.9. The color indicator received the highest score of 1, indicating that the selection and combination of colors in the E-Module are very appropriate, attractive, and able to improve the visual comfort of students. The navigation, media (images, videos, sound), and layout indicators each scored 0.91, indicating that the navigation system is easy to use, the supporting media is relevant and of high quality, and the layout is neat and proportional. Meanwhile, the typography and animation indicators received a score of 0.83, which is still considered highly valid and indicates that the fonts and animations used are clear, attractive, and support the readability and interactivity of the module. Overall, the average score of 0.9 confirms that the visual communication display of the E-Module meets excellent eligibility criteria and is suitable for use in the learning process without requiring significant revisions.

The fifth evaluation phase focuses on software utilization, encompassing seven technical assessment indicators: navigation, typography, media elements, color schemes, animation, and layout. The analytical results for each indicator are presented in detail in Table 6.

Table 6. Validation Results for Software Usability

Assessed Indicators	V	Average	Category
Interactivity	0,83	0,92	Very Valid
Canva	1		
Liveworksheet	0,94		
Originality	0,91		

Based on Table 6, the validation results on the aspect of software utilization show that all indicators are in the Very Valid category with an average score of 0.92. The Canva indicator obtained the highest score of 1, indicating that the Canva platform is very effective in E-Module development because it supports visual design, content presentation, and ease of access. The Liveworksheet indicator scored 0.94, indicating that the use of Liveworksheet is very helpful in increasing interactivity and providing a more active learning experience for students. Furthermore, the Originality indicator scored 0.91, indicating that the E-Module has a high level of originality and is not a duplication of other teaching materials. Meanwhile, the Interactivity indicator scored 0.83, which is still considered highly valid and indicates that the interactive features provided are effective enough to actively engage students. Overall, the average score of 0.92 confirms that the use of software in the development of E-Modules has met excellent feasibility criteria and is suitable for use in the learning process without requiring significant revisions.

The sixth aspect of joyful learning integration covers seven assessment indicators related to connecting material to real life, engaging all senses, learning technology, and enjoyable learning. Based on the analysis results, the results for each indicator are shown in Table 7.

Table 7. Validation Results for Joyful Learning

Assessed Indicators	V	Average	Category
Relating material to life	0,91	0,9	Very Valid
Engaging all senses	0,83		
Learning technology	0,91		
Enjoyable learning	0,91		

Based on Table 7, the results of the validation of the joyful learning integration aspect show that all indicators assessed have a high level of validity. The indicator linking the material to real life obtained a V score of 0.91, indicating that the learning is relevant to the real experiences of the students, while the indicator of sensory engagement obtained a V score of 0.83, which remains in the valid category and reflects the active involvement of students in learning. The indicators of learning technology and enjoyable learning each obtained a V score of 0.91, which indicates that the use of technology and the learning atmosphere created have supported the application of joyful learning. The average validation score of 0.9 in the highly valid category shows that the integration of joyful learning in learning has met the eligibility criteria and is effective in creating meaningful, interactive, and enjoyable learning.

The seventh aspect is knowledge and creative thinking, which includes two indicators for assessing knowledge and creative thinking. Based on the analysis results, the results of each indicator are shown in Table 8.

Table 8. Validation Results on Knowledge and Creative Thinking Aspects

Indikator yang dinilai	V	Average	Category
Knowledg	0,85	0,82	Very Valid
Creative Thinking	0,72		

Based on Table 8, the results of validation in terms of knowledge and creative thinking showed a score of 0.85 for the knowledge indicator, indicating that the learning material was in line with the intended competencies and was able to support students' understanding of the concepts well. Meanwhile, the creative thinking indicator scored 0.72, which was still in the valid category and indicated that the learning provided space for students to develop their creative thinking skills, although there was still room for improvement. The overall average score of 0.82, which falls into the highly valid category, confirms that both aspects have met the eligibility criteria, meaning that the developed learning materials are suitable for use in supporting students' mastery of knowledge and development of creative thinking skills.

Discussion

The development of integrated joyful learning digital teaching materials on measurement was carried out to The development of integrated joyful learning digital teaching materials on measurement was carried out to address the problems of low knowledge and creative thinking skills among students, as well as the limitations of teaching materials that are still passive and lack interactivity. The validity test results show that the developed teaching materials obtained an average Aiken's V score of 0.82, which is in the valid category. This score confirms that the product has met the academic and technical eligibility criteria for use as a learning tool.

The high validity score indicates that the teaching materials have met the main principles of teaching material development, namely scientific accuracy, curriculum alignment, and suitability with learning theories. In terms of material substance, the high validity score indicates that the measurement content is presented correctly, is up to date, and is relevant to scientific developments. This is in line with the opinion that good teaching materials must fulfill the principles of conceptual correctness, depth of material, and relevance to the applicable curriculum [19]. The alignment of the material with the Learning Outcomes of the Merdeka Curriculum also strengthens the position of these teaching materials as a contextual and adaptive tool for 21st-century learning needs.

The learning design aspects that received a highly valid rating indicate that the teaching materials have been systematically structured, starting from the learning objectives, presentation of material, learning activities, to evaluation. This design supports independent and learner-centered learning, which are key characteristics of modern curriculum implementation. Teaching materials designed with a clear and communicative learning flow can increase student engagement and help them build conceptual understanding independently [20].

High validity in visual communication and software utilization indicates a strong relationship between the developed product features and the initial problems identified. The use of attractive visual elements, clear navigation, and software integration such as Canva and Liveworksheet makes the teaching materials more interactive and responsive. This interactivity is a solution to the previous teaching materials, which were one-way and did not provide enough room for exploration for students. Multimedia learning theory states that well-designed combinations of text, images, and interactive elements can improve understanding and reduce cognitive overload [21].

The integration of joyful learning in teaching materials also contributes significantly to product validity. Learning that relates material to everyday life, involves various senses, and creates a pleasant learning atmosphere is considered very appropriate for increasing student motivation and engagement. A positive emotional climate in learning has been shown to enhance intrinsic motivation and persistence in learning tasks [22]. Furthermore, enjoyable and meaningful learning experiences can encourage deeper involvement and sustained attention, which are important for conceptual understanding [23]. This is relevant to the initial condition of students who demonstrate low levels of creative thinking skills.

In terms of knowledge and creative thinking, a validity score of 0.82 indicates that the teaching materials have been specifically designed to facilitate both aspects. Although the creative thinking indicator scored lower than the knowledge indicator, the score is still within the valid range. Creative thinking development requires learning environments that provide open-ended tasks, opportunities for idea exploration, and freedom to express original solutions [24]. Activities that encourage fluency, flexibility, originality, and elaboration are widely recognized as effective ways to nurture students' creative potential [25]. Therefore, the presence of such activities in the E-Module shows its potential to support creative thinking, although further empirical testing in classroom implementation is still needed [26].

However, this study has limitations because it only focuses on product validity testing. The practicality and effectiveness of the teaching materials have not been tested directly through classroom use. In development research, product validity is only the initial stage; further trials are needed to evaluate usability and learning impact in real settings [27]. Therefore, further research is recommended to continue with practicality testing to determine the ease of use of teaching materials by teachers and students, as well as effectiveness testing to empirically measure their impact on improving students' knowledge and creative thinking skills.

Overall, the results of this discussion confirm that the developed joyful learning integrated measurement digital teaching materials meet the validity criteria and have strong potential as an innovative learning solution to overcome physics learning

IV. CONCLUSION

Based on the results of the study, it can be concluded that digital teaching materials for measurement that integrate joyful learning are valid. This is indicated by an average validity score of 0.82, which is in the valid category and in line with the experts' assessment of the substance of the material, visual communication, instructional design, software utilization, and the integration of joyful learning in the development of students' knowledge and creative thinking skills. Thus, these teaching materials are suitable to proceed to the practical testing stage with students. Implicitly, this digital teaching material has the potential to be the right tool to overcome initial learning problems, particularly in improving students' understanding of measurement concepts and creative thinking skills.

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