



## Review: Ethnobotanical Studies in West Kalimantan as Biology Learning Resources

Mas Akhbar Faturrahman<sup>1</sup>, Dina Wahyuni<sup>2</sup>, Harun Asyroff<sup>3</sup>, Klaudia Mareta Sandra<sup>4</sup>, Kurnia Ningsih<sup>5</sup>, Afandi<sup>6</sup>, Syamswisna<sup>7</sup>

<sup>1,2,3,4,5,6,7</sup>Biology Education Study Program, Faculty of Teacher Training and Education, Tanjungpura University, Pontianak, Indonesia

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### ABSTRACT

**Purpose of the study:** This research aims to present concise information related to implementing ethnobotanical research in West Kalimantan as a biology learning resource.

**Methodology:** This research is classified as qualitative research with the type of literature review. Each scientific article found during the search process is then analyzed, and the results are presented as tables and graphs.

**Main Findings:** Based on the search, 63 scientific articles implement ethnobotanical research in West Kalimantan as a learning resource in biology subjects. The ethnobotanical research includes using plants as medicine, cosmetics, crafts, dyes, traditional ceremonies, boards, food, wrappers, and toys. The learning resources developed include 13 non-digital and 8 digital learning resources.

**Novelty/Originality of this study:** This research is unique in that it presents literature studies related to the implementation of ethnobotanical research, specifically in West Kalimantan, as a biology learning resource.

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### Corresponding Author:

Mas Akhbar Faturrahman,

Biology Education Study Program, Faculty of Teacher Training and Education, Tanjungpura University, Jl. Prof. Dr. H. Hadari Nawari, Pontianak, West Kalimantan, 78124, Indonesia

Email: [masakhbar123@gmail.com](mailto:masakhbar123@gmail.com)

## 1. INTRODUCTION

Learning resources are a component that cannot be separated from the learning process. Learning resources can be defined as everything outside of students that they can utilize to facilitate and improve the quality of the learning process [1], [2]. Learning resources are important in creating effective and efficient learning [3]. Learning resources accompany teachers' professionalism in creating learning that has a significant impact on students so that the expected learning activities and results can be achieved [4]. Learning resources that must be developed systematically before teachers and students can use them are known as learning resources by design [5], [6]. Learning resource development can be based on research results. One form of research that can be implemented as a learning resource is ethnobotany.

Ethnobotany is a survey conducted to find out how the culture of local communities utilizes plants around them to meet their daily needs [7]-[9]. Plants are living things with chlorophyll that have many important roles in human life, such as food sources, medicines, economic carrying capacity, decoration, and education [10]. The utilization of plants is inseparable from their traditional use. Various types of plants are used traditionally in everyday life, where this utilization of knowledge is local wisdom passed down from ancestors, customs, beliefs, or local habits [11]. However, traditional knowledge related to the use of plants has the potential to be lost due to modernization [12] and the absence of preservation and documentation of traditional knowledge sourced from the

community [13], [14].

Ethnobotanical research has been conducted in Indonesia, including in West Kalimantan. People in West Kalimantan are still thick with knowledge of traditional plant utilization to meet the needs of daily life [15]. In addition, ethnobotanical research in West Kalimantan has also been widely implemented as a learning resource developed mainly for natural science subject in junior high school (such as Ref. [16]) and biology subject in senior high school (such as Ref. [17], [18]). Learning resources developed from research results are expected to support students in understanding material more profoundly and foster various skills related to research results and material that is the intention of the research done [19], [20]. The developed learning resources can also be used as a reference. The existence of references regarding the traditional use of plants is a form of documentation so that this knowledge is not lost and has the potential to be developed as a variety of further research [21].

Although several ethnobotanical researches in West Kalimantan have been implemented as learning resources, we found a gap that the existence of ethnobotanical research implementation in West Kalimantan is still limited and arguably small when compared to the large number of regions and communities in the province. Research that summarizes ethnobotanical research in West Kalimantan and its implementation as a learning resource has never been done before. Therefore, this research aims to present concise information on implementing ethnobotanical research in West Kalimantan as a biology learning resource. This research is important because it can provide a reference for researchers in the field of education, especially biology education, to conduct ethnobotanical research more intensively, disseminate information that has never been studied before, and develop more innovative learning resources to support the learning process.

## **2. RESEARCH METHOD**

### **2.1. Type of Research**

This research is qualitative. Qualitative research can be defined as research that analyzes and describes the social phenomena studied to be interpreted descriptively [22]. The type of research conducted is a literature review. Literature review includes collecting, recording, sorting, and managing literature obtained by researchers [23]. This research conducted a literature review to collect various scientific articles related to implementing ethnobotanical research in West Kalimantan as a biology learning resource.

### **2.2. Data Sources**

The data in this research are secondary. Secondary data can be defined as data already available from various other sources, so researchers do not obtain it directly [24]. The secondary data used in this research are scientific articles published in scientific journals. The articles obtained from the search process were then filtered based on the predetermined inclusion criteria, namely accessible, using Indonesian or English, having precise research methods, relevant to the topic of the literature review conducted, and published in national journals (accredited and non-accredited) within the period 2015-2024. The period restriction was carried out to review the data development that became the literature review topic in the last decade [25]. Articles not meeting the inclusion criteria were removed and not used as data in this research.

### **2.3. Data Collection Techniques**

The data collection technique used in this research is documentation. Documentation is a technique for searching for documents that are already available, such as transcripts and books, to examine in depth [26]. Searches were conducted using Publish or Perish (PoP) with Google Scholar as the selected database. Some of the keywords used in this study are “Ethnobotany”, “West Kalimantan”, “Learning resources”, “Teaching materials”, and “Learning media”.

### **2.4. Data Analysis Techniques**

The data analysis technique used in this research is content analysis. Content analysis is interpreted as a review of the content of documents collected to obtain information relevant to the research topic [27]. In this research, content analysis was carried out on scientific articles collected through PoP and met the predetermined inclusion criteria. Each scientific article was analyzed to determine the year of publication, the ethnobotanical assessment carried out and its location, the form of implementation, the variety of submaterial or material that is the purpose of the implementation of ethnobotanical research, and how far the research stages are carried out. The results of the analysis were then presented in tables and graphs.

### **2.5. Data Validity and Reliability**

Data validity and reliability in qualitative research refer to data trustworthiness [28]. Data trustworthiness consists of four components that must be done, namely credibility, transferability, dependability, and confirmability [29]. Credibility in this research is achieved through diligent observation. Diligent observation means making more careful and continuous observations of the documents collected so that researchers can provide accurate and systematic descriptions of what is observed [30]. Transferability refers to the extent to which the research can be used or applied in various other situations. In this research, transferability is done by providing

a thick description, which involves the researchers elucidating components of the research extensively so that the readers can perceive the research results clearly [31]. Dependability and confirmability are done through discussions and cross-checking with the research team and supervisors.

## 2.6. Research Procedures

The literature review procedure carried out in this study refers to Ref. [32] which consists of six stages, namely the selection of literature review topics, determination of keywords to be searched, identification of literature sources, collection of literature sources, content analysis of each literature source, and writing research papers as a result of literature studies that have been carried out.

## 3. RESULTS AND DISCUSSION

Based on the literature collection, 63 scientific articles were found that discuss the implementation of ethnobotanical studies in West Kalimantan for biology subjects. The main results of the analysis of each scientific article are presented in Table 1.

Table 1. Main results of the literature review

Plants Utilization	Location	Form of Implementation	Submaterial/Material	Ref.
Medicines	Bange Village, Sanggau Ledo District, Bengkayang Regency	Documentary film	Biodiversity utilization (S)	[33]
Cosmetics, handcrafts, dyes, medicines, and traditional ceremonies	Tasik Malaya Village, Batu Ampar District, Kubu Raya Regency	Folding poster	Biodiversity utilization (S)	[34]
Medicines	Mandor District, Landak Regency	Pocketbook	Biodiversity utilization (S)	[35]
Medicines	Penyuguk Village, Ella Hilir District, Melawi Regency	Flipbook	Biodiversity utilization (S)	[36]
Medicines	Dadayu Hamlet and Lame' Ngundi Rukun Hamlet, Garu Village, Mempawah Hulu District, Landak Regency	Herbarium	Angiospermae plants (S)	[37]
Medicines, food dyes, cosmetics, cultural needs, and handcrafts	Arus Deras Village, Teluk Pakedai District, Kubu Raya Regency	Booklet	Biodiversity utilization (S)	[38]
Medicines	Tanap Village, Kembayan District, Sanggau Regency	Pocketbook	Biodiversity utilization (S)	[39]
Handcrafts	Mandor District, Landak Regency	Pocketbook	Biodiversity utilization (S)	[40]
Medicines	Amboyo Inti Village, Ngabang District, Landak Regency	Flipbook	Biodiversity utilization (S)	[41]
Medicines	Ladangan Village, Menyuke District, Landak Regency	Flashcard	Biodiversity utilization (S)	[42]
Medicines	Paloan Village, Sengah Temila District, Landak Regency	Booklet	Biodiversity (M)	[43]
Women self-care	Kadriyah Palace, East Pontianak District, Kota Pontianak	Folding poster	Biodiversity utilization (S)	[44]
Medicines	Seburing Village, Semparuk District, Sambas Regency	Flipbook	Biodiversity (M)	[45]
Children's appetite enhancers	Karya Usaha Hamlet, Kuala Mandor A Village, Kuala Mandor B District, Kubu Raya Regency	Pocketbook	Biodiversity utilization (S)	[46]
Medicines	Sibawek Hamlet and Kaca Lengkuas Hamlet, Garu Village, Mempawah Hulu District, Landak Regency	Booklet	Biodiversity utilization (S)	[47]
Medicines	Mungguk Hamlet, Rantau Prapat Village, Embaloh Hulu District, Kapuas Hulu Regency	Booklet	Biodiversity utilization (S)	[48]
Medicines	Sebente Village, Teriak District, Bengkayang Regency	Flashcard	Biodiversity utilization (S)	[49]
Medicines	Nipah Panjang Village, Batu Ampar District, Kubu Raya Regency	Folding poster	Biodiversity utilization (S)	[50]
Medicines	Seberkat Village, Tebas District,	Smart card	Biodiversity utilization (S)	[51]

Plants Utilization	Location	Form of Implementation	Submaterial/Material	Ref.
Medicines	Sambas Regency Pelimpaan Village, Jawai District, Sambas Regency	Flipchart	Biodiversity utilization (S)	[52]
Medicines	Selaba Hamlet, Mungguk Village, Ngabang District, Landak Regency	Pocketbook	Biodiversity utilization (S)	[53]
Digestive system disorders medicines	Nusa Pandau Village, Nanga Pinoh District, Melawi Regency	Documentary film	Human digestive system (M)	[54]
Medicines	Santaban Village, Sajingan Besar District, Sambas Regency	Module	Biodiversity (M)	[55]
Traditional ceremonies	Alwatzikhoebillah Palace, Dalam Kaum Village, Sambas District, Sambas Regency	Encyclopedia	Biodiversity utilization (S)	[56]
Handcrafts	Hli Buie Village, Siding District, Bengkayang Regency	Magazine	Biodiversity utilization (S)	[57]
Medicines	Kampung Baru Village, Toba District, Sanggau Regency	Flashcard	Biodiversity utilization (S)	[58]
Anthelmintic medicines	Anik Dingir Village, Menyuke District, Landak Regency	Pocketbook	Biodiversity utilization (S)	[59]
Medicines	Jirak Village, Sajad District, Sambas Regency	Magazine	Biodiversity utilization (S)	[60]
Medicines	Sabung Village, Subah District, Sambas Regency	Encyclopedia	Biodiversity utilization (S)	[61]
Cosmetics	Aur Sampuk Village, Sengah Temila District, Landak Regency	Magazine	Biodiversity utilization (S)	[62]
Medicines	Tanjung Bunga Village, Kembayan District, Sanggau Regency	Documentary film	Biodiversity utilization (S)	[63]
Boards	Sandai Kanan Village, Sandai District, Ketapang Regency	Pocketbook	Biodiversity utilization (S)	[64]
Foods	Mekar Pelita Village, Sayan District, Melawi Regency	Booklet	Biodiversity utilization (S)	[65]
Handcrafts	Ensaid Panjang Village, Kelam Permai District, Sintang Regency	Interactive multimedia	Biodiversity utilization (S)	[66]
Traditional ceremonies	Mabah Hamlet, Raut Muara Village, Sekayam District, Sanggau Regency	Flash flipbook	Biodiversity utilization (S)	[67]
Cosmetics	Tonang Village, Sengah Temila District, Landak Regency	Pocketbook	Biodiversity utilization (S)	[68]
Traditional ceremonies	Hli Buie Village, Siding District, Bengkayang Regency	Interactive PowerPoint	Biodiversity utilization (S)	[69]
Medicines	Selat Remis Village, Teluk Pakedai District, Kubu Raya Regency	Magazine	Biodiversity utilization (S)	[70]
Traditional ceremonies	Paloan Village, Sengah Temila District, Landak Regency	Documentary film	Biodiversity utilization (S)	[71]
Medicines	Raut Muara Village, Sekayam District, Sanggau Regency	Module	Biodiversity utilization (S)	[72]
Traditional ceremonies	Mulia Kerta Subdistrict, Benua Kayong District, Ketapang Regency	Pocketbook	Biodiversity utilization (S)	[73]
Foods	Raut Muara Village, Sekayam District, Sanggau Regency	Augmented reality	Biodiversity utilization (S)	[74]
Fabric dyes	Sambas Regency	Booklet	Biodiversity (M)	[75]
Hypertension medicines	Babane Village, Samalantan District, Bengkayang Regency	Encyclopedia	Circulatory system diseases and disorders (S)	[76]
Medicines	Bengkayang Regency	Module	Biodiversity (M)	[77]
Wrappers	Meliau District, Sanggau Regency	Encyclopedia	Biodiversity (M)	[78]
Medicines	Sumiak Hamlet, Sidas Village, Sengah Temila District, Landak Regency	E-magazine	Biodiversity utilization (S)	[79]
Food dyes	Simpang Kingdom, Simpang Hilir District and Tanjungpura Kingdom,	Pocketbook	Additives (S)	[16]

Plants Utilization	Location	Form of Implementation	Submaterial/Material	Ref.
	Sukadana District, North Kayong Regency			
Foods	North Kayong Regency	Encyclopedia	Biodiversity (M)	[80]
Breast milk-stimulants	Pasti Jaya Village, Samalantan District, Bengkayang Regency	Pocketbook	Breast milk and family planning (S)	[81]
Toys, foods, medicines, traditional ceremonies, and wrappers	Sambas Regency	Encyclopedia	Biodiversity (M)	[82]
Vertigo treatment	Singkawang City	Pocketbook	Nervous system (S)	[83]
Postpartum care	Pasti Jaya Village, Samalantan District, Bengkayang Regency	Booklet	Fertilization, gestation, and childbirth (S)	[84]
Menstrual pain medicines	Tumiang Village, Samalantan District, Bengkayang Regency	Module	Reproductive system disorders (S)	[85]
Traditional ceremonies	Kantuk Hulu Hamlet, Paoh Benua Village, Sepauk District, Sintang Regency	Flashcard	Biodiversity utilization (S)	[86]
Medicines	Madi Hamlet, Lumar District, Bengkayang Regency	Biocard	Biodiversity utilization (S)	[17]
Traditional ceremonies	Pentek Village, Sadaniang District, Mempawah Regency	Pocketbook	Biodiversity utilization (S)	[87]
Traditional ceremonies	Paloh District, Sambas Regency	Encyclopedia	Biodiversity (M)	[88]
Postnatal medicines	Bentunai Village, Selakau District, Sambas Regency	E-encyclopedia	Kingdom Plantae (S)	[18]
Plaits	Batu Daya Village, Simpang Dua District, Ketapang Regency	Encyclopedia	Biodiversity (M)	[89]
Foods	Ketapang Regency	Encyclopedia	Biodiversity (M)	[90]
Hypertension medicines	Mekar Utama Village, Kendawangan District, Ketapang Regency	Pop-up book	Biodiversity utilization (S)	[91]
Natural dyes	Caokng Village, Mempawah Hulu District, Landak Regency	E-module	Biodiversity utilization (S)	[92]

S: Submaterial, M: Material

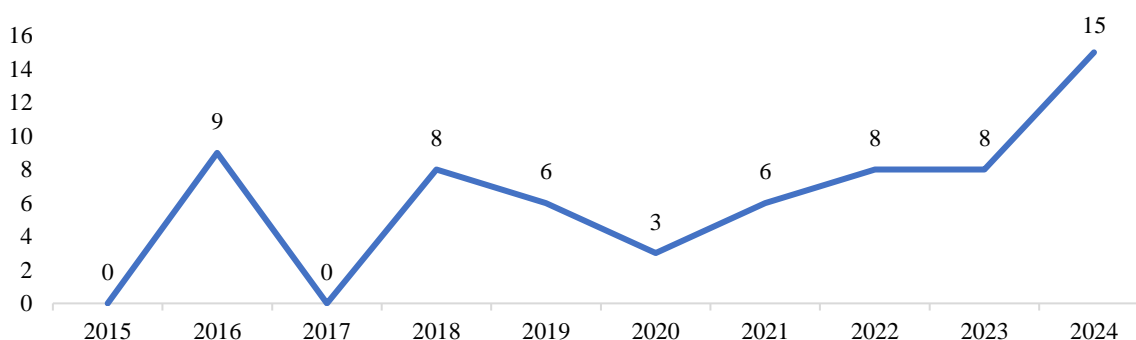


Figure 1. Amount of scientific articles based on the year published

Figure 1 shows the number of scientific articles on implementing ethnobotanical research as a biology learning resource each year. Based on the figure, it is known that the number of scientific articles found fluctuates every year. This is to the statement that research trends in education constantly change from time to time because they follow the phenomena that are developing in the field [93]. The absence of scientific articles in 2015 and 2017 could be due to a change in trend. Although the number of scientific articles related to implementing ethnobotanical research as a biology learning resource increased again in 2018, the number decreased again in 2019 and 2020. This decrease can be caused by the *Corona Virus Disease* 2019 (COVID-19) pandemic, which limits the mobility of researchers who conduct research.

The increase in positive COVID-19 cases in Indonesia has led to the emergence of a Large-Scale Social Restrictions (*Pembatasan Sosial Skala Besar*) policy [94]. This policy can hinder the implementation of ethnobotanical research as a biology learning resource, which must interact with the community on an uncertain scale to obtain data. Since 2021, the number of publications found has increased continuously, with the highest

number in 2024 totaling 15 scientific articles. Due to the pandemic conditions that are slowly recovering, research related to implementing ethnobotanical research as a biology learning resource can be carried out again. In addition, it is known that scientists in Indonesia have paid more attention to the importance of ethnobotanical research as a means to preserve traditional knowledge, especially for plants that have economic benefits and have never been scientifically described before [95].

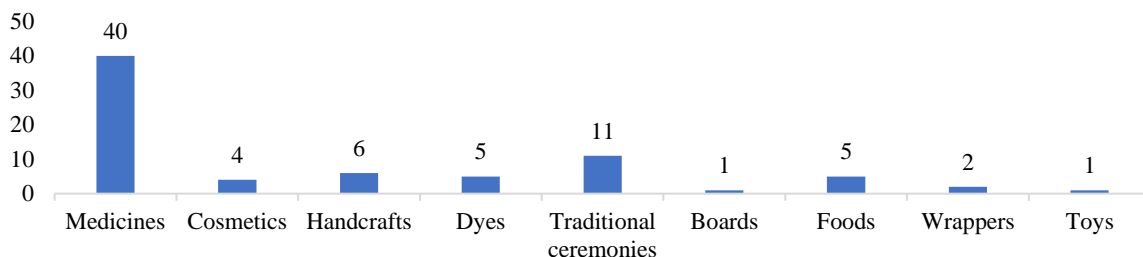


Figure 2. Amount of scientific articles based on the ethnobotanical assessment types

Figure 2 shows the number of scientific articles based on the type of ethnobotanical assessment conducted. The results of the literature collection show that ethnobotanical research in West Kalimantan that is implemented as a biology learning resource includes using plants as medicine, cosmetics, crafts, dyes, traditional ceremonies, boards, food, wrappers, and toys. Each community in Indonesia has different knowledge of the traditional use of plants [96], [97]. This can be triggered by differences in living situations, habits, ways of utilization, and community behavior [98].

The assessment with the highest number of scientific articles is the use of plants as medicines, with as many as 40 scientific articles. Plants are widely used as ingredients in traditional medicine because they have low or no side effects compared to drugs [99]. In addition, this traditional knowledge can be a starting point for testing the pharmacological activity of plants that have potential as drugs [100]. The type of assessment with the second highest number is using plants as ingredients for traditional ceremonies, with 11 scientific articles. Traditional ceremonies are traditional community traditions with sacred values related to the culture adopted by the community [101]. Implementing traditional ceremonies cannot be separated from utilizing natural resources, including plants [102]. The following sequence of ethnobotanical assessment types are crafts, with 6 scientific articles; dyes and food, with 5 scientific articles each; cosmetics, with 4 scientific articles; wrappers, with 2 scientific articles; and boards and toys, with 1 scientific article each.

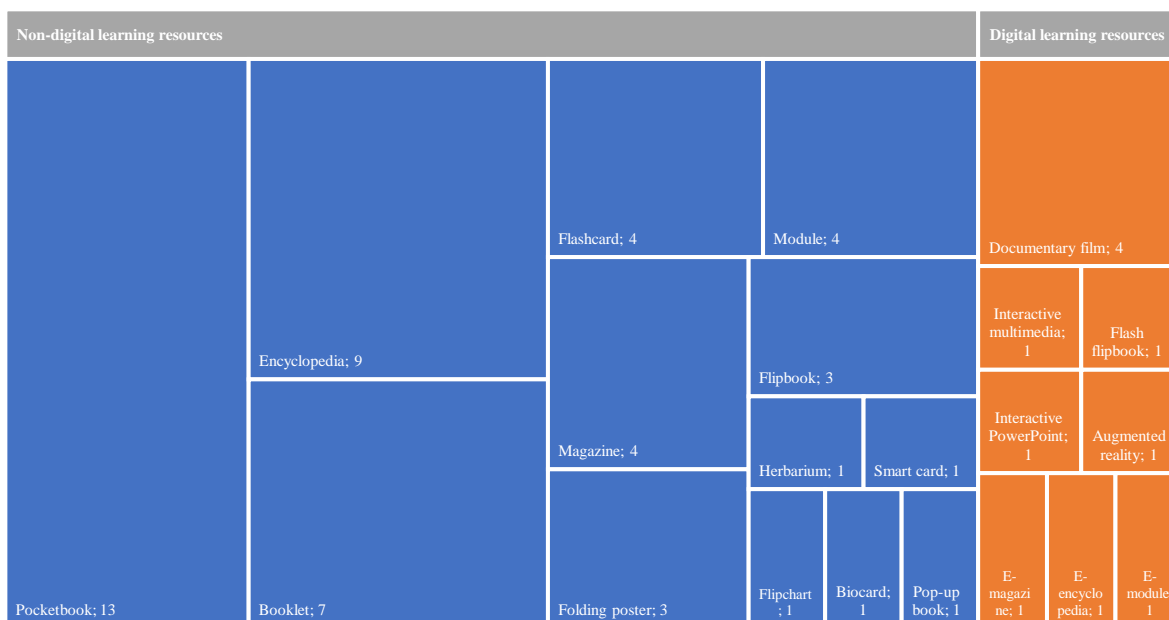


Figure 3. Amount of scientific articles based on the learning resource types

Figure 3 shows the number of scientific articles based on the type of learning resources developed. Based on the analysis, the learning resources developed are divided into two groups, namely non-digital learning resources and digital learning resources. Non-digital learning resources are learning resources that are physical

and generally paper-based [103], while digital learning resources are learning resources that use technology as the basis for their development and tend to be software-based [104]. From the articles, it is known that the non-digital learning resources include folding posters, pocketbooks, flipbooks, herbariums, booklets, flashcards, smart cards, flipcharts, modules, encyclopedias, magazines, biocards, and pop-up books; while the digital learning resources include documentary films, interactive multimedia, flash flipbooks, interactive PowerPoint, augmented reality, e-magazine, e-encyclopedia, and e-module. The selection of the developed learning resources is based on their possibility to solve problems that occur in schools [105], [106], especially biology concepts that tend to be abstract and challenging to visualize [107], [108]. In addition, it is known that more non-digital learning resources have been developed than digital learning resources. This could be because the schools targeted for the development of learning resources have limitations in technology and internet facilities, so printed learning resources are the most appropriate solution to problems related to learning in these schools. The limitations of digital-based facilities in schools significantly hinder the implementation of technology-based learning processes [109].



Figure 4. Amount of scientific articles based on the submaterial and material implementations

Figure 4 shows the number of scientific articles based on the submaterials or materials targeted in the developed learning resources. The analysis shows that out of 63 scientific articles analyzed, 51 implemented their research results in the submaterial, and 12 implemented their research results in the material. In addition, it is known that the most targeted development of learning resources from ethnobotanical research is the submaterial of biodiversity utilization. The biodiversity utilization submaterial is a submaterial that introduces students to various uses of natural resources, including plants, in people's lives [110]. Research results can be appointed as a biology learning resource if they meet several requirements, one of which is the suitability of the research with the target material and its designation [111]. Developing learning resources for a particular submaterial or material is also related to material management skills. Subject matter management includes selection, development, organization, presentation, and determination of learning strategies and procedures [112].



Figure 5. Amount of scientific articles based on the research steps implemented

Figure 5 shows the number of scientific articles based on the extent of the development stage. Analysis of the 63 scientific articles that have been conducted shows that 54 scientific articles limit the development stage

to feasibility analysis. The feasibility analysis determines whether the developed learning resources suit the learning process [113]. 9 scientific articles conducted research up to the field testing in the form of student responses, but there was 1 scientific article (Ref. [77]) that conducted field testing up to teacher responses and experiment stage. Measurement of student and teachers' responses aims to determine their responses to the learning resources developed and is carried out with an instrument in the form of a questionnaire [114], while experiments are carried out to determine the effectiveness of the learning resources developed [115]. The stages of learning resource development research can be modified according to the needs and objectives of the researcher [116].

Implementing ethnobotanical research into the biology learning process will strengthen the application of local potential-based learning. Local potential is crucial as a biology learning resource because students will learn more about local biodiversity and its conservation [117]. The use of local potential-based biology learning resources can improve students' science process skills [118], learning independence [119], and learning outcomes [120]. In particular, implementing ethnobotanical research in West Kalimantan as a biology learning resource can introduce students to various communities' traditional use of plants. The general public tends to be naïve about the local biodiversity around them [121], so ethnobotanical knowledge implemented as a learning resource can improve students' insights and overcome their limited knowledge in the field of biology, especially the use of plants in everyday life. In addition, learning that integrates local plant knowledge can increase individual empathy for the existence of plant species [122]. Therefore, it can be implied that biology teachers in West Kalimantan should be able to implement ethnobotanical research as a learning resource to improve students' cognitive, affective, and psychomotor aspects. In addition, the results of this research are also expected to be a reference for educational policy-makers; given that educational policy-makers are the parties responsible for developing legal documents that serve as guidelines for students, teachers, educational administrators, educational institutions, and other stakeholders to follow or implement specific regulations in the field of education [123].

The limitation of this study is that ethnobotanical research that is not implemented as a learning resource is not included as data in this study. This limitation causes the possibility that there are ethnobotanical research in West Kalimantan that is not summarized in this study. Therefore, it is recommended that a more comprehensive literature study related to ethnobotanical research in West Kalimantan be conducted. In addition, it is recommended that ethnobotanical research in West Kalimantan be intensified and implemented as a learning resource. This intensification certainly plays a role in preserving the traditional knowledge of local communities in West Kalimantan for the general public through scientific publications and for students through its implementation in the development of learning resources.

#### 4. CONCLUSION

Based on the search that has been conducted, it is known that there are 63 scientific articles related to implementing ethnobotanical research in West Kalimantan as a learning resource. Ethnobotanical research in West Kalimantan, implemented as a biology learning resource, includes using plants as medicine, cosmetics, crafts, dyes, traditional ceremonies, boards, food, wrappers, and toys. The learning resources developed include 13 non-digital and 8 digital learning resources. Recommendation that can be proposed based on the literature review that has been carried out are to test learning resources whose development is limited to feasibility analysis to students in order to determine the response and effectiveness of these learning resources. It is also recommended that research be intensified regarding implementing West Kalimantan ethnobotany knowledge as biology learning resources.

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