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THE DEVELOPMENT OF PHYSICS TEACHING MATERIALS BASED ON LOCAL WISDOM TO TRAIN *SARABA KAWA* CHARACTERS

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ABSTRACT

This research came up from the unavailability of the physics teaching materials containing the local wisdom of Tabalong Regency society, South Kalimantan, and the less optimal character education in the learning process. Therefore, the research and development on the physics teaching materials based on the local wisdom of Tabalong regency, South Kalimantan to train *saraba kawa* characters were conducted. The objective of this study was to produce feasible physics teaching materials integrated with the local wisdom based on the aspects of validity, practicality, effectivity, and character achievement. This research type is a research and development using ADDIE model. The subjects of the try out were 36 grade X students of MIPA in 4 SMA Negeri 2 Tanjung Tabalong Regency. The instruments used in this study were validation sheet, response questionnaire, student achievement test, and character observation sheet. The results showed that: (1) the validity of the teaching materials based on its content and appearance was in a good category, (2) the practicality of the teaching material categorized as very practical, (3) the effectiveness of the medium categorized as very practical, (4) and the achievement of *saraba kawa* characters categorized as very good. It concluded that the physics teaching materials based on the local wisdom to train *saraba kawa* characters is feasible for physics learning.

Keywords: local wisdom, *saraba kawa*

INTRODUCTION

Education is indispensable for human life. Its basic purpose is to improve abilities, develop potentials, educate and build individual characters. This is in accordance with the national education function and objectives contained in Law no. 20 The Year 2003 Chapter II Article 3. To achieve the national educational goals, school learnings should be implemented effectively. One of the High School subjects is Physics. Physics Learning could be done effectively if the teaching materials support the learning activities. For example, the teaching materials in the form of a learning module could help students comprehensibly master the subject. In addition, Azizahwati et al., (2015) said that one way to create an effective and conducive learning environment is to connect the physics learning to the local wisdom. This is parallel to Wahyuni (2015), who stated that local wisdom is relatable to education activities. Furthermore, local wisdom is important for students to stay close to the school and for teachers to engage with most learners (Pornpimon et

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al, 2014). According to Ratana (2016), local wisdom transmission should have a reciprocal relationship between learning networks and autonomous learning in order to play a significant role in national development. The local wisdom rooted in the students' life is contextual direct experience (Kurniawati et al., 2017). Learning based on the local wisdom is effective enough to improve students' basic competence (Suastra et al., 2011). Ethnoscience-based science learning concerning everyday life helps students grasp the learning materials (Arfianawati et al, 2016). Local wisdom contains values cultivated within a society. The value is a potential unit to develop education assessment (Toharudin & Kurniawan, 2017).

Based on the interviews conducted in SMA Negeri 2 Tanjung Tabalong regency of South Kalimantan, the physics learning took place in the school so far has not integrated learning materials with the local wisdom. Other than that, character cultivation during the learning process was less optimal. Based on the results of the analysis of physics teaching materials adopted in the school, the teaching materials have not included the potentials and local wisdom of the society in Tabalong regency.

One of the local wisdom of Tabalong community is producing brown sugar. Brown sugar is the sugar made of sap. Making brown sugar is closely related to the physics learning topic of temperature and heat. In addition, there is a well-known character of Tabalong called *saraba kawa*. According to Badan Pusat Statistik Kabupaten Tabalong (2015), *saraba kawa* is a native regional language which means struggle and determination of Tabalong people to perform their duties and obligations to the nation, state, and religion. This character is in accordance with the local wisdom of Tabalong regency in making the brown sugar which must be accompanied by hard work and desire. Therefore, it is necessary to develop physics teaching materials integrated with local wisdom to help learners gain learning experiences related to real-life activities. One of the potential developed materials is a module. Pratama et al., (2015) revealed that module development is a current ideal requirement because the competence approach presupposes the use of modules in learning activities. The use of teaching materials integrated with the local wisdom is suitable for Indonesian youth education (Meliono, 2011). In addition, Hidayanto et al., (2016) showed that the use of physics modules integrated with local wisdom could improve the learning effectiveness to improve the students' achievement. It is also supported by Oktaviana et al., (2017) who said that the module integrated with local wisdom could help cultivate the characters to students.

Keeping this in mind, the research and development of teaching materials in the form of modules was conducted. The purpose of this study was to develop the teaching materials integrated with local wisdom to introduce the character of *saraba kawa* based on its validity, effectiveness, practicality, and character achievement. It is expected that through this research, the physics materials based on the local wisdom of South Kalimantan are feasible to contribute to physics, that is to build scientific knowledge based on local wisdom. In addition, this research was expected to be an alternative reference to improve the quality of physics learning in gaining knowledge and cultivating characters of students.

METHODS

It was a research and development using the ADDIE model comprising the steps of analysis, designing, developing, implementing, and evaluating (Rahmayanti et al., 2016). The subjects of this research were the physics learning materials of temperature and heat integrated with the local wisdom of making brown sugar for the *saraba kawa* character. The research objectives were the feasibility of physics teaching materials based on its content and appearance validity, practicality, effectiveness in cultivating students' character. The subjects of the try out were taken by using purposive sampling technique in 36 grade X students of MIPA in 4 SMA Negeri 2 Tanjung Tabalong. The instruments employed in data collection were validation sheet, response questionnaire, achievement test, and character observation sheet.

The validity of the teaching materials was measured using a validation sheet of teaching materials (Sari & Alarifin, 2016). The validation result of the teaching material was determined by the criteria in Table 1.

Table 1. The Assessment Criteria for Each Aspect of Validation of Teaching Materials

Average Score	Classification
$X > 3.40$	Very good
$2.80 < X \leq 3.40$	Good
$2.20 < X \leq 2.80$	Fair
$1.60 < X \leq 2.20$	Less good
$X \leq 1.60$	Poor

(Adopted from Widoyoko, 2016)

The practicality of the teaching materials was measured by the students' questionnaire response (Khumairah et al., 2014). The questionnaire used consisting of ease, benefit, and time efficiency aspect (Hamdunah, 2015). The criteria for teaching materials practicality are shown in Table 2.

Table 2. The Assessment Criteria for Teaching Materials Practicality

Average Score	Classification
X > 3.40	Very practical
2.80 < X ≤ 3.40	Practical
2.20 < X ≤ 2.80	Quite practical
1.60 < X ≤ 2.20	Less practical
X ≤ 1.60	Not practical

The effectiveness of teaching materials is seen from the level of success achieved by students after the learning process using the teaching materials (Suryani et al., 2014). The Effectiveness of the learning is measured using the student achievement test (Rahmayanti et al., 2016), from the pretest and posttest scores (Rahayu & Sudarmin, 2015). The achievement test was analyzed using the normalized gain (N-gain) equation (Hake, 1998).

$$\langle g \rangle = \frac{(\%<Sf>-\%<Si>)}{(100-\%<Si>)} \qquad (2)$$

The S_f and S_i was the average score of posttest and pretest classes. The effectiveness of students' learning outcomes appears in Table 3.

Table 3. The Criteria for Learning Effectiveness

No.	N-gain value	Criteria
1	$\langle g \rangle \geq 0.7$	High
2	$0.7 < \langle g \rangle \geq 0.3$	Medium
3	$\langle g \rangle < 0.3$	Low

(Hake, 1998)

The achievement of the students' character was assessed using the observation sheet (Lusia & Arief, 2013). The average score obtained from the observation sheet was adjusted to the criteria of the students' achievement on the *saraba kawa* characters is presented in Table 4.

Table 4. The Assessment Criteria Achievement of Students Character

Average Score	Classification
X > 3.26	Very good
2.42 < X ≤ 3.26	Good
1.58 < X ≤ 2.42	Fair
0.74 < X ≤ 1.58	Less good
X ≤ 0.74	Poor

(Widoyoko, 2016)

RESULTS AND DISCUSSION

The Developed Product

The product developed in this research is physics teaching materials integrated with local wisdom on temperature and heat material on the tenth grade at the 2013 curriculum to educate the *saraba kawa* characters. The local wisdom meant in this study was the process of brown sugar making in Tabalong regency which was associated with the temperature and heat topic as well as the characters of *saraba kawa*.

The ethnoscience approach was implemented in physics learning by incorporating culture (making brown sugar). The production process of brown sugar was discussed using physics concepts of temperature and heat. The physics teaching materials integrated with local wisdom were expected to assist the students in finding information as well as translating hereditary science about the making brown sugar in Tabalong area into scientific knowledge. As stated by Rahayu & Sudarmin (2015), the development of ethnoscience-based module is an assimilation of scientific knowledge and original knowledge.

The physics teaching materials developed in this study were in the form of modules referring to the criteria from the Department of National Education (2008) consisting of the opening, core, and closing part. The opening section included a cover, introduction, table of contents, instructions on the use of modules, core competencies, basic competencies, learning indicators, learning objectives, module description, map concepts, the introduction of local wisdom, and keywords. The core section comprised a description of the material, student worksheet, summary, competency test and its answer key. The cover section involved a glossary and a bibliography. The material description was developed into four meetings associated with the local wisdom of making the

brown sugar and *saraba kawa* characters. The student worksheets were assigned in every meeting to know the achievement of learning objectives.

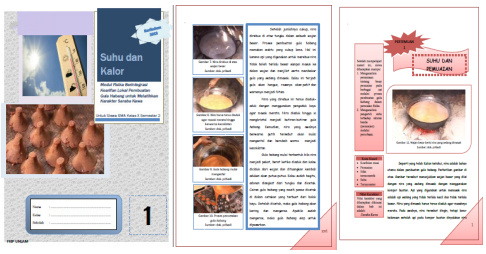

Figure 1. The Development Result of Physics Materials

The Validation Results of the Physics Learning Materials

The validation of physics learning materials was divided into content validation and appearance validation. The results of the teaching material validation analysis are given in Table 5.

Table 5. The Validation Results of Material Content

Aspect of Assessment	Average	Category
Quality of Content	3.50	Very good
Organization	3.33	Good
Language	3.00	Good
Evaluation	3.00	Good
Validity	3.21	Good

The average results of the content validation of the teaching materials were 3.21 and categorized as good. The validation analysis results of the teaching materials on the appearance aspect is shown in Table 6.

Table 6. The Validation Results of Teaching Materials Appearance

Aspect of Assessment	Average	Category
Consistency	3.56	Very good
Format	3.33	Good
Appeal	3.58	Very good
Form and font	3.33	Good
Language	3.00	Good
Validity	3.36	Good

The average validation result of the teaching material appearance was 3.36 and categorized as good.

The validity is a measurement used to indicate the validity of an instrument (Arikunto, 2013). The validity of teaching materials can be done using a validation sheet (Wati et al., 2017). The validity of this study was obtained based on assessments of academic and practitioner validators. The validation results of the contents categorized as good. The content validation covered the quality aspects of content, organization, language, and evaluation. Of teaching materials, it indicated that teaching materials required minor revisions. Revisions were made based on suggestions provided by the validators. The validation results of the appearance classified as good. The appearance validation of teaching materials involved the aspects of consistency, format, attractiveness, font size, and language which categorized as good yet needed minor revisions.

Referring to Afriadi et al., (2013) the validity shows the suitability, meaningfulness, and usability of the conclusions made. Therefore, the higher the validity of the teaching materials developed the better the conclusions, the level of meaning, and its usefulness was. The teaching materials validation on the aspect of content and appearance resulted in the good category. This category indicated that the physics teaching materials integrated with the local wisdom have been made in accordance with the aspects of the content and appearance validation; therefore, it is suitable for the teaching-learning process.

The Practicality of the Physics Teaching Materials

The practicality of teaching materials was measured through a response questionnaire comprising the aspects of convenience, benefits, and efficiency. The analysis results of the teaching materials are presented in Table 7.

Table 7. The Results of Questionnaire Response Analysis

Aspect of Assessment	Average	Category
Ease of use	3.46	Very practical
Benefits	3.43	Very practical
The efficiency of learning time	3.42	Very practical
Average	3.44	Very practical

The analysis results of the teaching materials practicality were 3.44 and classified as very practical.

According to Nieveen in Rochmad (2012), the practicality level indicated that the materials were easy to be run by teachers. Referring to the analysis results, the developed physics teaching materials categorized as very practical. This showed that the teaching materials made it easy for the learners to grasp and fostered them to learn independently.

In regards to the module, it is a printed teaching material designed by teachers for students to be learned independently (Fitri et al., 2013). A module is arranged systematically and attractively covering the materials, methods, and evaluations (Tjiptiany et al., 2016). According to Prastowo (2015), a module is a teaching material arranged systematically using comprehensible language for learners in line with their level of knowledge and age. Hence they can learn independently with or without a teacher's assistance.

Local-based science (physics) learning process could encourage learners to build their knowledge and connect it to with reality/phenomena experienced by students in everyday life (Setiawan et al., 2017). This can increase students' interest (Damayanti et al., 2013), motivation (Perdana et al., 2017), enthusiasm in learning science (Atmojo, 2015) resulting in more meaningful learning (Nisa et al., 2013). The use of the teaching materials integrated with the local wisdom could provide benefits for students. The same thing is also stated by Asfiah et al., (2013), that is by using the module, it could help students comprehend the materials better.

The Effectiveness of the Physics Teaching Materials

The effectiveness of the teaching materials developed was measured through assessment of the students' learning outcomes. The analysis results of the student's achievement test are shown in Table 8.

Table 8. The Test Results Analysis of the Student Achievement

Pretest Average	Posttest Average	N-gain
2.51	66.18	0.65

The N value < g> obtained from the analysis of the students' cognitive achievement was 0.65 and categorized on the medium category. It indicated that the physics teaching materials integrated with the local wisdom were effective to improve the students' achievement and accomplish the learning objectives.

Through these physics teaching materials, the students could easily understand the discussed materials and see examples of the application of temperature and heat topic in everyday life based on the events of making the brown sugar presented through pictures and information on the module. In addition, the images and information concerning the manufacturing process of brown sugar served to motivate the students to study the developed teaching materials and the students' achievement increased so that the learning objectives were accomplished.

Modules could help realize a good quality learning (Jaya, 2012). The use of modules in the learning process requires students to learn independently (Yuliawati et al., 2013) so that learners are actively involved in the learning process. The students' activities ultimately affect the achievement (Izzati et al., 2013), thus, the learning quality would be better (Setyowati et al., 2013). In addition, the local wisdom integration in the learning process supports the science learning well (Suastra, 2010).

This is in accordance with the research results by Oktaviana et al., (2017) that the local wisdom-based physics module could improve the effectiveness of learning and students' achievement (Rahmayanti et al., 2016). Ethnoscience-based science learning guides students in finding and building their own knowledge (Rahayu & Sudarmin, 2015). Moreover, the local wisdom-based learning results in a more meaningful learning since the observed object exists in the environment (Susilawati et al, 2016).

Cultivating Characters to the Students through Physics Teaching Materials

The characters trained in the developed physics teaching materials were the characters of *saraba kawa*. The achievement indicators were tenacity in encountering the problems during the learning process, ability to solve the problem by finding the right solution, and ability to do the task carefully and timelines in completing the tasks. The average achievement for each meeting can be seen in Table 9.

Table 9. The Achievement Results of the Learners' Characters

Character	Meeting	Average	Category
Saraba kawa/ Hard Work	I.	3.25	Good
	II	3.31	Very good
	III	3.25	Good
	IV	3.36	Very good
Overall Average		3.29	Very good

The achievement analysis result of *saraba kawa* character was 3.29 classified as very good. Based on the achievement analysis of the *saraba kawa* character, it indicated that the students finished the task carefully and neatly, did not give up in facing the problems, made use of the time effectively, and were capable of solving the problems by looking for the right solution. This showed that the use of the physics teaching materials integrated with local wisdom in Tabalong regency could help students practice *saraba kawa* characters.

The physics learning integrated with local wisdom created a harmony between the knowledge and cultivated attitudes for the values growth in society. The development was accomplished through several stages of exploration, focusing, investigation of various perspective, elaboration, and confirmation (Suastra & Yasmini, 2013). The local wisdom-based learning is able to grow students' character (Khusniati, 2014). This is in accordance with the results done by Hartini et al., (2017) which found that the use of local wisdom-based physics materials could assist teachers to educate characters related to the local wisdom. This is parallel to Mardiansyah et al., (2013), who revealed that effective teaching materials not only made students understand the subject but also flourish in values and characters.

CONCLUSION

Based on the development and testing result, it concluded that the physics teaching materials integrated with the local wisdom to cultivate *saraba kawa* were feasible to use. This was supported by the data collected during the study, namely the teaching materials validity from both aspects of content and appearance which classified as good, the practicality which categorized as very practical, the effectiveness of the teaching materials which included in the medium category, and the accomplishment of *saraba kawa* characters which was in very good category.

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