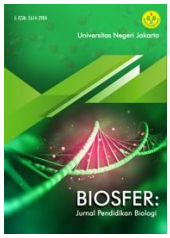
Biosfer: Jurnal Pendidikan Biologi

Journal homepage: http://journal.unj.ac.id/unj/index.php/biosfer



Pocketbook based on local wisdom and its effectivity in improving students' knowledge on the utilization of traditional medicine plants

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ARTICLE INFO

Article history
Received: 29 February 2020
Revised: 19 April 2020
Accepted: 27 April 2020

Keywords:
Knowledge
Local Wisdom
Medicinal Plants
Pocketbook

A B S T R A C T

Nowadays, the young generation's knowledge about local wisdom in utilizing medicinal plants is decreasing. This study aimed to develop a pocketbook of antimicrobial medicinal plants based on local wisdom of the Serawai and Muko-Muko tribes (PAMP-LWSMT) in Bengkulu Province-Indonesia and its effectiveness in improving students' knowledge about the utilization of plants as traditional medicine (UPTM). This type of research was a research and development (R&D) of Sugiyono, and it had 10 stages. Five stages have been conducted and published in 2018 and will be continued to the last five stages, namely product trials, product revision, trial use, product revision, and mass production. The results showed that 1) pocketbooks had an excellent response for students and teachers. It can be identified from the average score of teacher response (75,33) and the average score of children's response (65,31) 2). The pocketbook was quite adequate to increase students' knowledge about the utilization of plants as traditional medicine. It can be shown from N-gain value (0.5413). The value of Sig (2-tailed) was 0,000; it means there was a significant difference before and after using a pocketbook. Through the development and effectiveness of pocketbooks, it can preserve the values of the local wisdom of the Serawai and Muko-Muko tribes in utilizing plants as medicine. This pocketbook is recommended to be used widely as a learning resource for high school students in various districts in Bengkulu Province, Indonesia so that students' knowledge can develop.

Zukmadini, A. Y., Kasrina, K., Jumiarni, D., & Rochman, S. (2020). Pocketbook based on local wisdom and its effectivity in improving students' knowledge on the utilization of traditional medicine plants. *Biosfer: Jurnal Pendidikan Biologi, 13*(1), 59-75. https://doi.org/10.21009/biosferjpb.v13n1.59-74

INTRODUCTION

Each region or each tribe has different characteristics in terms of traditional medicine. This variation of characteristics is caused by natural conditions that contain efficacious plants in each region, differences in cultural philosophy, and customs that lie behind them (Peneng & Sumantera, 2007). One of the local wisdom in Bengkulu Province-Indonesia is utilizing the plants as traditional medicine. Serawai and Muko-Muko tribes are native tribes from Bengkulu Province-Indonesia. They use 41 species of antimicrobial medicinal plants from 28 families to cure 19 diseases caused by a microorganism (Zukmadini, Jumiarni, & Kasrina, 2018). Plants contain several antibacterial active compounds that function to inhibit and stop the bacterial activity. These compounds include phenols, terpenoids, alkaloids, lectins, and polypeptides, Polyacetylene. These compounds act as antimicrobial by damaging cell membranes, inactivating enzymes, binding to proteins, inhibiting the action of enzymes, damaging cell walls, and so on (Silva & Fernandes, 2009).

Knowledge about the utilization of medicinal plants decreased because of a lack of adequate documentation and knowledge transfer limitations from generation to generation (Motaleb, 2010). The majority of information about that is widely known by adults (Wegener, 2017; Reyes-García, 2010). However, the younger generation knows very little information about medicinal plants (Zarger, 2010; Gallois, & Reyes-García, 2018). Especially in developing countries, only a few student has direct experience and necessary information about living things, biology, ecosystems, and their contribution to people's lives (Tunnicliffe, 2010).

It is known that the majority of students in their teens rarely use plants as medicine. As many as 80% of students get knowledge about medicinal plants from their parents and relatives, both of them have very little or no knowledge of it at school (Strgar, Pilih, Pogačnik, & Žnidarčič 2013). From that study, the majority of students used plants as medicine. However, knowledge of these plants was inadequate. Students can correctly identify some species of plants and some of them can't (Strgar et al., 2013). According to data obtained from secondary school students in Izmir-Turkey, it was concluded that the transmission of ethnobotanical skills was not sufficient for allowing traditional herbal medicine practices to persist within the local community (Harahap, et al., 2019; Ugulu & Aydin, 2011).

According to a study that involved 23 students at the senior high school number 9 of Bengkulu City, Indonesia in 2017/2018 school year, 75% of students did not know the types of plants that have the potential to treat diseases due to microorganism infections. 50 % of students did not know the potential of local wisdom that exists in Bengkulu, Indonesia in utilization plants as traditional medicine. 55% of students did not know the types of diseases caused by bacteria or other microorganisms. 95% of students did not know how the tribes in Bengkulu utilized plants to to cure a disease. From the results of the preliminary study, the level students' knowledge about the utilization of plants as traditional medicine is known.

A pocketbook of antimicrobial medicinal plants based local wisdom of Serawai and Muko-Muko tribes has been developed as biology teaching materials for 10th-grade students in senior high school. This pocketbook can be used for students to learn about the biodiversity topic. Pocketbook has been validated and ready to be trialed (Zukmadini et al., 2018). Several types of pocketbooks have been used widely for various topics and purposes, including the use of pocketbooks to increase conceptual knowledge, attitudes, and skills (Sofiana & Ayu, 2017; Gultom & Pardosi, 2015).

Pocketbook is also widely used in learning in schools for various subjects (Saputra, Abidin, Ansari, & Hidayat, 2018; Indianasari, Suharini, & Handoyo, 2019). Many examples of pocketbooks have been developed in various countries to provide practical guidance and information for users, thus, it helping users to learn (Ogle, Middlehurst, Silink, & Hanas, 2017; Goldthwaite, 2010). Nevertheless, no pocketbook was developed based on the local wisdom of a tribe in utilizing plants as an antimicrobial drug. This study aimed to develop a pocketbook of

antimicrobial medicinal plants based on local wisdom of the Serawai and Muko-Muko tribes in Bengkulu Province, Indonesia and to know the effectiveness of pocketbook for improving students' knowledge about the utilization of plants as traditional medicine (UPTM). Pocketbook of antimicrobial medicinal plants based on local wisdom of the Serawai and Muko-Muko tribes is called PAMP-LWSMT.

METHODS

Research Design

The type of research was Research and Development (R&D). The R & D method's steps were adjusted to the needs of researchers from Sugiyono (2008). The development model consisted of 10 stages, consisted of potential and problems, data collection, product design, design validation, design revision, design testing, product revision, product testing, product revision, and mass production. Stages of research 1-5 were published at JPBI Journal (Zukmadini, et al., 2018). It will continue until the the 6th -10th stage is continued in 2019-2020 and be published in this journal. They were design testing, product revision, product testing, product revision, and mass production. The research steps in developing of pocketbook are illustrated in Figure 1.

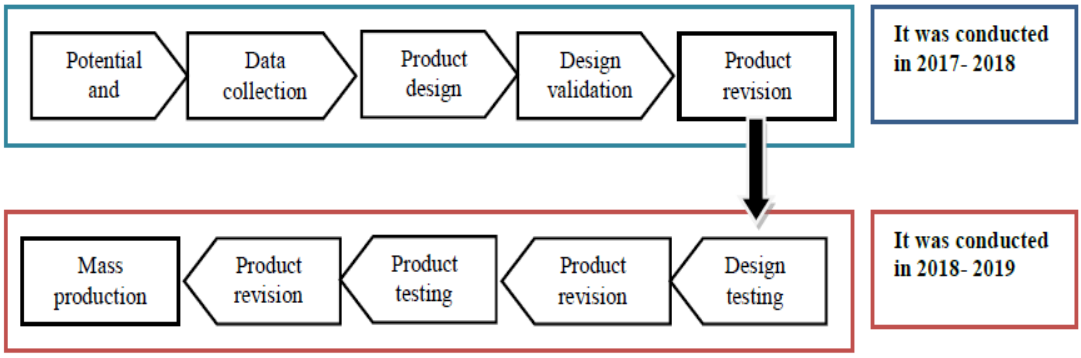

Figure 1. Research steps in developing of pocketbook.

Population and Samples

The populations of this study were students and teachers from Senior High School Number 9 and Senior high school IT Iqra-Bengkulu City, Indonesia. Both schools were chosen because they have students and teachers from various regions in Bengkulu with different cultural and tribe backgrounds. Samples students that involved in design testing were 22 students. Samples teachers that involved in design testing were 3 teachers. The number of students in product testing was 46 students from 10th grade. 25 students are from Senior High School, and 21 students are from Senior high school IT Iqra. There were 27 female students and 19 male students. The sampling technique was done by purposive sampling.

Instrument

The instrument in this research was questionnaire sheets. There were two types of questionnaires, namely the questionnaire response to the PAMP-LWSMT and a questionnaire to measure students' knowledge about the utilization of plants as traditional medicine (UPTM). The first questionnaire instrument was used to determine student and teacher responses about pocketbooks as a learning resource. This instrument refers to the PEI Department of Education (2008), which has some parameters. Parameters of the instrument of PAMP-LWSMT as learning resources can be seen in Table 1.

Table 1.
Parameters of instrument of PAMP-LWSMT as learning resources.

No	Parameters
1	Support and be consistent with provincial and local pilots/programs curriculum outcomes.
2	Developed by competent authors and producers and meet high standards of quality in factual content and presentation.
3	Appropriate for the subject area and for the age, emotional development, ability level, learning styles, and social development of the students for whom the materials are selected.
4	Have an aesthetic, literary, and social value.
5	Have a physical format and appearance suitable for their intended use.
6	Be one of a variety of media presentation modes.
7	Preferably be Indonesian where these materials are of equal quality to other available materials.

Based on Table 1, the instrument's parameters was developed into 16 questions about using a pocketbook as a learning resource for students. The questions in the questionnaire consisted of 5 alternative answers compiled using a Likert scale. Each alternative answer was given a score of 1-5 namely 1 (disagree) 2 (less agree) 3 (quite agree) 4 (agree) 5 (strongly agree). The second questionnaire instrument was used to determine students' knowledge about the utilization of plants as traditional medicine. This instrument was adapted from Otieno & Analo (2012), which had some parameters. It can be seen in Table 2.

Table 2.
Parameters Instrument to measure students' knowledge about UPTM.

No	Parameters
1	The local name of plants.
2	Disease/condition treated by the plant.
3	Plant part(s) used for the treatment .
4	Preparation method.
5	Indigenous, typical (Bahasa Indonesia) and Scientific name of the plants.

Based on Table 2, the instrument's parameters were developed into 20 questions to find out students' knowledge about the utilization of plants as traditional medicine. The questions in the questionnaire consisted of 5 alternative answers compiled using a Likert scale. Each alternative answer was given a score of 1-5. They are 1 (not know), 2 (less) 3 (quite) 4 (know) 5 (really know).

Procedure

The procedure in this study was a continuation procedure from previous studies (Zukmadini et al., 2018). This stage consists of design testing, product revision, product testing, product revision, and mass production. The design testing stage was conducted to see the responses of teachers and students when using a pocketbook in learning. Design testing involved the teachers and students in finding out the suitability, convenience, and teacher's opinion about the pocketbook for teaching and learning. At the product revision stage, the pocketbook was revised based on suggestions from teachers and students in the design testing stage. Product testing was conducted to determine the effectiveness of pocketbooks to improve students' knowledge about local wisdom. The PAMP-LWSMT implemented as a teaching material in biology class on a biodiversity topic. The effectiveness test was done by using the Quasi Experiment with the One-Group Pretest-Posttest design. It consisted of one experimental group without a control group. For the first steps, students filled out a questionnaire before they studied using PAMP-LWSMT. It was conducted to determine students' knowledge about the utilization of plants as traditional medicine before they used PAMP-LWSMT. After that,

students will be given a pocketbook to read and learn. Students were asked to bring a pocketbook and use the pocketbook to learn the topic when they were learning in class. After learning, students had to fill the questionnaire. This design compared the pretest (students' knowledge about the utilization of plants as traditional medicine before using the pocketbook) to the posttest (students' knowledge about UPTM after using the pocketbook). After students used the pocketbook in the learning process, if there was a product improvement, it will be revised. The final stage of this development was disseminating the product to schools; this stage is called mass production.

Data Analysis Techniques

Scores from teachers' response and students'response were analyzed using the formula based on Sudjana (2006).

$$Average\ total\ score = \frac{Total\ Score}{Number\ of\ respondents}$$

Based on the average total score that has been obtained, we would make criteria of response by using the following formula based on Sudjana (2006).

The highest score = number of assessment aspects x the highest score
The lowest score = Number of assessment aspects x the lowest score
The gap of score = the highest score – the lowest score.
The range for Each criteria $= \frac{Gap\ of\ score}{Number\ of\ criteria}$

The questionnaire sheet about the use of pocketbook in learning for teachers and students consisted of 16 questions. The score from the teacher's assessment and student assessment was categorized into 4 criteria based on the formula from Sudjana (2006). The criteria for using PAMP-LWSMT in learning according to the teachers and the students can be seen in Table 3.

Table 3.
The criteria for using PAMP-LWSMT in Biology learning.

Score	Criteria
64-80	Very interesting/very suitable/very helpful
48-63	Interesting/appropriate/helpful
32-47	Quite interesting/quite appropriate/quite helpful
16-31	Unappealing/not suitable/not helpful

The effectiveness of using a PAMP-LWSMT can be seen from the normalized gain (N-gain) that has been calculated using the formula (Hake, 1998). The level of effectiveness of PAMP-LWSMT to improve students' knowledge about UPTM can be seen in Table 4.

Table 4.
The level of effectiveness PAMP-LWSMT.

Score N-Gain (g)	Criteria Interpretation	Level of Effectiveness
$\langle g \rangle \geq 0{,}70$	High	Effective
$0{,}30 \leq \langle g \rangle < 0{,}70$	Medium	Quite Effective
$\langle g \rangle < 0{,}30$	Low	Ineffective

After knowing the level of effectiveness, then the significance of the students' knowledge about UPTM before and after learning using a pocketbook was tested by the t-test. The SPSS program analyzed it. Significance tests were studied to determine any real differences between

students' knowledge before using the pocketbook and after using the pocketbook. if Sig. (2-tailed) <0.05, there was a significant difference between students' knowledge about UPTM before and after using a pocketbook. But if the value of Sig. (2-tailed)> 0.05 means there is no significant difference between students' knowledge about UPTM before and after using a PAMP-LWSMT.

RESULTS AND DISCUSSION

The pocketbook was developed based on the results of field research from the diversity of antimicrobial medicinal plants used by the Serawai and Muko-Muko tribes. The results from validating stages before showed that the PAMP-LWSMT was valid, and it has a good response from teachers and students for the design (Zukmadini et al., 2018). In turn, this would make it feasible to be used in biology learning activities for biodiversity topics.

Design Testing

At this stage, design testing was conducted to see the responses of students and teachers when using a pocketbook in learning activities. The response test at this stage was different from the response test at the previous stage. At the stage of validation stage previously, a feasibility test was performed to see students' responses about the pocketbook design. Whereas in the design testing stages, it aimed to find out responses from teachers and students if they used this pocketbook in classroom learning. The results of design testing from teachers and students can be seen in Table 5.

Table 5.
Responses from Teachers and Students about pocketbook.

Respondent	Average Score	Criteria
Teacher	75,33	Very interesting/very suitable/very helpful
Students	65,31	Very interesting/very suitable/very helpful

From Table 5, there was a positive response from students and teachers. PAMP-LWSMT was very helpful for teachers in teaching-learning material as well as helping students in understanding material about biodiversity in Indonesia. It was because the material content was developed based on research on the local wisdom of the Serawai and Muko-Muko tribes in using plants as medicine to overcome diseases caused by microorganisms (Zukmadini et al., 2018). PAMP-LWSMT was developed contextually, contained learning material that is close to the daily lives of students and teachers, so it provided the real experiences for students to learn. Learning in contextual teaching helped teachers to improve learning outcomes of students, giving freedom to students to think, and linking the concepts with students' daily lives (Marini, 2016). A teacher gave a positive response to the content of local wisdom to be a source of biology learning (Abidinsyah, Ramdiah, & Royani, 2019). Identification of medicinal plants derived from local knowledge of an area can be used to develop teaching materials based on local wisdom (Pit'ay, Anggraito, & Ngabekti, 2019).

Based on the results of student responses, PAMP-LWSMT could motivate students to learn about local wisdom and increase knowledge about medicinal plants. Besides that, PAMP-LWSMT can also help students to learn about the concept of biology material that is learned in school. The responses were consistent with the opinion that a pocketbook can enhance students' conceptual knowledge (Winarto, Khiyarusoleh, Ardiyansah, Wilujeng, & Sukardiyono, 2018).

Product testing

Product testing was aimed to know the effectiveness of PAMP-LWSMT for improving students' knowledge about the utilization of plants as traditional medicine. It compared the pretest (students' knowledge about UPTM before using the PAMP-LWSMT) to the posttest (students' knowledge UPTM after using the PAMP-LWSMT). Effectiveness of PAMP-LWSMT for improving students' knowledge about the utilization of plants as traditional medicine can be seen in Table 6.

Table 6
Effectiveness of the average before and after using pocketbook to increase Students' knowledge about UPTM.

Before	After	N-Gain	Criteria
34,93	70,32	0,5413	Quite Effective

Based on the testing of PAMP-LWSMT that involved two schools in the Bengkulu city, pocketbook can effectively increase students' knowledge about the utilization of plants as traditional medicine. The use of PAMP-LWSMT as teaching material strongly influenced the inceasing students' knowledge about UPTM. Teaching material in the form of a pocketbook can provide information to students about the biodiverse material they learn. The handling of diseases due to microorganism infections needs to be done quickly. The knowledge aims to avoid the form of infection and the broader spread of disease by microorganisms. Quick handling needs to be accompanied by adequate students' knowledge about how to deal with it. The knowledge can be obtained from local wisdom that develops around the student environment. One effort that can be done to improve that knowledge is through education. Education is not only limited to learning activities in schools but can also be developed through teaching materials that contain noble values based on local wisdom (Tanjung & Fahmi, 2015). Using teaching materials based on local wisdom will affect the students' attitudes to maintain their environment Ardan (2016).

Using a pocketbook as a teaching material has been able to increase students' knowledge about UPTM. Although this pocketbook is not tested to improve student learning outcomes, the development pocketbook based on field research is very potential to be used in improving learning outcomes. The use of a pocketbook, as a learning resource, has improved student learning outcomes (Khulafa & Santoso, 2018). There is an increase in student motivation after using a pocketbook as teaching material (Fahma, Suryani, & Musadad, 2018). The percentage and criteria of students' knowledge about the utilization of plants as traditional medicine for each aspect can be seen in Table 7.

Table 7
Average before and after of percentage (%) and criteria of Students' knowledge about UPTM for each aspect.

Assessment aspects	Average before and after of Percentage (%) and Criteria of Students' Knowledge			
	Before (%)	Criteria	After (%)	Criteria
Students know more than 10 types of plants that are used as antimicrobial drugs	67,83	Quite high	82,17	High
Students know more than 5 types of diseases due to microbial infections	75,00	Quite high	83,01	High
Students know the parts of plants used as antimicrobial drugs	65,00	Quite high	73,04	Quite high

Students know how to process plants as antimicrobial drugs	54,00	Less	63,91	Quite high
Students know that their parents/family have been used plants as antimicrobial drugs	86,15	High	83,91	High
Students know that the Muko-Muko tribe used plants as medicine	67,00	Quite high	77,39	High
Students know that the Serawai tribe used plants as medicine	40,00	Less	68,69	Quite high
Students know more than 5 types of plants that are used as antimicrobials medicine by Serawai tribe	40,00	Less	60,43	Quite high
Students know more than 5 types of plants that are used as antimicrobials medicine by Muko-Muko tribe	44,00	Less	69,56	Quite high
Students know that the of medicinal plants by the Muko-Muko and Serawai tribes is a form of local wisdom that needs to be preserved	77,00	Quite high	80,00	High
Students know about the active compounds that found in antimicrobial medicinal plants	80,87	High	80,00	High
Students know the use of plants as medicine has been carried down for generations	64,83	Quite high	69,56	Quite high
Students know about 50% of the people around them still use plants as medicine	70,00	Quite high	76,52	Quite high
Students know the Muko-Muko and Serawai tribe using plants as medicine to treat diseases caused by microorganism infections	47,00	Less	59,56	Quite high
Students know that the Muko-Muko and Serawai tribe believed in the use of plants as medicine to treat diseases caused by microorganism infections	43,00	Less	54,34	Less
Students know 5 antimicrobial medicinal plants that are planted around the house	34,82	Less	64,34	Quite high
Student know 5 antimicrobial medicinal plants that are planted around the school	29,13	Less	65,65	Quite high
Students know 5 types of antimicrobial medicinal plants that are planted around my house	42,2	Less	66,95	Quite high
Students know that medicinal plants are a form of biodiversity that young people need to know	40,00	Less	64,34	Quite high
Students know the using of plants as medicine is a form of local knowledge that must be preserved	37,41	Less	62,17	Quite high

Before students used the PAMP-LWSMT, the percentage of their knowledge of antimicrobial medicinal plants was 67.8%, and after using the pocketbook, the percentage increased to 82.17%. Before high school, students used a pocketbook, they only knew about 5-10 plants that could cure diseases caused by microorganisms, but after using a pocketbook, students know 10-15 types of antibacterial medicinal plants. The types of antibacterial medicinal plants commonly known by students are ginger (*jahe-jahean*), soursop (*sirsak*), papaya (*pepaya/kates*), green coconut (*kelapa hijau*), sugar plam (*aren*), jatropha (jarak), *Tinospora cordifolia* (*brotowali*), and guava (*jambu biji*). These plants are the plants generally used by Serawai and uko-Muko tribes to treat various diseases. According to other studies, it is known that plants such as ginger, guava, jatropha, papaya are also often used by the other Tribes as medicine (Ihsan, Kasmawati, & Suryani, 2016). The several types of plants known by students as medicine can be categorized into several families, such as *Annnonacea, Zingiberaceae, Cariaceae, Myrtaceae, Euphorbiaceae* (Kandowangko, Latief, & Yusuf, 2018). Based on Table 7, students' knowledge of the utilization of traditional medicine by their parents/family was included in the high category. Most students got knowledge from their parents, and their parents also got knowledge from descendents. It was relevant that Both children and adults learned about the use of medicinal plants, especially from their families (Bruschi, Sugni, Moretti, Signorini, & Fico, 2019; Nankaya, Gichuki, Lukhoba, & Balslev, 2019).

However, students' knowledge about the parts of plants used as medicine before and after using a pocketbook has the same category. It means there was no change in the category of knowledge. Based on students' answers, the parts of plants commonly used as medicine are leaves, fruit, and roots. The utilization of plant materials as a medicine 53 % were leaves, 39 % were fruits, and remaining plant products were root, flower, seed, tuber, bark, bulb, latex, etc. (Selson, Edison, & Abragam, 2019). Based on the data obtained, the level students' knowledge about the active compounds contained in antibacterial medicinal plants is included in the high category. Students are very familiar with the names of active compounds found in plants such as phenols, alkaloids, tannins, saponins, and essential oils. The active compounds in antimicrobial medicinal plants include phenols, alkaloids, quinones, terpenes, essential oils, tannins, saponins, glycosides, lignans, and peptides (Ferdes, 2018).

The most common method of traditional processing plants known by students is by boiling plant parts such as leaves, stems, or roots, coolong them, then filtering and drinking. This method is known as an infusion. Infusion is the most popular method of processing medicinal plants that are done by mixing hot water with several pieces of plant parts after it is cold, then filtered, and honey or sugar can be added as a sweetener (Keskin, 2018). Students' knowledge of the types of diseases caused by bacterial infections is quite high. These diseases include fever, acne, diarrhea, flu, coughing, typhus, vomiting, measles, smallpox, and malaria. Students know that the disease can be cured traditionally by using plants as medicine. The use of plants as medicine to cure several types of diseases is a form of local wisdom that has been developing for a long time in various communities (Nankaya et al., 2019; Mahwasane, Middleton, & Boaduo, 2013).

Based on SPSS test results, it is known that the value of Sig. (2-tailed) obtained is 0,000. From the results of the analysis, if the Sig. (2-tailed) <0.05, there was a significant difference between students' knowledge about the utilization of plants as traditional medicine before and after using a PAMP-LWSMT. This pocketbook was developed based on ethnic and social issues from the Serawai and Muko-Muko tribes. It was very appropriate for learning resources. The pocketbook contains concept material and the values of local wisdom from the community to provide positive feedback to students (Andambi & Kariuki, 2013). The material developed in the PAMP-LWSMT comes from the values of local wisdom that develop in people's lives. By learning the concept with social values, they will become human beings who tolerate each other, even in different environments. As social beings, humans always interact with other

people in different environments, so that social ethics in society become their moral guidelines for interacting with each other (Andambi & Kariuki, 2013).

The effort to develop local wisdom values is the responsibility of all elements of society, including teachers, students, and lecturers. The Efforts that they can make are developing teaching materials based on local wisdom and using it in the classroom learning activities. The form of developing local wisdom can revive the remaining knowledge and wisdom (Hariyadi, Tamalene, & Hariyono, 2019; Mungmachon, 2012). Knowledge of medicinal plants has a vital role in the development of herbal medicines. However, this knowledge has been eroded from the lack of adequate documentation and limited transfer of knowledge from generation to generation (Motaleb, 2010). Using plants as traditional medicine is a high-value form of local wisdom. Knowledge about that contain not only historical values but also social, cultural, spiritual, moral, and scientific values. One form of the development of teaching materials based on research is by ethnobotany studies (Zukmadini et al., 2018). Ethnobotany is a term that describes the relationship between humans and plants in the social life of society. It is closely related to the biology of conservation, environmental management, and environmental education (Bennett, 2005).

Pocketbook that developed based on ethnobotany studies can be a learning source for students to be actively involved in developing insights on environmental education, conservation, and resources. Ethnobotany is a crucial subject for conservation and sustainable development (Ristanto, et al., 2020; Hamilton et al., 2003). Capacity building in applied ethnobotany is urgently needed in developing countries because of the intimate links between rural people and local plants. The development of a pocketbook based on ethnobotany studies is a form of development of learning based on local wisdom. Learning based on local wisdom can improve students' attitudes and discussion skills regarding their knowledge of the environment (Titin & Rasmawan, 2017; Ernawati, Azrai, & Wibowo, 2016). A study about children's ethnomedicinal knowledge can support the protection and conservation of medicinal plant knowledge by encouraging the sustainability of the local cultural heritage (Nankaya et al., 2019).

The use of PAMP-LWSMT as supplementary teaching materials for biology courses is an effort to develop the value of local wisdom through formal education. Besides being able to increase students' knowledge about the utilization of plants as traditional medicine. It is expected that the pocketbook can also develop students' positive attitudes. The result is in tune with the statements that stated the application of science learning based on local wisdom could enhance students' positive character, such as responsibility, care for the environment, and curiosity (Subali, Sopyan, & Ellianawati, 2015). Teaching materials developed based on ethnobotany study are very proper to develop students' understanding (Khastini, Wahyuni, Saraswati, Alimuddin, & Nuangchalerm, 2019). Learning resources about medicinal plants and ethnobotany are not only a come from the pocketbook, but it can be developed from online learning resources. A variety of online resources, including curricula, laboratory investigations, school garden ideas, and science fair projects, provide educators and students with excellent opportunities to explore the fields of medicinal plants and ethnobotanics (Straus & Chudler, 2016). Besides instructional instruments developed based on local wisdom such as lesson plans, students 'worksheets, and learning achievement tests can also improve students' ability to communicate (Astutik, Hobri, & Suharto, 2015).

Product Revision

Product revision was conducted based on suggestions from teachers and students. The first product revision was conducted before the product testing stage. In this stage, adding the source of the image is needed (Figure 2).

(a) (b)

Figure 2. Display of pocketbook (a) before revision (b) after revision.

After students used the pocketbook in the learning activities, students were asked again to give suggestions for improvements display of PAMP-LWSMT. In the final product revision, the covers of PAMP-LWSMT was revised to be a colorful display, sharp images, and high image resolution (Figure 3).

(a) (b)

Figure 3. Display of pocketbook's cover (a) before revision (b) after revision

The pocketbook is a colorful learning resource, needs to be designed with a more attractive appearance, and comes with the selection of colors and images (Ummah, Wibowo, & Aminatun, 2016). So it can attract students' attention to use it. A good pocketbook is not only seen from the appearance, but also must provide information that can increase knowledge, skills, and attitudes for its users (Gultom & Pardosi, 2015; Sofiana & Ayu, 2017). Therefore pocketbooks must present material or information effectively and attractively so that it can be easily understood by users to achieve the desired goals.

CONCLUSION

Pocketbook of antimicrobial medicinal plants based on local wisdom of the Serawai and Muko-Muko tribes (PAMP-LWSMT) has developed as teaching material for 10th-grade students in senior high school. Pocketbook has good responses from students and teachers to use in biology learning activities on biodiversity topics in class X high school. It can be seen from the average score of student and teacher responses obtained from the design testing stage. The average score of the teacher's response to the pocketbook is 75.33, while the average score of the student's response is 65.31. The results from the effectiveness of PAMP-LWSMT obtained

that the PAMP-LWSMT is quite effective in increasing students' knowledge about the utilization of plants as traditional medicine. This can be seen from the N-Gain value obtained, which is 0.5413. There was a significant difference in students' knowledge about UPTM before and after using PAMP-LWSMT. It was shown from the value of Sig. (2-tailed). Product testing in this study was only conducted in schools from the city of Bengkulu. Therefore, PAMP-LWSMT needs to be tested by involving several schools in several districts so we can get much data about students' knowledge from a variety of cultural backgrounds. This pocketbook is expected to preserve the local wisdom of the Serawai and Muko-Muko tribes and to increase the caring attitude of the younger generation towards their cultural values.

ACKNOWLEDGMENT

The Athors would like to give special thanks for Research Institutions and Community Service of Universitas Bengkulu that has provided research funding support (No. 1540/UN30.15/LT/2018).

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