



## Development of Medicinal Plants Ethnobotany Study-Based Encyclopedia as Plantae Study Media

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### Abstract

The competence of plantae material is grouping plants' characteristics into divisions and linking their roles in life. This study aims to test the validity and effectiveness of the encyclopedia media for medicinal plants in Berastagi and Desa Pantai Labu, North Sumatra. Research methods and development of medicinal plants encyclopedia using the model analysis, design, development, implementation, and evaluation. The medicinal plants' encyclopedia was developed from the plant exploration research results, which were then validated and readability tests. The trial was conducted at SMA N 16 Medan using one control class (without an encyclopedia) and one experiment class (using an encyclopedia and textbooks). The exploration and identification of medicinal plant species in Berastagi and Pantai Labu Village found 30 species of medicinal plants belonging to 17 families. The characteristics of the encyclopedia of medicinal plants include images in the encyclopedia from the research results in the form of identification and inclusion of scientific names, local names, and the benefits of medicinal plants. The validation of media experts is 98%, and material experts are 95% with very valid criteria. The media readability test is 90.50% with easy-to-understand standards. The media's effectiveness in the cognitive aspects of the experiment class was higher than the control class, namely by 90% with very effective criteria. Classical mastery of the experiment class's psychomotor aspects and affective aspects was 100% with very effective criteria.

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## INTRODUCTION

Basic competencies (KD) learned in the *plantae* material for high school level consist of two basic competencies such as KD 3.8 and KD 4.8. The two KD respectively are grouping plants into divisions and linking their roles in daily life, as well as presenting phenetic, phylogenetic, and plant-related roles in daily life. The *plantae* material for high school is very broad, consisting three groups of plants such as mosses, ferns, and seed plants. There are around 30,000 types of plants in Indonesia, 7000 of which have medicinal properties (Jumiran et al., 2017). Therefore, the types of plants in the *plantae* material need to be selected so that students can easily understand them and the KD targets can be achieved.

The results of observations and interviews at five high schools in Medan City show that *plantae* learning material has not been associated with a role in everyday life. Learning media and learning meeting time are limited so that it is not sufficient to learn all the *plantae* materials. Teachers generally use textbooks, students' worksheets, *power point* media, and school libraries as students learning resources. Students tend to memorize the material and the learning process which is less active so that students do not master the *plantae* material well and learning outcomes are less than optimal because most students do not achieve the minimum completeness criteria (KKM).

The results of interviews with students showed that students had difficulty in understanding the *plantae* material because the teacher only used the lecture method and did not carry out practicum activities. Students find it difficult to recognize scientific names because the characteristics of plants cannot be understood. Students never describe the characteristics of plants and relate its role in everyday life, therefore, not all targets in KD 3.8 and 4.8 can be achieved.

*Plantae* learning material is closely related to the use of local biological resources as a medium of learning. Local wealth-based learning using encyclopedia media is proven to be able to improve cognitive, psychomotor, and affective learning outcomes (Wismarini et al., 2012).

Encyclopedias are enrichment books to complement textbooks (Nurhatmi, 2015). Attractive

medicinal plant encyclopedia media are easy to understand so that students' interest and learning outcomes increase, especially in *plantae* material (Sukoco et al., 2016). These media are a comprehensive source of information and the explanation is equipped with interesting and relevant pictures or photos so that students' insight increases.

The development of an encyclopedia of medicinal plants based on ethnobotany studies has several advantages. Ethnobotany includes the study of the interaction between local communities and the surrounding environment in the use of plants as medicine (Meliki, 2013). The use of plants as medicine is one of the roles of plants for life that needs to be introduced so that students can apply it in their daily life (Arham et al., 2016).

Community's knowledge about ethnobotany is very important to dig up information on the local potential of medicinal plants (Handayani, 2015). Ethnobotany-based encyclopedia is a contextual media, because it is extracted from people's knowledge directly along with the development of science and technology.

The objective of this study was to analyze the validity and effectiveness of using encyclopedia media for medicinal plants in *plantae* learning. The media are expected to help students to achieve KD in the cognitive, psychomotor, and affective learning outcomes.

## METHODS

The research and development of an encyclopedia of medicinal plants use the ADDIE model which consists of stages (*Analysis, Design, Development, Implementation, and Evaluation*). The *analysis* stage includes observation to determine the form of instructional media required for exploration and interviews in the Berastagi area, Karo Regency and in Pantai Labu Village, Deli Serdang Regency in order to obtain medicinal plant data and ethnobotan. The *design* stage is carried out to develop the content and concept of a medicinal plant encyclopedia by considering the functional and aesthetic aspects. The *development* stage is to develop a product according to the results of analysis and design. The validation of product development results is determined through the assessment of

material and media experts, which is then revised according to the validator's suggestions. Small-scale tests and large-scale tests are carried out during the *implementation* stage.

The *implementation* stage was carried out at SMA Negeri 16 Medan on March - May 2019. A small-scale test was carried out through filling out a questionnaire to 10 X MIA students to ensure the encyclopedia's readability level. The effectiveness of using the encyclopedia is measured through large-

scale tests. This test is carried out on the control class (using textbooks) and the experimental class (using textbooks and encyclopedias). The effectiveness of using the encyclopedia is measured in the cognitive, psychomotor, and affective aspects. The *evaluation* stage is to revise the encyclopedia product based on the results of implementation.

The main data collection of this study are shown in Table 1

**Table 1.** Data Collection Techniques

No	Types	Data collection techniques	Instrument
1.	Types of medicinal plants and ethnobotany Exploration	Methods plants used by the community	Plant bservation sheets and interviews
2.	Characteristics of encyclopedia	Design	Sheet design
3.	Validation of theValidation	Questionnaire	Sheet observation
4..	Readability of the Readability	Questionnaire	Sheet observation
5.	Cognitive learning outcomes	Test	Pretest and posttest questions
6.	Psychomotor learning outcomes	Observation	Sheet observation
7.	Affective learning outcomes	Observation	Sheet observation

## RESULTS AND DISCUSSION

The results of this study consist of 1) types of plants medicine in Berastagi and Pantai Labu Village, 2) encyclopedia characteristics, 3) encyclopedia validation results, 4) encyclopedia readability, and 5) analysis of the effectiveness of using encyclopedias on aspects (cognitive, psychomotor, and affective).

### Types of Medicinal Plants in Berastagi and Pantai Labu Village

Thirty species of medicinal plants found in Berastagi and Pantai Labu Village belonging to 17 families which are dominated by Lamiaceae, Myrtaceae, Fabaceae, and Euphorbiaceae. List of types of medicinal herbs and their benefits are presented in Table 2.

**Table 2.** Plant Medicine and Benefits in Berastagi and Pantai Labu Village

No	Name Family	Name Species	Benefits of plants
1.	Polytrichaceae	Polytrichum commune L.	Treating trush
2.	Cyatheaceae	Cythea contaminata L.	Treating medicine after child birth
3.	Annonaceae	Annona muricata	Treating lumbago, dysentery and boils
4.	Apiaceae	Centella asiatica L.	Treating nosebleeds, ulcers and hemorrhoids

Continued **Table 2.** Types of medicinal plants and their benefits in Berastagi and Pantai Labu Village

No	Name Family	Name Species	Benefits of plants
5.	Apocynaceae	Adenium obesum L.	Treating gonorrhoea
6.	Asteraceae	Ageratum conyzoides L.	Treating flatulence, heartburn and vomiting
7.	Balsaminaceae	Impatiens balsamine	Treating fever and diabetes
8.	Brassicaceae	Raphanus sativus	Treating coughs and fever
9.	Euphorbiaceae	Euphorbia heterophylla L.	Treating constipation and asthma
		Jatropha curcas L.	Treating itching disease
		Jatropha multifida L.	Treating wounds
		Phyllanthus urinaria L.	Treating malaria, cough, and epilepsy
10.	Fabaceae	Leucaena leucocephala	Treating diabetes and worms in the intestine
		Senna alata L.	Treating ring worm
11.	Lamiaceae	Mentha piperita L.	Treating colds
		Ocimum sanctum	Treating ring worm and flatulence
		Orthosiphon aristatus L.	Treating urinary tract infections
		Plectranthus scutellarioides	Treating pain and wounds
12.	Malvaceae	Gossypium hirsutum L.	Treating inflammation of the intestine
		Urena lobata L.	Treating influenza and swelling
13.	Meliaceae	Melia azedarach L.	Treating hypertension
14.	Myrtaceae	Melaleuca quinquenervia L.	Treating insomnia and rheumatism
		Psidium guajava L.	Treating pain diarrhea
		Syzygium polyanthum L.	Treating pain of gout and diabetes
15.	Poaceae	Cymbopogon citratus	Treating coughs up phlegm and appetite enhancer
		Imperata cylindrical L.	Treating hospital for urine laxative
16.	Rutaceae	Ruta graveolens L.	Treating menstrual pain, cramps, loss of appetite, and high blood pressure
17.	Zingiberaceae	Alpinia galanga L.	Treating skin fungus or tinea versicolor
		Curcuma xanthorrhiza	Treating liver, hepatitis and lymph disease

The findings in both locations indicate that the Myrtaceae and Fabaceae families have wide adaptability so that they can live in various ecosystems (Nurasyikin, 2019). Myrtaceae leaves contain various oil compounds secreted by the glands in the leaves. These compounds can be in the form of essential oils and other terpenoids (Niinemets, 2018). Some Fabaceae leaves have been shown to contain polyphenols, which in several studies can have biological to antiviral activity (El-Toumy et al., 2018; Sarikurku et al., 2020).

There are also flowers in the plants in the sampling area that can be used as herbs, for example, the flowers from the Lamiaceae family. Flowers from this family are widely used as medicine, fragrances, and essential oils. The compound content in the Lamiaceae family is essential aromatic oil compounds, phenolic, tannins, saponins, and organic acids (Anggraini, 2017).

Plants from the three families above are commonly cultivated plants. There are also plants

that grow wild on roadsides, grass fields, areas that are exposed to sunlight in lowlands without reducing their potential as pharmacological agents. An example of this plant type is from the Euphorbiaceae family. This family contains saponins, tannins, and flavonoids (Nopriyanti, 2019).

Other plants found in this study also have biological benefits, such as plants from the Apocynaceae, Annonaceae, Apiaceae, Polytricheae, Cyathaceae, Asteraceae, Poaceae, Balsaminaceae, Brassicaceae, Meliaceae, Rutaceae, Zingiberaceae, and Malvaceae families. Each of these plants contains secondary metabolite compounds. Secondary metabolites are the key to the pharmacological effects of plants (Romero-Benavides et al., 2017).

#### Characteristics of the Encyclopedia of Medicinal Plants

The encyclopedia media have been adapted to the basic competencies of 3.8 and 4.8, as well as

students' need. This encyclopedia is equipped with general knowledge about plants, plant relationships, and information on each type of medicinal plant. The encyclopedia is also equipped with clear photos of the results of own study.

The encyclopedia of medicinal plant contains morphological descriptions of medicinal plants found in Berastagi and Pantai Labu Village, complete with information on the classification and benefits of ethnobotany. This information can help students understand the characteristics of medicinal plants, so they can classify medicinal plants according to their respective divisions.

Encyclopedia of medicinal plants has the appearance of printed media (*hardcopy*). This encyclopedia is able to provide additional information for students because the content of the material is not included in their textbooks. Learning media which have enrichment of material can make students have broader insights so that their understanding increases (Dyah & Suarsini, 2016).

The advantage of the encyclopedia of medicinal plants compared to other teaching materials is that it can be used for independent study, anytime and anywhere. This is because this media is equipped with instructions for using the media, which will make it easier for students to learn independently.

### Media Validation of Medicinal Plant Encyclopedia

Validation of the encyclopedia of medicinal plants was carried out by media and material experts. The encyclopedia of medicinal plants in this study has an average media validation score of 98%, so it is included in the very valid criteria, while the material validation score is 95% with very valid criteria. The results of the validation of media and materials are in Table 3.

Validation assessment points by media experts include 3 aspects, namely 1) graphic aspects, 2) encyclopedia components, and 3) language eligibility. The media expert's assessment score shows that the media developed is very valid, yet there are still revisions, namely images taken from the internet need to be replaced with images of research photos themselves. The name of the compiler on the cover does not include the name of the supervisor on the front of the cover, so it needs

to be replaced by the name of the supervisor on the front of the cover.

**Table 3.** Expert Validation of Teaching Materials and Learning Materials

Expert	Aspects are rated	Percentage (%)	Criteria
Teaching Materials	Graphic aspects	95	Very valid
	Encyclopedia Components	100	Very valid
	Feasibility language	100	Very valid
Averages		98	Very valid
Learning material	Feasibility content	86	Very valid
	Presentation feasibility	100	Very valid
	Language eligibility	100	Very valid
Average		95	Very valid

The points of validation assessment by material experts include 3 aspects, namely 1) content feasibility aspects, 2) presentation feasibility, and 3) language feasibility. The material expert's assessment score shows that the media developed is very valid. Material experts also provide some suggestions for improvement, it is said that the scientific names of plants are inconsistent and the difference in morphology of each plant is unclear. The media have been improved by prioritizing the consistency of plant scientific names and replacing plant morphological information to make it clearer.

The encyclopedia image displayed is more attractive and makes students not bored and increases students' curiosity and responses to learn more deeply in accordance with the environment around students (Munawwaroh et al., 2018; Rahmati et al., 2017).

### Readability of the Encyclopedia of Medicinal Plants

The analysis of media readability is the implementation stage of the media in the form of a small scale test. The small scale test was followed by 10 students of X MIA class who were not part of the large-scale test group. The media readability

questionnaire used as an assessment instrument contained the readability response of grammar, word difficulty, and long and short sentences. The legibility test results showed an average value of 90.50%, which was included in the easily understood criteria.

The length and shortness of sentences can affect students' memory. In addition, the readability factor also affects the level of students' understanding of the content (Komang et al., 2017). This encyclopedia of medicinal plants media has an organized appearance with short sentences and representative pictures. Therefore, it is hoped that it can make it easier for students to learn *plantae* material as well as to add insight and to increase students' curiosity.

Teaching materials that have appropriate language and are communicative will make it easy for readers to understand them (Yulia et al., 2017). In general, the use of language in this plant encyclopedia is relatively easy to understand.

### The Effectiveness of the Encyclopedia of Medicinal Plants

The effectiveness of the media is a part of the implementation phase which is carried out as a part of a large-scale test. The effectiveness is measured from the cognitive, psychomotor, and affective aspects of learning outcomes. This large-scale test was carried out in two classes at SMA Negeri 16 Medan consisting of the control class (using textbooks) and the experimental class (using encyclopedia and textbooks). KKM in SMAN 16 Medan is 75. The learning outcomes of the cognitive aspects gained from the *pretest* and *posttest* are presented in Table 4.

**Table 4.** Results Of Learning Cognitive

Class	Average		Classical complete nessa (%)	Criteria
	Pretest	Posttest		
Control	51.83	79.83	76.66	Effective
Experimental	61.50	86.16	90.00	Very effective

The effectiveness of the cognitive learning outcomes of the control class is lower than the experimental class. The control class uses a different textbook than the experimental class which uses textbooks and encyclopedia media.

The plant images in the textbook only contain scientific names without any information from the plant image, plant characteristics, plant classification, and the benefits of the plant. Students find it difficult to do practicum to identify the characteristics of medicinal plants. Students do not get information about the benefits of medicinal plants.

Students in the control class answer questions on the worksheets using the information in the textbook. Students' distrust of their findings closes the opportunity for the development of analytical skills.

The experiment class trials of students use teaching materials in the form of textbooks and encyclopedia media. The media of medicinal plant encyclopedia contain images of the results of medicinal plant research so that students can easily compare the information from each plant image. Students find it easier to identify plants because the images presented in the media are accompanied by descriptions of the types of parts of the plants so they are not much different from the results of students' observations. The experimental class was superior because students were more active in the learning process than the control class who still had difficulty in identifying the characteristics of medicinal plants.

Learning activities using textbooks and encyclopedia media are carried out contextually. Contextual learning provides opportunities for students to be active in learning (Sudarisman, 2013). Students' activeness can affect motivation and interest in learning, so that students feel happy. Pleasure makes it easier for students to understand the material being studied (Bire et al., 2017).

The encyclopedia media for medicinal plants based on KD for cognitive aspects is KD 3.8. It classifies the plants into their respective divisions and their roles in life. The development of instructional media can improve students learning outcomes (Sari et al., 2012).

The psychomotor aspects of *plantae* material are in accordance with KD 4.8, which is to present the reports on phenetic and phylogenetic relationships and the role of plants in everyday life. Each class is divided into several groups and each group brings the tools and materials needed.

Psychomotor assessment is carried out by means of observation. The aspects assessed were observation skills, identification skills, and

information seeking skills. Psychomotor learning outcomes of both classes can be seen in Table 5.

**Table 5.** The results for Psychomotor Learning

Class	Average	Classical Completeness (%)	Efficacy Criteria
Control	81	100	Effective
Experiment	90	100	Very Effective

In control and experimental class students active and creative in doing practical work, so that psychomotor results in the effective control class and the experimental class are very effective. Practical implementation is assisted by the LKS that has been provided.

In the control class, the score for the aspect of observing skills tends to be lower than in the experimental class. Students do not understand the material seriously and are not serious in observing plants. The experimental class used encyclopedia media and textbooks to observe the morphological characteristics of medicinal plants that had been prepared. Encyclopedia media is able to foster students' skills in observing plants and information on descriptions of morphological features contained in the media.

The aspect of identifying the control class is also lower than the experimental class, students in the control class have difficulty in identifying plants because students references from textbooks and the internet are incomplete. The experimental class uses encyclopedia and packet media, so that students have many references to understand.

The control class has a lower score for information seeking aspects than the experimental class. It happens because students do not understand and have difficulty in finding the phenetic and phylogenetic relationships of medicinal plants. The experimental class has a high score of information seeking aspects, because students use textbooks and encyclopedia media to understand the relationship between medicinal plants contained in the media. The right media can help students in understanding *plantae* material and achieve learning objectives so that students learning outcomes increase and make it easier for students to study the objects of study that are not available (Yelianti et al., 2016).

Assessment of affective aspects is carried out by observation during the learning process. Aspects that are assessed are attitudes during practicum (cooperation, thoroughness, curiosity, and responsibility), and attitude in reporting (honesty and discipline). Affective learning outcomes in both classes can be seen in Table 6.

**Table 6.** Results of Study of Affective

Class	Average	Classical Completeness (%)	Efficacy Criteria
Control	85	100	Very effective
Experiment	92	100	Very effective

Control classes have lower scores practical aspect, because the meticulous attitude, cooperation and students' responsibility are less compact in doing practicum which is caused by the lack of students in mastering the material. The experimental class uses plant encyclopedia media and textbooks in groups, so as to foster the character of cooperation and accuracy in identifying the morphological characteristics of medicinal plants. Group practicum activities can increase students' cooperation, encourage students to express their opinions, and help each other (Purnamasari et al., 2012).

The attitude of making reports also occurs in the discipline of students. In the control class, students are confused about making reports so that this attitude makes students less focused in doing practicum. Meanwhile, the experimental class has a higher reporting attitude. The use of detailed media will be able to increase motivation, interest in learning and make it easier for students to understand the subject matter (Arsana et al., 2013).

## CONCLUSION

This study shows that there are 30 types of medicinal plants in Berastagi and Pantai Labu Village which is belonging to 17 families. The characteristics of the encyclopedia of medicinal plants have been adjusted to the 3.8 and 4.8 basic competencies, consisting the images which comes from the results of the research photos in the form of *hardcopy*. It contains a description of the morphological classification and benefits of plants,

and is equipped with instructions for using media, which will make it easier for students to learn independently. The medicinal plant encyclopedia deserves to be used as high school media because it is very valid and easy for students to understand (high readability scores), and is very effective on cognitive, psychomotor, and affective learning outcomes.

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