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Developing Students' Scientific Literacy Skills in Driving Schools Through the Use of Local Wisdom-Based Physics Lesson E-module

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Abstract

Scientific literacy is the primary goal of learning physics. However, this ability does not need to be carried out well in schools, especially those integrated with local wisdom. Therefore, this study aims to describe the feasibility of South Borneo's local wisdom-based physics e-modules on renewable energy materials to improve students' scientific literacy. This study uses the ADDIE development model. However, it is still in the ADD stage: Analyze, Design, and Development. Data were collected using an e-module validation instrument emphasising content and construct validity. The validation results show that three experts said that the physics e-module based on local wisdom on renewable energy materials developed is feasible and can be used as a reference for physical libraries to improve students' scientific literacy.

Keywords: E-module; Local Wisdom; Scientific Literacy

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INTRODUCTION

In the era of globalisation, scientific and technological innovation is developing in people's lives, including information and communication (Zulaiha & Kusuma, 2021). This condition requires everyone to master 21st-century life skills, including scientific literacy. According to Afandi & Afriani (2016), scientific literacy skills are needed to face life's challenges in the era of globalization that continues to grow. It can be defined as scientific skills and knowledge to be able to examine questions, gain experience and new knowledge, describe phenomena that occur scientifically and make conclusions from what is seen, understand science in life, and the importance of science and technology in a good environment. nature, education, culture, and actively participate or empathize with global issues related to science and issues around the place of residence (OECD, 2016)

The scientific literacy movement in schools prepares a generation that can face the increasingly rapid development of science and technology. Scientific literacy is an ability that must exist in every individual, and none need to be familiar with learning physics at school. Because

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the achievement of student learning outcomes will be better if each individual has good scientific literacy skills (Febryana et al., 2020). Students become more responsive to the problems of modern society in the environment around their homes, health, economy, etc. If the country has a young generation with good scientific literacy skills, the rate of development will be more rapid. According to Prastika et al. (2019), several developed countries are actively trying to develop each individual's scientific literacy so they can later compete with the growing global world.

However, the results of the Program for International Student Assessment (PISA) every three years revealed that in 2018, Indonesia was still ranked 72 out of 77 countries (Schkeicher, 2019). The low level of scientific literacy shows that Indonesia's education quality is lower than in other countries. Students can generally only remember simple information and knowledge in learning (e.g. names, definitions, equations) and use their knowledge to conclude phenomena that exist in everyday life (Wulandari & Sholihin, 2016). According to Situmorang (2016)The low scientific literacy of students in Indonesia can be influenced by various factors, including the curriculum and education system, the selection of learning models and methods, teaching materials, learning infrastructure, and so on.

The results of the researchers' initial observations in class XB at one of the driving schools in Banjarmasin through filling out *Google Forms showed* that students' scientific literacy was still in the low category, namely 50.79% of students had difficulty explaining scientific phenomena, evaluating and designing scientific investigations (61.90%), and challenges in interpreting data and providing scientific evidence (80.95%). This is reinforced by the results of an interview with the physics teachers of the driving school in Banjarmasin that the learning carried out by the teacher still needs to train students' scientific literacy well. In addition, the textbooks used are less able to train students' scientific literacy because the explanations of the material are less detailed, they lack examples of questions and solutions used by students to deepen their understanding of the material, and the material being taught is not linked to the potentials that exist in the environment around where they live. student.

One solution to overcome problems related to students' low scientific literacy, which can combine technological developments with the demands of 21st-century learning, is to use physics e-modules based on local wisdom in South Kalimantan. In line with (Asri & Dwiningsih, 2022), e-modules include learning materials that are made systematically on specific subjects, which are distributed in the form of links or links so that they can be accessed electronically, including images, animations, videos and links. Using e-modules in learning can help increase students' understanding of the learning process because it provides exciting material that can be accessed anytime and anywhere (Ali, 2018).

The application of local wisdom is believed to help students understand physics concepts in depth and apply them in explaining natural phenomena and overcoming problems in the environment around where they live (Fitriah et al., 2021; Hartini et al., 2018; Misbah et al., 2020; Oktaviana et al., 2017; Wati et al., 2019). Students are presented with theoretical concepts of physics and applications in real life in the surrounding environment (Bakhtiar, 2016; Fuad et al., 2018; Wati et al., 2020). As the opinion (Murti & Sunarti,

2021). Local wisdom is a comprehensive insight into life in the form of lifestyle, knowledge and community activities, as well as regional cultural and geographical advantages that are used as guidelines or guidelines in social life if problems occur. According to Martawijaya & Hasyim (2019) local wisdom contains environmental and local cultural issues, so it is suitable for science literacy-based learning.

It is hoped that integrating local wisdom into the learning process will enable students to use their scientific knowledge to obtain information by connecting various scientific materials with problems that exist in society so that students' scientific literacy increases (Wibowo & Ariyatun, 2020). Learning integrated with local wisdom will also contain global community issues that each individual can use to explore problems or phenomena that occur in the environment around their residence, especially those that prioritize the development of science and technology, as research conducted by (Martawijaya & Hasyim, 2019) shows that learning physics using books based on local wisdom can improve students' scientific literacy in high school. This is to the demands of an independent curriculum for driving schools, namely every educator, so that they can develop teaching modules that are by the needs of students, by the characteristics of the potential possessed by an area, especially local wisdom. The contents of this e-module further highlight the local wisdom owned by the province of South Kalimantan to explain phenomena and solve life problems. In each sub-chapter explanation of the material, more emphasis is placed on every scientific literacy indicator you want to improve.

Based on the description above, this study aims to describe the feasibility of physics e-modules based on local wisdom in South Kalimantan to improve students' scientific literacy to support physics learning in driving schools.

METHOD

The ADDIE development model is selected because it provides an opportunity to evaluate and revise continuously in every phase it goes through (Hadi & Agustina, 2016). This model consists of five steps, namely: analysis, design, development, implementation, and evaluation which was developed by (Tegeh et al., 2015). However, this research is limited to the development stage due to time constraints.

The stages carried out in the development of this e-module are analysis stage. At this stage, activities are carried out to study existing products in the field, conduct curriculum analysis, analysis of material and student characteristics, and analyze resources for problem-solving. The design stage is divided into two activities: the design of learning activities and the design of the initial structure of the e-module content. The last stage is the development stage; this stage involves collecting and searching various relevant sources to enrich the materials, editing and setting the layout of the e-module, as well as integrating the e-module, which has been developed with professional flip *PDF software* and is hosted using the www page.webhosting.com so that the e-module can be accessed online. This stage also designs research instruments for collecting validation data. At each stage, a formative evaluation is also carried out for improvement or revision if necessary. This research still needs to be carried out in the implementation phase to determine the practicality and effectiveness of the e-module to be applied to driving schools.

This research produces an e-module based on local wisdom of South Kalimantan physics to improve students'

scientific literacy on renewable energy materials. The physics e-module based on the local wisdom of South Kalimantan that has been developed is then reviewed by the core development team and continued with validation carried out by three validators of physics learning experts by filling out the content validity and construct validity instrument sheets of the e-module.

This study uses data analysis with quantitative and qualitative analysis techniques (Setiyoaji et al., 2020)The quality of the e-module is seen from the average score given by the three validators, which are then adjusted to the validity criteria: $\bar{x} > 3{,}4$ (very valid); $2{,}8 < \bar{x} \leq 3{,}4$ (valid); $2{,}2 < \bar{x} \leq 2{,}8$ (quite valid); $1{,}6 < \bar{x} \leq 2{,}2$ (less valid); and $\bar{x} \leq 1{,}6$ (invalid). In addition, the reliability value was calculated using the Cronbach Alpha equation assisted by IBM SPSS Statistics 21, then adjusted for the criteria of very high, high, moderately high, low, and very low. After validation, suggestions and input from the validator are obtained, which are used as research material to improve the quality of the developed e-module.

RESULT AND DISCUSSION

The e-module developed contains material on renewable energy accompanied by pictures, animations, videos, *links*, sample questions, practice questions, worksheets, and evaluation questions to help train and improve students' scientific literacy skills. The physics e-module based on local wisdom in South Kalimantan, which was developed, is intended for educators and prospective educators to be used as a reference in terms of improving students' scientific literacy. The front cover of the physics e-module that has been developed is shown in the following Figure 1 and the outline of the e-module developed in Table 1.

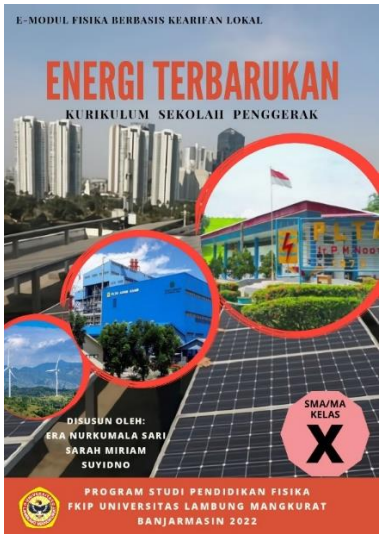

Figure 1 Cover of e-module

Table 1 Outline of the contents of the e-physics module based on local wisdom

Part	Contents	
Frontpage	▪ Cover ▪ Foreword ▪ Table of contents ▪ Introduction ▪ Instructions for using e-module ▪ Concept maps ▪ Learning outcomes and prerequisites	
Material 1 Business	▪ The difference between work in physics and everyday life ▪ work with force in the same direction as the displacement	▪ *Let's try* (Examples of questions and solutions

Part	Contents	
	▪ work with staff forms an angle with removal.	accompanied by scientific literacy indicators)
Material 2 Energy	▪ The magnitude of the PLTA. ▪ The basic form of energy is hydropower.	▪ *Let's fight* (Practice questions/guided practice)
Material 3 The Law of Conservation of Mechanical Energy	▪ Work-energy theorem ▪ The law of conservation of mechanical energy	▪ *Let's do it* (Group exercise)
Material 4 Energy Sources	▪ Type of energy source ▪ Renewable and non-renewable energy sources	▪ Summary ▪ *Quiz* (evaluation questions)
Material 5 Efforts to Fulfill Energy Needs	▪ The problems that occur due to the use of energy and solutions to meet the community's energy needs.	▪ Self-assessment
Closing Page	▪ Glossary ▪ Science Literacy Test ▪ Answer key ▪ Author Information ▪ Bibliography	

Based on Table 1 the e-module begins with the cover, foreword, table of contents, introduction to instructions for using the e-module, concept map, and learning outcomes and prerequisites. This e-module is designed systematically in 5 materials. **Material 1** discusses work in physics, including work with the direction of the force in the direction of the displacement and works with the direction of the force forming an angle with the removal. In this business material, the explanation is related to the local wisdom of barges transporting coal. **Material 2** discusses the physical quantities and forms of primary energy found in the Riam Kanan Hydroelectric Power Plant in Banjarbaru. The elemental energies discussed are the kinetic energy of water, gravitational potential energy, heat energy, and electrical energy in the generator. **Material 3** discusses the work-kinetic energy theorem, the work-potential energy theorem, and the law of conservation of mechanical energy whose material is associated with Pelaihari's typical coconut-carrying oxcart. **Material 4** discusses the types of energy sources, both renewable and non-renewable, such as fossil energy, biogas, biomass, water, wind, sun, ocean waves, tides, and geothermal energy. The material is always related to the existing power plants in every discussion and will be developed in Kalimantan. **Material 5** discusses the problems that occur due to the excessive use of fossil energy and the solutions or efforts that must be made to meet the community's energy needs.

Each distribution of material, this e-module is also equipped with sample questions *(Let's try)* containing questions about a material that contains local wisdom of South Kalimantan accompanied by scientific literacy indicators that you want to train and their solutions. Then there are practice questions *(Let's fight)* used so that students can practice deepening the material with the teacher's guidance. Then there are *Let's do it,* questions that students in groups must answer under the teacher's direction. At the end of each material, a summary is provided containing an

overview of the material students have studied. And lastly, this e-module is also equipped with evaluation questions *(quizzes)* that function so students can independently measure their understanding of the material.

At the end of the e-module is a glossary containing essential words or terms in a material. Then there is the scientific literacy test, the final test used to assess the achievement of students' scientific literacy on renewable energy materials. A brief answer key to the questions in the e-module also accompanies this e-module. Then the author's information and bibliography.

The analysis of the results of the feasibility of the e-module developed in this study was deemed feasible to improve students' scientific literacy skills. The results of the validation analysis of the physics e-module based on local wisdom in South Kalimantan are presented in Table 2.

Table 2 The results of the validation of the physics e-module based on local wisdom

Assessment Aspect		Validity				Reliability	
		Score	Category	Average	Category	α	Category
Contents	Software engineering	3.24	V	3.31	V	0.61	T
	Content quality	3.48	SV				
	Organization	3.22	V				
	Language	3.25	V				
	Evaluation	3.33	V				
Construct	Consistency	3.44	SV	0.52	V	0.52	CT
	Format	3.33	V				
	Attractiveness	3.25	V				
	Font shape and size	3.00	V				
	Characteristics	3.40	V				

Description: SV (Very Valid), V (Valid), CT (Sufficiently High), and T (High)

Based on Table 2, the e-module has met the validity of the content and construct and is reliable. This e-module fulfills content validity because it meets the assessment of software engineering aspects, where all navigation buttons function correctly, the *software* used for application development is appropriate, namely using *Flip PDF Professional* and publications based on *open access web*, in addition to *bugs* and *errors* in few applications, e-modules do not consume much memory and do not require a long *loading* time. For content quality, the material is by the learning indicators, the concept map is easy to understand, and some pictures and videos help students understand the material; examples and practice questions contain events of local wisdom and components of scientific literacy. This is supported by the research results of Fuad et al., (2018) that learning physics associated with local wisdom in South Kalimantan can motivate students to more easily understand a physics concept in the learning process because the events studied are very close to the environment where students live. In the organizational aspect, the material in the e-module and the arrangement between sub-chapters and between paragraphs have been organized, systematic, and coherent. The work sub-matter is presented as an opening material and becomes the basis for the energy sub-matter and the mechanical energy conservation law. At the same time, the sub-material of efforts to meet energy needs is presented as a closing material before students must study the previous sub-material, namely energy sources. As stated by Magdalena et al. (2020) that one

of the characteristics of a good e-module is to present systematically organized material.

The e-module also obtained a valid category in the linguistic aspect, which stated that the language used was clear and by the concept and contained local wisdom terms; according to language rules, there were no ambiguous sentences, and according to the age of students' cognitive development. This is to research conducted by Aulia & Andromeda (2019) that e-modules are categorized as valid on the linguistic component, which indicates that the e-module developed uses language according to the Enhanced Spelling and does not have multiple meanings, so it can provide information and knowledge that easier for students to understand. For the evaluation aspect, the evaluation is in a valid category, indicating that the e-module contains evaluation questions based on the specified learning indicators and is available on renewable energy materials. Each evaluation question is by the specified scientific literacy indicators. The e-module also provides an answer key for each evaluation question and practice questions that are appropriate and by the specified rules. Instructions for working on the questions are also apparent; each question has a different difficulty level according to the material.

The feasibility of the e-module can be seen from the validity of the construct, which obtained a very valid category in the aspect of consistency assessment. This shows that the shape and size of the letters, the spacing, the distance between the title and the first line and the main text, as well as the terms or symbols and layouts used in the e-module, are consistent in each section. This consistency is to the characteristics of the e-module, which has been determined by the Ministry of (Depdiknas, 2008) the font, spacing, and layout must be consistent in the e-module section. The use of attractive designs and colors is an integral part of the appearance of the e-module. The form used in this e-module predominantly uses bright yellow and green colours with images of power plants closely related to renewable energy. Using yellow in e-modules can stimulate students' minds and mental activity and improve individual analytical skills. This allows students to be motivated to learn with the help of this e-module.

The e-module also fulfills the valid category in the aspect of format assessment that the column format used is by the layout, shape, and size of the e-module so that it affects the aesthetics of the e-module display. Single columns dominate this e-module, but several sections use double columns. The column format must be proportional to single-column and double-column forms. The next aspect of the assessment is attractiveness which gets a valid category, which says that the design made is attractive, the selection of the right display color, the color of the text that matches the background, the material presented is explicit, and the use of the right image proportions. As explained by Winatha (2018) a valid e-module must have a good appeal; besides that, the color of the text with the background must be contrasting or opposite.

The next aspect of construct assessment is the shape and size of the letters that get a valid category. The shape and size of the letter (font) are an essential part of the e-module. This means that the developed e-module contains the right font shape and size, especially since this module is displayed on a smartphone. The teaching materials in this e-module are presented in TW Cen MT font with a font size of 15 and 1.5 spacing between lines. Fonts displayed on smartphones with a size of more than 12 will be more attractive to readers. This is

the opinion of Darroch et al. (2005) who states that the font size used on smartphones must be by the target reader. This e-module also meets the validity category in the aspect of character assessment. Based on the distinctive aspects of the e-module developed according to Wijayanti & Sungkono (2017) it consists of five characteristics, namely (1) self-instruction, the e-module must have the proper structure so that students can learn independently; (2) self-contained, the material compiled must be in one unit so that students can study material to completion; (3) stand-alone, the developed e-module does not depend on other devices; (4) adaptive, e-modules are developed using devices by technological developments; and (5) user friendly, easy to access e-modules anywhere and anytime.

The advantages of the physics e-module based on South Kalimantan's local wisdom that was developed include renewable energy material, which is quite recently applied in the independent curriculum of the driving school. This renewable energy material is integrated with local wisdom owned by South Kalimantan, including (a) Business sub-chapters in physics associated with the barge transporting coal on the Barito River; (b) The primary forms of energy associated with the Riam Kanan Hydroelectric Power Plant (PLTA) in Banjarbaru; (c) the work-energy theorem and the law of conservation of mechanical energy associated with the typical oxcart of the Pelaihari area; (d) energy sources are linked to the Asam-Asam PLTU in Tanah Laut, PLTS at the Banjarmasin flyover, and so on. As shown in the following Figure 2.

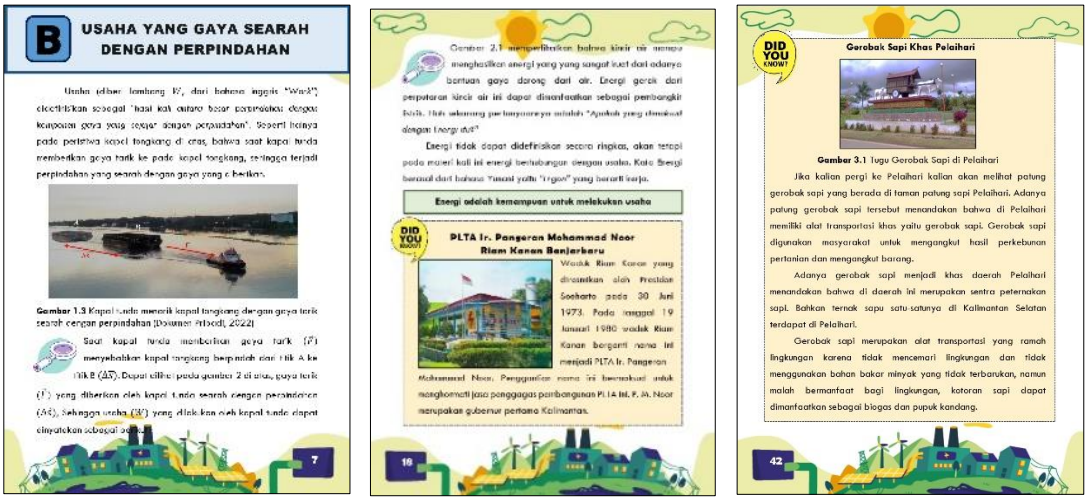

Figure 2 An example of the linkage of renewable energy materials with the local wisdom of South Kalimantan

In addition, the developed e-module also contains sample questions and their solutions and practice questions containing scientific literacy indicators to train students' scientific literacy skills. This is supported by the research of Wahab et al. (2021) that a learning resource conforming with scientific literacy indicators will produce good scientific literacy teaching resources as well. Each of the examples and practice questions also contains regional potentials around the student environment, such as local wisdom possessed by South Kalimantan. Because

researchers believe that learning that is associated with local wisdom will have global community issues so that students can utilize their knowledge and scientific concepts to solve problems that exist in everyday life to improve students' scientific literacy skills. This is reinforced by Setiawan (2019) who states that students' scientific literacy skills can be enhanced by using the characteristics and potential of students, as well as developing learning tools that are appropriate to the student's learning environment. Because by providing good quality learning resources, in terms of content and presentation of literacy, students' scientific literacy skills will be able to improve (Wahab et al., 2021). Some examples of scientific literacy questions are shown in Figure 2.

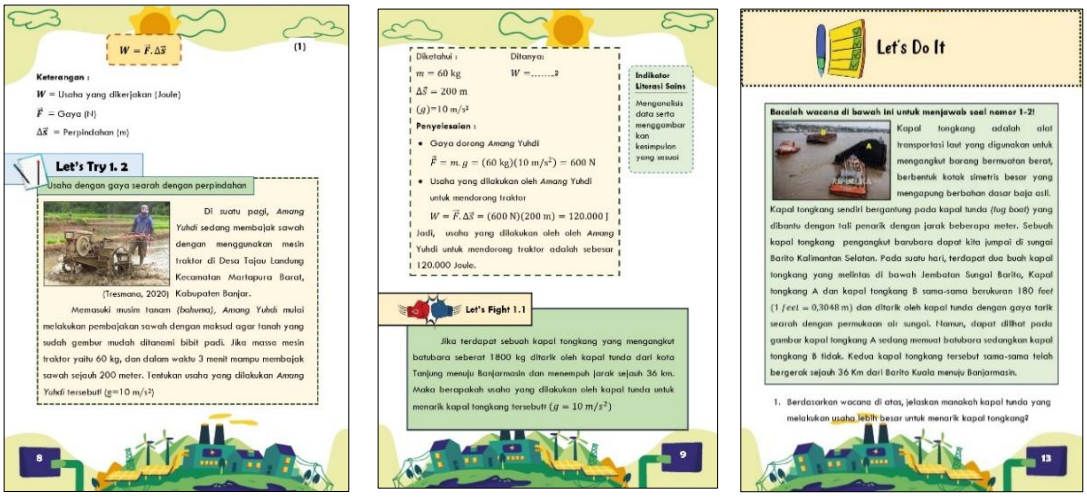

Figure 3 Some examples of scientific literacy questions

The weakness of the developed e-module is the need for more sample questions and exercises for scientific literacy questions with indicators suggesting ways to investigate scientific questions. Because this scientific literacy indicator is only trained in one meeting. The developed e-module also sometimes takes a long time to load when it first opens on some devices that do not support it.

CONCLUSION

This research has produced an e-module of physics based on local wisdom in South Kalimantan, which is both valid in content and construct, so it can be said that it is feasible as an alternative for educators to improve students' scientific literacy skills in learning physics in driving schools. The next researcher recommends testing the implementation on a broad scale to determine its practicality and effectiveness in learning physics in driving schools.

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