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3R-Based Teaching Module for Biology Education Students: A Research Development

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ABSTRACT

The teaching modules are structured learning packages encompass lesson unit concepts, designed to align with the semester learning plan (RPS), and aimed at achieving specific competency standards. This study explores the application of a 3R-Based Teaching Module for Biology Education through a validation process. The research follows a Research and Development (R&D) methodology, utilizing the ADDIE model, which includes three stages: Analysis, Design, and Development. The study was conducted in the Biology Education programs of Riau Islamic University, Muhammadiyah University, and Lancang Kuning University from July to December 2023. The sample included 15 third-semester students as respondents, along with three experts—specialists in material, learning, and media—selected through purposive sampling techniques. These students had previously completed Environmental Science courses at the three universities. Validation data were collected using questionnaires distributed via Google Forms to both student respondents and expert validators. The validation results revealed high validity scores from media experts (94.44), learning experts (96.59), and material experts (100), with an overall validation score of 96.67. Student readability was also rated highly at 91.16. Based on these results, the 3R-Based Teaching Module was deemed valid and practical for use in biology education programs.

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1. INTRODUCTION

Education plays a crucial role in human life, providing individuals with the skills needed to compete and adapt in a world that is advancing rapidly across various fields. It should equip students with the ability to think critically and prepare them to address challenges such as globalization, environmental issues, technological advancements, a knowledge-based economy, and the rise of creative industries and cultural shifts (Rafi'y et al., 2022; Taufan et al., 2023). Despite these needs, education often remains focused on imparting knowledge and understanding of material, which results in a lack of emphasis on developing critical thinking skills, problem-solving abilities, and the practical application of concepts learned in academic settings to real-world situations (Mubarak et al., 2021).

The module used is a learning package that contains a concept of lesson units that are interactive and are applied by utilizing the internet. Some research evidenced that the utilization of modules can be used asching materials (Jannah &Fathuddi, 2023., Sidiq &Najuah, 2020). The teaching module is a learning tool or learning design based on the semester learning plan (RPS) which applied with the aim of achieving predetermined competency standards. Teaching modules have a major role in supporting lecturers in designing the learning process. In the preparation of learning tools that play an important role are lecturers, honed thinking skills to be able to innovate in teaching modules. Therefore, making teaching modules is a competency that needs to be developed, it is hoped that teaching techniques in the lecture process will be more effective, efficient, and so that the lecture process can run as it should (Maulida, 2022., Logan et al., 2021).

Higher education, in general, and students, in particular, are educational institutions that accommodate students' need to be equipped with science, one of which is biology education. With biology background, they need to be aware on plastic pollution materials, aiming to instill a sense of environmental care. One of the efforts to overcome these problems is to improve learning strategies and models. (Khoirunnisa & Kadarohman, 2022), stated that the use of plastic-based goods has now become a necessity in human life and has become a culture among the community. This is because plastic materials have various functions and can meet the needs of the community. Initially, plastic is a material that has many advantages that can be formed as desired with the help of heat and or pressure. However, over time, it turns out that plastic has a long-term impact because of its strong and difficult to decompose nature, of course, it can have an impact on the environment, both on land and sea in the environment for a long time.

For this reason, students in a university, must be sensitive to differences in activities, interests, and social status that someone has, making the lifestyle that everyone has different. This lifestyle is formed to preserve the environment (Escario et al., 2020), Reducing environmental pollution can include many things, including 3R (Reduce, Reuse and Recycle). Referring to the Regulation of the Minister of Environment (Peraturan Menteri Negara Lingkungan Hidup Republik Indonesia Nomor 13 Tahun 2012 Tentang Pedoman Pelaksanaan Reduce, Reuse, Dan Recycle Melalui Bank Sampah, 2012)**,** Reduce, Reuse, and Recycle activities are all activities that are able to reduce everything that can cause waste, waste reuse activities that are suitable for use for the same or different functions, and activities to process waste into new products. The trend of municipal waste management that prioritizes 3Rs needs to be supported, so that the amount of waste disposed of is reduced, and future waste management patterns are organized (Juliandi, 2023., Junaidi & Utama, 2023), in this case it is guided by the 3R principle, namely Recycle, Reduce and Reuse. Supported (Ratri et al., 2022). Reduce, improving environmental impact by reducing resources used. Reuse, utilization of resources, but not with the same purpose. Recycle, processing plastic into new products (Mohammed et al., 2021)**.**

As for the problems in the field that were found to have no material enrichment about plastic pollution, the teaching modules provided were in the form of handouts so that the desire to learn for students had not been achieved properly, had not been developed optimally learning about 3R-based on plastic pollution for students. The creation of modules will rejuvenate the understanding of the material, make it more interesting and equipped with pictures that add enthusiasm to the learning process. To overcome this, it is necessary to make teaching modules so that the lecture process can run in accordance with the goals to be achieved.

The results of previous research that the science module of 3R-based waste handling materials (reduce, reuse, recycle) towards zero waste for grade X students is suitable for use in the learning process based on quality assessment according to education expert lecturers, science teachers and students (Marsolina & Anggreini, 2022). Furthermore, the 5R waste management module based on Problem Based Learning is suitable for high school / MA students. The feasibility of the module is based

on the assessment of the Problem Based Learning based waste management module by validators and obtained the final results and field test results that are declared suitable for use.

This research offers several suggestions for the development of future modules. First, it recommends conducting more in-depth research to mitigate the impact of pollution caused by waste management activities on the residents of Malang city. Second, further research should focus on developing additional teaching materials, particularly those that integrate critical thinking, environmental knowledge, and environmental awareness, to foster a deeper appreciation and care for the environment (Demokratis et al., 2021). The goal of this study is to develop a 3R-based teaching module for Biology Education students, providing an innovative, critical, and sustainable teaching approach that can be applied to enhance education effectively over the long term. This approach aims to equip future graduates with the skills needed to adapt to rapid changes and challenges.

2. METHOD

The research was carried out at the Biology Education Study Program, Riau Islamic University, Muhammadiyah University, Lancang Kuning University. Conducted from July to December 2023. Validators in the development of this teaching material are material expert validators, learning expert validators, media expert validators, and readability tests to 15 students as 3rd semester respondents who have received environmental science courses at 3 universities. The object in this study is a 3R-Based Teaching Module for Biology Education Students: A Development Research. The method used is the development method (Research and Development) with the ADDIE model, which consists of 5 stages, namely Analysis, Design, Development,Implementation, and Evaluation. The ADDIE learning model was developed by Reiser and Mollanda in 1967 (Nisa et al., 2022).

In this 3R-Based Teaching Module for Biology Education Students: A Development Research, study using Research and Development (R & D) developed with the ADDIE Model which has steps with 5 stages, namely analysis (Analisys), design (Design), development (Development) at this stage several validations are carried out by validators including media expert validators, learning expert validators, material expert validators, student readability, while for the stage (Implementation), and evaluation (Evaluation) has not been carried out (Firmansah, 2021). The steps of Research and Development (R&D) developed with the ADDIE Model can be described in the figure below as follows;

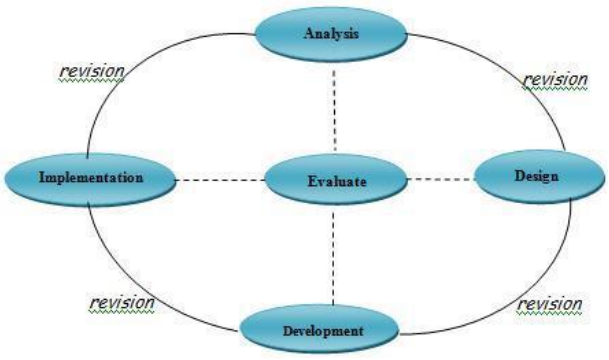


Figure 1. ADDIE Development Model Chart (Sugiyono, 2019)

In this research, ADDIE development research steps from the analysis stage (Analyze, Design, Development, Implementation, Evaluation). This research was only carried out during the development stage. As for the explanation of the development design, the steps are explained as follows:

1. Analysis

The analysis stage involves defining the requirements for developing teaching modules, including curriculum analysis, material analysis, and student analysis. This stage requires conducting a gap analysis between the current teaching module and the 3R-based teaching model to identify areas for improvement and guide the construction of the new modules. The analysis helps determine the learning needs, the target audience, and the competencies students are expected to master after the learning process. It includes evaluating the existing curriculum, understanding student needs, and analyzing the material. Discussions focus on aligning the content of the modules with the course syllabus (RPS) to ensure relevance and effectiveness.

2. Design

The purpose of this stage is to develop 3R-based teaching modules on plastic pollution in accordance with the curriculum. At this stage, it is determined how the module is designed as a whole in accordance with the subject matter and then compiled indicators for learning objectives that will be designed into teaching modules. Includes cover and module design design with the Canva Application program, images on modules are sourced from various sources and arranged according to user wishes

After doing the analysis, the next step is to carry out the design process. Aims to facilitate the process of making covers from teaching modules. Then the design projects include the preparation of teaching materials, practice questions and other additional features. Learning materials are sequentially arranged based on RPS which is adjusted to references related to integrated learning courses which are then compiled into Microsoft Word and converted into Pdf. The design raised by the researcher is made attractive with a combination of colors that make students feel at home in reading this teaching module. The instruments prepared consist of 3 (three), namely assessment instruments on media feasibility by media experts, material feasibility instruments by material experts and assessments on learning feasibility of learning experts, materials and media for student readability. The instrument is arranged in the form of a questionnaire with 4 alternative answers, namely the score 1 = if no descriptors appear, 2 = if only 1 descriptor appears, 3 = if only 2 descriptors appear, 4 = if all three descriptors appear. The determination of module eligibility categories consists of 4 categories, namely highly valid, valid, quite valid, and invalid.

3. Development

The development phase focuses on creating 3R-based teaching modules on plastic pollution that align with the curriculum. Once the modules are drafted, they undergo validation by experts to ensure that the concepts and language align with the curriculum and the study program's syllabus (RPS). After finalizing the design, the modules are created using Microsoft Word and then converted into PDF format using the Canva application. At this stage, all pre-designed components are assembled, and the researcher tests the functionality to ensure everything operates correctly. This process also verifies whether the concepts align with the intended design of the modules. The validation test is crucial for assessing the module's suitability before its implementation in the learning process. During this process, suggestions and feedback are gathered for further improvements. Expert validation plays a key role in determining whether the modules are ready and suitable for use in education (Ramadhani & Fitri, 2022).

4. Validators

Biology education experts and competencies in their fields as many as three experts are listed in Table 1 as follows;

Table 1. List of Validator Names

No.	Validator Name	Expert Field	Information
1.	Dr. Nurkahiroh Hidayati S. Pd. M.Pd	Material Expert	Lecturer in Biology, Faculty of Teacher Training and Education, Universitas Islam Riau
2.	Sepita Ferazona S.Pd.M.Pd.	Learning Expert	Lecturer in Biology, Faculty of Teacher Training and Education, Universitas Islam Riau
3.	Nurul Fauziah M.Pd.	Media Expert	Lecturer in Biology, Faculty of Teacher Training and Education, Universitas Islam Riau

Source: Researcher Data 2023

A questionnaire with a structured validation sheet was used to gather feedback from experts, focusing on three key areas: content feasibility (8 statements), presentation quality (3 statements), and language use (4 statements). Learning experts evaluated aspects such as module structure (4 statements), writing organization (3 statements), language (3 statements), module presentation (11 statements), and overall benefits (1 statement). Meanwhile, media experts assessed the module based on cover design (3 statements), content quality (3 statements), and the benefits of the media (1 statement) (Noviola, 2020). After the teaching module was developed and validated, a limited feasibility trial was conducted with biology students from three universities. The trial involved a sample of 15 third-semester students, as detailed in Table 2 below.

Table 2. List of Semesters in Biology Students for Trials

Semester (Level)	Address	Number of students
Semester 3	Univeristas Islam Riau	15
Semester 3	Universitas Muhammadiyah	15
Semester 3	Univeristas Lancang Kuning	15

Source: Data by Researchers 2023

The study employed a purposive sampling technique, selecting participants based on specific criteria, as described by Sugiyono (2019). This method involved selecting 15 students from each of the three universities. The analysis technique used in this research is quantitative descriptive analysis, which evaluates the effectiveness of the 3R-based teaching modules on plastic pollution. This approach draws on data gathered from validity test activities, including validation and evaluation sheets, as well as field practitioner questionnaires and effectiveness tests for real-world application. The percentage analysis of each validity aspect is calculated using a specific formula.

$$V = (TSe/TSh) \times 100\%$$

Explanation
V : Validation
TSe : Empirical total score
TSh : Maximum total score

The percentage of module validity will be calculated for five different validators.. On each questionaries there are assessment score that need to be choose from 1 to 5, range from very good (5) to very bad (1). Then the score will be calculated as validation score as above to get the validity result.The validity results of each (experts and lecturers), the percentage level can be matched or confirmed with the criteria in Table 3 below.

Table 3. Validity criteria according to validator assessment

No.	Validity criteria	Validity Level
1.	85,01% - 100%	Highly valid, or can be used without revision
2.	70,01% - 85%	Quite valid, or usable but needs minor revisions
3.	50,01% – 70%	Less valid, it is recommended not to be used because it needs major revisions
4.	01,00% - 50%	Invalid, or may not be used.

Source; (Sugiyono, 2019)

3. FINDINGS AND DISCUSSION

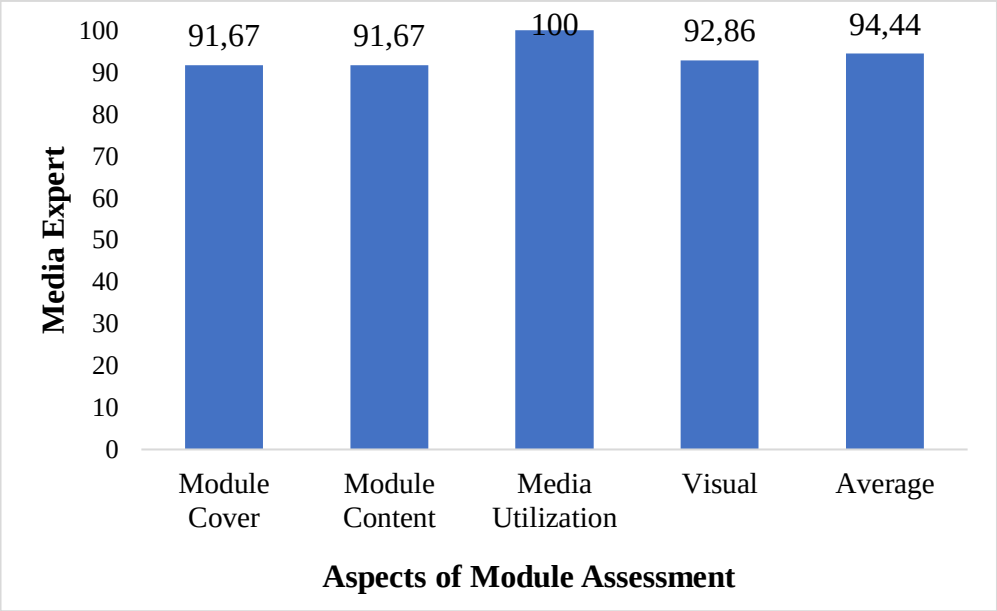
There are several findings that can be highlighted after the research conduct, thoroughly 3 assessment aspects of validation: media experts, learning experts, and material experts.Firstly, on media experts' aspects, it was found the importance of material packaging. This learning media is helping the student to understand learning material objectives and several milestones along the study. With this, it is also proven that visual hold an important key during learning process.

Secondly, on learning experts' aspects, it was found that how material structured is affected on how the module application during learning process with objectives to aim clearer and easier subject deliveries. Starting from structured and well-arranged content, clear writing organization and language also hold important factor to support understanding independently feasible. In addition, presentation of the module needs to be in simple manner and with good readability also accountable.

Lastly, from material experts' aspects, it was found that comprehensive material need to be summarized well with some limitation of spaces. The content required to be informative and compiled the necessary details yet simplify and hold clarity. Presentation is encouraging to create critical, creative, innovative, and support learning process. And how communicative language used is to deliver messages, support, and knowledge is well expressed. The detail explanation of this findings can be seen below:

3.1 Assessment Aspects of Media Expert Validator Module

Aspects of assessing the media expert validator module to determine the feasibility of the teaching modules developed are selected in accordance with competence and understanding in their fields assessment and suggestions are given into material for revision to be better, which can be seen in graph 1 as follows;



Graph 1. Assessment Aspects of Media Expert Validator Module

Data from Graph 1 above, for the module cover aspect, a value of 91.67 is obtained with a highly valid category, because the module cover is the first display that will be seen before entering the contents. For this reason, Cover is the main information that is closely related to writing, both title, author name, identity. Then the cover also allows other readers to identify the material at a glance. Where the module cover must be attractive by combining colors and illustration images, the shape and size of the font must be harmonious so that it looks more attractive. Furthermore, the validation results of the cover image validator are clarified, the title of the subchapter forn 14, image consistency, image position must have a source, the results of this suggestion can be improved as a whole.

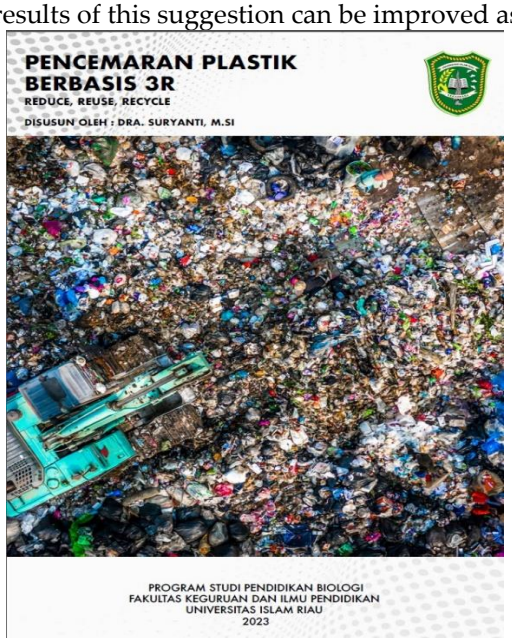


Figure 2. 3R-Based Module Development Cover
Source: Research Data 2023

The aspect of the module content is obtained a value of 91.67 with a highly valid category, it can be understood in the content section of the module to place stimuli in the form of images or illustrations, containing sequences that are considered to represent the material of the entire module content including starting from the table of contents, concept maps, learning objectives, plastic materials, various types of plastic, plastic waste, the function of plastic waste, plastic waste problems, other facts about plastic waste and the environment, pollution due to plastic waste, how to prevent 3R-based plastic waste pollution (*Reduce, Reuse, Recycle*), a way of processing modern plastic waste. Assignments and exercises are packaged in such a way as not to be boring and interesting to read and do according to the characteristics of students. Everything presented by media validator experts is considered feasible, especially in terms of material enrichment for lecture modules for students. Learners' need for media can be based on curriculum demands, so that the preparation of material in a learning media must be guided by Basic Competencies and Core Competencies or in accordance with learning objectives (Putra et al., 2021). A clearer description of the preface, table of contents and concept map can be seen in figure 2 as follows;

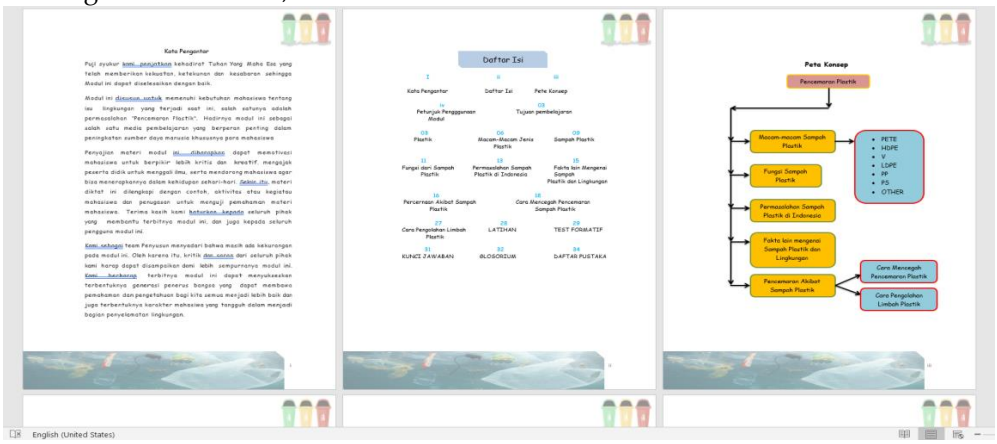


Figure 3. Module Content (preface, table of contents and concept map)

Furthermore, the description of the Module Content (glossary and bibliography) can be seen in figure 3 as follows;

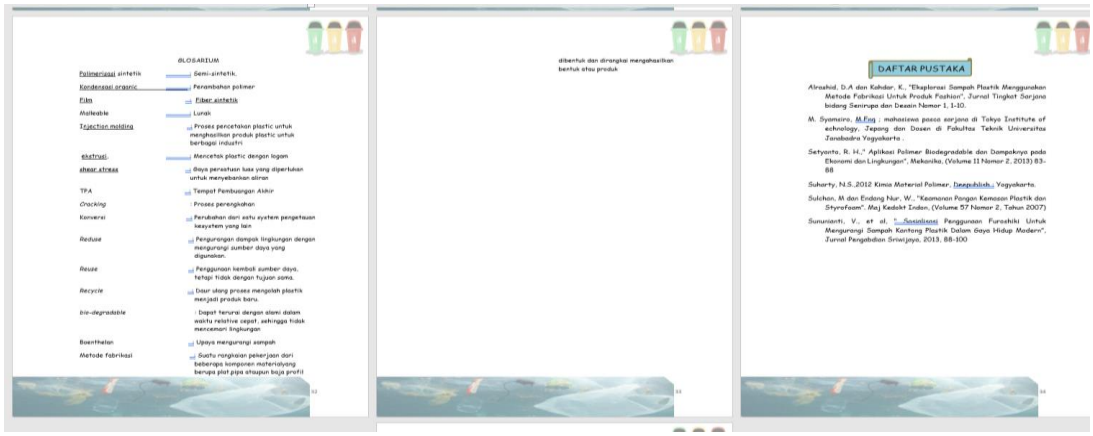


Figure 4. Module Contents (glossary and bibliography)
Source: Research Data 2023

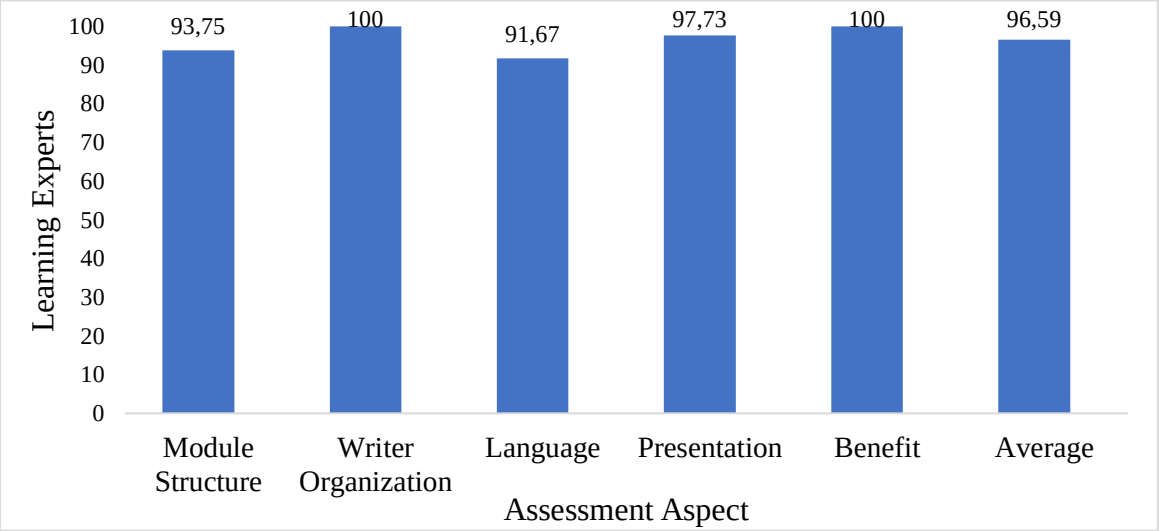
The benefits of media obtained by 100 data with categories are highly valid, because the module is one of the tools used as a guide in lecture activities in the form of designs according to needs.

Considered as a determinant of a learning objective and consideration of the material to be delivered. This is so that later the learning process is more interesting and not monotonous. Because in the module itself there are important components, these components will be used as a reference. According to (Angriani et al., 2020). Media and learning resources have an important role in the learning process, this is because the media can help students understand the information to be conveyed. Next (Faizzah et al., 2023). Media is one of the learning tools that can provide stimulus, provide experience to students and help make the same observations in students, So that students have the same understanding of the information conveyed.

The module display obtained 92.86 data with highly valid categories, is expected to be interesting for those who see, meaningful and challenging so as to foster student interest in learning, understand the fun, involve all students actively so that they can interact and participate so that lecture goals can be achieved properly. The display of the Teaching module can use a simple organizing system and color combinations so that the filter is more impressive to make students' reading desires better (Rahmayanti, 2023). The overall average result of module validation from media experts obtained a value of 94.44 with a highly valid category, because the display of media in the module for the learning process is more representative so that it is suitable for use in the lecture process for students.Supported by research results (Haristah et al., 2019). The overall percentage results carried out by media expert validators were obtained at 86.25% with very good criteria. If it represents all aspects of the media, the learning media is valid or suitable for use in the learning process.

3.2 Assessment Aspects of the Learning Expert Validator Module

The Assessment Aspects of the Learning Expert Validator Module can be seen in graph 2 below;



Graph 2. Assessment Aspects of the Learning Expert Validator Module

The assessment of the module by learning expert validators revealed that the module structure received a score of 93.75, categorized as highly valid. A well-structured module is crucial, as it ensures that all necessary components are present in the printed module, making it fully suitable for use in the lecture process. This structure not only facilitates lecturers in delivering content but also aids students in understanding the material and following the lectures more effectively. Additionally, the organizational aspect of writing received a perfect score of 100, also categorized as highly valid. Attention to the organization of writing in the module is essential to ensure its overall quality, including

aspects such as font usage, word choice, punctuation, and the correct use of borrowed terms. Once these elements are refined, the module is deemed ready and appropriate for use in the classroom.

The language aspect of the learning aspect of the value of 91.67 with a highly valid category, preferably the language used in accordance with the situation or writing conditions in the module, must be in accordance with applicable rules such as in accordance with spelling, punctuation, terms and grammar methods, this is very necessary in compiling the module so that the resulting language is easy to understand and interesting for students to read. And more importantly to note the sentences we write and compose can fulfill as correct sentences. According to (Wanabuliandari et al., 2021). To mentioning the use of good and correct language according to the EYD is very important. Remembering by using language that will make it easier for students to understand the material and feel comfortable in the learning process.

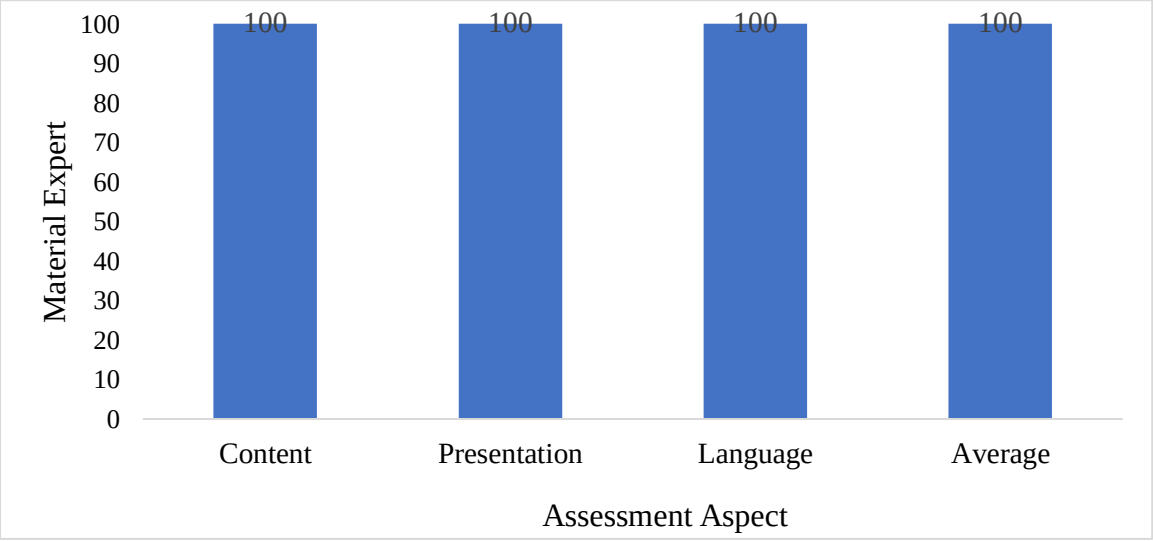
The presentation aspect of the module received a score of 97.73, categorized as highly valid. This high score reflects the importance of adjusting the presentation style to ensure that the module is clear, simple, and easy for students to read and understand, aligning with the intended learning outcomes. Based on the validators' suggestions, learning objectives were added before the material, which was subsequently revised accordingly.

The aspect of benefits scored a perfect 100, also categorized as highly valid. The module is designed for both individual and classroom use, allowing students with varying abilities to learn independently while also supporting simultaneous learning in a classroom setting through discussions and material enrichment. This dual approach is complemented by both individual and group evaluations.

Overall, the learning expert validators gave an average score of 96.59, placing the module in the highly valid category. This indicates that all necessary aspects for module development have been successfully addressed, making the module suitable for use. According to Harahap et al. (2022), well-prepared instructional materials crafted by lecturers can engage students and provide the necessary guidance to help them achieve the desired learning outcomes.

3.3 Assessment Aspects of Material Expert Validator Module

The aspect of assessing material expert validator modules can be seen in graph 3 below;



Graph 3. Assessment Aspects of Material Expert Validator Module

From the results of module development on the feasibility aspect of content with a value of 100 categories are highly valid, it is very understandable that the material provides imformation, simplifies and clarifies the material so that it is not too verbal, has been compiled in detail, has complete competition, overcomes the limitations of space, time and sensory power of students and lecturers, and can be used appropriately and varied. Especially very helpful in the lecture process. Furthermore, a module must pay attention to the content feasibility component.

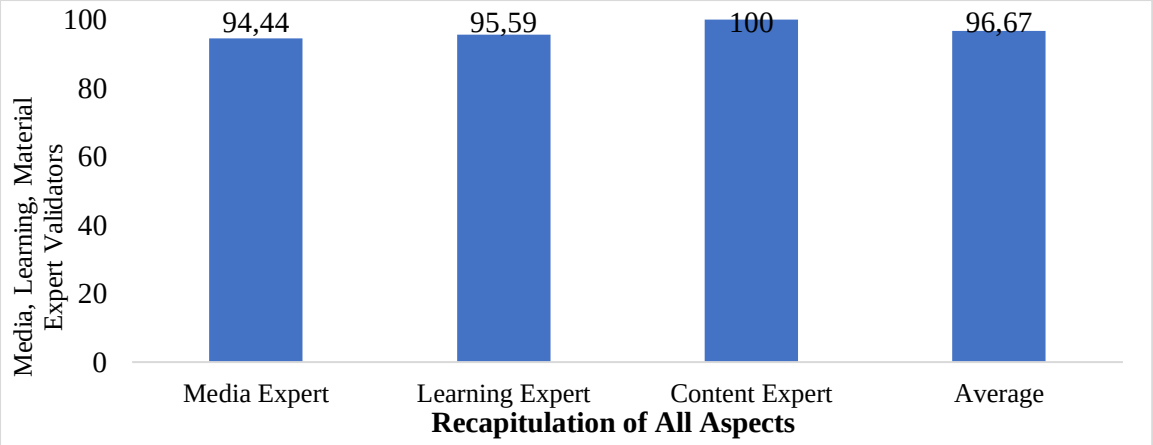
The feasibility aspect of presentation is obtained a value of 100 with a highly valid category, interpreted as a whole this aspect has met the existing provisions, contains concepts presented interestingly, interactively and is able to encourage the process of critical, creative, innovative and deep thinking, as well as metacognition and self-evaluation. Suggestions from material validators at the beginning of the material add theories about pollution. This has also been fixed as per the suggestions.

The language aspect obtained data with a value of 100 categories is highly valid, because the language used in the module contains imformations, messages, and knowledge that is expressed in written form and can be communicated with readers. It must be in accordance with its function, the situation then has a truth value, the value that is expected to give a feeling of pleasure and happiness that cannot be separated must refer to good and correct Indonesian methods, meaning that a module must pay attention to its language component. This is in line with (Sidiq & Najuah, 2020) one of the characteristics of a good teaching module is using communicative language so that students more easily understand the content of teaching materials. Polite or positive language will help the teacher to understand the characteristics of students.

Average for Assessment Aspects of the Material Expert Validator Module with a value of 100 Highly valid categories. This can be understood because with interesting material containing challenging things, especially the problem of plastic pollution to be studied so as to get a good understanding and students can apply it to everyday life about the importance of 3R. In accordance with the research (Sariyah, 2023., Haristah et al., 2019) The results state that the teaching module is a collection of imformations that provide a description of the material needs needed must be seen as good material aspects and suitable for use as learning materials and learning processes.

3.4 Recapitulation of All Aspects of Module Assessment Validators Media Experts, Learning Experts and Material Experts

The aspect of module assessment validators material experts, learning experts and media experts to be clearer can be seen in graph 4 below;

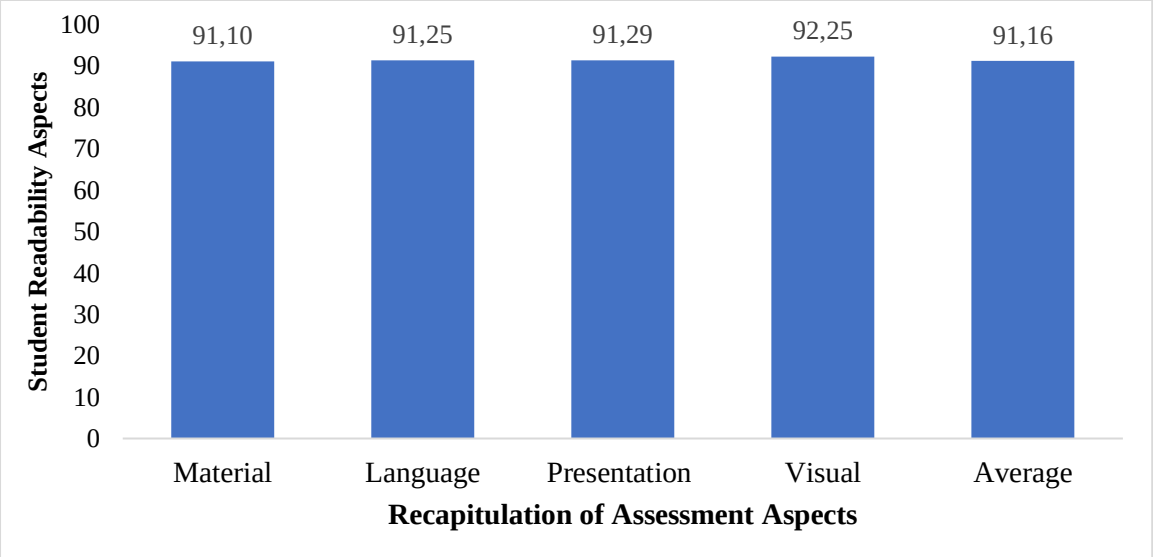


Graph 4. Recapitulation of All Aspects of Module Assessment Validators Media Experts, Learning Experts and Material Experts

The results of the recapitulation of the three validator experts, the aspect for media experts with a value of 99.44 categories is highly valid, where the cover, content, media benefits and visual presentation as a whole have met the existing rules in making module development on 3R-based plastic pollution material (*Reduce, Reuse, Recycle*). Recapitulation for aspects for learning expert's assessment module validator learning experts obtained 95.59 with categories is highly valid, because the module structure, writing organization, language, presentation and benefits are considered good when carried out in the teaching process. The recapitulation for the assessment aspect of the expert material validator module obtained by 100 categories is highly valid, because the feasibility of content, feasibility of presentation and language have met existing and applicable provisions so that the material presented in the module can be interesting to students because of the variety of images that represent the material. The teaching module is arranged in such a way that it will contain fragments with interactive questions to make it easier for users to understand the material (Taufan et al., 2023).

3.5 Recapitulation of Assessment Aspects of Student Readability Teaching Modules

The assessment aspects of student readability teaching modules from 3 universities with 4 aspects for more clarity can be seen in chart 5 below;



Graph 5. Recapitulation of Assessment Aspects of Student Readability Module

The data obtained from the average recapitulation results of student readability teaching modules from 3 universities, from the aspect of material with a value of 91.10 categories are highly valid, it is hoped that the selection of material must be essential where it is important to be mastered and understood by students and is sustainable. The material must attract interest so that learning time does not become bored, it must be meaningful in the sense that students are able to relate new imformations or lecture materials with concepts or other things that already exist in the cognitive structure. In addition, the material must also be clear about the existence of content, presentation and language so as to develop an attitude of challenge. Must be relevant according to the type according to the type of course learning outcomes. It must be contextual where the material emphasizes the relationship between the material and real-life conditions, especially where in the material page with words, pages with titles must be connected.

The linguistic aspect with a value of 93.01 categories is highly valid, because language is an important key and the main for making modules, because the language of students can and is able to interact with

each other and language is also a resource for the lecture process to be understood correctly. Language is also a vehicle for understanding each other's purpose for the module to be used. Strengthened must listen well so that communication runs smoothly.

The presentation aspect obtained a value of 94.87 categories is highly valid, because this aspect itself must be considered in the module, regarding 1. Systematic presentation, sequence of concepts, and continuity between chapters 2. Presentation of lectures which include student centering to stimulate metacognition, imagination and creative thinking, 3. The presentation consists of an introduction, a content section and a concluding part. The presentation is also interactive and participatory which motivates students to engage mentally and emotionally

The display aspect obtained a value of 93.73 categories is highly valid, this must be able to choose colors that are calm and not flashy because of the accuracy in determining the background so that it can be assessed properly. Color harmony also greatly affects creativity, color compatibility with images, neatness, imagination and cleanliness. The clarity of the image is very decisive and balanced followed by sufficient detail but not excessive, the lines must be clean and firm so that they can draw as a whole what is expected. Furthermore, it has to do with conformity with instruction or decryption and using appropriate techniques and in accordance with neatness and proportional form.

The average recapitulation of 4 aspects for student readability teaching module obtained a value of 93.73 categories is highly valid, if the material, language, presentation and appearance in the development of teaching modules are considered properly, then at the end of the process all in accordance with existing provisions specifically and generally. The results of interviews conducted with students that this module seen in terms of cover is interesting, the color is not monotonous and not too crowded, the content of the module is clear, because the material is not too long and uses language that is easy to understand so that it is easy to understand and can help in the learning process. This value indicates that students can accept the modules that have been created and the modules get a positive response from students. Based on validation tests and student responses, Modules can also be disseminated in a wider context so that students can use them to increase their insight and knowledge related to the material in the module. According to (Agnestia et al., 2021), for readability, which means that the teaching module is easy to read and understand in terms of pollution, plastic pollution and 3R material by biology students who are concerned with reducing and maintaining the environment so that it is not more polluted. This is in accordance with the basic assumptions of researchers regarding the readability of teaching modules that have met the criteria in making teaching modules.Furthermore, the results of research (B. P. Putra et al., 2022) on teaching moadul amengajar the material presented is more interesting, the presentation of material associated with the real world is able to encourage students to make connections between the knowledge they have and their application in everyday life. Using this teaching module, lecturers can make one of the practical learning media when learning. Supported by research (Wilujeng et al., 2020), the teaching module involves students fully in understanding, explaining from the material obtained so that the learning process is dominated by students in finding and conveying concepts and training to be able to be more independent, active, think creatively in the learning process.

4. CONCLUSION

The research results reveal several key findings regarding the effectiveness of the 3R-Based Teaching Module. The module's design supports the learning process by providing clear and well-organized content, promoting independent understanding, and presenting material in a comprehensive and accessible manner. The data demonstrate that the developed module is both valid and practical for biology students, with most aspects evaluated as highly valid. Feedback from respondents who have taken environmental studies courses further supports these findings, highlighting the module's role in enhancing their understanding of the subject matter.

However, the study has some limitations, including the need for broader testing to assess the module's effectiveness across different learning environments and student populations. Future research should focus on evaluating the module's impact on various educational settings, particularly through more extensive trials. Additionally, testing the module's applicability in other study programs with environmental science components would help to ensure its broader utility. This could pave the way for its use in a wider range of courses, particularly those addressing topics such as environmental pollution.

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REFERENCES

Agnestia, S., Kasrina, K., & Yani, A. P. (2021). Pocket Book Keanekaragaman Mangrove Di Kawasan Teluk Sepang Sebagai Media Belajar Taksonomi Tumbuhan. *Diklabio: Jurnal Pendidikan Dan Pembelajaran Biologi*, *5*(1), 121–127. https://doi.org/10.33369/diklabio.5.1.121-127

Angriani, A. D., Kusumayanti, A., & Nur, F. (2020). Pengembangan Media Pembelajaran MATHSC Berbasis Android Menggunakan App Inventor 2 Pada Materi Barisan dan Deret Aritmatika. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *4*, 926–938.

Demokratis, Sueb, & Amin, M. (2021). Pengembangan Modul Pengelolaan Sampah 5RC (Reduce, Reuse, Recycle, Replace, Repair, Composting) Berbasis Problem-Based Learning. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *6*, 35–42. http://journal.um.ac.id/index.php/jptpp/

Escario, J. J., Rodriguez-Sanchez, C., & Casaló, L. V. (2020). The Influence Of Environmental Attitudes And Perceived Effectiveness On Recycling, Reducing, And Reusing Packaging Materials In Spain. *Waste Management*, *113*, 251–260. https://doi.org/10.1016/j.wasman.2020.05.043

Faizzah, Q. N., Wilujeng, B. Y., Maspiyah, & Pritasari, O. K. (2023). Pengembangan Media Pembelajaran Berbasis Video Tutorial Menggunakan Aplikasi Adobe Premiere Pada Materi Pelurusan Rambut di SMK Negeri 6 Surabaya. *Jurnal Tata Rias*, *12*, 349–355.

Firmansah. (2021). Pengembangan Media Pembelajaran Biologi Melalui Pemanfaatan Barang Bekas di SMA Negeri 1 Madapangga. *Jurnal PIPA: Pendidikan Ilmu Pengetahuan Alam*, *02*(01), 7–12. https://doi.org/10.36312

Harahap, S. A., Laila, Hardiansyah, F., Yulianti, Rambe, S. A., Rahmayanti, D., Konaidi, H., Sudiadharma, Fitria, U., Heriansyah, Mendoza, W. D., & Haryanto, P. P. P. (2022). *BELAJAR DAN PEMBELAJARAN* (S. N. I. Trisnawati, Ed.; Pertama). Tahta Media Group.

Haristah, H., Azka, A., Setyawati, R. D., & Albab, I. U. (2019). Pengembangan Modul Pembelajaran. *Imajiner: Jurnal Matematika Dan Pendidikan Matematika*, *1*(5), 224–236.

Jannah, F., & Fathuddi, T. I. (2023). Penerapan Modul Ajar Berbasis Kurikulum Merdeka II UPT SD Negeri 323 Gresik. *SOKO GURU: Jurnal Ilmu Pendidikan*, *3*(1), 131–143. https://doi.org/10.55606/sokoguru.v3i1.2099

Juliandi. (2023). Model Pengelolaan Sampah Berbasis Sumber Dengan Sistem Reduce-Reuse-Recycle (3R) di TPS 3R Desa Baktiseraga. *Jurnal Pendidikan Geografi Undiksha*, *10*(3), 301–307. https://doi.org/10.23887/jjpg.v10i3.50529

Junaidi, & Utama, A. A. (2023). Analisis Pengelolaan Sampah Dengan Prinsip 3R (Reduce, Reuse, Recycle) (Studi Kasus di Desa Mamak Kabupaten Sumbawa). *Jurnal Ilmu Sosial Dan Pendidikan (JISIP)*, *7*(1), 2598–9944. https://doi.org/10.58258/jisip.v7i1.4509/http

Khoirunnisa, F., & Kadarohman, A. (2022). Dilema Penggunaan Plastik: Kebutuhan dan Keberlanjutan Lingkungan (Tinjauan Aspek Etika dalam Perspektif Aksiologi). *Jurnal Filsafat Indonesia*, *5*.

Logan, R. M., Worsham, J. W., & Johnson, C. E. (2021). Development Of An E-Learning Module To Facilitate Student Learning And Outcomes. *Teaching and Learning in Nursing*, *16*, 139–142.

Marsolina, N., & Anggreini, E. (2022). *Development of Science Module for 3R Based Waste Management Materials (Reduce, Reuse, and Recycle) Towards Zero Waste* (Vol. 11, Issue 1).

Maulida, U. (2022). Pengembangan Modul Ajar Berbasis Kurikulum Merdeka. *Tarbawi : Jurnal Pemikiran Dan Pendidikan Islam*, *5*(2), 130–138. https://stai-binamadani.e-journal.id/Tarbawi

Mohammed, M., Shafiq, N., Elmansoury, A., Al-Mekhlafi, A. B. A., Rached, E. F., Zawawi, N. A., Haruna, A., Rafindadi, A. D., & Ibrahim, M. B. (2021). Modeling Of 3R (Reduce, Reuse And Recycle) For Sustainable Construction Waste Reduction: A Partial Least Squares Structural Equation Modeling (PLS-SEM). *Sustainability (Switzerland)*, *13*(19). https://doi.org/10.3390/su131910660

Mubarak, S., Ansharullah, & Dewi, H. I. (2021). Pengembangan Modul Pembelajaran Tematik Melalui Problem Based Learning. *Jurnal Instruksional*, *3*, 57–65.

Nisa, E. M., Bahar, A., Purwidiani, N., & Romadhoni, I. F. (2022). Pengembangan Media Pembelajaran Interaktif Berbasis Web Pada Kompetensi Dasar Personal Hygiene di SMK Negeri 2 Ponorogo. *JURNAL TATA BOGA*, *11*(2), 89–97. https://ejournal.unesa.ac.id/index.php/jurnal-tata-boga/

Noviola, C. (2020). *Keanekaragaman Hayati Buah Lokal di Kabupaten Indragiri Hilir Provinsi Riau Sebagai Modul Bahan Ajar Biologi Kelas X SMA Skripsi*.

Peraturan Menteri Negara Lingkungan Hidup Republik Indonesia Nomor 13 Tahun 2012 Tentang Pedoman Pelaksanaan Reduce, Reuse, Dan Recycle Melalui Bank Sampah. (2012).

Putra, B. P., Purwanto, A., & Risdianto, E. (2022). Respon Peserta Didik Terhadap Keterbacaan E-Modul Berbasis SSCS (Search, Solve, Create, Share)Untuk Melatihkan Kemampuan Berpikir Kreatif Peserta Didik Pada Materi Gelombang di SMA. *Amplitudo : Jurnal Ilmu Pembelajaran Fisika*, *2*, 75–82.

Putra, P. D. P. P., Priantini, D. A. M. O., & Winaya, M. A. W. (2021). Pengembangan Video Animasi Pembelajaran Interaktif Berbasis Tri Hita Karana Untuk Meningkatkan Hasil Belajar Siswa SD. *Jurnal Ilmiah Pendidikan Citra Bakti*, *8*(2), 325–338. https://doi.org/10.38048/jipcb.v8i2.344

Rafi'y, M., Normalita De Lima, C., Siti, W. O., Day, H., Welerubun, P., & Merauke, U. M. (2022). Pengembangan Modul Pembelajaran Terpadu Untuk Mahasiswa PG-PAUD Universitas Musamus. *Jurnal Pendiidkan Indonesia:Teori, Penelitian Dan Inovasi*, *2*(6), 218–228.

Rahmayanti, M. N. (2023). Pengembangan E-Modul Pembelajaran Berbasis Flipbook Pada Kompetensi Dasar Menerapkan Teknik Kerja Aseptis Di SMKN 1 Kuningan. *Jurnal Pendidikan*, *14*(1). https://jp.ejournal.unri.ac.id/index.php/JP/index

Ramadhani, N., & Fitri, R. (2022). Pengembangan Media Pembelajaran E- Learning Berbasis Edmodo pada Mata Pelajaran Biologi. *Spizaetus: Jurnal Biologi Dan Pendidikan Biologi*, *3*(3), 56. https://doi.org/10.55241/spibio.v3i3.71

Ratri, I. S., Meidiana, C., Eka, K., Jurusan, S., Wilayah, P., & Kota, D. (2022). Peran TPST Dan TPS 3R Dalam Mereduksi Sampah Di Kota Batu. *Planning for Urban Regionand Environment Journal (PURE)*, *11*(1), 121–132.

Sariyah, W. P. L. M. S. (2023). *Waste Recycling Education As An Effort To Prevent Environmental Pollution Caused By Plastic Waste At Sdi Wolotopo*. *1*(2), 104–113. https://doi.org/10.54066/jkb-itb.v1i2.655

Sidiq, R., & Najuah. (2020). Pengembangan E-Modul Interaktif Berbasis Android pada Mata Kuliah Strategi Belajar Mengajar. *Jurnal Pendidikan Sejarah*, *9*(1), 1–14. https://doi.org/10.21009/jps.091.01

Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D* (A. Nuryanto, Ed.; 3rd ed.). Alphabet.

Taufan, A., Astutik, S., Muhammad Asyroful Mujib, Elan Artono Nurdin, & Bejo Apriyanto. (2023). Pengembangan E-Modul Interaktif Berbasis Aplikasi Canva Pada Materi Pengelolaan Sumber

Daya Alam Indonesia Siswa SMA. *Jurnal Pendidikan Geografi Undiksha*, *11*(2), 133–143. https://doi.org/10.23887/jjpg.v11i2.61947

Wanabuliandari, S., Ristiyani, R., & Kurniasih, N. (2021). E-Modul Matematika Berbasis Santun Berbahasa Bagi Siswa Slow Learner. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(2), 1260. https://doi.org/10.24127/ajpm.v10i2.3574

Wilujeng, I., Suci, T., & Putri, Y. (2020). Development of SETS E-Module Integrated with POE Model for Science Learning. *Journal of Educational Science and Technology*, *6*, 252–264. https://doi.org/10.26858/est.v1i1.144735