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Development of Heat and Temperature E-Module Containing Local Wisdom in South Kalimantan

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Abstract

The aim of this study was to produce a valid electronic module integrated the local wisdom in South Kalimantan on heat and temperature materials, receiving positive responses from students. The ADDIE model was employed for this study, focusing on high school students in South Kalimantan, totaling 62 participants. Research instruments included validation sheets and response questionnaires, with data collected through a survey technique. Data analysis involved the Aiken formula and mean calculations. Results indicated high validity for the e-module concerning both media and material aspects (0.92-1.00). Students' average response to the e-module was excellent, scoring 4.41. Consequently, the e-module demonstrated validity and positive reception among students, making it suitable for use in physics education, particularly for heat and temperature topics.

Keywords: Development; Electronic Modul; Heat and Temperature; Local Wisdom

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INTRODUCTION

Local wisdom, an integral part of Indonesian culture, has been transmitted through generations (Kusumaningrum & Masruro, 2022). It is imperative for the younger generation to acquaint themselves with this cultural knowledge as it serves as a guide for life (Pingkan et al., 2021). Local wisdom encompasses values and principles that can provide guidance to communities, emphasizing the need for its preservation (Pingkan et al., 2021; Lesmana & Nurussaniah, 2022; Fauzi et al., 2022; Kusumaningrum & Masruro, 2022). Therefore, local wisdom holds significant importance for the community.

Indeed, local wisdom is closely interlinked with the concepts and principles of physics, a scientific branch of study. At the senior high school level, one of the topics covered in physics is temperature and heat. However, students often find this subject challenging due to its abstract concepts, which are difficult to visualize, along with complex principles that may lead to misconceptions and mathematical equations that pose problem-solving difficulties (Risqa et al., et 2021; Asmin & Rosdianti, 2021; Sa'diah et al., 2022).

This challenge is also evident in a public school in Banjarbaru City. Interviews with the physics teacher at the school revealed that some students face difficulties in comprehending temperature and heat concepts. Furthermore, students have not previously explored the connection between temperature and heat with local wisdom. Consequently, they are unaware that their region's local wisdom encompasses the concepts and principles of temperature and heat. Integrating physics education with local wisdom enables students

to engage in more meaningful learning experiences by relating physics to daily activities in their environment (Fajriyani, 2023; Fitriah et al., 2021; Jannah et al.,, 2022; Misbah et al., 2020; Nurleni et al., 2023). Associating local wisdom with the subject matter also fosters a deeper appreciation for their local culture among students (Setianingrum et al., 2023).

Based on interviews with a physics teacher in one of the public schools in Banjarbaru City, it is evident that the teacher has been using blackboards, printed media, and PowerPoint for teaching. However, the teacher has never incorporated flipbooks or digital media into the teaching methods, despite the school having internet facilities available for accessing digital content. A flipbook is a three-dimensional digital book with pages that can be opened like a printed book (Setianingrum et al., 2023).

Flipbooks offer several advantages over printed books, including the integration of video, audio, and animation (Muhammad et al., 2021; Ningsi et al., 2021; Setianingrum et al., 2023). Flipbooks have various benefits, namely attracting students' attention to learning (Misbah et al., 2021; Ningsi et al., 2021; Setianingrum et al., 2023; Saprudin et al., 2021); being easy to use because they can be accessed anywhere and anytime so students can learn more flexibly (Sa'diah et al., 2022; Setianingrum et al., 2023); developing scientific thinking skills (Saprudin et al., 2021; Setianingrum et al., 2023); improving learning outcomes, scientific literacy, learning motivation, and science process skills (Saprudin et al., 2021). Therefore, utilizing flipbooks as teaching materials offers multiple advantages for students, such as attracting attention, facilitating flexible learning, and enhancing overall learning outcomes.

In light of the above, a module was developed in the form of a flipbook, referred to as an e-module because students use it electronically through their devices, assisted by the Internet. This e-module is enriched with local wisdom from South Kalimantan. The content of this local wisdom includes the concept of temperature in Asyura porridge, the principle of expansion of the valve during the stable process, the relationship between heat and temperature, the form of sugar in duck and lamang aids, the Black principle in serving rice soup, and heat transfer when roasting haruan fish. The material on temperature and heat is closely related to everyday life, and the features of the flipbook help students connect with their environment, making learning more authentic through audio and video (Patmawati & Kholiq, 2021).

This e-module enriches the previous research and development of local wisdom e-modules (Wati et al., 2021; Kurniawan & Syafriani, 2021; Elisa et al., 2022). The advantage of this e-module lies in its incorporation of local wisdom from South Kalimantan into the discussion of temperature and heat. Therefore, understanding the relevance of physics to local wisdom adds a valuable dimension to existing studies. The primary objective of this study was to develop an electronic module in the form of a flipbook, enriched with local wisdom from South Kalimantan, which is both valid and well-received by students. Consequently, this article focuses on the e-module's validity and students' responses to it.

METHOD

The five-step ADDIE research design was used to develop the e-module in this study. The five steps are analysis, design, development, implementation, and evaluation (Dick et al., 2001; Welty, 2007). The product of this research is an electronic module in the form of a flipbook titled "*E-Modul Suhu dan Kalor Bermuatan Kearifan Lokal untuk Kelas XI IPA SMA/MA Sederajat*."

The research sample consisted of 62 students from one of the SMAN schools in Banjarbaru City, studying physics in the even semester of the 2022/2023 academic year. The purposive sampling technique was utilized.

Research instruments included e-module validity sheets and student response questionnaires. Data collection involved a survey, with the e-module's validity analyzed using the Aiken formula (1985), and student responses analyzed using the mean formula (Widoyoko, 2019). Response results were also categorized based on Widoyoko's criteria (2019).

RESULT AND DISCUSSION

E-Module Development Process

a. *Analyse*

This step was the first step in development. The activities carried out in this step were as follows:

1) Needs analysis, based on the results of interviews with teachers in four schools, it was known that students have difficulty learning physics. Their interest in these subjects was also lacking. So far, teachers had not provided learning resources and media in the form of e-modules. They also taught without linking physics material to local wisdom. The teachers stated that they needed learning resources and learning media that could help them convey material to students so that students did not have difficulty learning. Apart from that, these sources and media should contain local wisdom so that the physics material taught is contextual.
2) Clarifying the problem, the results of the interviews were then analyzed and it was concluded that teachers need learning resources and learning media that contain local wisdom and can make students interested in studying physics.
3) Proposing solutions to solve problems, based on existing problems the research team proposed solutions in the form of developing electronic modules on heat and temperature materials containing local wisdom.
4) Determining the objectives for developing the e-module, the e-module was designed to help students learn physics so that it was easier for them to understand the material and attract their interest in learning.

b. *Design*

At this stage, learning objectives and research instruments were determined. In detail, this can be explained as follows:

1) Learning objectives for the heat and temperature module:
    a) Determine the length of the object after experiencing length expansion, the area of the object after experiencing area expansion, and the volume of the object after experiencing volume expansion.
    b) Determine the amount of heat required to increase the temperature and the amount of heat used to change the state of the substance.
    c) Analyze the state of substances, their characteristics, and their behavior when receiving or releasing heat.
    d) Analyzing heat transfer in everyday life.
2) There are two research instruments, namely the e-module validity sheet and student response questionnaire.

c. *Development*

At this stage, the e-module development, assessment instrument development, expert validation and e-module revision were carried out. In detail, this can be explained as follows:

1) Developing the e-module, the research team prepared a text in Word according to the module components. The research team also included various pictures and illustrations

in the Word manuscript. After the manuscript in Word has been prepared, the manuscript was then uploaded into flipbook form. Then, the research team added a video link or Google form in the flipbook. Finally, an e-module was produced in flipbook form as draft 1.

2) Development of assessment instruments, validation sheet instruments and response questionnaires whose statement indicators had been determined and then made into finished instruments. The validation sheet was in the form of a Google Form, while the response questionnaire was in the form of a questionnaire that was ready to print.
3) Expert validation, validation of e-module was carried out by three educational expert validators. Validation was carried out online by validators.
4) E-module revision, based on suggestions and criticism of the e-module, a revision of the e-module was carried out. After revisions were made, a second e-module draft was produced.

d. Implementation

At this stage, the e-module was distributed to students at one of the high schools in Banjarbaru City which was the sample for this research. They were asked to use e-modules when studying physics in class. After they used the e-module, the students were asked to fill out a response questionnaire.

e. Evaluation

At this stage the research team analyzed student responses to the e-module. Based on the results of the analysis, the research team evaluated the e-module and made revisions. The e-module that had been developed can be seen at the link https://online.flipbuilder.com/cexmb/josd/.

E-Module Validity

The electronic module can be accessed online in the form of a flipbook. Before using this e-module, it was validated by three validators who are experts in the field of physics education. They filled out a validation sheet adapted from research (Nisrina et al., 2022). Tables 1 and 2 show the results of the three validations after being analyzed with the Aiken formula.

Based on Table 1 and Table 2, it is known that the developed e-module is valid in terms of the aspects of subject matter, auxiliary information, affective considerations, and pedagogy. It is known that the validity of the e-module from media and materials aspects is 0.92-1.00. These results indicate that the e-module is theoretically valid (Malinda et al., 2021; Firdaus & Pahlevi, 2022) and the e-module was developed according to a theoretical basis (Sa'diah et al., 2022; Wati et al. al., 2021). This also means that the e-module has good quality as a learning tool (Supriyadi et al., 2021) and is suitable for learning (Patmawati & Kholiq, 2021; Lestari & Cintamulya, 2022; Elisa et al., 2022; Armani et al., 2021).

Table 1 The Validity of The Electronic Module from The Media Aspect

No.	Indicators	V_{count}	V_{table}	Category
1.	Interface (Display)			
	a. The cover illustration reflects the contents of the e-module	1.00	0.92	Valid
	b. Harmonization of color combinations on the cover	1.00	0.92	Valid
	c. Proportional size and shape of the letters on the cover	1.00	0.92	Valid
	d. Easy-to-read typeface	0.92	0.92	Valid
	e. Consistency in the placement of e-module elements	0.92	0.92	Valid
	f. Consistency in the layout of chapter titles/equivalent	1.00	0.92	Valid

No.	Indicators	V_{count}	V_{table}	Category
	g. Clarity of the meaning of objects from illustrations (pictures/videos)	0.92	0.92	Valid
	h. Appropriate spacing between illustrations and text	0.92	0.92	Valid
	i. The clarity and ease of size and typeface are visible	0.92	0.92	Valid
	j. Video sound clarity is heard	1.00	0.92	Valid
	k. Conformity of spacing between text and illustrations	1.00	0.92	Valid
	l. Harmonization of e-module fill color combinations	1.00	0.92	Valid
	m. Symbols/symbols are used consistently	0.92	0.92	Valid
2.	Navigation (E-module page switching)			
	a. E-module link accessibility	1.00	0.92	Valid
	b. Match the page numbers with the table of contents	0.92	0.92	Valid
	c. Ease of understanding the instructions for using the e-module	1.00	0.92	Valid
	d. The ease of understanding the instructions for working on the questions	1.00	0.92	Valid
	e. Ease of understanding self-assessment instructions	1.00	0.92	Valid
3.	Robustness (Resilience in minimizing errors)			
	a. E-module accessibility	1.00	0.92	Valid
	b. The e-module link function is good	1.00	0.92	Valid
	c. Good video link function	1.00	0.92	Valid
	d. Good link function	1.00	0.92	Valid
	e. The link practice question function is good	1.00	0.92	Valid
	f. The practice questions function on Google Forms is good	1.00	0.92	Valid

Table 2 The Validity of The E-Module from The Material Aspect

No.	Indicators	V_{count}	V_{table}	Category
1.	Subject Matter (Main or content of discussion)			
	a. The suitability of the material with scientific concepts	0.92	0.92	Valid
	b. The depth of the material is discussed and according to competence	0.92	0.92	Valid
	c. The accuracy of the order of presentation of the material	0.92	0.92	Valid
	d. Systematic presentation of material	1.00	0.92	Valid
	e. Learning objectives according to the material	1.00	0.92	Valid
	f. The content of local wisdom is in accordance with the material	1.00	0.92	Valid
	g. Language mudslides are understood and unambiguous	0.92	0.92	Valid
	h. The suitability of language with the development of students' thinking	0.92	0.92	Valid
	i. Spelling corresponds to Enhanced Spelling	0.92	0.92	Valid
	j. Terms are consistently written	1.00	0.92	Valid
	k. Symbols are used appropriately	0.92	0.92	Valid
	l. Systematic messages on content and interrelated	1.00	0.92	Valid
2.	Auxiliary Information			
	a. Ease of reading concept maps to describe the subject matter of the e-module	1.00	0.92	Valid
	b. Preliminary suitability of e-module	1.00	0.92	Valid
	c. The ease and suitability of the instructions for using the e-module to achieve competency	0.92	0.92	Valid
	d. The content of local wisdom expands knowledge	1.00	0.92	Valid
	e. Student understanding is strengthened by examples of questions	0.92	0.92	Valid
	f. The scope of the summary contains the core material	1.00	0.92	Valid

No.	Indicators	V_{count}	V_{table}	Category
	and is understood			
	g. Students are helped to evaluate understanding with self-assessment	1.00	0.92	Valid
3.	Affective Considerations (E-module motivates learning)			
	a. The illustration at the beginning of the material motivates students	0.92	0.92	Valid
	b. Language is dialogic	1.00	0.92	Valid
	c. The content of local wisdom associated with material motivates students to learn	1.00	0.92	Valid
4.	Pedagogy (Relating to learning)			
	a. The e-module feature makes students actively interact	0.92	0.92	Valid
	b. Practice questions according to the specified competencies	1.00	0.92	Valid
	c. Answer keys and precise feedback	1.00	0.92	Valid
	d. Feedback or answer keys that can be accessed directly make it easier for students to measure their abilities	1.00	0.92	Valid

The results of this study support the results of previous research that electronic teaching materials, including e-modules with flipbook software on temperature and heat materials, can be used as learning resources (Saprudin et al., 2021; Saprudin et al., 2021; Armani et al., 2021). Thus, the e-module that has been developed is suitable for use in learning (Firdaus & Pahlevi, 2022; Putra & Mufit, 2022; Supriyadi et al., 2022; Wahab et al., 2023).

The e-module consists of 65 pages. The e-module consists of a front cover and back cover, table of contents, concept map, glossary, introduction, material description divided into four chapters, summary, evaluation, bibliography, and author profile. Figure 1 shows several parts of the electronic module that have been developed.

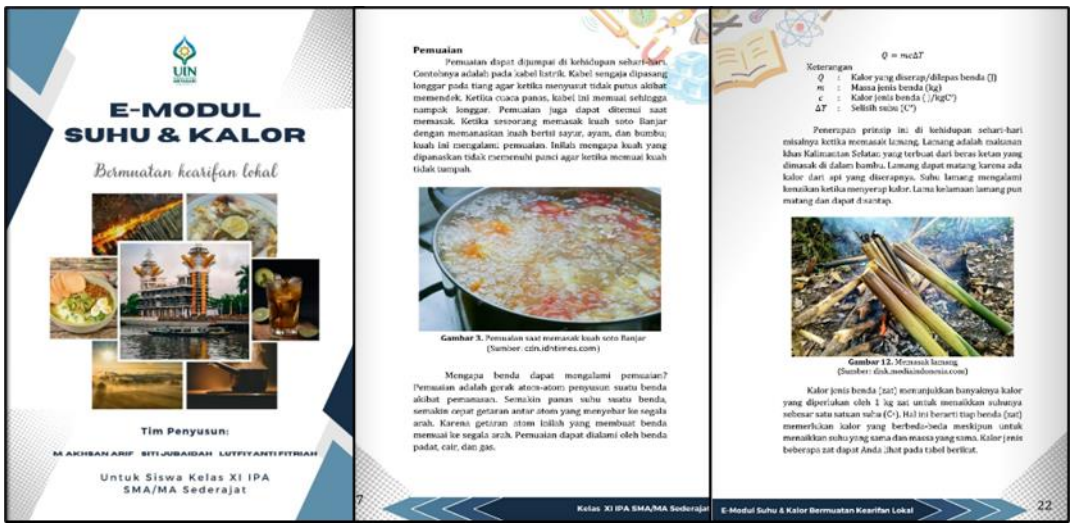

Figure 1 Some Parts of The Developed E-Module

Student Response to E-Module

Students' responses to the temperature and heat electronic module are known by the response questionnaire filled out by students. The response questionnaire was adapted

from (Sa'diyah, 2021). Based on the analysis results, students' responses were obtained, as shown in Figure 2.

Figure 2 shows the students' responses to the temperature and heat e-module filled with local wisdom from South Kalimantan were very good. This result is in line with the results of previous research, which showed that the e-module temperature and heat received a good response from students (Elisa et al., 2022; Wati et al., 2021). This indicates that the e-module being developed is indeed needed by students (Armani et al., 2021). This also shows that the use of e-modules that have been developed in learning temperature and heat is very suitable to be applied in this learning and is practically used by students so that student responses are positive (Elisa et al., 2022).

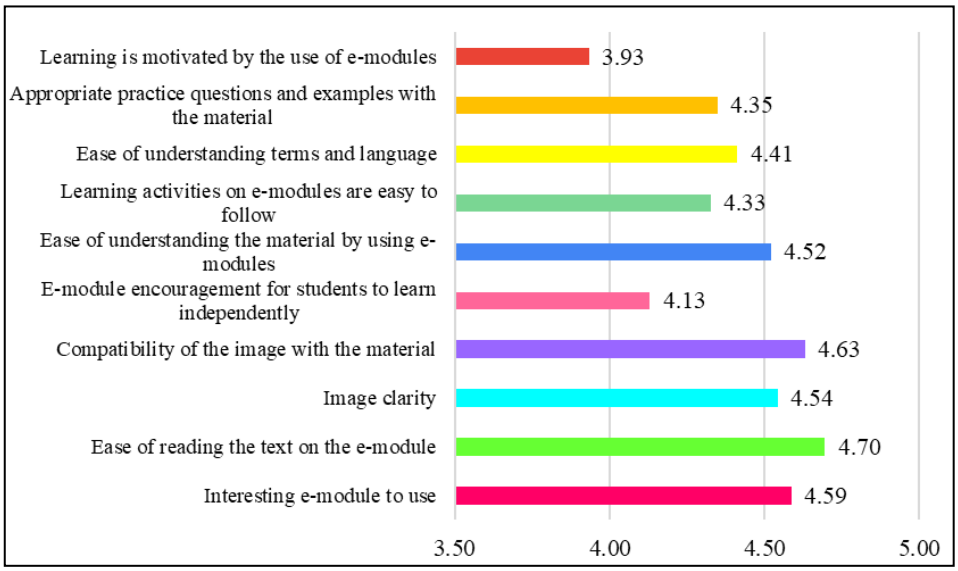

Figure 2 Student Responses to the E-Module

This outstanding result can be attributed to the developed e-module that incorporates local wisdom. Elisa et al., (2022) stated that e-modules integrated with local wisdom help students learn, improve thinking skills, contextualize lessons, and attract students' attention to learning. Local wisdom content also allows students to connect the concepts of temperature and heat with phenomena they encounter in everyday life and more easily understand them (Agustinasari et al., 2021). The positive student response to the e-module is attributed to the local wisdom content, which simplifies comprehension of temperature and heat materials. Additionally, the test questions align with the taught material, the e-module uses straightforward language, and it enhances students' awareness of the relevance of local wisdom to temperature and heat topics, thereby motivating them to learn (Wati et al., 2021).

Furthermore, the favorable student response to the e-module is also attributed to its digital format. E-modules in digital form are visually appealing, portable, foster students' learning independence, and present temperature and heat materials more comprehensively through the inclusion of videos (Wati et al., 2021). In addition, the e-module received a very good response because it was flipbook-based. Armani et al., (2021) assert that flipbooks actively engage students in the learning process by encouraging them to explore various features, generating interest. The flipbook format is visually appealing, interactive, and incorporates pictures, videos, and audio. The practicality of the flipbook-based e-module contributes to its very positive reception among students (Supriyadi et al., 2021).

Additionally, flipbooks offer intriguing three-dimensional effects, creating a sensation akin to real books, and the inclusion of animated pictures and videos enhances their appeal to students (Putra & Mufit, 2022).

CONCLUSION

The electronic module, enriched with local wisdom, encompasses valid content on heat and temperature materials, with a validity coefficient ranging from 0.92 to 1.00. Moreover, students demonstrated a highly positive response to the e-module, earning it an average score of 4.41. Consequently, the developed electronic module is deemed suitable for use as a learning resource for temperature and heat among high school students or their equivalents.

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