The development of local plants e-module based on mobile learning for the subjects of botany and plant morphology

Feliksitas Angel Masing*, Vinsensia Ulia Rita Sila

Biology Education, Faculty of educational Science, University of Timor, Indonesia

*Corresponding author: feliksitasm@gmail.com

A R T I C L E   I N F O

A B S T R A C T

This research aims to know: 1) develop a local plant e module from Timor Tengah Utara Regency based on android mobile, 2) test the feasibility of a local plant e module from Timor Tengah Utara Regency based on android mobile on the aspect of substance/material and aspects of learning media. This type of research is development research using the Design and Development Research (DDR) method at the Validity stage which includes development, internal validation by material experts and learning media experts and external validation by third semester students of Biology Education Study Program, University of Timor as test participants. The results of this study are; 1) development of local plant modules from Timor Tengah Utara Regency based on mobile android in accordance with the Design and Development Research (DDR) development model at the Validity stage which includes development, internal validation, and external validation, 2) local plant modules from Timor Tengah Utara Regency based on android mobile is feasible to use in terms of substance/material and learning media. Based on the assessments of material experts and learning media experts, this module is in the "good" category, while the assessment by students as trial participants is in the "very good" category. The content of the E module is local plants originating from Timor Tengah Utara Regency which consists of several plants such as Santalum album, Pinus merkusii, Piper majusculum Blume, Coffea arabica, Arenga pinnata, Aleurites moluccana, Rhizophora apiculata, and so on. Each plant presented in the e module is equipped with its classification and morphology so that it is very useful for Biology students at the University of Timor in studying plant botany and morphology courses.

INTRODUCTION

The use of media in learning in the era of the industrial revolution 4.0 experienced significant modernization. Changes in learning media are in line with the shift in habits towards a digital society. Learning media that used to use more traditional tools and materials are slowly starting to utilize digital technology that can be accessed using the internet network or offline. According to Wityastuti et al. (2022) digital technology influences the education system due to several factors such as points of effectiveness, attractiveness, and efficiency in its use. Technology-based learning media used by educators have fulfilled these elements. Selection of appropriate learning media by educators by considering values, functions, ways to use, and benefits obtained from media (Wijaya et al. 2021).

Educators as learning facilitators who direct students to be able to learn through various digital learning media that are appropriate to the circumstances and environmental conditions as well as the characteristics of students. One of the learning media that can be used is the Android e-module. The e-module itself has the characteristics of independence in learning and according to Lubis et al (2015), the advantages of this module can facilitate students to participate in learning activities according to their respective pace and abilities and can measure their own learning outcomes. The module is a teaching material that is arranged systematically using language that is easily understood by students according to their level of knowledge and age so that they can study independently with minimal guidance from the teacher (Prastowo, 2014). Meanwhile, a learning module is a self-contained, formally structured learning experience with a coherent and explicit set of learning outcomes and assessment criteria. The module requires students to actively interact with the learning material, not just passively read the material alone. Students are asked to do various learning activities and obtain feedback on what they are doing (Rufii, 2015).

E-Module based on Android mobile can be accessed anytime and anywhere using a smartphone or tablet (Meister, 2011). Smartphones and tablets have the power to transform the learning experience. This is because these two devices are now increasingly being used in society, including educators and students. Android is one of Google's operating systems that is used the most in Indonesia and around the world. The results of research conducted by DeWitt et al. (2014), showed that out of 14 students there were 12-13 students who agreed that science learning used M-learning based modules. This shows that the development of mobile android-based learning modules is one of the breakthroughs in overcoming.

Based on observations of students in the Biology Education Study Program at the University of Timor, it is known that students tend to have difficulty classifying plants because they only know plant names in local and Indonesian languages. Besides that, in determining the morphological characteristics of plants, students also have difficulty explaining scientifically according to morphological language. Some of the problems found in this direct observation are things that must be found for solutions, since the material on plant classification and morphology is included in the core courses, namely Plant Botany and Plant Morphology in the Biology Education Study Program, University of Timor. The development of plant E-modules based on android mobile can be an option as a solution in helping students learn plant classification and plant morphology. Mobile Learning is expected to be one of alternative learning sources that can enhance efficiency and effectiveness of learning process for human (Martono & Nurhayati , 2014). The results of a literature review conducted by Wulandari et al., (2021) and Nordiansyah (2021) also state that e-modules as interactive teaching materials can increase learning motivation, scientific literacy, learning outcomes, independence and critical thinking skills of students during a pandemic.

The plant based e-module android mobile displays local plant material from Timor Tengah Utara Regency which is the location of the University of Timor. The plant material is the result of previous research conducted by Sila et. al (2022). The local plant in question is the phanerogamae plant species. Phanerogamae plants are a group of high-level plants or often also referred to as seed plants (Spermatophyta) (Hartono et al., 2020; Ulfa, 2019). In contrast to lower plants, higher plants have roots, stems and true leaves that can already be clearly distinguished. This plant group consists of two major groups which are distinguished mainly on the basis of protection against the ovule, namely open seed plants (gymnosperms) and closed seed plants (angiosperms) (Campbell & Reece, 2010).

The e-Module based on android mobile local plant material is in the next step used by students as a medium in higher plant botany and plant morphology courses because the contents of the e-module include plant classification and morphology. This study aims to develop an Android Mobile-based

Phanerogamae Local Plants Module from Timor Tengah Utara Regency and test the feasibility of an Android Mobile Phanerogamae Local Plants Module from Timor Tengah Utara Regency in terms of substance/material and learning media aspects.

METHODS
Research Design
This research is a type of development research using the Design and Development Research (DDR) model from Richey & Klein (2008). The stages of development adopted are the stages of developing a research model at the stage of validity, causal inferences, generalitation and interpretation, and anticipating problems (Masing & Aminatun, 2022). In this study, it reached the validity stage (product validity), which was limited to three (3) stages, namely the development model, the internal validation model, and the external validation model.

In Design and development research according to Richey and Klein (2008), development model is the first step in the development stage. Design and development research is not based on field needs, in the context of product development in the form of e-modules it is based on knowledge or relevant literature review. The stages carried out in the development model are literature/literature study, building a conceptual framework, analyzing system requirements, as well as product design and development.

At the internal validation stage e plant modules will be assessed by face validity consisting of learning media experts and material experts. The selected learning media experts are lecturers who specifications in learning and multimedia programs. While material experts are lecturers with specifications in the field of botany. At the external validation stage the e module will be assessed by third semester students of the biology education study program. This assessment is in the form of student responses to the plant e-modules developed.

Instrument
Data collection instruments in research are:1) Validation Assessment Sheet. This assessment sheet is used to determine the feasibility of the developed mobile android-based plant module. The feasibility assessment consists of substance/material aspects and construction aspects. The module feasibility assessment for these 2 aspects involved one substance expert and one construction expert. 2) Questionnaire. Making a questionnaire instrument begins with making a questionnaire grid. Module feasibility assessment questionnaires were given to substance experts and construction experts. Questionnaires were also given to students to find out students' responses to the developed Android module.

Procedure
At the validity stage (product validity), development is carried out in 3 steps, namely the development model from Richey & Klein (2008), the internal validation model, and the external validation model. The following is an explanation of the 3 model validity stages (product legitimacy) ; 1) development model, the development phase includes literature studies, building a conceptual framework, system requirements analysis, and product design and development. 2) the internal validation model, At the internal validation stage of the android module, face validity will be assessed, consisting of learning construction experts and material experts. The construction experts who will be selected are lecturers who master learning and learning multimedia programs. According to Sugiyono (2015) E-module can be said to be valid if it meets internal and external validity. Expert validation of learning constructs includes a) the accuracy of the learning objectives formulated, b) the accuracy of the pictures containing explanations about plants, and c) the completeness of the content in the description of the material, d) the legibility of the text, e) the quality of the design, f) the quality of the images, g) layout. The selected material experts are lecturers who master biological material, especially plant material. Material expert validation includes a qualitative assessment in the form of criticism and suggestions which will become a reference in improving the Android module, and a quantitative assessment in the form of a scale questionnaire sheet. The material expert's assessment on the substance aspect includes: a) the relevance of facts to the concept of plants, b) the completeness of the presentation to support the formulation of the concept of plants, and c) the correctness of the concept of plants. 3) the external validation model, At the external validation stage the android module will be

assessed by students. This assessment is in the form of student responses as participants in the Android module trial. Assessment by students includes aspects of the language used in the module which consists of communicative language, common language and the language used does not cause multiple interpretations. In addition, students also assess the study material, the form of presentation of the module and the appearance of the module in general. Deficiencies found in small group trials are used as a reference for making product improvements (Branch, 2009)

Data Analysis Techniques

The collected data will be analyzed using qualitative and quantitative analysis techniques. a) Qualitative analysis. In the qualitative descriptive statistical analysis technique used to describe the data in the form of criticism and suggestions obtained from the questionnaire instrument given to construction experts, material experts, lecturers, peer reviewers and students. b) Quantitative analysis. Scale Questionnaire Sheet. The data obtained from the validation results of construction experts, material experts, teachers and peer reviewers will be in the form of scores in the form of 3 categories namely (3) good, (2) poor, and (1) not good. While the data obtained from students in the form of responses to the quality of the Android module will be formed into 5 categories, namely very good (5), good (4), quite good (3), not good (2), and very bad (1) (Masing & Aminatun, 2022).

RESULTS AND DISCUSSION

The product developed in the form of a local plants module from Timor Tengah Utara Regency ased on Android Mobile that can be downloaded on Playstore found on Android devices such as smartphones or tablets with a capacity of 56.79 MB. E Local Plant Modules were developed according to the Validity Stages according to Richey & Klein (2008). At the stage of Validity E Local Plant Module Through the Practice of Development, Internal Validation by Material Experts and Learning Media Experts and External Validation by Students as Test Participants E Local Plant Module E -Module. Validation of material experts by one of the biology lecturers who have qualifications in the plant field. The assessment consists of three asepek, namely the truth of the concept, the composition of the material and the clarity of the material. Validator provides an assessment on the validation sheet in the form of a questionnaire. Scores and responses obtained are then converted with 3 scales. Value conversion results can be seen in Table 1.

Table 1
The results of assessment of material aspects by material experts

No	Assessment Aspects	Score	Category
1	Truth of concept	3	Good
2	Material stirring	3	Good
3	Clarity of material	3	Good
	Average	3	Good

Based on Table 1 it is known that the results of the module assessment by the material expert in the aspect of the truth of the concept with a score of 3 are included in the good criteria, the aspect of the material in the material with a score of 3 is included in the good criteria, and the last aspect is the clarity of the material with a score of 3 included in the good criteria. This assessment shows the quality of products that are suitable for use with the revision provided. Product revision in the form of advice given by the material expert, namely improving plants so that it looks clearer, paying attention to the writing of words so that there is no typo and need to be given a more detailed explanation of the benefits of the plant.

Furthermore, the validation of learning media experts by one of the biology education lecturers who has qualifications in the field of learning and media. Aspects of the assessment include the suitability of the material with the learning achievements of the course, the accuracy of evaluation questions, the accuracy of plant images, language components, presentation, components of crackers and technical components. The results of the conversion of construction expert assessment results can be seen in Table 2

Table 2.
Assessment of construction aspects by construction experts

No	Assessment Aspects	Score	Category
1	Content compatibility with CPMK	3.0	Good
2	The accuracy of the evaluation questions	3.0	Good
3	Plants image accuracy	2.0	Good Enough
4	Language component	3.0	Good
5	Presentation aspect	2.9	Good
6	Graphic component	2.4	Good Enough
7	Technical component	2.7	Good
	Average	3.0	**Good**

Based on Table 2 the results of the module quality assessment by learning media experts on the aspect of Content compatibility with CPMK got a score of 3 are included in the good criteria, the accuracy aspect of the evaluation questions with a score of 3 is included in the good criteria, the aspect of the accuracy of plant images with a score of 2 is included in the fairly good criteria, on the language component with a score included in the good criteria, presentation aspect with a score of 2.4 included in the fairly good criteria, the graphical component with a score of 2.9 included in the good criteria, and finally the technical component with a score of 2.7 included in the good criteria. The average of all aspects of the assessment is at a score of 2.8 with good criteria so that the plant module is suitable for use with revision. Product revisions in the form of suggestions given by learning media experts are to improve pictures of plants, evaluation questions can be replaced with multiple choice test forms so that they can be done directly, the front view of the module can be added to university logos and study programs, and fixing location points so they can be accessed.

The next stage is external validation which involves students as test subjects to assess the quality of the module in terms of substance/material and aspects of learning media. The assessment was carried out by 82 students of the third semester Biology Education Study Program. The results of the recapitulation of module quality assessments by students in limited trials can be seen in Table 3.

Table 3.
The results of the module quality assessment in extensive trials

No	Assessment Aspects	Score	Category
1	Material Aspects	4.6	Very Good
2	Aspects of Learning Media	4.5	Very Good
	Average	4.5	Very Good

Based on Table 3 the results of the module quality assessment by trial participants on the substance/material aspect with an average score of 4.6 are included in the very good criteria and on the learning media aspect with an average score of 4.5 are included in the very good criteria. The response from the trial participants was that the plant module application as a whole was very good and helped students in the learning process. The android module application should be developed in other subjects, it is necessary to add plant species in the surrounding environment and the appearance of the module needs to be made more attractive.

The final product developed is a Phanerogamae Local Plant Module from Timor Tengah Utara regency Based on Android Mobile. The Local Plants Module was developed according to the development stages of Richey & Klein (2008) consisting of development (model development), internal validation (internal validation model), and external validation (external validation model). The local plant e-module application can be used by downloading it on the Playstore with the keyword local plant e-module and can be accessed online or offline. The following is a picture of the plant module e that has been developed.

Figure 1. E Module on Playstore

Figure 2. Initial display of e module

Figure 3. The menu contained in the e module

Figure 4. Plant subject in e modul

The E module developed is one of the learning media that can be used by biology education students at the University of Timor. E Module contains local plant material from Timor Tengah Utara regency which is the result of research by Sila et al. (2022). The local plants in question consist of 2 varieties of sandalwood (*Santal um album L*), *Pinus merkusii, Piper majusculum, Coffea arabica, Arenga pinnata, Aleurites moluccana, Lannea coromandelica, Ziziphus mauritiana, Rhizophora apiculate, Avicenia sp, Jatropha gossypifolia*, and *Melaleuca leucadendra*. These plants are a combination of endemic plants such as sandalwood and plants that are beneficial and have economic value for the people of Timor Tengah Utara regency. The history of the trade in sandalwood, which has the local name hau meni for the people of Timor Tengah Utara Regency, in the past has contributed to the fact that sandalwood is a native plant in East Nusa Tenggara, especially on the islands of Timor and Sumba (Riswan, 2001; Seran et al., 2018). Furthermore, Pinus merkusii with the local name of the people of Timor Tengah Utara is called "ijaob" this in taxonomy is one of the species of the Pinacea tribe and is native to Indonesia (Harahap & Aswandi, 2006; Sall, 2013). Each plant displayed in the e module is accompanied by a picture, location map, classification, morphology and benefits of the plant.

Products in the form of Local Plant E Modules from Timor Tengah Utara Regency Based on Android Mobile have passed the stages of internal validation and external validation. At the internal validation stage, the e-module was assessed by material experts and learning media experts and received a number of inputs or revisions, such as aspects of plant material that needed additional plant benefits in more detail. While in the learning media aspect, the input obtained is in the form of pictures of plants, improving evaluation test questions, and adding some of the initial appearance of the module. The local plant e-module was then revised according to input from material experts and learning media experts to then be tested on the third semester students of the Biology Education study program, University of Timor. At the external validation stage, the revised e-module is given to students as trial participants. The student response to the local plant e-module that was developed was very positive and they hope it can be developed in other subjects. This is because the e-module based on Mobile Learning is a form of electronic learning that can be accessed anywhere and anytime, supported by the ability to browse or search quickly and very effectively (Boyinbode & Akinyede, 2008). Some of the advantages of mobile learning according to Behera (2013) and Sarrab et al. (2012) namely increasing mobility, saving time, 3) being environmentally friendly, having the opportunity to acquire skills at individual learning speeds, and supporting distance learning.

The results of data analysis on the quality assessment of Local Plants E Modules from Timor Tengah Utara Regency Based on Android Mobile by material experts and learning media experts using a Likert scale with a scale range of 1-3 consisting of poor, good enough, and good categories. In the aspect of local plant materials and aspects of learning media, the average rating scale is included in the good category. Subsequent data analysis from the student response questionnaire to the Local Plant Module from Timor Tengah Utara Regency Based on Android Mobile using a Likert scale with a scale range of 1-5, and it is known that the material aspects and learning media aspects are included in the very good category.

Local plants E Modules from Timor Tengah Utara Regency Based on Android Mobile have several advantages, namely they can be used independently according to each individual's learning speed, and can be used anytime and anywhere. Local plant e-modules are flexible in their use, not limited by space and time (Masing & Aminatun, 2022). This is supported by Android devices which are small in size, light in weight and easy to carry anywhere (Lubis & Ikhsan, 2015). E module development has fulfilled the characteristics of the module and the characteristics of mobile learning. where learning modules have independent characteristics (self-instruction), a unified whole (self-contained), stand-alone, adaptive, friendly (user friendly) (Daryanto, 2013). Meanwhile, a good mobile learning system at least consists of the following components: Mobile learning devices; mobile learning software; and learning content (Pocatilu, 2010). In addition, Suarsana & Mahayukti (2013) and Damarsasi (2013) in their research related to the e-module showed effective results for improving students' thinking skills and learning outcomes.

CONCLUSION

Based on the data obtained in the development of the e-module, it can be concluded that development of Local Plant Modules from Timor Tengah Utara Regency Based on Android Mobile in accordance with the Design and Development Research (DDR) development model through three stages, namely development, internal validation, and external validation. The E module contains local plants consisting of 2 varieties of sandalwood (*Santalum album L*), *Pinus merkusii, Piper majusculum, Coffea arabica, Arenga pinnata, Aleurites moluccana, Lannea coromandelica, Ziziphus mauritiana, Rhizophora apiculate, Avicenia sp, Jatropha gossypifolia*, and *Melaleuca leucadendra*. Each plant displayed in the e module is accompanied by a picture, location map, classification, morphology and benefits of the plant. The Local Plant Module from Timor Tengah Utara Regency Based on Android Mobile is suitable for use in terms of substance/material and learning media. Based on the assessment of material experts and learning media experts, this e-module is in the "good" category, while the assessment by students as trial participants is included in the "very good" category. The plant E module will be used by students of biology education at the University of Timor in studying plant botany and morphology.

ACKNOWLEDGMENT

REFERENCES

Behera, S. K., & Purulia, W. B. I. (2013). M-learning: a new learning paradigm. *International Journal on New Trends in Education and Their Implications*, *4*(2), 24-34. http://www.ijonte.org/FileUpload/ks63207/File/2013.2.complete.pdf#page=31

Boyinbode, O. K., & Akinyede, R. O. (2008). Mobile learning: An application of mobile and wireless technologies in Nigerian learning system. *International Journal of computer science and network security,* *8*(11), 386-392. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=ddd4866c3dc81331a6b2a839d23f6982a539a477

Branch, R. M. (2009). *Instructional Design: The ADDIE Approach*. Springer.

Campbell, N.A., & Reece, J.B. (2010). *Biology vol 3 (eighth ed.).* (Translation of Damaring Tyas Wulandari). San Francisco: Pearson Education, Inc. (Original book published in 2008)

Damarsasi, G., D., Soeprodjo & Saptorini. (2013.) *Application of the E-module Assisted Inquiry Method. Journal of Chemistry Education Innovation*, *7*(2), 1201-1209.

Daryanto. (2013). *Developing Modules, Teaching Materials for Teacher Preparation in Teaching*. Yogyakarta: Gava Media Publisher.

DeWitt, D., Siraj, S., & Alias, N. (2014). Collaborative mLearning: A module for learning secondary school science. *Journal of Educational Technology & Society*, *17*(1), 89-101. https://www.jstor.org/stable/jeductechsoci.17.1.89

Directorate of High School Development. (2010). *Technical Instructions for the preparation of affective assessment tools in SMA*. Jakarta

Hamalik, O. (2004). *Teaching Planning Based on Systems Approach*. Earth Script: Jakarta.

Harahap, R. M. S and Aswandi. (2006). *Development and Conservation of Tusam (Pinus merkusii Jung.et de Vries) Tapanuli and Kerinci Strains. Proceedings of the Expose of Research Results "Conservation and Rehabilitation of Forest Resources". Forest Research and Development Center and Nature Conservation*. Bogor. Q : 223-232.

Hartono, A., Adlini, M. N., Ritonga, Y. E., Tambunan, M. I. H., Nasution, M. S., & Jumiah, J. (2020). *Identification Higher Plants (Phanerogamae) at UINSU Campus II*. Biolocus, 3(2). https://doi.org/10.30821/biolokus.v3i2.755

Herawati, N. S., & Muhtadi, A. (2018). *Developing Interactive Chemistry E-Modul For The Second Grade Students of Senior High School. Jurnal Inovasi Teknologi Pendidikan,* 5(2), 180–191. https://doi.org/10.3454/at-tadbir.v4i1.3751

Lubis, I. R. & Ikhsan, J. (2015). *Development of Android-Based Chemistry Learning Media to Increase Learning Motivation and Cognitive Achievement of High School Students. Journal of Science Education Innovation, 1(2)*. 191-201. https://doi.org/10.21831/jipi.v1i2.7504

Lubis, Mina S., Syahrul, R., & Juita, N. (2015). *Development of Indonesian Language Learning Modules Assisted by Mind Maps on Paper Writing Material for Class XI SMA/MA Students. Journal of Language, Literature and Learning, 2*(1), 16-28.

Martono , K.T dan Nurhayati ,O.D . (2014). *Implementation Of Android Based Mobile Learning Aplication As A Flexible Learning Media. IJCSI International Journal of Computer Science Issues,* Vol. 11, Issue 3, No 1.168-174. https://ijcsi.org/papers/IJCSI-11-3-1-168-174.pdf

Masing, F.A., & Aminatun, A. (2022). *Developing An SSI-Based Learning Model of Android Module to Improve Critical Thinking Skills of Students. Jurnal Pembelajaran dan Biologi Nukleus*, *8*(3), 673-685. https://doi.org/10.36987/jpbn.v8i3.3226

Meister, Jeanne C., Kaganer, E., Von Feldt, Rick. (2011). *The Year of the media tablet as a learning tool. Proquest, 65* (4). 28-31

Nordiansyah, M. R. (2021). *Development of Islamic Religious Education and Moral Learning Modules Using Flipbook Media, the Kvisoft Flipbook Maker Application to Improve Student Achievement in Grade VIII Students of SMP Muhammadiyah 06 Dau-Malang*

Priyanthi, Kadek Aris, M.Si. Dr. Ketut Agustini, S.Si, and M.Cs Gede Saidra Santyadiputra, S.T. (2017). *"Development of E-Modules Assisted by Simulation Oriented Problem Solving in Data Communication Subjects (Case Study: Class XI Students of TKJ SMK Negeri 3 Singaraja)."* Collection of Articles for Informatics Engineering Education Students (KARMAPATI) 6(1): 40.

Pocatilu, P. (2010). *Developing Mobile Learning Applications for Android using Web Services. Informatica Economică, 14*(3), 106-115

Prastowo, A. (2014). *Development of Thematic Teaching Materials theoretical and practical reviews.*

Jakarta: Kencana Prenadamedia Group

Richey, R. C., & Klein, J. D. (2008). *Design And Development Research*. New York: Lawrence Erlbaum Associates Inc.

Riswan, S. (2001). *Botanical Studies, Ecology and Distribution of Sandalwood Trees (Santalum album L.).* News Biology, 5(5), 571–574.

Rufii, R. (2015). *Developing Module On Constructivitist Learning Strategies To Promote Students Independence And Performance. International Journal of Education*. Vol. 7, No. 1. 18-28

Sall, M. K. (2013). *Pinus (Pinus merkusii Jungh et de Vriese) dan Keberadaannya di Kabupaten Tana Toraja, Sulawesi Selatan. Buletin Eboni, 10(2).* https://doi.org/10.20886/buleboni.5013.

Sarrab, M., Elgamel, L., & Aldabbas, H. (2012). Mobile learning (m-learning) and educational environments. *International journal of distributed and parallel systems*, *3*(4), 31-38.

Seran, Y. N., Sudarto, Hakim, L., & Arisoesilaningsih, E. (2018). *Sandalwood (Santalum Album) growth and farming success strengthen its natural conservation in the Timor Island, Indonesia. Biodiversitas, 19(4), 1586–1592*. https://doi.org/10.13057/biodiv/d190452.

Santyasa, I. W. G. (2009.) *Module Development Theory. Bali*: Ganesha University of Education.

Sila, V.U.R., Masing, F.A. Santiari, M. (2022). *Identification and Characterization of Secondary Metabolites Endemic Plants from Fatunisuan Village, Timor Tengah Utara Regency*. *Jurnal Sains dan Teknologi*, *11*(1), 184-191. https://dx.doi.org/10.23887/jst-undiksha.v11i1

Suarsana, I M. dan Mahayukti, G.A. (2013). *Problem Solving Oriented E-Module Development To Improve Students' Critical Thinking Skills. Journal of Mathematics Education.*

Sugiono. (2016). *Research and Development Methods (Research and Development/ R&D).* Bandung: Alfabeta CV.

Ulfa, S. W. (2019). *Inventory of Higher Plant Diversity in Medan Amplas District, Medan City, North Sumatra Province. Journal of Biology Education, 2(1)*. https://doi.org/10.30743/best.v2i1.1771

Wijaya, A. M., Arifin, I. F.,Badri, M. (2021). *Digital Learning Media As A Learning Medium Independence In The Pandemi Time In History Subject. Jurnal Sandhyakala*, 2(2), 1-10.

Wityastuti, E. Z.,Masrofah, S.,Haqqi, T. A. F.,Salsabila, U. H. (2022). *Implementation of the Use of Digital Learning Media during the COVID-19 Pandemic. Jurnal Penelitian Inovatif (JUPIN)*, *2*(1), 39-46. https://doi.org/10.54082/jupin.39

Wulandari, F., Yogica, R., & Darussyamsu, R. (2021). *Analysis of the Benefits of Using Remote E-Modules During the Covid-19 Pandemic. Educational Scientific Journal Khazanah Education*, 15(2), 139–144. https://doi.org/10.30595/jkp.v15i2.10809