

## Research Article

# Ethnobotanical study of medicinal plants utilized by the Baduy tribe used as a learning resource

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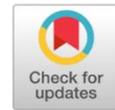
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### ABSTRACT

The existence of contextual learning resources has been known to be able to improve the meaningful learning, particularly biology learning. This research provides the information about the medicinal plant utilized by the Baduy tribe as well as its endeavour in developing the results obtained as a contextual-based module. This research and development was designed using Thiagarajans' model, which was limited in three phases (define, design, and development). The data was collected using interview guideline, validation sheets, and students' response questionnaires. The research findings inform that there were 67 species utilized by the Baduy tribe as the medicinal plants. These species belong to Spermatophyte and divided into 31 families. Furthermore, the validation results showed that the media developed was valid; in which the best component of module, based on students' response, was its presentation (the mean value was 89.5%). It can be concluded that the media developed is feasible to use as a learning resource.



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## INTRODUCTION

The paradigm of teacher-centered delivery for learning process in school need to be changed into student-centered as it can lead to various problems such as lecturers most often acts as an important resource (Fry, Ketteridge, & Marshall, 2009; Karimi, 2011; Strømme & Furberg, 2015), dominates most of the learning activities, and learning acquisition can be very limited due to much reliance on information by lecturers. Student-centered has been proven effective in the learning process where memorizing the information and knowledge is not only student activity. The active engagement in the learning process is a key factor in

improving students' conceptual understanding by constructing knowledge based on their interaction in the environment (Sadler et al., 2013). The concepts on what they learned through to knowledge and experience need to discover by the student itself. It is in accordance with Piaget's opinion in 1983 that through the learning process, student students will have many activities on trying to do new things by relating their experiences and building their knowledge. This statement also may develop when the student learns about plant biodiversity, especially traditional plant-based medicines, knowledge, customs, and uses of plants. However, the new era of instructional practices seems to be different than previous, due to the growing a lot of information is rapidly reported. The education systems should help the student understand without neglect cultural values. According to DeDonno (2016), a key component to succeed in any environment is the ability to learn. The rapid changes in technology and societal changes due to globalization, make the ability to learn is a necessity in functioning in society. Therefore, traditional and modernize information should be in balance for student education. A student learning material has the potential as a solution to contribute to the goals of education, by supporting autonomous, life-long, student-centered learning.

Indonesia is one of the world's richest nations in terms of its biodiversity as the country is archipelago made up of about 17,000 islands. Each island has unique ecosystems containing a large number of diverse species, including plant (Baines & Hendro, 2010; Woodruff, 2010). However, most of the Indonesian people do not realize the importance the biodiversity since there are a lot of human activities degrade the environment and will have an impact of biodiversity loss. Experiences of biodiversity for students seemed to be important for the future development of their understanding. The student can construct the information by their own experiences of biodiversity in nature and develop the ideas the necessity for conserving nature as lifelong learning and for a sustainable future. Fieldwork is an alternative to conventional lecture and laboratory classes and offers much scope for student-centered process in Biodiversity learning. According to Berg, Jäkel, and Penzes (2016) and Jäkel (2014), teaching and learning about plant biodiversity, in general, should give preference to outdoor ecological settings and fieldwork methods can facilitate student to explore and experience nature. However, fieldwork cannot frequently be used in the classrooms since the method has disadvantages such as difficult to organize with a large number of students, risks of injury, etc.

These problems can be solved by providing contextual material such as module, which helps students to connect the learning content with the life contexts. The module is a learning material which has systematically compiled and designed to help students achieve a specific learning objective. Learning depends on the active involvement of the learner (Collins, 2004). As they strive to attain learning objectives, they draw upon their previous experiences and build upon existing knowledge. By learning the subjects in an integrated, multidisciplinary manner and inappropriate contexts, they are able to use the acquired knowledge and skills in applied contexts. Thus, contextual learning module refers to the materials that let the student processes new information or knowledge in such a way that it makes sense to them in their own frames of reference. This assumes that the mind naturally seeks meaning in context, that is in relation to the person's current environment, and that it does so by searching for relationships that make sense and appear useful. The contextual learning module also serves as independent learning. It contains self-instruction by various kinds of methods, the entire learning material from one unit of competency studied contains in just one complete module and stand-alone (Daryanto, 2013). The module is not depending on any other media, or should not be used in conjunction with other media

Ministry of National Education of Indonesia, regulation number 22 of 2006, each educational unit must develop its own curriculum based on local content. Local content is a study material which is intended to form the students understanding of the potential in the area where the student lives. In Article 77 of Government Regulation, No. 32 the Year 2013 about National Education Standards states that local content for each educational unit should introduce on the local potential and uniqueness. Local content is developed and implemented at any educational institution. Local content itself further constitute the study materials in the education unit that contains the content and process of learning about the local potential and uniqueness that is intended to form the students understanding of the potential in the area where he lives such as knowledge of the various characteristic natural environment of the region.

Based on the results of interviews with high school biology teachers in Banten province, the student faced were some obstacles in learning Plant biodiversity concept. Poor identification skills among the student become a fundamental limitation and may contribute to a reduced ability or willingness to engage in documenting plant biodiversity. How student exploit and conserve plant diversity if they cannot recognize it. Identity and giving names of plant species will facilitate student on sharing about the utilization of the species (Silalahi, 2017). Many benefits and roles possessed by plants as a source of food, and also as medicine (Fernando, 2012). Also, learning material accessed by the student also lacked information and knowledge regarding the surrounding environment and traditional value. One of strategy to overcome the obstacle in the learning

process is by developing the module's content based on ethnobotany study on medicinal plants carried out in Inner Baduy, Cibeo Hamlet, Kanekes village, sub-district of Leuwidamar, district of Lebak, Banten Province.

Baduy is inhabitants of the Kendeng mountain region, less than 200 km from Jakarta, the capital of Indonesia. The Baduy traditional community depend on the biodiversity of the forest resources for their livelihood. They practice norms and beliefs that are articulated in the form of a code of conduct, and they have taboos that mediate their daily behavior. The natural resources utilization by Baduy traditional community depends on the traditional knowledge which influenced the paradigm of the people on health and local wisdom to conserve the biodiversity of their region (El Islami, Nuangchalerm, & Sjaifuddin, 2018; Parmin, Nuangchalerm, & El Islami, 2019). This information needs to be introduced to the student. In addition, since there is poor documentation related to Baduy biodiversity, inventory activities to record and process this information is a vital component to sustain biodiversity management. Many specimens provided in the developed module are photographed, drawn and used to produce an illustrated group report on plant biodiversity utilize by the Baduy tribe will give student chance students to examine, identify and interpret the concept. The students potentially acquire in-depth knowledge about the specimens provided. This research aimed to develop a contextual-based module as a learning resource in medicinal plant diversity and ethnobotany from Inner Baduy community in West Java, Indonesia.

## METHOD

This research was employed research and development (R & D) method with three phases of Thiagarajan, Semmel, and Semmel (1974) model: define, design, and development for developing a contextual-based module as a learning resource. The dissemination phase was not conducted in this research since the research objectives were to develop a valid media which have been obtained at a development phase. Data were collected through qualitative methods by teaching materials and curriculum analysis, questionnaire assessment of module and material analysis supported by medicinal plant exploration and ethnobotany. The steps carried out in the research are described in Table 1.

Table 1. Steps of instructional development

Steps	Work Log	Descriptions
Define	Identification of needs, contents, objectives, evaluation, materials, instructional media curriculum analysis	<ol style="list-style-type: none"> <li>1. Identified a problem in the plant diversity learning activities 5 five state senior high school (SSHS): SSHS 1 of Rangkas Bitung, SSHS 1 of Pandeglang, SSHS 1 of Cilegon, SSHS 1 of Tangerang and SSHS 8 of Serang, represented district and city in Banten Province.</li> <li>2. Instruments used in this step was a questionnaire to find out the needs of students and teachers. The items consisted of the students' questionnaire were the student's perception of learning material and resources and study experience. While on teacher questionnaire were same as the student but based on teacher point of view. The analysis used was qualitative analysis based on the results of questionnaires were obtained. The interview was also carried out to support the data on the need assessment.</li> <li>3. Curriculum analysis was conducted in order to get information on basic competencies, indicators, the essential material, and students needs.</li> <li>4. Prior to documenting ethnobotany data, semi-structured interviews and focus group discussions, personal conversations with locals included several <i>Dukun</i> (traditional healer) and indigenous people who were interviewed in order to record their household recipes for the preparation of medicinal plant into traditional medicine, and field surveys were carried out on February-April 2018</li> </ol>
Design	Create module design, cover, story board & module content	Prepared the initial draft of the module with several aspects of consideration: feasibility, linguistic and presentation, graphics, and local knowledge of biodiversity and ethnobotany, local wisdom in exploration and interview the Baduy traditional community.
Development	Produce modules, validation material and modules by experts, and determine the level of effectiveness	<p>The questionnaire instruments used are a validation questionnaire for media experts (construct, language, and media) and material experts (biodiversity and local wisdom) used in the design validation stage by education professionals and peers.</p> <p>Revise the comment given by experts for developing contextual-based module; experts raised their opinions and ways to develop a module as well. Then, the module was implemented with students for correcting the appropriateness and feasibility.</p>

## RESULTS AND DISCUSSION

Based on need assessment analysis through the students and teacher questionnaires indicated that many of the student have difficulties on mastering plant diversity concept as 70% of learning resources provided the related information without any supporting images and the language used is difficult to understand. According to the teachers there is a little reference used as student learning resources based on local content, even though Banten Province has a variety of habitat types, natural potential and high levels of biodiversity. In addition, learning resources available on the market generally do not match the conditions of the school or the characteristics of students, and a lot of adjustments need to be made. Therefore, there is an urgency to develop the student learning materials which adapted to the conditions of students and usefulness of the instructional materials throughout the student daily activities. Beside that it is also necessary to develop learning materials that can facilitate the the student to implement the learning process independently, such as the research-based module.

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Learning materials available today already meet the needs of students of the theory curriculum but cannot lead students to develop a critical mindset to be able to apply the theory (Flores, Matkin, Burbach, Quinn, & Harding, 2012; Serdyukov, 2018). Students should be empowered, facilitated, motivated, and allowed to construct knowledge according to their interests and needs and give the freedom to learn by themselves (Mahbub, Imtiaz, Roy, Rahman, & Ahad, 2013). Therefore, learning material in the form of the module was developed in aiming to help the students understand the concept of theory but also common in doing scientific activities to dig their knowledge. Scientific activity is the process that involves students in forming a hypothesis including identifying variables and selecting a variable, planning and carrying out the investigation, recording, presenting, and interpreting the results, evaluating the hypothesis in relation to the results of the investigation, drawing any inference from the results, and communicating the findings (Supasorn & Waengchin, 2014). Utilization of appropriate learning resources can improve the student learning process so that it can be effective and efficient. In accordance with Bahri, Syamsuri, and Mahanal (2016), the existence of modules in the learning process can provide learning resources that contain material, methods, and methods of evaluating systematically designed to help students achieve learning competencies.

The development of Contextual based Student's Medicinal Plant Diversity and Ethnobotany Module as learning media for Plant Diversity was preceded by designing the module according to the Curriculum 2013. In general, it contains the Biodiversity general concept, Biodiversity level, Ecosystem, and Biodiversity Utilization. The materials are delivered simply and supported by interesting pictures and cultural contents such as Baduy traditional culture. The development stage is necessary because according to Amin (2010), the development of learning materials based on contemporary research will provide the strengthening of education development based on the development of contemporary biological knowledge. Contextual learning used as an approach for student activity in learning plant diversity by involving seven major aspects: constructivism, questioning, inquiry, learning community, modeling, and authentic assessment.

The constructivism aspect in the developed module was applied through the illustrations of guava (*Psidium guajava* L.) plants morphology which has familiar to students. Guava is an exquisite, nutritionally valuable, and remunerative fruit crop of tropical and subtropical regions of the world. Guava cultivation became a commercial proposition in recent years due to its high nutritive value and popular processed products (Amin, 2010). According to Henson (2003), constructivist theory places the student at the center of the learning experience, and learner-centered education can be facilitated in a variety of ways. In addition, the benefit of guava plant utilization also provided in order to give information related to daily life activities. The student also suggested a similar plant which can be easily found in their surroundings and try to identify the

morphology and its utilization. The activity can give students opportunities to develop deep explanations; learning is enhanced across content areas.

A questioning aspect is provided in the module by giving student higher-order thinking questions rather than a conventional question, which is a heavy emphasize on memory-based. The activity can give students opportunities to develop deep explanations based on analysis so that learning is enhanced across content areas. By modeling good questioning and encouraging students to ask questions of themselves, it can help students learn independently and improve their learning (Corley & Rauscher, 2013). This is in agreement with Albergaria-Almeida (2011) that analytical, creative, and practical abilities are directly related to questioning, critical thinking, and creativity. Therefore, in the module, a questioning aspect provided in the form of independently evaluated or assignment which consists of multiple choices questions.

Material aspects for module content were obtained based on medicinal plant exploration and interview with Baduy traditional community. A total of 67 medicinal plant species belongs to the division Spermatophyte recorded and divided into 31 families. For each species, the scientific name with voucher number, family, vernacular name in Sundanese, ailments treated, parts used, forms of preparation, and uses were documented. The reported plant families were Asteraceae (5 species), Fabaceae, and Euphorbiaceae (4 species each), Acanthaceae, Poaceae, and Rubiaceae (3 species each), Lamiaceae, Crassulaceae and Melastomataceae (2 species each), Amaranthaceae, Convolvulaceae, Moraceae, Urticaceae, Myrtaceae, Meliaceae, Annonaceae, Anacardiaceae, Piperaceae, Polygalaceae, Apiaceae, Apocynaceae, Arecaceae, Verbenaceae, Malvaceae, Cucurbitaceae, Solanaceae, Caesalpiniaceae, Elaeocarpaceae, Lauraceae, and Orchidaceae (3 species each).

All reported plants are commonly used in medicines to treat several diseases and disorders by the Baduy because they are commonly cultivated or grow as wild plants that can be harvested in the forest environment near where the Baduy reside. Out of total species used for medicinal value, the majority are herb (41%) followed by tree (31%), shrub (19%), climber (7%) and epiphyte (2%) climber (7%) (Figure 1). The most widely used family of medicinal plants was the Zingiberaceae, and the highest usability value was the *jukut bau/babadotan* (*Ageratum conyzoides*) with a value of 0.2. The most practice of drugs' preparation and administration was powder. Leaves were the most frequently used plant parts in the preparation of ethnomedicinal recipes.

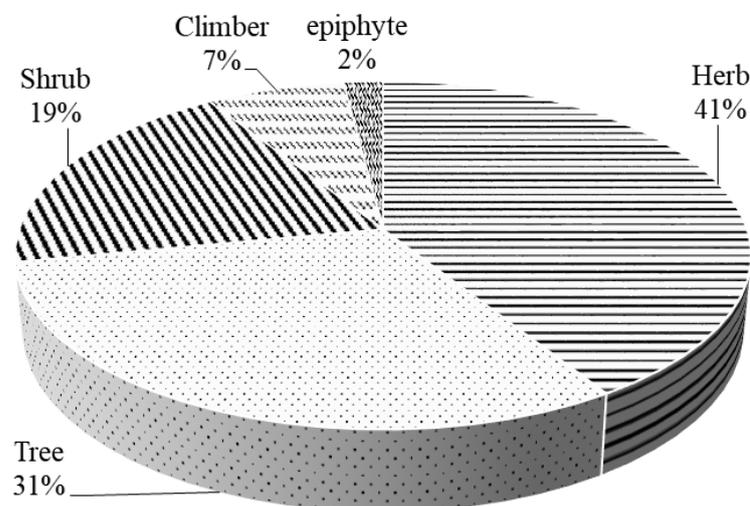


Figure 1. Type of medicinal plants

Traditional management and resource use of traditional community based on local knowledge, beliefs, and practice have much to contribute to the conservation of biodiversity and environment (Berkes, 2008; Chunhabunyatip, Sasaki, Grünbühel, Kuwornu, & Tsusaka, 2018; Finn, Herne, & Castille, 2017; Kanene, 2016; Negi, 2010), included in this case is the traditional Baduy community (El Islami et al., 2018; Ichwandi & Shinohara, 2007; Iskandar, 2017; Iskandar & Iskandar, 2017). Baduy traditional community has a philosophy of life implemented in their life activities; the mountains may not be destroyed, the valleys may not be damaged, what is a long may not be cut short, what is short may not be lengthened, the ancestral injunctions may not be changed. There are also many prohibitions locally called *buyut* or *teu wasa*. It means that their territory is

sacred and therefore they do not allow anything (they called *teu wasa*) to disturb the ecosystem. If it is disobeyed, there will be a great disaster upon human life. This norm and belief are articulated in the form of a code of conduct, and it is imposed as a taboo on their daily behavior (Ichwandi & Shinohara, 2007). That's a valuable knowledge in which transfer from generation to generation along time.

Inquiry activity contained in the developed module is applied through student instruction for carrying out some observations inside and outside the classroom (Dostál, Nuangchalem, Stebila, & Bal, 2016). Through the observation activity, students are expected to obtain meaningful experience. Based on observation, the student will have opportunities to clarify, justify their own preconceptions, and describe the result based on what they see. The student also needs to analyze the material aspect provided on plant biodiversity used by Baduy traditional community and additional information about it. Minner, Levy, and Century (2010) claimed that students learning through inquiry activity such as scientific investigations are more likely to increase conceptual understanding than rely on more passive techniques.

According to Lenning and Ebbers (1999), learning communities take four generic forms which are curricular learning communities are made up of students co-enrolled in two or more courses (often from different disciplines) that are linked by a common theme; classroom learning communities treat the classroom as the locus of community-building by featuring cooperative learning techniques and group process learning activities as integrating pedagogical approaches; residential learning communities organize on-campus living arrangements so that students taking two or more common courses live in close physical proximity, which increases the opportunities for out-of-class interactions and supplementary learning opportunities; and student-type learning communities are specially designed for targeted groups, such as academically underprepared students. Application of the learning community component on the developed module is in the form of observation are carried out in the classroom. Learning communities were formed by divided the classroom member into several groups of students. There are three characteristics in learning community formation according to Intanam and Wongwanich (2014), the student can work collaboratively together with reflective dialogue or discussion among them, collective focus on student learning and their professional goals and gathering and using the results of the evaluation to make decisions regarding the learning progress. In the module, the student will conduct an interview on a key person who will give information on medicinal plant surrounding their environment.

The application of the reflection component is applied to the developed module in the form of a column. In this column, the student needs to write conclusions and summary of the material that has been studied, which performed after learning process finished. Student reflection is an effective way in the learning process. Students sometimes are hesitant to ask related questions with the teacher. Bolton (2009) stated that reflective practice as the process of paying critical attention to the practical values and theories which inform everyday actions, by examining the practice of reflection. Through the provided column, they have the opportunity to ask questions and share information through written dialogue. Through written reflections, students often shared things that confused them about the week's content or lessons. They asked extended questions about the week's objectives, or seek clarification on information shared during class lessons.

The authentic assessment considers teaching, learning, and assessment as an ongoing, inter-wined, and all happening at the same time (Puckett & Black, 2000), and that they strongly influence each other. In this module, the authentic assessment does not only measure students' theoretical ability but rather the application of their skill and manner. Application of this component to the developed module is through the assessment of all activities carried out by students. These activities include quizzes, observations homework, and competency tests. Each activity supplied 15% in averages except the competency test.

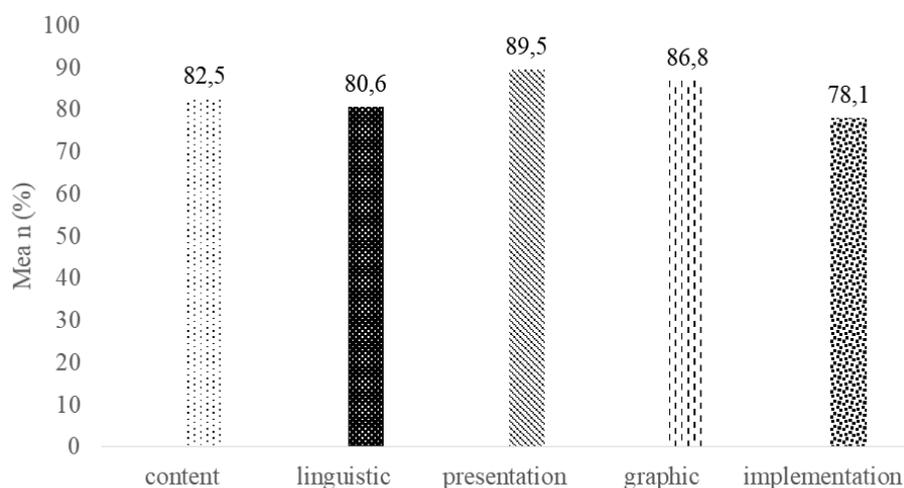
Then, a contextual-based module in medicinal plant diversity and ethnobotany was developed and assessed by two experts. The results of the learning material validation analysis based on the material aspects as well as the aspects of contextual learning component, constructs, and language are shown in Table 2. Experts showed valid category with the percentage of 85,75%. This indicates that there was the conformity of the content of the learning material with the guidance of the preparation of learning material, so the learning material was valid to be used. The module has included core competence, basic competence, and achievement indicators of competence inside.

**Table 2.** Expert's validation results on contextual module

No.	Validation	Validation value (%)	Category
1	Content (Biodiversity and Local wisdom)	93	Valid
2	Construct	80	Valid
3	Language	80	Quite valid
4	Media	90	Valid
	Average	85,75	Valid

After the validation from the experts has been carried out, several aspects need to be revised and improved. The material used had to be varied to avoid monotony, instructions were given also need a slightly revised to further refers to measures scientific approach. The use of language was also slightly revised by taking into account the grammatical structure of General Guidelines for Indonesian Spelling called *PUEBI (Pedoman Umum Ejaan Bahasa Indonesia)*. Some revisions were also conducted in aspects such as the appearance of the size and font type used, the empty space available as the characteristics of the module, and some colored composition. The attractiveness of learning materials can be placed in several parts such as the cover, the content of the section by placing stimuli in the form of pictures or illustrations, and interestingly packaged exercises as in agreement with [Molina, Navarro, Ortega, and Lacruz \(2018\)](#) that the design mainly of images and text can influence the efficiency of learning materials. The contents or cover of teaching materials can be packaged by combining attractive colors. According to [Arsyad \(2009\)](#) color is used as a determinant and attracting attention to important information.

The suggestions are used as guidance in the improvement of the module to produce the appropriate module as learning materials. The next stage was the implementation of the product. In this stage, the revised module based on the assessment of the experts has to be tested. The small-scale trial was conducted by the simulation to 8-12 student randomly to determine the quality of the module based on the aspects of practicality. Students, as respondents were asked several questions by filling out a questionnaire, included five indicators: content, linguistic, presentation, graphic, implementation ([Figure 2](#)).



**Figure 2.** Students' opinion towards contextual-based module

Students have an opinion towards contextual-based module, in general, is 83.53% with a very feasible category. The student gave a positive response to the developed module. Presentation aspect gets the highest score (89.5%) with the category very decent. It can be indicated that the module has been developed in a systematic structure and interesting. According to [Bahtiar \(2015\)](#), good teaching materials must contain adequate substance and presented systematically to achieve goals learning. In addition, [Suryawati and Osman \(2018\)](#) state that the module developed in this study can facilitate contextual learning by providing real samples on the concept explanation and have a positive impact on students.

## CONCLUSION

The module provided Ethnobotany-based learning process which compiles works that explore traditional plant-based medicines and knowledge, customs, and uses of plants have been developed through define, design, and development stages of Thiagarajans' model. Based on the judgment and validation proved that the media was very properly able to be used in classroom and instruction. The response of students to the learning material was very good with 83.5%. Overall it can be concluded that the use of learning media were very proper to develop students' understanding of plant biodiversity concept based on the National Education Standardization Agency.

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