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Increasing Mentawai Tribe Medicinal Plant Literacy in Students through the Plant Identification Application

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ABSTRACT

This study aims to evaluate the effectiveness of the medicinal plant identification application in increasing medicinal plant literacy among Mentawai students, focusing on how this application introduces knowledge about local medicinal plants, the challenges faced by students, and their perception of technology in the preservation of traditional knowledge. Using a qualitative approach with a case study method, data was collected through in-depth interviews, direct observations, focus group discussions (FGDs), and documentation studies involving 20 students using medicinal plant identification apps such as Google Lens and PlantNet. Key findings show that these apps significantly improve students' literacy about medicinal plants by expanding their knowledge beyond the commonly known plants, as well as helping them understand the therapeutic benefits of them. However, challenges such as limited internet signals, difficulty distinguishing similar plants, and limited local plant databases in the application are obstacles that need to be overcome. Nonetheless, students generally have a positive perception of these apps as an effective tool in documenting and disseminating traditional knowledge. The study concludes that medicinal plant identification applications have great potential to connect traditional knowledge with modern technology, but to maximize their effectiveness, the application needs to be updated with the addition of offline features and local plant database updates. This research contributes to the literature by incorporating technology in the preservation of local cultural knowledge, as well as enriching the understanding of the use of technology-based applications in the context of environmental and health education. The limitations of this study lie in the small sample size and the reliance on applications that require internet access, so further research is recommended to expand the sample, develop offline features, and explore the long-term impact of app use on students' behavior in using medicinal plants as well as the integration of hands-on training with technology to support more holistic learning.

1. INTRODUCTION

Increasing literacy of medicinal plants has a very important role in improving public understanding and health (Oda et al., 2024), especially in Indonesia which is rich in biological wealth. One of the community groups that has extensive knowledge about medicinal plants is the Mentawai Tribe. The tribe has long relied on plants as part of their traditional medicine (Syukma, 2021). However, with the development of the times and modernization, this knowledge is increasingly in danger of losing its relevance, especially among the younger generation (Moutouama & Gaoue, 2024). As one of the steps to maintain and preserve this knowledge, innovation is needed in the form of technological applications that can introduce and improve the literacy of medicinal plants, especially for students, so that this knowledge can survive and develop in the future (Hart et al., 2023).

Several previous studies have shown the importance of the application of technology in environmental education and traditional knowledge. For example, research reveals that the use of technology-based applications in introducing medicinal plants can accelerate students' understanding of the material and increase their awareness of the importance of medicinal plant conservation (Mu'minah et al., 2023). In addition, other research mentions that plant identification apps can be an effective tool to introduce different types of medicinal plants to the wider community, including the younger generation who are more familiar with technology such as Google Lens and PlantNet (Hart et al., 2023).

However, even though there are many similar applications, research on applications that specifically target the literacy of medicinal plants of the Mentawai Tribe is still very limited. Recent research conducted by (Siregar et al., 2023) revealed that there is a gap in the use of technology to preserve knowledge of traditional medicinal plants in remote areas, such as in Mentawai. This shows the need for more in-depth research on how technology can be adapted to improve literacy about medicinal plants in the context of local cultures, such as the Mentawai Tribe.

Increasing literacy about medicinal plants of the Mentawai tribe can be achieved through the use of plant identification applications that support learning among students (Bilyk et al., 2020). An app like PlantNet, which has proven effective in the process of plant identification, offers an innovative approach to engaging students in learning about biodiversity and the utilization of medicinal plants (Mu'minah et al., 2023). Through this app, students can conduct identification independently, which not only increases

knowledge about plants but also promotes practical skills relevant to their environmental context.

Applications of plant identification, such as those researched in the work of Fals and Brennan, can serve as powerful pedagogical tools. They emphasized that integrating innovative programs such as culinary gardens into the health education curriculum can strengthen the connection between communities and traditional knowledge, including the use of medicinal plants at the local level (Eisenberg et al., 2023; Fals & Brennan, 2023). In this context, plant identification applications can be part of an experiential learning approach that encourages students to interact directly with their environment.

In addition, research conducted by Kaspul and Utami shows that the introduction of plants is not only limited to aesthetic aspects but also includes the potential of plants as traditional medicine. Environmental education programs that engage students in the exploration of plants around the school environment demonstrate a successful approach to raising awareness of the importance of medicinal plants (Kaspul & Utami, 2024). This knowledge is very important in supporting traditional medicine and health maintenance among the community.

Through a review of the literature, it can be concluded that the literacy of medicinal plants among Mentawai students is still low and there is a gap between traditional knowledge that has been passed down from generation to generation with the understanding of modern students. Therefore, the hypothesis proposed in this study is that the use of plant identification applications can increase medicinal plant literacy among Mentawai tribal students. In addition, this study also aims to identify how effective this application is in connecting traditional knowledge with technology, as well as how students perceive the application in enriching their knowledge about medicinal plants.

The main purpose of this study is to evaluate the application of medicinal plant identification that can increase medicinal plant literacy in Mentawai tribal students. This study aims to answer the following questions: How effective is the use of medicinal plant identification applications in increasing medicinal plant literacy among Mentawai students?; What are some of the challenges faced by students in using this app to understand the medicinal plants that exist in their environment?; and What is the student's perception of the application of medicinal plant identification in relation to the recognition and preservation of their traditional knowledge?

This article offers a scientific novelty in the technological approach used to improve the literacy of medicinal plants through technology-based applications, especially those directed at Mentawai tribal students. The study

also introduces a local context in the development of medicinal plant identification applications, which have not been explored much in the literature before. Thus, this research is expected to make a significant contribution in the field of education and preservation of traditional knowledge, as well as provide new insights in the development of local culture-based education applications.

In the last two years, there have been several important issues related to medicinal plant literacy and the conservation of traditional knowledge, both in Indonesia and globally. Nationally, the main problem that arises is the loss of knowledge about medicinal plants along with changes in people's lifestyles which lead to the consumption of modern medicines. The Indonesian government itself has emphasized the importance of the use of medicinal plants in supporting health through policies such as the National Movement for the Use of Medicinal Plants launched in 2021, which aims to increase public awareness of the benefits of medicinal plants. Internationally, similar issues are also emerging in many countries, with a decline in the use of traditional medicines that are harmful to the sustainability of local knowledge. In addition, the COVID-19 pandemic has also increased public interest in herbal medicines, triggering the need for more accurate education and information about medicinal plants.

The type of data used in this study includes qualitative data. Qualitative data was obtained through in-depth interviews with students and traditional leaders of the Mentawai Tribe to explore their understanding and perception of medicinal plants. This data will be analyzed to measure the effectiveness of the application in improving students' understanding of traditional medicinal plants. Related to policies, Indonesia has several policies that support the preservation of knowledge about medicinal plants. One of them is the National Action Plan for Biodiversity Conservation which emphasizes the importance of the conservation of traditional medicinal plants. In addition, the government through the Ministry of Health has also launched various programs related to the use of medicinal plants in alternative medicine that can strengthen public literacy, especially the younger generation, about the use of medicinal plants in daily life.

2. LITERATURE REVIEW

The use of plant identification applications has shown significant potential in improving plant literacy, both in the context of formal and non-formal education in Indonesia. Some studies show that this app serves not only as a tool to find out plant species, but also as an educational medium that supports direct interaction with the natural environment. For example, research by

Shafirany et al. emphasizes the importance of analytical technology in the evaluation of medicinal plant quality, suggesting that technology-based applications can contribute to the development of public knowledge regarding the mutation and quality of medicinal plants (Shafirany et al., 2019).

In addition, Suliartini et al. reported on the exploration and identification of medicinal plant species in the Senaru Coffee Garden Tourism Village, showing that the identification application is not only beneficial for students' knowledge, but can also increase the economic value of the existence of medicinal plants through tourism development (Suliartini et al., 2023). In this context, the application of identification doubles as an educational tool and a guide for the development of local potential.

Furthermore, research by Ayu et al. shows that people can use the app to obtain information about 42 types of plants used as traditional medicines, proving that the identification application can enrich knowledge at the individual level (Ayu et al., 2023). By involving the community in the identification and use of medicinal plants, these apps can contribute to the preservation of centuries-old medicinal traditions in different tribes and regions.

Dahniar et al. and Khoiriyah et al. also emphasized the importance of data collection through observation and interview methods to build effective medicinal plant databases. Dahniar highlighted how the community in Lakea District utilizes at least 60 types of medicinal plants, which is in accordance with the results of research which shows that there are 60 types of medicinal plants used by the community in traditional medicine (Dahniar et al., 2023). This information can be effectively accessed through an identification app, which brings users, especially students, closer to their traditional medicine practices.

On the other hand, technology-based plant identification applications as described by Rianta et al., which use image processing methods, show the latest technological developments that support the identification of rhizome-shaped medicinal plants. This research makes it clear that the integration of modern technology is urgently needed to explore the biodiversity that exists in Indonesia (Rianta et al., 2024). The use of technology in this identification application provides an opportunity for students to not only understand biodiversity but also to apply the energy of creativity in the exploration of plants in their local environment.

A research reference by Canuto states that teachers' perceptions of the effectiveness of identification applications confirm that this tool can be an important measuring tool in developing scientific literacy among students (Canuto, 2023). Thus, the application of plant identification not only facilitates

the identification of plant species but also increases students' awareness and knowledge of the importance of biodiversity and the function of plants as medicine.

Overall, plant identification applications have great potential in increasing literacy about medicinal plants, both in schools and in the general public. Through the use of this app, students can not only recognize and understand efficacious plant species but also contribute to the preservation of local cultural knowledge related to the use of medicinal plants in traditional medicine.

3. METHODS

This study uses a qualitative approach with a case study method focused on Mentawai tribal students. This approach will make it possible to deeply understand students' experiences and perceptions of medicinal plant identification applications. The population in this study is Mentawai tribal students who are in local schools in the Mentawai area, especially students who have prior knowledge about medicinal plants or are involved in learning activities related to medicinal plants as many as 20 students who have used the medicinal plant identification application. The sampling technique used is purposive sampling, which is selecting students who have experience using the application or who interact directly with medicinal plants.

Data collection will be done through several techniques, starting with in-depth interviews with students to explore their experiences in using the app. This interview will focus on students' experiences when using the app, the challenges they face, as well as their perception of the benefits of the app in the preservation of traditional knowledge. In addition, hands-on observation will be conducted to observe how students interact with the application and medicinal plants in their environment, providing a practical overview of the effectiveness of the application. Focus Group Discussions (FGDs) will also be held with several students who use the app, to get a collective view of the application, the challenges faced, and their perceptions of the preservation of traditional medicinal plant knowledge. Finally, a documentation study will be conducted to collect secondary data in the form of documents or reports related to the use of applications and knowledge of medicinal plants that students have had before.

The research instruments used will include a semi-structured interview guide, designed to explore three main aspects: the effectiveness of the application, the challenges of using the application, and students' perceptions of the preservation of traditional knowledge. In addition, there will be

observation sheets that are used to monitor students' interactions with the application and medicinal plants around them. The FGD guide will contain questions related to the effect of the application on students' knowledge of medicinal plants as well as its impact on the preservation of traditional knowledge.

Thematic analysis techniques will be used to analyze data obtained from interviews, FGDs, and observations, with the aim of identifying the main themes that emerged from students' responses regarding the effectiveness of the application, the challenges faced, and their perception of the application in relation to the preservation of traditional knowledge. To ensure the validity of the data, data triangulation will be applied, by comparing the results of interviews, observations, and FGDs to find similarities and differences in students' perceptions of the application.

The research schedule will begin in Weeks 1-2, with initial data collection and identification of participating students. On Weeks 3-5, in-depth interviews and observations of the use of the application by students were conducted. Week 6 will be filled with FGDs and collection of related documents. Finally, in Weeks 7-8, the data will be analyzed and a research report will be compiled.

4. RESULTS AND DISCUSSION

Improving Medicinal Plant Literacy Ability

Based on data obtained through in-depth interviews, direct observations, focused group discussions (FGDs), and documentation studies, this study shows that the use of medicinal plant identification applications such as Google Lens and PlantNet in figure 1. can increase the literacy of medicinal plants among Mentawai tribal students.

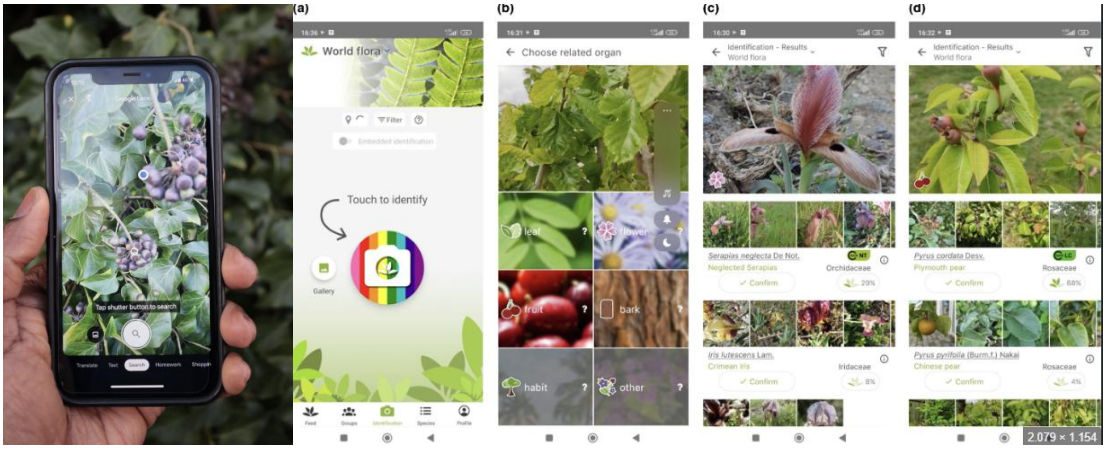

Figure 1. Google Lens and PlantNet applications used by students to identify medicinal plants of the Mentawai tribe

In this study, the increase in medicinal plant literacy among Mentawai tribal students after using the medicinal plant identification application was proven to be significant, this is in line with the research (Rianta et al., 2024). The results of in-depth interviews with students show considerable changes in the way they recognize and utilize medicinal plants in their environment. Previously, students only knew several types of medicinal plants that were often used in their daily lives, such as curcuma and turmeric. These plants, although widely known, do not encompass the full potential of the medicinal plants that exist around them. However, by using a medicinal plant identification app, students begin to expand their knowledge regarding the diversity of plants that can be used for health.

For example, one student shared his experience: *"I came to know that the plants that I used to see in the forest could be used for medicine, such as sambiloto leaves and guava leaves, which I didn't know before."* This statement signifies that the app not only provides basic information about medicinal plants, but also opens up students' insights to dig deeper into the different types of plants that they may have previously thought of as ordinary plants, without realizing their therapeutic potential. This shows that the app helps students change their perception of the surrounding plants and identify the medicinal functions contained in the various plants present in their environment (Liliyanti et al., 2021).

Direct observation strengthens the results of the interview. During the data collection process, the researchers noted that many students used the app with great care and enthusiasm. They were seen identifying the various plants they encountered around the school environment and outside the school, both in activities in the school garden and when they walked around the forest area. This phenomenon reflects the successful application in making knowledge of medicinal plants more practical and accessible, even in more natural environments in line with research (Rahmad et al., 2024). In addition, many students make use of the app to confirm the names and benefits of plants they encounter in their daily lives. This shows that this app is not only a learning tool, but also a tool that encourages students to be more directly involved in getting to know the world of their medicinal plants.

Furthermore, the use of this medicinal plant identification application makes an important contribution to contextual-based learning. In this context, students not only learn theories or information provided by teachers, but they can also apply the knowledge gained directly in the field. For example, in out-of-class learning activities, the app allows students to identify and classify medicinal plants that they encounter in their daily commutes. With this app, students can document and classify such plants, allowing them to verify

traditional knowledge that has been passed down from generation to generation by their community. This is in line with research (Rianta et al., 2024) which states that the knowledge gained through the app then becomes more personal and relevant to their daily lives, which makes it easier to understand and remember.

Not only does it recognize frequently used plants, it also allows students to find out the potential benefits of plants that are rarely used in their lives. For example, some students mentioned that they were previously unaware of the uses of sambiloto leaves, which are known to have anti-inflammatory and antiviral properties. With this app, they not only know the name of the plant, but also understand its benefits for health. For example, another student revealed, *"The sambiloto leaves that I found in the forest can be used to treat fever. I didn't know before that the plant was so useful."*

Increasing the literacy of medicinal plants through this application is not only limited to knowledge of plant names, but also involves a deeper understanding of the therapeutic functions and potential treatments that can be obtained from these plants. As a result, students can not only recognize medicinal plants, but also be able to develop a more comprehensive understanding of how to use them in everyday life, which is directly related to their health traditions (Winara & Mukhtar, 2016).

The use of this medicinal plant identification application reflects an important change in the way Mentawai students approach learning about medicinal plants. Previously, knowledge of medicinal plants was more limited to traditional knowledge taught orally or through direct experience (Paniagua-Zambrana et al., 2016). The app brings that traditional knowledge into a more structured and organized realm, allowing students to learn not only from their parents or traditional elders, but also from technology that can access information in a broader and more detailed way.

One of the interesting findings of the study is how students are using these apps as a means to validate their traditional knowledge. Previously, they relied on personal experience or teachings from parents and the local community, which often only covered a small fraction of the medicinal plant potential that existed around them. However, the app introduces them to a broader range of information, allowing them to broaden their understanding and strengthen their relationship with the traditional knowledge that has been passed down by their community (Hart et al., 2023).

This application also allows students to interact with knowledge more dynamically, as information about medicinal plants can be accessed quickly and easily. There are no more time and space limitations in acquiring knowledge about medicinal plants (Oda et al., 2024). For example, students

can use the app to conduct a live search about medicinal plants they encounter in the field, allowing them to obtain information directly without having to rely on teachers or others.

Overall, the findings of this study show that the application of medicinal plant identification significantly increases medicinal plant literacy among Mentawai tribal students. By providing easy and quick access to information related to medicinal plants, the app not only introduces students to a wider variety of plant types, but also provides a deeper understanding of the benefits and uses of these plants in traditional medicine. This increase in literacy plays an important role in strengthening students' knowledge about medicinal plants around them, so that they are better able to appreciate and utilize the potential of medicinal plants for their health (Liliyanti et al., 2021).

The use of this application also opens up opportunities for students to maintain and preserve their traditional knowledge, presented in a more modern and accessible form, without compromising existing cultural values. The knowledge gained from the application can be used to enrich their local knowledge, which can be integrated with traditional wisdom in efforts to preserve culture and public health.

Challenges Faced by Students in Using the App

One of the main challenges faced by students is the limitation of internet signals in certain areas in the Mentawai region. Most students reveal that they often have difficulty accessing apps to the fullest due to unstable signals, which directly impact their ability to download data or access information in real-time. One student revealed, "*Sometimes the app is difficult to open because the internet signal in my village is very weak, so I can't find out more about the plants I encountered.*" This is a major obstacle because this application relies on an internet connection to provide the necessary information.

Limited internet access not only hinders the use of the application directly, but also reduces the opportunity for students to conduct further searches or verify information about the medicinal plants they encounter. In this context, applications that require real-time data can sometimes only be used on a limited basis, which reduces the potential of applications to make the maximum contribution to student learning.

The solution proposed by the students is the development of offline mode or data cache, which allows applications to remain usable even if the internet connection is unstable. This feature will be of great help to students in areas with limited technological infrastructure, so that they can access information related to medicinal plants without relying on a strong internet connection.

The second challenge faced by students is the difficulty of distinguishing similar plants based on the images provided by the app. One of the problems that often arises is the lack of clarity in the comparison of images of plants that have similar physical shapes, such as basil leaves and basil leaves. One student revealed: "*Sometimes I find it difficult to distinguish similar leaves, such as basil leaves and basil leaves. Even though the app provides images, sometimes the images are not clear enough.*" This shows that although the app offers images for identification, the images presented are sometimes not detailed enough or are not able to show the subtle differences between two plants that look very similar.

This difficulty has the potential to confuse students, especially for those who do not have much experience in visually distinguishing medicinal plants. Blurry or overly generic images make it difficult for students to ascertain the type of plants they encounter, potentially reducing the accuracy of their identification. In addition, the limitations of imaging are also a big problem in ensuring that the identification provided by the application is truly precise, especially when it is based on very specific morphological traits such as previous research (Yusuf et al., 2023).

In this case, it is important for app developers to pay attention to image quality and focus on finer morphological details, as well as include additional guidance or clearer visual captions regarding the distinguishing characteristics of similar plants. Alternatively, the app can provide video tutorials or audio guides that help students distinguish plants based on clearer visual features, such as leaf shape, color, and plant size.

Despite the various challenges in using this application, the results of interviews and FGDs show that students still have a positive perception of the medicinal plant identification application. They feel that this app provides many benefits in expanding their knowledge of medicinal plants that they did not know about before. As one of the students said, "*Even though it was difficult at times due to the weak signal, I still enjoyed using this app. I was able to learn a lot about plants that I had only seen before without knowing their names or benefits.*"

Most students expect the app to continue to be updated and refined, both in terms of data availability and image quality, in order to accommodate their needs more effectively. They also hope that the application can provide offline features that allow them to still access information even in areas where it is difficult to get internet access.

Students' Perceptions of Applications in the Preservation of Traditional Knowledge

The use of medicinal plant identification applications has given rise to diverse perceptions among Mentawai students, particularly related to the role of the application in the preservation of their traditional knowledge. Based on the results of focused group discussions (FGDs), most students see this app as a very useful tool in documenting, disseminating and confirming knowledge about medicinal plants that have been passed down by their ancestors. Students feel that these apps provide easier and faster access to obtain information that they previously received only through oral stories or direct experiences that are limited to their social and cultural contexts.

As one of the students expressed, *"This app made me appreciate my ancestors' knowledge of medicinal plants more. I used to only know from stories, now I can verify and know more."* This statement reflects the views of students who assess the application as a tool that supports the preservation of existing knowledge, while enriching their understanding of the functions and benefits of medicinal plants present in their environment. With this app, students feel more connected to traditional knowledge, as the app provides visual evidence and scientific data that supports the knowledge they have learned for generations.

Students also feel that this app gives them more control over the information they acquire, as they can access and explore various medicinal plants according to their needs. This is important in the context of the introduction and preservation of medicinal plants, as students can be more active in searching for and verifying different types of plants that were previously known only orally as previous research (Odunlade & Okiki, 2019). Thus, the app not only becomes an additional learning tool, but also allows students to have broader and more organized access to existing knowledge, and at the same time strengthens their relationship with the local culture in line with the research (Liliyanti et al., 2021).

However, while these apps are seen as a useful tool, some students have also expressed deep concerns about the authenticity of their traditional knowledge in the context of using technology (Rianta et al., 2024). Much of this concern focuses on the possibility that knowledge that has been passed down through generations will be eroded or replaced by the digital information provided by applications. One student said, *"I'm worried that if we rely too much on this app, we might forget how to recognize medicinal plants in nature. This knowledge must still be taught directly from parents or traditional elders."* This statement illustrates fears that technology-based approaches could

replace traditional ways of acquiring knowledge, which they say are more profound and meaningful.

These concerns lead to the view that apps should be seen as complementary and not a substitute for hands-on learning conducted by parents or indigenous elders. The knowledge of medicinal plants gained through direct interaction with nature and direct teaching from previous generations has a depth that cannot be fully understood through application alone. Therefore, some students emphasize the importance of maintaining a balance between the use of technology and traditional approaches in identifying medicinal plants.

Furthermore, some students suggested that this application could be combined with practical training programs that involve hands-on learning in the field. They argue that while apps can provide basic understanding and additional information, students should still be taught by traditional elders or local practitioners on how to identify plants firsthand through experiences in nature. For example, one student said, "*This app is good for learning theory and knowing plant names, but we need hands-on training to be able to understand how to recognize medicinal plants in the forest or garden.*" This suggests that students want a holistic approach that blends the theoretical knowledge provided by the application with traditional praxis implemented directly by experts or indigenous elders.

Ultimately, despite the challenges and concerns that arise, the majority of students see the application of medicinal plant identification as a beneficial tool for preserving their traditional knowledge. This application is considered a positive complement in the effort to maintain local wisdom, as it provides easier and wider access to knowledge about medicinal plants that was previously only available in the form of oral stories or direct experience, this is in line with research (Base et al., 2022). Therefore, it is important to maintain a balance between the use of technology and traditional approaches in preserving medicinal plant knowledge that is very important to the Mentawai Tribe community.

5. CONCLUSION

This study shows that the use of medicinal plant identification applications has a significant impact on increasing medicinal plant literacy among Mentawai tribal students. Based on findings from in-depth interviews, hands-on observations, focused group discussions (FGDs), and documentation studies, apps like Google Lens and PlantNet help students recognize different types of medicinal plants that they didn't know about before. The app also

enriches students' knowledge of the therapeutic benefits of plants, as well as supports the preservation of traditional knowledge that has been passed down by their ancestors. Despite challenges such as limited internet signals and difficulties in distinguishing similar plants, students generally have a positive perception of the app as a learning tool that supports their introduction and understanding of medicinal plants.

Regarding the research question, the use of this application has been proven to be effective in increasing medicinal plant literacy among students. The app allows students to expand their knowledge of the medicinal plants that exist around them and identify the health benefits that can be derived from them. Challenges faced by students include limited internet access in some areas and difficulties distinguishing plants that have similar characteristics based on the images provided by the app. Nevertheless, students still find this app very useful, and they hope that it will continue to be updated and improved. Regarding the preservation of traditional knowledge, students see apps as tools that help document and disseminate knowledge about medicinal plants, although they are concerned about the influence of technology on traditional ways of recognizing medicinal plants.

This research makes a new contribution to the literature by introducing the use of medicinal plant identification applications in the context of local culture, especially for the Mentawai community. The research also provides important insights into how technology can link traditional knowledge with technology-based learning, as well as enriching the existing literature on local culture-based education and the preservation of medicinal plant knowledge. However, this study has limitations, such as the limited sample that only involves students in a few schools in the Mentawai Tribe and problems related to internet access that affect the maximum use of the application. Therefore, further research is recommended to expand the sample, explore the long-term effects of application usage, as well as develop offline features to address signal limitation issues.

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