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Kemplang Panggang and Salted Fish as Potential Issues in Physics e-Module: An Effort to Enhance Students' Creative Thinking Skills

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Abstract: This study aims to produce a physics e-module based on the local wisdom of *kemplang panggang* and salted fish to help improve the creative thinking skills of senior high school students. Three stages of Rowntree's development model, namely planning, development, and evaluation with Tessmer's formative evaluation technique were applied in this study. A total of twenty-eight of eleventh grade students from SMAN 1 Tanjung Batu were selected purposively as research participants. Students' creative thinking skills were measured using the creative thinking skills test and analyzed using the normalized gain formula. The results showed that the average pretest and posttest scores of students were 28.20 and 71.65 with an average n-gain value of 0.6. The results of the study concluded that the use of e-modules based on the local wisdom of *kemplang panggang* and salted fish was quite effective in improving students' creative thinking skills.

Keywords: physics e-module, local wisdom, creative thinking skill.

▪ INTRODUCTION

Learning is a process of interaction between students and the things around them, both with educators and with learning resources (Chalkley et al., 2024). Learning resources can be things that are naturally available in the learning environment or materials developed by the teacher himself (Gomis, Oladinrin, Saini, Pathirage, & Arif, 2023). One of the learning resources that can be developed by teachers themselves is teaching materials. Along with the development of technology, teaching materials can now be integrated with other media (Negoro, Rusilowati, & Aji, 2023), such as audio and video (Carrete-Marín, Domingo-Peñafiel, & Simó-Gil, 2024; Göbel, Bönte, Gösch, & Neuber, 2022; Widiyatun et al., 2020). Modules are one of the teaching materials that can be used as a guide for independent learning, because the module contains instructions for its users (Sirisuthi & Chantarasombat, 2021; Tabuena & Villareal, 2024). Along with the rapid advancement of technology, learning modules have been widely presented in electronic format because of their advantages, namely being more environmentally friendly because they do not use paper, can be accessed anytime, anywhere, and can display images, videos, audio and animations, and allow direct feedback (Charlina, Septyanti, Mustika, & Rahmi, 2022; Delita, Berutu, & Nofrion, 2022; Findayani, Suparta, & Sariyasa, 2023).

The 21st century is marked by the development of technology and science which has experienced many changes that greatly affect life. One of the skills that must be mastered in the 21st century is creative thinking skills. Creativity is the ability to create something new or see something from a different perspective so that interesting solutions can be found (Akpur, 2023; Habibi et al., 2020; Stevenson, Baas, & van der Maas, 2021). Suryandari, Rokhmaniyah, & Wahyudi (2021) stated that creative thinking is a new way of seeing and doing something that contains 4 aspects, namely fluency, flexibility, originality, and elaboration. Good creative thinking skills can help students solve physics

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problems well. However, students' creative thinking skills, especially in physics subjects, are still quite low (Batlolona, Diantoro, Wartono, & Latifah, 2019; Muflikhun & Setyarsih, 2022; Nazhifah, Wiyono, Ismet, & Azairok, 2023; Rahmawati, Mirna, & Khaeruddin, 2022). Creative thinking skills can be developed in several ways, such as paying attention to intuition, using imagination, seeing a problem from a different perspective, and expressing new possibilities (Prabaningtias, Istiyono, Mahmuda, Arman, & Arifiyanti, 2022). The learning approach that can be applied to facilitate these things is contextual-based learning. Contextual Teaching and Learning (CTL) encourages students to connect their knowledge and apply it contextually in real-life situations (Lestari, Ahmadi, & Rochmad, 2021). Several studies have stated that the use of contextual teaching and learning (CTL) can improve students' learning understanding, learning motivation, and critical thinking skills (Haryadi & Nurmala, 2021; A. D. Lestari, Sutarno, Rohadi, Sakti, & Nirwana, 2021; Ramdani, Jufri, Gunawan, Fahrurrozi, & Yustiqvar, 2021; Saidi, 2022). Contextual learning can be integrated into physics learning materials or media, such as in the research of Hasanah, Sunarno, & Prayitno (2021) who developed a CTL-based science module, the research of Saparini, Wiyono, & Muslim (2020) who developed a contextual-based learning video for wetlands, and the research of Pabri, Medriati, & Risdianto (2022) who used contextual-based e-worksheets. One of the contexts that can be raised in contextual learning is the local wisdom of a region.

Local wisdom is knowledge, values, behavior, and ways of acting towards certain things and events in an area (Laila, Asri Budiningsih, & Syamsi, 2021). By incorporating the context of local wisdom into the education process, local wisdom can be preserved and learning becomes more meaningful (Amiruddin, Admoko, Kholiq, & Zainuddin, 2023). Several studies have shown the development of physics teaching materials based on local wisdom, one of which is the study (Laos & Tefu (2020) which produced physics teaching materials based on local wisdom that are valid and effective in improving students' critical thinking skills. Then the study of Sukma, Mundilarto, & Putri (2019) which produced an e-book based on local wisdom on Newton's Law material, and the study of Misbah, Hirani, Annur, Sulaeman, & Ibrahim (2020) which produced a physics module integrated with local wisdom to foster the character of Sanggup Bagawi Gasan Masyarakat of valid students. One of the interesting areas to explore local wisdom is the province of South Sumatra, especially Burai village. Burai Village is one of the villages in Ogan Ilir Regency, South Sumatra, which is located on the banks of the Musi River, so the main food source for the villagers is fish. When the river water recedes, the villagers get more fish from the river. Residents usually take advantage of this condition as additional income, namely by processing the abundant fish into grilled crackers and salted fish. Based on the description above, the researcher intends to develop a physics e-module based on the local wisdom of kemplang panggang and salted fish to improve the creative thinking skills of high school students, especially on the heat material studied in grade 11 of high school.

▪ METHOD

The type of research conducted is development research with the Rowntree development model. This research was conducted from May to December 2023.

Participants

This study involved three experts and three students at the one-to-one evaluation stage and nine students at the small group evaluation stage. The trial process involved 28 eleventh graders in the odd semester of the 2022/2023 academic year at SMAN 1 Tanjung Batu. The sample was selected using a purposive sampling technique, which was selected based on its relevance to the research objectives (Al Gharsi, Ali Belhaj, & Nirmala, 2024; Ngatman, Hidayatullah, Sugiyanto, & Purnama, 2024). This sample was chosen because the topics discussed in the e-module is heat material which is studied in the physics subject of 11th grade students.

Research Design and Procedures

The research conducted is a development research that aims to produce a physics e-module based on local wisdom of kemplang panggang and salted fish to improve the creative thinking skills of senior high school students that are valid, practical and effective. The development was carried out using the Rowntree model in three stages, consisting of three stages: planning, development and evaluation (Kusuma, Lia, Hakim, & Mian, 2023; Sadly & Akhsan, 2023). This model was chosen because it is oriented towards output or products, especially teaching materials (Akhsan, Putra, Wiyono, Romadoni, & Furqon, 2023; Murniati, Fathurrohman, & Letari, 2022). The evaluation stage was carried out by adopting Tessmer's formative evaluation which consists of several stages, namely self-evaluation, expert review, one-to-one evaluation, small group evaluation and field test (Tessmer, 1993). Data collection was carried out using expert validation sheets, student response questionnaires and creative thinking skills tests. Expert validation sheets are used at the expert review stage, student response questionnaires are used at the one-to-one evaluation and small group evaluation stages, then creative thinking skills tests are used at the field test stage (pre-test and post-test). The results of expert validation, student response questionnaires and creative thinking skills tests are then analyzed to determine the validity, practicality and effectiveness of the developed e-module.

Instrument

This study used two types of non-test instruments, namely expert validation sheets and student response questionnaires, as well as one type of creative thinking skills test instrument. The expert validation instrument was adapted from the textbook criteria according to the National Board of Education Standards which had been validated by the team (Aboe & Bahara, 2022; Wulanningtyas, Arfi, & Ramadhan, 2023). The expert validation instrument consists of material validation, presentation and appearance, and language. The creative thinking skills test instrument consists of 12 questions developed by the researcher with the assistance of two supervisors. The validity and reliability of this instrument were carried out through calculations using SPSS. The outline of the creative thinking test instrument is presented in the following table.

Table 1. Indicators of creative thinking skills test

No.	Indicators	Descriptions	Number of items	Question number
1	Fluency	Can provide correct answers/ideas to questions asked	3	2. 5. 6

2	Flexibility	Can produce varied answers with different points of view	3	1. 3. 7
3	Originality	Can provide answers according to one's own thoughts	3	4. 10. 11
4	Elaboration	Can detail an idea or answer so that it is clearer	3	8. 9. 12

Data Analysis

The results of expert validation and student response questionnaires obtained at the evaluation stage were then analyzed using the following calculations.

$$P = \frac{f}{N} \times 100\%$$

With P is the percentage of test results, f is the total assessment score, and N is the maximum assessment score. The results of the expert validation percentage are then grouped based on the following expert validation results (EVR) categories (Wiyono, 2015).

Table 2. Validation results categories

Percentages (%)	Category
86 ≤ EVR ≤ 100	Very Valid
70 ≤ EVR ≤ 86	Valid
56 ≤ EVR ≤ 70	Less Valid
0 ≤ EVR ≤ 56	Invalid

Meanwhile, the percentage results of the student response questionnaire are grouped based on the following one-to-one and small group evaluation (HEOS) results categories (Wiyono, 2015).

Table 3. One-to-one and small group evaluation results categories

Persentase (%)	Kategori
86 ≤ HEOS ≤ 100	Very Practical
70 ≤ HEOS ≤ 86	Practical
56 ≤ HEOS ≤ 70	Less Practical
0 ≤ HEOS ≤ 56	Not Practical

The results of the creative thinking skills test (pre-test and post-test) were analyzed using the normalized gain formula and interpreted based on the following categories (Maryani, Putri, & Supriadi, 2022).

Table 4. N-gain classification

Average score	Interpretations
$(g) \geq 0.7$	High
$0.3 \leq (g) > 0.7$	Medium
$(g) < 0.3$	Low

▪ RESULT AND DISSCUSSION

The development of e-module are presented based on the following stages.

Planning

In the planning stage, the identification of physics concepts in the local wisdom of Burai village was carried out. The identification of physics concepts in the local wisdom of Burai village is presented in Table 5. Based on this identification, the physics concept that is most often found is in the Heat material, especially in the local wisdom of kemplang panggang and salted fish. This material is very close to everyday life, but it is a little difficult to understand because it is abstract so that it can cause misconceptions (Komikesari et al., 2020; Sofianto & Irawati, 2020; Sundari & Sarkity, 2021). Then, this stage is continued by analyzing the needs of students by distributing questionnaires in the form of Google Forms to high schools in Ogan Ilir Regency. Based on the results of the questionnaire, it can be concluded that students want e-modules whose material is explained in detail and equipped with example questions, can improve creative thinking skills, use communicative and easy-to-understand language, can increase insight, and is based on local wisdom. The last part of the planning stage is the formulation of the learning objective flow. The formulation of the learning objective flow is carried out by analyzing learning achievements (Zulaiha, Meldina, & Meisin, 2022)

Table 5. Identification of physics concepts

No	Local Wisdom	Physics Concepts
1	Making *Kemplang Panggang*	Heat, expansion, heat transfer, the effect of heat on matter
2	Making Salted Fish	Heat, heat transfer, the effect of heat on matter
3	Making *Songket*	Force, Newton's laws and pressure
4	Making *Purun* Crafts	Heat, force, Newton's laws

Develop

The development stage is the stage of designing teaching materials, including topic development, drafting, and prototype production. At the topic development stage, the author makes an outline of the contents of the e-module which contains the initial design of the contents of the e-module and determines the learning materials that are in accordance with the learning topic (Yanindah & Ratu, 2021). The e-module created contains the context of local wisdom as an introductory part or example of a phenomenon from a sub-material. For example, in the expansion sub-material, a video is presented at the beginning showing the increase in the size of kemplang during the roasting process. This event is then explained physically, namely with the concept of expansion. In several parts of the final sub-material, a Let's Think Creatively box is provided which contains questions to direct students to find answers that involve creativity. By including surrounding phenomena into the learning process, it can encourage students to be more creative (Yani & Widiyatmoko, 2023). After determining the outline of the contents, the next step is to compile a draft of the teaching materials. The draft is compiled by sequencing the material and components presented in the E-Module such as the cover page, table of contents, instructions for use, learning activities, and so on.

At the prototype production stage, the researcher created an E-Module prototype according to the initial design. The E-Module prototype was created using Articulate Storyline 3 software. This software was chosen by the researcher because it has advantages including: allowing the inclusion of various learning media in the E-Module, creating tests/quizzes that provide responses automatically and immediately and do not require a programming language in the creation process so that it is quite easy to use for beginners (Febrianto, Hidayati, & Rini Untari, 2022; Indirawati Leztiyani, 2021; Monika, Fatmaryanti, & Maftukhin, 2022; Nurmala, Triwoelandari, & Fahri, 2021). Furthermore, the researcher designed the cover, content and illustrations on the E-Module using Canva. After all the prototype production processes were completed, the E-Module was published in HTML5 format so that it could be accessed by students online. The E-Module that has been produced and published is then referred to as prototype 1 and is ready to be evaluated.

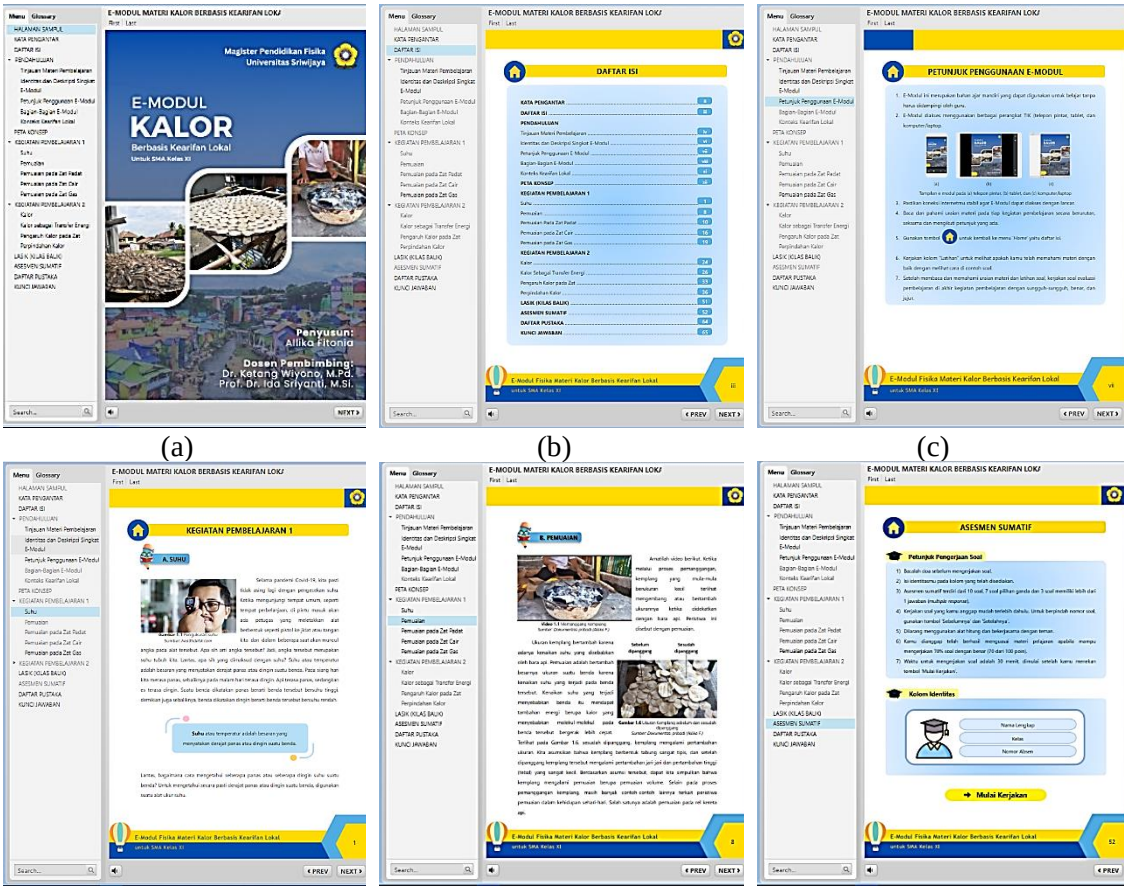

Figure 1. (a) cover, (b) table of contents and 'home' menu, (c) instructions for using the e-module, (d) learning activities, (e) local wisdom content, and (f) summative assessment.

Evaluation

The evaluation stage begins with a self-evaluation conducted by the author and the supervisor independently by examining several components such as material, presentation and appearance, and language of prototype 1. Then the evaluation is

continued with the help of experts (expert review). At this stage, the researcher asked three experts to assess one component each, namely material, presentation and appearance, and language. The results of the expert assessment at the expert review stage can be seen in Table 6.

Table 6. The results of expert review

Component	Evaluation criteria	Percentage (%)
Content	Suitability of material with curriculum	100.00
	Truth of learning material substance	93.75
	Suitability of material with local wisdom context	100.00
	Suitability of product with creative thinking skills	75.00
	Average	**92.19**
Presentation and Layout	Presentation accuracy	100.00
	Learning presentation	95.00
	Completeness of presentation	85.00
	E-module display	91.67
	Average	**92.92**
Language	Communicative	75.00
	Dialogical and Interactive	82.50
	Straightforward	87.50
	Coherence and sequence of thought flow	75.00
	Suitability with Indonesian language rules	87.50
	Suitability with student development	75.00
	Use of terms and symbols/emblems	87.50
	Average	**81.43**

The percentage of expert validation results is classified according to the expert validation result category according to (Wiyono, 2015). Based on the results of the expert review stage, the average percentage of assessment on the material component was 92.19%, which is classified as very valid. The presentation and display components are also categorized as very valid with an average assessment percentage of 92.92%. Meanwhile, the language component is categorized as valid with an average assessment percentage of 81.43%. This means that overall prototype 1 is worthy of being tested (Novitasari, Connie, & Risdianto, 2022; Wulandari & Radia, 2021). In addition to what is presented in Table 6, the experts also provided comments and suggestions for improvements in the development of the e-module.

After prototype 1 was declared valid, the evaluation continued to the one-to-one evaluation stage. This stage was carried out by involving three students of class XI MIPA 4 SMA Negeri 1 Tanjung Batu to fill out the student response questionnaire. Students will be given the opportunity to access local wisdom-based physics e-modules to improve creative thinking skills, then provide assessments and comments related to prototype 1. The assessment results at the one-to-one evaluation stage showed an average of 90.46% so that it can be categorized as very practical. The three students also provided some input and suggestions, such as there were several pages that could not be swiped so that they had to press the previous or next button to move pages. Comments and suggestions from both experts and students were used as considerations in revising prototype 1 (Sania, Syuhendri, & Akhsan, 2021; Saputra, Thalia, & Gustiningsi, 2019; Widyastuti & Susiana,

2019). The revised e-module after going through the expert review and one-to-one evaluation stages was then referred to as prototype 2.

Prototype 2 will be evaluated for practicality at the small group evaluation stage. This stage involved nine students of class XI MIPA 4 SMA Negeri 1 Tanjung Batu to fill out the same questionnaire as the previous one-to-one stage. The assessment results at the small group evaluation stage showed an average of 95.16% so that prototype 2 can also be categorized as very practical. After going through the small group evaluation stage, the revised prototype 2 will be called prototype 3. This prototype 3 will be tested at the field test stage. The field test stage was carried out in class XI MIPA 4 SMA Negeri 1 Tanjung Batu involving 28 students. At this stage, a pre-test and post-test were carried out. These two tests were carried out to see the extent of student development after participating in learning (Adri, 2020), in this case using a local wisdom-based physics e-module to improve creative thinking skills. The average results of the pre-test and post-test are presented in Table 7.

Table 7. The results of pretest and posttesst

	Pretest	**Posttest**
Number of Participants	28	28
Highest score	41.67	83.33
Lowest score	14.58	64.58
Mean	28.20	71.65
N-gain average	0.6	

In the pre-test, the average score obtained by students was 28.20. While in the post-test the average score of students was 71.65. This shows that there is an increase in student scores before and after using the developed e-module. Based on the results of the analysis, it is known that 5 students have high interpretations, 23 others have moderate interpretations and no students have poor interpretations. From these data it can be concluded that the average interpretation of students of XI MIPA 4 SMA Negeri 1 Tanjung Batu is moderate with an average n-gain value of 0.6.

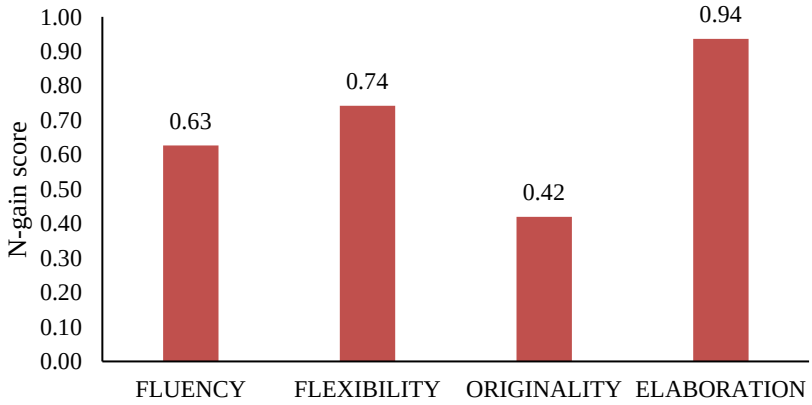

Figure 2. N-gain average for each indicators of creative thinking skills

If we look at Figure 2 above, the average n-gain on the flexibility and elaboration indicators is categorized as high with an n-gain value of more than 0.7. Meanwhile, the fluency and originality indicators are categorized as medium with n-gain values between 0.3 and 0.7. From these data, it can be concluded that students' creative thinking skills are highest in the elaboration indicator and lowest in the originality indicator. This means that after using the local wisdom-based physics e-module, students are fluent in expanding the picture of a problem so that they can solve it in detail, but are still less fluent in using different ways of thinking according to their own thoughts. However, the use of local wisdom-based physics e-modules is descriptively effective in improving the creative thinking skills of high school students. This is in line with research (Misbah et al., 2021; Wati et al., 2020) which obtained an average n-gain of 0.67 and 0.6, respectively.

Based on the five stages of evaluation that have been carried out, it was found that the e-module based on local wisdom of kemplang panggang and salted fish to improve the creative thinking skills of senior high school students was valid, practical and effective descriptively. This finding is in line with research that also produces similar outputs or products, namely physics e-modules to improve valid, practical and effective critical thinking skills (Cynthia, Arafah, & Palloan, 2023), ethnophysics e-modules for critical thinking skills during the Covid-19 pandemic that are valid, practical and effective (N. Lestari & Apsari, 2022), physics e-modules assisted by augmented reality based on local wisdom of Becak to improve mathematical communication and effective critical thinking skills (Dewi & Kuswanto, 2023), physics learning e-modules integrated with the practice of Pancasila values on effective momentum and impulse (Arviyanto Himawan & Ariswan, 2023), and STEM-themed e-modules to improve students' creative thinking skills that are very valid, very practical and very effective (Wulansari, Irdawati, Razak, Chatri, & Fajrina, 2023).

The improvement of students' creative thinking skills is influenced by many things, for example by observing or experiencing directly things that happen in the environment around their homes. During the study, it was found that students understood the material learned more quickly when it was associated with phenomena that they had seen or experienced directly. The context of local wisdom in Burai village is very relevant to students' lives, encouraging them to think of new possibilities or see something from another perspective. Integrating local wisdom into the learning process is considered quite appropriate to increase students' creativity (Noorhapizah, Agusta, & Pratiwi, 2020).

▪ CONCLUSION

Based on the research that has been conducted, it can be concluded that the physics e-module based on the local wisdom of *kemplang panggang* and salted fish to improve students' creative thinking skills that was developed is stated to be very valid, both in terms of material components, presentation and appearance, and language. The developed e-module has also been categorized as very practical in terms of ease of use, attractiveness of presentation, and benefits. This study produced a physics e-module based on the local wisdom of the *kemplang panggang* and salted fish village which is quite effective in improving the creative thinking skills of high school students. There are advantages and disadvantages in using this e-module. This e-module has a disadvantage, namely that it can only be accessed online and cannot be printed. The advantage of this e-module is that it can be accessed independently because it contains several features that allow students

to receive feedback. The e-module produced in this study is expected to be a choice of innovative learning resources for educators and high school students in supporting learning, especially in improving 21st century skills, especially creative thinking skills. Further researchers are advised to develop physics e-modules based on local wisdom from other regions on other physics materials to improve 21st century skills.

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