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Validity of Environmental Education E-Module Based on Education for Sustainable Development Using Flipcreator Platform to Develop Environmental Awareness in Geography Education Students at Khairun University

Rusman Rasyid[a,*], Andi Tenri Pada Agustang[a], Vrita Tri Aryuni[a], Rosmini Maru[b], Ita Mufiana[a], & Handri Soamole[a]

[a]*Department of Geography Education, Faculty of Teacher Training and Education, Universitas Khairun, Ternate, Indonesia*
[b]*Department of Geography, Faculty of Mathematics and Natural Sciences, Universitas Negeri Makassar, Makassar, Indonesia*

Abstract

This research aims to analyze the validity of the environmental education e-module based on Education for Sustainable Development (ESD) to foster environmental awareness of Educational Geography students at Khairun University. The research method used was Research and Development (R&D) with the ADDIE development model. This research was conducted only at three stages of the five stages of the ADDIE model, namely analyze, design and development, while the implementation and evaluation stages were not carried out because this research and development was only limited to the development stage which was focused on the validity test process. The data analysis techniques used in this research were qualitative descriptive and quantitative descriptive analysis techniques. Qualitative descriptive analysis was used to process data reviews from material/content experts and media and design experts which were used to revise the development product. While quantitative descriptive analysis was used to process the data obtained through validation sheets. The results of this research showed that the validity value of the material/content expert validator and media and design experts on the environmental education e-module based on Education for Sustainable Development (ESD) that was developed had very valid, therefore it is suitable to use in the learning process. This can be seen from the validity of the e-module material/content feasibility reaching a score of 91.25% and the validity of the media and design feasibility reaching a score of 90.38%. In addition, the e-module is also packaged using the Flipcreator Platform which displays text, images, animations, and videos so that it is interesting to learn and easy for students to use anytime and anywhere independently in order to foster an attitude of caring for the environment.

Keywords: e-module; environmental education; education for sustainable development; environmental care

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1. Introduction

Environmental problems have become a global issue that must be overcome immediately because environmental problems will directly affect to the quality of human life (Rasyid, Agustang, & Aryuni, 2021). Even environmental problems such as air pollution will be the leading cause of death in 2050 (OECD, 2012). Environmental problems certainly do not just appear out of nowhere, however the effects of various human activities (Khoiriyah & Ristianti, 2011). Where the human activities are in the form of illegal logging and the use of natural resources excessively without sustainable conservation as a result of the lack of human knowledge and concern for the environment (Simarmata, Daulae, & Raihana, 2018). Regarding to this issue, environmental awareness influenced by environmental knowledge is important to be instilled from an early age through education (Rasyid, Agustang, Aryuni & Robo, 2023; Tanaya & Rastini, 2016). This is because of education is considered for internalization and transformation of beliefs, values, knowledge, and skills (Azhar, Basyir, & Alfitri, 2015).

* Corresponding author.
E-mail address: rusman_rasyid68@unkhair.ac.id

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As an educational institution, the Geography Education Study Program at Khairun University also strives to give environmental knowledge and foster students' environmental awareness by implementing compulsory courses that discuss the environment, both monolithically such as environmental education (PLH) and Environmental Impact Analysis (Amdal) or integrated into other courses such as Basic Natural Sciences (IAD), Ecology, and others (Rasyid, Agustang, Aryuni & Robo, 2023). A preliminary study conducted on students who had taken the PLH course shows that there were still 19 people or 25% of 73 respondents who still have low environmental knowledge. There were even students who like to litter and even tend to be indifferent to the arrangement and cleanliness of the campus environment (Rasyid, Agustang, Aryuni & Robo, 2023). In fact, environmental knowledge is a very important domain for the formation of an attitude of caring for the environment (Aminrad, Zakariya, Hadi, & Sakari, 2013). Furthermore, the preliminary study also found that lecturers only provide environmental learning in a theoretical context in the classroom using power points which are considered less effective, and the teaching materials available are only limited to books, the number of which is still limited.

Based the problem, it is necessary to develop teaching materials to motivate students to understand and care about the environment in the form of electronic modules (e-modules) based on Education for Sustainable Development (ESD), which is an approach to teaching based on the principle of sustainability in providing quality education and improving human development (KNIU, 2014). Moreover, if the module is packaged in contemporary digital media using the Flipcreator Platform which displays text, images, animations, and videos so that it is interesting to learn (Laili, Ganefri, & Usmeldi, 2019). The reason for choosing this ESD-based e-module because it is easy for students to use anytime and anywhere independently with the help of smartphones that they generally have (Kustini, Syutaridho, & Zahra, 2022).. In addition, it is also supported by several studies showing that ESD-based e-modules can be used to foster an attitude of caring for the environment (Kusumawati, Aristiyanto, & Muflikhah, 2023; Marlina, Hardigaluh, & Yokhebed, 2015).

2. Method

This research used research and development (R&D) to develop and validate certain products (Sugiyono, 2011). Where the product developed was an environmental education e-module based on Education for Sustainable Development (ESD) which is valid to foster environmental awareness among Geography Education students at Khairun University. The research design used the ADDIE model because it has product development stages that are coherent, rational, complete and simple and easy to implement (Kuncahyono, 2018; Purnamasari, 2019; Khairani & Titisari, 2022; Pratiwi, Dantes, & Divayana, 2021; Pribadi, 2011). The ADDIE model consists of 5 stages, namely Analyze, Design, Development, Implementation, and Evaluation. This research is only limited to the Development stage which focuses on the validation test of e-module based on the assessment of the material/content expert validator and the media and design expert validator, therefore it does not reach the trial stage to measure the practicality and evaluate the effectiveness of the e-module developed.

The procedure of this research carried out by analyzing the needs of the e-module developed by considering student characteristics, learning objectives, identifying learning content/materials, identifying the learning environment and delivery strategies in learning. At the design stage, the design of the e-module to be developed was carried out which included the design of e-module components, design of e-module materials/contents, and design of e-module displays. Furthermore, at the development stage, it was carried out by developing a draft of an environmental education e-module based on Education for Sustainable Development (ESD) as designed at the design stage and then continued by validating and revising the developed e-module based on suggestions from material/content expert validators and media and design validators.

The data analysis techniques used in this study were qualitative descriptive and quantitative descriptive analysis techniques. Qualitative descriptive analysis was used to process data reviews from material/content experts and media and design experts which were used to revise the development product. While quantitative descriptive analysis was used to process the data obtained through validation sheets by validators using a Likert scale, namely a score of 4 (very good), a score of 3 (good), a score of 2 (not good), and a score of 1 (very bad). Furthermore, based on the instruments that have been filled in, the presentation is sought using a formula.

$$Percentage\ (\%) = \frac{\text{Total score obtained}}{\text{Total score maximum}} x\ 100\ \%$$

In order to interpret the validity and practicality values, the validity and practicality classification used with the conversion of value acquisition (Marthalena, Kartini, & Maemunah, 2021). The value conversion is as follows:

Table 1. E-Module Validity Assessment category

No	Score	Validity category
1	85.01% - 100%	Very Valid
2	70.01% - 85.00%	Valid
3	50.01% - 70.00%	Less Valid
4	1.00% - 50.00%	Invalid

3. Result

This development research has produced a product in the form of an electronic module (e-module) for environmental education based on Education for Sustainable Development (ESD) using the Flipcreator Platform to foster an environmental awareness attitude among Geography Education students at Khairun University which was developed using the ADDIE development model through the following stages:

3.1. Analysis Stage

Analysis is the first stage of the ADDIE development model, where in this stage a needs analysis is carried out on the e-module to be developed by paying attention to student characteristics, learning objectives, identifying learning content/materials, identifying the learning environment and delivery strategies in learning. Based on a preliminary study of students who had taken the Environmental Education (PLH) course, it shows that there were still 19 people or 25% of 73 respondents who still have low environmental knowledge. There were also students who like to litter and even tend to be indifferent to the arrangement and cleanliness of the campus environment, in addition, the preliminary study also found that the teaching materials available in the Geography Education study program at Khairun University are still very limited, and lecturers only provide environmental learning only in the context of theory using power points which are considered less effective. Therefore, based on the preliminary study, it is necessary to develop an e-module that is easy for students to use anytime and anywhere independently with the help of smartphones that they generally have. Where the developed e-module is based on Education for Sustainable Development (ESD) which is packaged in contemporary digital media using the Flipcreator Platform which displays text, images, animations, and videos so that it is interesting to learn and is expected to be able to foster students' environmental awareness.

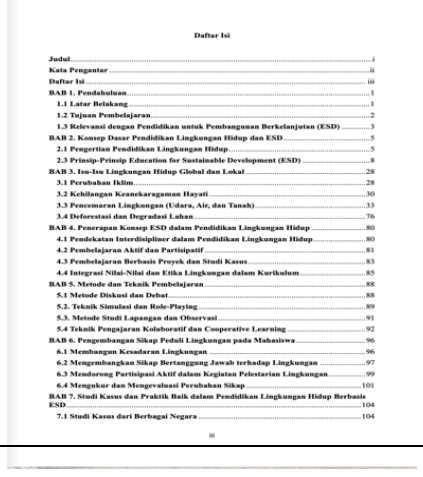
3.2. Design Stage

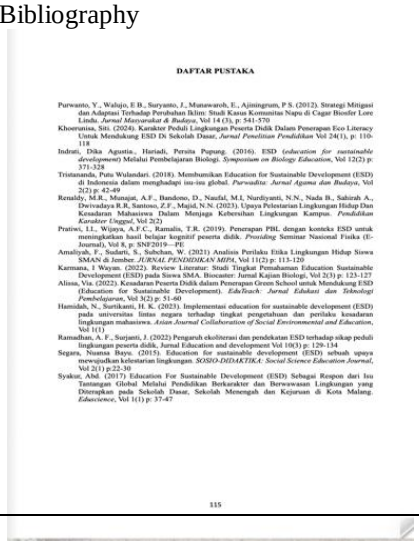
After the analysis stage was conducted, the design stage or planning for the e-module product is carried out by considering the following stages:

3.2.1 E-Module Component Design

In designing the environmental education e-module product, there are several components that have been included in the environmental education e-module, the design of E-module can be seen on Table 2.

Table 2. Environmental Education E-Module Storyboard

No	Board	Information
1.	Cover	E-module cover contains the Khairun University logo, e-module title, author's name and several images related to the e-module title.
2.	Foreword **Kata Pengantar** Puji syukur Penyusun panjatkan kehadirat Allah SWT, atas berkat Rahmat dan Hidayah-Nya, sehingga penyusunan E-Modul yang berjudul Pendidikan Lingkungan Hidup Berbasis ESD ini dapat terselesaikan dengan baik. Modul Elektronik (E-Modul) ini disusun sebagai acuan dalam memudahkan mahasiswa pendidikan Geografi melaksanakan pembelajaran mandiri. E-Modul ini berisikan tentang (1) Konsep Dasar Pendidikan Lingkungan Hidup dan ESD, (2) Isu-Isu Lingkungan Hidup Global dan Lokal, (3) Penerapan Konsep ESD dalam Pendidikan Lingkungan Hidup, (4) Metode dan Teknik Pembelajaran, (5) Pengembangan Sikap Peduli Lingkungan Pada Mahasiswa, dan (6) Studi Kasus dan Praktik Baik dalam Pendidikan Lingkungan Hidup berbasis ESD. E-Modul ini juga dilengkapi dengan contoh konkret dan interaktif, meliputi tombol-tombol aktif yang berfungsi dengan baik, serta gambar animasi dan video untuk membantu pemahaman mahasiswa terhadap setiap topik bahasan. E-Modul ini merupakan produk hasil riset pengembangan dengan pendekatan ADDIE (*Analyze, Design, Development, Implementation, dan Evaluated*) yang telah divalidasi dan dinyatakan layak untuk digunakan dalam pembelajaran. Penyusun sadari bahwa E-Modul ini masih terdapat banyak kekurangan, baik dari segi tulisan, pokok-pokok materi, maupun contoh konkretnya. Untuk itu saran dan kritik yang konstruktif, sangat kami harapkan guna menyempurnakan E-Modul ini. Akhirnya, selamat membaca dan semoga modul elektronik (E-Modul) ini dapat bermanfaat bagi kita semua, Amin. Ternate, Juni 2024 Penyusun ii	Foreword contains expressions of gratitude for the preparation of the e-module, the outline of the e-module contents, and hopes regarding criticism and suggestions from readers.
3.	Table of content  **Daftar Isi** **Judul** ..... i **Kata Pengantar** ..... ii **Daftar Isi** ..... iii **BAB 1. Pendahuluan** ..... 1 **1.1 Latar Belakang** ..... 1 **1.2 Tujuan Pembelajaran** ..... 2 **1.3 Relevansi dengan Pendidikan untuk Pembangunan Berkelanjutan (ESD)** ..... 3 **BAB 2. Konsep Dasar Pendidikan Lingkungan Hidup dan ESD** ..... 5 **2.1 Pengertian Pendidikan Lingkungan Hidup** ..... 5 **2.3 Prinsip-Prinsip Education for Sustainable Development (ESD)** ..... 8 **BAB 3. Isu-Isu Lingkungan Hidup Global dan Lokal** ..... 28 **3.1 Perubahan Iklim** ..... 28 **3.2 Kehilangan Keanekaragaman Hayati** ..... 30 **3.3 Pencemaran Lingkungan (Udara, Air, dan Tanah)** ..... 33 **3.4 Deforestasi dan Degradasi Lahan** ..... 76 **BAB 4. Penerapan Konsep ESD dalam Pendidikan Lingkungan Hidup** ..... 80 **4.1 Pendekatan Interdisipliner dalam Pendidikan Lingkungan Hidup** ..... 80 **4.2 Pembelajaran Aktif dan Partisipatif** ..... 81 **4.3 Pembelajaran Berbasis Proyek dan Studi Kasus** ..... 83 **4.4 Integrasi Nilai-Nilai dan Etika Lingkungan dalam Kurikulum** ..... 85 **BAB 5. Metode dan Teknik Pembelajaran** ..... 88 **5.1 Metode Diskusi dan Debat** ..... 88 **5.2. Teknik Simulasi dan Role-Playing** ..... 89 **5.3. Metode Studi Lapangan dan Observasi** ..... 91 **5.4 Teknik Pengajaran Kolaboratif dan Cooperative Learning** ..... 92 **BAB 6. Pengembangan Sikap Peduli Lingkungan pada Mahasiswa** ..... 96 **6.1 Membangun Kesadaran Lingkungan** ..... 96 **6.2 Mengembangkan Sikap Bertanggung Jawab terhadap Lingkungan** ..... 97 **6.3 Mendorong Partisipasi Aktif dalam Kegiatan Pelestarian Lingkungan** ..... 99 **6.4 Mengukur dan Mengevaluasi Perubahan Sikap** ..... 101 **BAB 7. Studi Kasus dan Praktik Baik dalam Pendidikan Lingkungan Hidup Berbasis ESD** ..... 104 **7.1 Studi Kasus dari Berbagai Negara** ..... 104 iii	The table of contents contains the title of the material and the page number. The table of contents can make it easier for readers to find the material to be studied without having to open each e-module page one by one.

No	Board	Information
4.	Learning materials	The learning material contains a description of the material that will be studied in the e-module.
5.	Evaluation	The evaluation contains interactive practice questions given to the reader at the end of each learning material. In addition, the evaluation display also provides instructions for completing the questions and passing criteria. After answering the questions, the final score will be displayed automatically. These practice questions are used to measure the reader's understanding of the material that has been studied.
6.	Bibliography 	The Bibliography contains all reading sources that are used as references in writing the designed e-module. The reading sources that are used as references can come from books, journals, proceedings, websites, theses, or dissertations.

3.2.2 E-Module Material/Content Design

In this research, the developed material was environmental education based on Education for Sustainable Development (ESD) which aimed to foster students' environmental awareness. The scope of the material/content of the designed e-module includes the basic concepts of environmental education and ESD, global and local environmental issues, the application of the ESD concept in environmental education, learning methods and techniques, and the development of students' environmental awareness. In designing the material/content of the e-module, several reading sources are used as references such as books, journals and proceedings.

3.2.3 E-Module Display Design

After finishing the e-module component and material/content, the e-module display was designed to attract students' interest in learning environmental education. The e-module display design includes the selection of colors and background covers and e-module materials/contents, the selection and layout of interactive images and videos, as well as the type of font, size and spacing used. The e-module design will be presented using the Flipcreator Platform.

3.3. Developing stage

After the design or planning stage is carried out, the activity was continued at the development stage. At this stage, it is conducted by developing a draft of an environmental education e-module based on Education for Sustainable Development (ESD) as designed at the design stage and continued by validating the developed e-module. The development stage was carried out through several activities, including the following.

3.3.1 E-Module Product Validation

In the validation stage of the e-module product, the feasibility of the e-module product was assessed by involving two material experts and two media and design experts. The results of the validation test on the material/content of the environmental education e-module based on Education for Sustainable Development (ESD) can be seen in the Table 3.

Table 3. The results of Content/Material Expert Validation

Aspect		Indicator	Validator		Score		Score (%)	Category
			1	2	Σ	Maks		
Understanding ESD	a	Compliance of materials with ESD concepts and principles	4	4	8	8	100	Very Valid
	b	Clarity of ESD-related material	4	4	8	8	100	Very Valid
	c	Relevance of the material to contemporary ESD issues	3	3	6	8	75	Valid
	d	The material of e-module is in accordance with the lesson plan (RPS)	4	4	8	8	100	Very Valid
Increasing Environmental Awareness	a	the role of e-modules in increasing student awareness of environmental issues	3	3	6	8	75	Valid
	b	Relevance of examples used in building students' environmental awareness	4	3	7	8	87,5	very Valid
	c	The effectiveness of materials in increasing students' environmental awareness attitudes	3	3	6	8	75	Valid
Language used	a	The language used in the e-module is not ambiguous	4	4	8	8	100	Very Valid
	b	The spelling of the language used in the e-module is in accordance with standard Indonesian language rules	4	4	8	8	100	Very Valid
	c	The language used is easy to understand	4	4	8	8	100	Very Valid
Total			**37**	**36**	**73**	**80**	**91,25**	Very Valid

Table 3 show the validation of the feasibility of the material/content of the environmental education e-module based on Education for Sustainable Development (ESD) which includes aspects of understanding ESD, increasing environmental awareness, and language used presented in 10 indicators found that in the aspect of understanding ESD (4 indicators) all indicators are in the very valid category, in the aspect of increasing environmental awareness (3 indicators) 2 indicators are in the valid category and 1 indicator is in the very valid category, it is the indicator of the relevance of examples used in building students' environmental awareness, in the aspect of language used (3 indicators) all indicators are in the very valid category. This shows that all the validity of material/content of the environmental education e-module based on Education for Sustainable Development (ESD) reaches a score of 91.25% with very valid criteria, thus, it is feasible and valid to use.

Meanwhile, the results of the validation test by media and design experts on the environmental education e-module based on Education for Sustainable Development (ESD) can be seen in the Table 4.

Table 4. The result of Media and Design Expert Validation

Aspect		Indicator	Validator		Score		Score (%)	Category
			1	2	Σ	Maks		
Interactive	a	Interactive elements to support learning is running well	3	3	6	8	75	Valid
	b	Ease of use of interactive features	4	4	8	8	100	Very Valid
	c	Student involvement in interactive activities	3	4	7	8	87,5	Very Valid
	d	The relevance of the interactions provided, according to the learning objectives	3	3	6	8	75	Valid
Display Quality	a	The e-module display looks attractive	4	3	7	8	87,5	Very Valid
	b	The colors used are not contrasting	4	4	8	8	100	Very Valid
	c	The cover design is in accordance with the graphic elements	4	3	7	8	87,5	Valid
	d	The placement of the sentence structure is appropriate	4	4	8	8	100	Very Valid
	e	The page size is in accordance with the module writing standards	4	4	8	8	100	Very Valid
	f	The module systematics is in accordance with national standard standards	3	3	6	8	75	Valid
Language Used	a	The language used is not ambiguous	4	4	8	8	100	Very Valid
	b	The spelling of the language used in the e-module is in accordance with standard Indonesian language rules	4	3	7	8	87,5	Very Valid
	c	The language used is easy to understand	4	4	8	8	100	Very Valid
		Total	**48**	**46**	**94**	**104**	**90,38**	Very Valid

Table 4 shows the validation of the eligibility of media and design on the environmental education e-module based on Education for Sustainable Development (ESD) which includes the interactive aspect, display quality, and language usage presented in 13 indicators found that in the interactive aspect (4 indicators) 2 indicators are in the very valid category and 2 other indicators are in the valid category, in the display quality aspect (6 indicators) 5 indicators are in the very valid category and 1 indicator is in the valid category, it is the module systematic indicator is in accordance with national standard standards. In the language used aspect (3 indicators) all indicators are in the very valid category. This shows that overall the validity of the eligibility of media and design of the environmental education e-module

based on Education for Sustainable Development (ESD) reaches a score of 90.38% with very valid criteria, Therefore it is feasible and valid to use.

3.3.2 Revision of E-Module Product Validation Test Results

After conducting a validation test on the feasibility of the environmental education e-module based on Education for Sustainable Development (ESD), the next step was revising the e-module developed based on suggestions and input from material/content experts and media and design experts. The suggestions and input from material/content experts and media and design experts can be seen in the Table 5.

Table 5. Suggestions for Improvement from Validators of Material Experts and Media and Design Experts

Validator	Suggestion	The result of revising
Material Experts 1	1. It is necessary to add examples of cases or good practices in ESD-based PLH learning. 2. Add a summary of the material	1. Added examples and good practices in ESD-based PLH learning 2. A summary of the material has been added
Material Experts 2	1. Add references from the most recent journal sources. 2. It is necessary to compile systematic and structured instructions for using e-modules so that they are easy for users to understand.	1. Several references from the latest journals have been added. 2. Instructions for using the e-module have been compiled and added.
Media and Design Expert 1	1. There are still typos in the writing of words. 2. Reduce free space 3. Add supporting images and videos	1. The spelling of words in the e-module has been corrected. 2. The empty space on the e-module has been reduced. 3. Added images and videos
Media and Design Expert 2	1. Add some images and videos that can be accessed interactively 2. Correct the margins of both the paper margins and the writing column.	1. Interactive images and videos have been adde 2. The margins on the e-module have been fixed

Based on the suggestions and input contained in table 5 provided by the material/content expert validator and the media and design expert validator, the following improvements were made:

a) The Examples of cases or good practices in ESD-based PLH learning

In the validation stage, the material/content expert validator provided suggestions to add examples of cases or good practices in environmental education learning based on Education for Sustainable Development (ESD), where at the design stage it did not include this in the e-module. However, after suggestions and input from the material/content expert, additions were made to the e-module. This aims to enable students to gain insight from various countries about how environmental challenges can be overcome by implementing education based on Education for Sustainable Development (ESD). The results of the revision can be seen in the Figure 1.

b) Summary of the subject matter

In the design stage, the summary of the subject matter was not included so that the suggestions and input of the subject matter/content expert validator asked to add a summary of the material by shortening the text or informative material without sacrificing the substance or meaning of the information in order to help students get an overview of the subject matter without having to read it all. The results of the revision can be seen in the Figure 2.

Studi Kasus dan Praktik Baik dalam Pendidikan Lingkungan Hidup Berbasis ESD

BAB 7

7.1 Studi Kasus dari Berbagai Negara

Studi kasus dari berbagai negara memberikan wawasan tentang bagaimana berbagai bangsa menghadapi tantangan lingkungan dan mengimplementasikan Pendidikan untuk Pembangunan Berkelanjutan (ESD). Misalnya, di Jepang, pendidikan lingkungan hidup telah diintegrasikan secara komprehensif dalam kurikulum sekolah. Program "*Mottainai*" yang berarti "*jangan menyia-nyiakan*" mengajarkan anak-anak untuk menghargai sumber daya dan meminimalkan limbah. Program ini mencakup kegiatan praktis seperti daur ulang, penghematan energi, dan konservasi air.

Di Finlandia, pendidikan lingkungan hidup dimulai sejak dini di taman kanak-kanak dengan program yang mendorong anak-anak untuk berinteraksi dengan alam. Melalui pendekatan bermain di luar ruangan, anak-anak diajarkan tentang keanekaragaman hayati dan pentingnya menjaga lingkungan. Sekolah-sekolah di Finlandia juga menggunakan proyek berbasis lingkungan yang melibatkan siswa dalam penelitian dan tindakan nyata untuk pelestarian lingkungan.

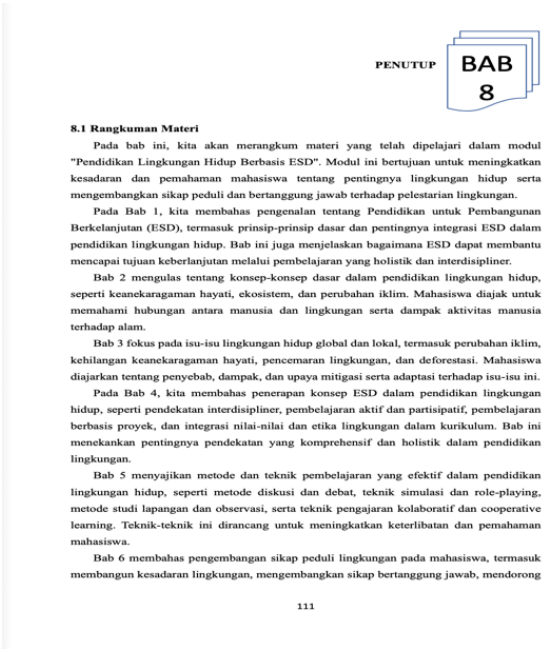
Selandia Baru memiliki pendekatan unik dengan menggabungkan nilai-nilai budaya Māori dalam pendidikan lingkungan. Konsep "*Kaitiakitanga*", yang berarti penjagaan atau pengelolaan, mengajarkan pentingnya hubungan manusia dengan alam. Sekolah-sekolah di Selandia Baru menerapkan *Kaitiakitanga* dalam kurikulum mereka, mendorong siswa untuk menjadi penjaga lingkungan dan mempraktikkan keberlanjutan.

Jerman terkenal dengan program pendidikan lingkungan yang kuat melalui "*Umweltbildung*". Negara ini memiliki pusat pendidikan lingkungan yang tersebar di seluruh negeri, menyediakan program pendidikan yang berfokus pada energi terbarukan, efisiensi energi, dan pengelolaan limbah. Program ini melibatkan siswa dalam proyek-proyek praktis seperti pemasangan panel surya dan sistem pengomposan.

Di Costa Rica, pendidikan lingkungan hidup sangat penting dalam menjaga keanekaragaman hayati yang kaya. Program pendidikan lingkungan di sekolah-sekolah

104

Figure 1. Addition of Case Examples and Good Practices



PENUTUP

BAB 8

8.1 Rangkuman Materi

Pada bab ini, kita akan merangkum materi yang telah dipelajari dalam modul "Pendidikan Lingkungan Hidup Berbasis ESD". Modul ini bertujuan untuk meningkatkan kesadaran dan pemahaman mahasiswa tentang pentingnya lingkungan hidup serta mengembangkan sikap peduli dan bertanggung jawab terhadap pelestarian lingkungan.

Pada Bab 1, kita membahas pengenalan tentang Pendidikan untuk Pembangunan Berkelanjutan (ESD), termasuk prinsip-prinsip dasar dan pentingnya integrasi ESD dalam pendidikan lingkungan hidup. Bab ini juga menjelaskan bagaimana ESD dapat membantu mencapai tujuan keberlanjutan melalui pembelajaran yang holistik dan interdisipliner.

Bab 2 mengulas tentang konsep-konsep dasar dalam pendidikan lingkungan hidup, seperti keanekaragaman hayati, ekosistem, dan perubahan iklim. Mahasiswa diajak untuk memahami hubungan antara manusia dan lingkungan serta dampak aktivitas manusia terhadap alam.

Bab 3 fokus pada isu-isu lingkungan hidup global dan lokal, termasuk perubahan iklim, kehilangan keanekaragaman hayati, pencemaran lingkungan, dan deforestasi. Mahasiswa diajarkan tentang penyebab, dampak, dan upaya mitigasi serta adaptasi terhadap isu-isu ini.

Pada Bab 4, kita membahas penerapan konsep ESD dalam pendidikan lingkungan hidup, seperti pendekatan interdisipliner, pembelajaran aktif dan partisipatif, pembelajaran berbasis proyek, dan integrasi nilai-nilai dan etika lingkungan dalam kurikulum. Bab ini menekankan pentingnya pendekatan yang komprehensif dan holistik dalam pendidikan lingkungan.

Bab 5 menyajikan metode dan teknik pembelajaran yang efektif dalam pendidikan lingkungan hidup, seperti metode diskusi dan debat, teknik simulasi dan role-playing, metode studi lapangan dan observasi, serta teknik pengajaran kolaboratif dan cooperative learning. Teknik-teknik ini dirancang untuk meningkatkan keterlibatan dan pemahaman mahasiswa.

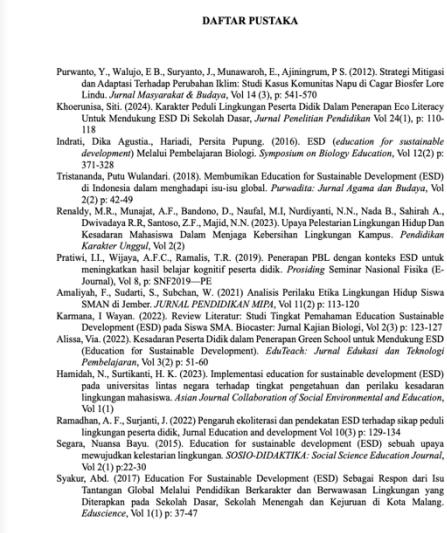
Bab 6 membahas pengembangan sikap peduli lingkungan pada mahasiswa, termasuk membangun kesadaran lingkungan, mengembangkan sikap bertanggung jawab, mendorong

111

Figure 2. Additional Summary of Material

c) Journal references

Journal references in e-modules play an important role in improving the quality of content and ensuring the validity of the information presented. This is the reason for expert material/content validators to add references from journals to the e-modules being developed considering that references from journals provide a strong scientific basis for the learning materials being compiled because they are based on findings or research that have been tested by experts in their fields. The addition of journal references can be seen in the following image:



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Gambar 3. Additional Journal References of E-Module

d) Guidance Instructions of e-module

Based on suggestions and input from expert validators of material/content, it is necessary to add instructions for using the e-module which were not included in the design stage. This is important to add considering that the instructions for using the e-module function as a tool that can ensure that students can use the e-module as effectively as possible to achieve learning objectives. The addition of instructions for using the e-module can be seen in the Figure 4.

Gambar 4. Additional Guidance instruction for E-Module

e) Additional supporting images and videos

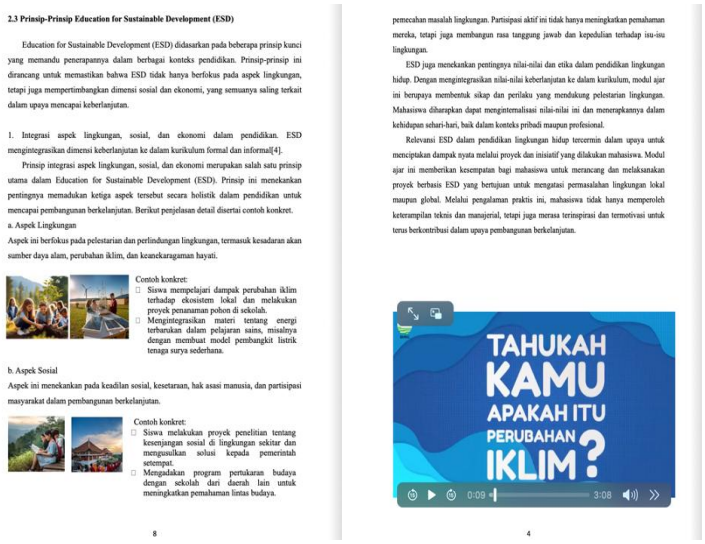
The validation activity suggested to add relevant images or videos with the aim of creating a more comprehensive, interactive, and effective learning experience. The material for images and videos can be seen in the Figure 5.

4. Discussions

4.1. E-Module Development Procedure

In the first stage, the researcher conducted a needs analysis of the e-module to be developed by considering student characteristics, learning objectives, identifying learning content/materials, identifying the learning environment and

delivery strategies in learning. The analysis stage was carried out to identify the problems faced and get the right solution offers for the problems raised (Sanjaya, 2008). After conducting a needs analysis, it was found that there were still 19 people or 25% of the 73 respondents who still had low environmental knowledge. There are some students who like littering and tend to be ignorance to the arrangement and cleanliness of the campus environment, in addition, preliminary studies also found that the teaching materials available in the Geography Education study program at Khairun University were still very limited, and lecturers only provide environmental learning only in the context of theory using power points which are considered less effective. One way to make students more interested in learning is to create modules in electronic form that can be used as interactive media because they can be inserted with other media such as images, animations, audio or video (Winata, Suharsono, & Agustini, 2015) Therefore, the developed E-module based on Education for Sustainable Development (ESD) which is packaged in contemporary digital media using the Flipcreator Platform which displays text, images, animations, and videos so that it is interesting to learn and is expected to be able to foster an attitude of caring for the environment among students.



Gambar 5. Additional Supporting Images and Videos

After conducting the analysis stage, the design or planning stage of the e-module product is carried out. In this stage, the researcher designs the E-Module components, material/content, display design, and instrument design. This is very important so that the module developed can attract students' interest so that they are more aware of the environment. As research states that e-modules are capable because they are designed in an attractive and simple way (Pradnyana, Agustini, & Santyasa, 2021) This is because students are more likely to see learning content that suits their tastes, level of understanding, and personal characteristics, so that the learning process is more efficient (Agustini & Ngarti, 2020).

After the design or planning stage conducted, the activity continued to the development stage. In this stage, it is carried out by developing a draft of an environmental education e-module based on Education for Sustainable Development (ESD) as designed at the design stage and then continued by validating the developed e-module. Module validation can be carried out by several experts according to their expertise, these experts include subject matter, language, and instructional method experts. At the validation stage of e-module product, it is carried out by assessing the feasibility of the e-module by involving material experts and media and design experts. This is done to test the content of the module that has been developed according to the needs of students so that they can learn independently and comfortably (Lastri, 2023) The data of validation shows that all the validity of the media and design of the environmental education e-module based on Education for Sustainable Development (ESD) has been in the very valid criteria, so it is feasible and valid for use.

4.2. E-Module Validation

Validation of e-module products is carried out by assessing the feasibility of e-module products by involving experts in subject matter, language, and instructional methods. In this research, there were two validations conducted, they are validation of material/content and media and design. The results of the validation test on the material/content of the environmental education e-module based on Education for Sustainable Development (ESD) overall reached a score of

91.25%. This shows that the validity of the material/content of the environmental education e-module based on Education for Sustainable Development (ESD) is in the very valid category, so it is feasible and valid to be used. Thus, students can achieve the set competencies and can gain a meaningful learning experience (Rahayu & Sudarmin, 2015).

Meanwhile, the results of the validation test from media and design experts on the environmental education e-module based on Education for Sustainable Development (ESD) for all indicators reached an average score of 90.38%. This shows that all the validity of the media and design of the environmental education e-module based on Education for Sustainable Development (ESD) is in the very valid category, so it is worthy of being used for. This is important considering that attractive designs can increase students' self-confidence, motivation, and learning outcomes (Istiqoma, Prihatmi, & Anjarwati, 2023)

5. Conclusion

Based on the results of the research and discussion, it can be concluded that the environmental education e-module based on Education for Sustainable Development (ESD) that was developed has a very valid category of validity results so that it is suitable for use in learning. In addition, the e-module is also packaged in digital media using the Flipcreator Platform which displays text, images, animations, and videos so that it is interesting to learn and easy for students to use anytime and anywhere independently in order to foster an attitude of caring for the environment.

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