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Validity of research-based e-module on conservation theme to environmental literacy attitude of junior high school students

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Abstract

Ujung Kulon National Park is a national park with a lot of biodiversity that is almost extinct, but it has still not been realized by many students. Students' understanding and concern for the flora and fauna found in the TNUK area can be trained through learning based on environmental literacy. This study aims to determine the validity level of research-based e-modules on conservation themes to train environmental literacy attitudes of junior high school students. The research method used is research and development Research and Development R & D) concerning Thiagarajan, then adapted to the capabilities and needs of researchers, it is limited to 3 stages: define, design, and develop. The instrument used is a validation instrument sheet, which three validators will carry out, each on material expert validation, media expert validation, and teaching materials expert. The validation results obtained on the material expert get a percentage value of 82.88% with the category "very valid", on the media expert get a percentage value of 90.91% with the category "very valid", and on the teaching materials expert get a percentage value of 91.55% with the category "very valid" so that from the results of the validation of the research-based e-module conservation theme can be used with some revisions.

Abstrak. *Taman Nasional Ujung Kulon merupakan salah satu taman nasional yang mempunyai banyak biodiversitas yang hampir punah akan tetapi hal tersebut masih belum disadari oleh banyak siswa. Padahal pemahaman dan kepedulian siswa terhadap flora dan fauna yang terdapat di kawasan TNUK bisa di latih melalui pembelajaran yang berbasis literasi lingkungan. Penelitian ini bertujuan untuk mengetahui tingkat validitas e-modul berbasis riset tema konservasi untuk melatih sikap literasi lingkungan siswa SMP. Metode penelitian yang digunakan merupakan penelitian dan pengembangan Research and Development R & D) dengan mengacu pada Thiagarajan, kemudian disesuaikan dengan kemampuan dan kebutuhan peneliti sehingga dibatasi pada 3 tahapan saja, yaitu: tahap define, design, dan develop. Instrumen yang digunakan yaitu lembar instrumen validasi yang akan dilakukan oleh 3 validator masing-masing pada validasi ahli materi, validasi ahli media dan ahli bahan ajar. Didapatkan hasil validasi pada ahli materi mendapatkan nilai persentase 82,88% dengan katagori "sangat valid", pada ahli media mendapatkan nilai persentase 90,91% dengan katagori "sangat valid" dan pada ahli bahan ajar mendapatkan nilai persentase 91,55% dengan katagori "sangat valid" sehingga dari hasil balidasi tersebut e-modul berbasis riset tema konservasi dapat digunakan dengan beberapa revisi.*

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A. Introduction

Ujung Kulon National Park is a conservation area in Banten Province that has a lot of biodiversity. The high biodiversity found in TNUK can be used as additional content for understanding students related to science learning so that it is contextual. Students' understanding and concern for the flora and fauna found in the TNUK area can be trained through environment-based learning. Environmental literacy is a person's ability to understand and interpret the conditions of the environment, and the results of this understanding can decide the proper steps in maintaining, restoring, and improving the condition of an environment (Kusumaningrum, 2018). The concept of environmental literacy is confirmed by the Environmental Education and Training Partnership (EETAP), which says straightforwardly that someone who is environmentally literate knows what he has to do for the environment (Nasution, 2016).

Environmental education must foster an understanding of life in the environment, the cause-and-effect relationship between human attitudes and behaviour toward the environment, and a person's conscious attitude to maintain the environment to maintain its balance. This conscious attitude is also defined as an attitude of sensitivity to the environment because it not only has knowledge of the environment but also has a responsive attitude and can provide solutions to environmental problems. Environmental literacy is needed from an early age to maintain biodiversity in TNUK. According to Prasetiyo (2017) there are four components in environmental literacy: knowledge about the environment, cognitive abilities, attitudes, and behaviour towards the environment.

One strategy that can foster students' environmental literacy is implementing science learning that is contextual and relevant to the environment in schools through research (Dianti & Sueb, 2022). Research in the form of careful investigation or search activities to obtain new facts in the branch of science is the right concept to be applied in learning (Anisa, 2017; Astuti, 2019). So, it is expected that the character formed in students will be the soul of a scientist who can solve environmental problems (Slameto, 2015).

Based on the results of the analysis on the textbooks used by three junior high schools in Pandeglang Regency, the material on environmental literacy is almost not found in the textbooks used by both teachers and students. The material contained in the textbooks, both teacher and student books, only discusses the primary materials in the field of science, especially in the subject matter of biology; the teaching materials contained in the textbooks, both teacher books and student books, have not linked environmental issues. In addition, the teaching materials developed by teachers have not integrated the concept of environmental literacy in each discussion of the material, causing students' environmental literacy skills to be still not achieved.

The next problem found based on the observation of three junior high schools in Pandeglang Regency is that the applied learning process targets the mastery of the material. It is still rare for learning outside the classroom or school to get to know the surrounding ecosystem related to the existence and problems of animals or plants. So, students are indifferent to environmental conditions and living things around them, such as stepping on small plants in their school gardens. So, the learning process has not been integrated into the environmental literacy component, which is knowledge about the environment, cognitive abilities, attitudes, and behaviour of students' concern for the environment.

Another problem found is that the teaching materials used by teachers in three junior high schools in Pandeglang Regency are still digital modules from the government. The modules used do not contain environmental literacy components. Then, the module's content is still a lot of material, so students tend to be less interested in reading it. Furthermore, teachers in the three junior high schools have not developed teaching materials based on environmental literacy as an alternative companion teaching material. Teaching materials are mostly only BSE books or summaries from science subject teachers, which contain only material and questions. In addition, the availability of technology to students cannot be supported by digital teaching materials for their daily learning. Therefore, students need to be facilitated in an independent learning process with an environmental literacy orientation in TNUK, namely as supporting teaching materials. One of the teaching materials that is by the demands of the independent learning curriculum also aims to answer the challenges of education in the era of the industrial revolution 4.0, which in its realization must support skills in critical thinking and problem solving, creative and innovative, and skilled in communicating and collaborating for participants, and innovative, as well as skilled in communicating and collaborating for students.

E-modules are non-print teaching materials that are packaged by including various features such as videos, images, text, self-assessment components that can contain indicators of learning independence, and environmental literacy components in teaching materials and e-modules themselves have the aim of being able to be studied independently because there are already instructions and steps for learning and interactive evaluation tools equipped with answer keys that can measure the extent of student understanding (Taufik et al., 2023). In addition, the components are more complex and structured, making it more communicative (two-way), so e-

modules are very facilitative with the independent curriculum whose learning is student-centred.

In this development research, a theme is raised, namely conservation. The theme contains research material that is contextual and relevant. This conservation theme also inserts teaching materials that can foster students' awareness of the surrounding environment and the existence of TNUK. Because the school's location is still in the Pandeglang area, it is hoped that students will know the importance of protecting the environment and caring about the survival of flora and fauna in TNUK. From the existence of this theme, a connected type of integrated model is used to prepare the material for the e-module to be developed. Connected is an integrated model that combines the concept of one basic competency (BC) and another BC to see problems not only in one field of study (Kristina et al., 2022).

Mardianti et al. (2020) is have conducted relevant research, that the ethnoscience-based science learning module on environmental pollution material can train the science literacy of seventh-grade students in junior high school. Furthermore, there is research from Amir et al. (2016) shows that the science enrichment teaching materials for junior high school/MTs based on research on the eating behaviour of long-tailed monkeys (*Macaca fascicularis*, Raffles) in the Rubber Forest developed according to validators are classified as valid and in research by Aziza (2022) which produced an electronic module based on environmental literacy on the material on the interaction of living things. Their environment is very valid and practical for junior high school students to use in learning.

B. Material and method

This learning media development research is based on Augmented Reality using the 4-D development model. The development stage of this model is divided into three, namely define, design, develop, and disseminate (Thiagarajan et al., 1974, modified by Triyani et al., 2022). However, the study is limited to the development stage of develop only because this research only focuses on the level of validation of Augmented Reality-based learning media developed. Subjects in measuring the level of validity in this study were three material expert validators, three media expert validators, and three teaching materials expert validators. The research time carried out was from June to July 2023.

The type of instrument used to determine the level of validation and efficiency of research-based e-modules is a questionnaire sheet. The questionnaire sheet used is a validation questionnaire sheet. The validation questionnaire sheet is used to assess the validity level of the product that a team of validation experts has validated. The level of validity of the research-based e-module will be measured based on the criteria for teaching materials modified from BNSP, including the dimensions of content feasibility, presentation feasibility, language, and graphics, which a team of experts will validate. The data summarised is divided into two forms, namely qualitative data and quantitative data.

This qualitative data is reached from the acquisition of assessments that have been carried out to determine the validity of the product development results. Evaluation of the level of validation with a questionnaire that uses a Likert scale with four scales to assess the validity of the results of the product developed. The description of the quantitative data assessment can be seen in Table 1. The validation questionnaire data given after that is calculated using Formula 1 by Purwanto (2014). Based on the percentage value obtained, it can then be categorised according to the criteria in Table 2.

The qualitative data analysis on the validation questionnaire sheet is seen from the input and suggestions given by material experts, media experts, and teaching materials experts. The analysis of input and suggestions will be connected and associated with the quantitative data analysis results, namely the validity criteria level through descriptive explanations. The description will be used as a reference for product development improvement of e-modules based on conservation theme research by researchers.

Table 1 Assessment score criteria

Score	Catagory
4	Very good
3	Good
2	Less good
1	Not good

(Source: Modified from Widyoko, 2012; Purnamasari, 2015)

$$NP = \frac{R}{SM} \times 100\% \text{.....Formula 1}$$

Information:
NP = Percentage value obtained
R = Score obtained
SM = Maximum score

Table 2 Percentage criteria for validity results

Percentage range (%)	Validity category
81,50 < x ≤ 100	Very valid
62,50 < x ≤ 81,25	Valid
43,75 < x ≤ 62,50	Less valid
25 < x ≤ 43,75	Not valid

(Source: Modified from Pratiwi et al., 2019)

C. Results and discussion

Product development of research-based e-modules that are integrated with aspects of environmental literacy and contain additional information from observations at TNUK. After the development of the research-based e-module is complete, the next stage

is to conduct a validity test using a validation questionnaire sheet by material experts, media experts, and teaching materials experts to detail the level of validity. Figure 1 is the cover and table of contents of the research-based e-module that has been developed. The results of the questionnaire sheet assessed by the validator were then calculated, and the results and percentages of all aspects and any input and suggestions submitted by the validator were used as a reference in improving the research-based e-module. The overall results of the experts' assessment are in Table 3.

Figure 1 E-module cover (A) and table of contents (B) (in Indonesian)

Table 3 Results of validation

No	Validators	Precentage	Category
1	Material expert	82,88%	Very Valid
2	Media expert	89,71%	Very Valid
3	Teaching materials expert	91,55%	Very Valid
Average		**88,04%**	**Very Valid**

Based on Table 3 regarding the results of validation that have been carried out by material experts, media experts, and teaching materials experts on research-based e-module teaching materials get different percentage values, the percentage value of the material expert is 82.88% in the "very valid" category, the percentage value of the media expert is 89.71%% with the category "very valid" and the percentage value of the teaching materials expert is 91.55% with a very "very valid" category. So, the overall value is obtained based on the percentage value of the experts of 88.04% with the category "very valid". with the results obtained from the experts, the research-based e-module teaching material on the theme of conservation has fulfilled the previously established validity category. Researchers need to make improvements as input and suggestions by experts are seen from various aspects of the e-module compiler, with details of the validity results from experts as follows.

Table 4 Results of material expert validation

No	Aspects	Percentage	Category
1	Content appropriateness	87,04%	Very Valid
2	Presentation	79,17%	Valid
3	Language	81,25%	Valid
4	Environmental Literacy	84,08%	Very Valid
Average		**82,88%**	**Very Valid**

Table 5 Validator feedback material expert

Validation	Suggestions and revisions
Material Expert	1) There need to be improvements that support the attitudinal and behavioral aspects of environmental literacy. 2) There needs to be additional information about the problem and about endemic animal data in the park to support the environmental literacy aspect. 3) The packaging of the questions and the types of questions chosen also need improvement because they are less interesting and integrate environmental literacy and research in them.

Table 6 Results of media expert validation

No	Aspects	Percentage	Category
1	Presentation	90,97%	Very Valid
2	Graphics	90,10%	Very Valid
3	Learning	91,67%	Very Valid
Average		**90,91%**	**Very Valid**

Table 7 Validator feedback media expert

Validation	Suggestions and revisions
Media Expert	1) In the writing section, the typing is still wrong. This must be improved because it can make students misperceive. 2) The questions presented in the competency test section must be packaged more interestingly and there needs to be an image number so that students can easily find images in research-based e-modules.

Table 8 Results of teaching materials expert validation

No	Aspects	Percentage	Category
1	Content appropriateness	90,28%	Very Valid
2	Language	88,89%	Very Valid
3	Graphics/appearance	93,06%	Very Valid
4	Learning	93,98%	Very Valid
Average		**91,55%**	**Very Valid**

Table 9 Validator feedback teaching materials expert

Validation	Suggestions and revisions
Teaching Materials Expert	1) There needs to be a classification of one-horned rhinos as TNUK icons. 2) Improvement of questions so that they are presented more interestingly 3) Addition of tasks to present images 4) The duration of the video should be faster. 5) The magnification of the image and the order of the arrangement of the indicators must be coherent.

Material expert validation

Validation by material experts intends to detail scores that emphasize the material's content on research-based e-modules, shown from several aspects of research-based e-modules. The overall validation result is 82.88% in the "very valid" category. The results obtained from calculating the percentage of material experts are available in Table 4 after the validation stage is continued with the improvement stage based on the material expert validator's improvement suggestions, which are explained in Table 5.

The assessment results on the content's feasibility aspect obtained a percentage value of 88% with the category "very valid". The evaluation is based on the scope of conformity with the core competency

(CC) and BC of the 2013 curriculum with the material presented with the conservation theme. This is in line with Prastowo (2019), who said that the BC must take the teaching materials in the curriculum. The e-module presents BC based on the 2013 Curriculum, which contains material on the achievement indicators that support students in understanding environmental literacy. The BC used in this conservation theme is Class VII BC 3.7 regarding ecosystems, BC 3.2 regarding the classification of living things, and BC 4.7 regarding observations of ecosystems so that the integrated BC can explain the conservation theme.

The assessment for the presentation aspect received 79.17% in the "valid" category sourced from presentation techniques, supporting presentation and presentation of learning both in the form of presentation of material, questions, and activities presented coherently. According to Asrial et al. (2020), the systematic arrangement of teaching materials can improve the quality of students' knowledge and make it easier for them to understand learning materials. This is in line with the presentation of e-modules in accordance with the deductive flow of thinking (general to specific) so that students learn with directed and targeted material.

The assessment for the presentation aspect received a percentage of 81.25% in the "valid" category derived from the use of straightforward language and the use of language by the students' level of education. In the language presented in the e-module, there are still some writing errors, so improvements are made so that students can easily understand the contents. According to Paramita et al. (2022), sentences in a media must be written in good and correct language, making it easier for students to understand the material and not causing multiple interpretations. The authors made improvements to facilitate and prevent students from experiencing difficulties in understanding the e-module.

The assessment for environmental literacy aspects received 84.08% in the "very valid" category sourced from environmental knowledge, cognition, attitudes, and behaviour. Additional information on TNUK observation results in the form of the latest number of one-horned rhinos can help students understand conservation areas in e-modules. Using material on this conservation theme requires many examples so that the delivery of ecosystem material and classification of living things can be adequately conveyed; additional images of flora and fauna directly from the TNUK environment, such as langkap plants in the Cidaon area, are needed in line with Khusniati (2014); Alfiyah et al. (2017) who said that a lesson obtained from the environment makes students care more about the environment and love nature around them.

In addition, the presentation of observation results from TNUK in the form of pictures of conservation activities in the form of inventory and the latest information on the state of TNUK can help train students related to environmental knowledge, cognition, attitudes, and behaviour of students in environmental literacy.

The research-based e-module can help students apply environmental literacy in everyday life. The e-module presents a project related to the problem of animal exploitation that can make students aware of the act of exploitation. Science learning using e-modules integrated with environmental literacy makes it easier for students to understand science material. It can encourage students' attitudes to better protect and improve the environment around them (Setyowati et al., 2013).

Media Expert Validation

Validation by media experts aims to assess the product's appearance based on several aspects of research-based e-module teaching materials. The results of media expert validation get an overall percentage score of 89.71% in the "very valid" category. The acquisition of percentage scores given by media experts is included in Table 6. The following stages of improvement based on the suggestions of media expert validators are described in Table 7.

The assessment for the presentation aspect obtained a percentage value of 90.44% in the "very valid" category derived from evaluating the cover design and the design of the e-module content that makes students interested in studying the e-module. The layout composition component (title, illustration, author, logo, and book size) of the cover and content of the e-module are in harmony. This shows that the layout of the cover and content of the e-module is balanced between the size, design of illustrations, author's title, conservation activities, and the university logo used with the size of the book. In line with the narrative of Harackiewicz et al. (2016), an attractive appearance is expected to provide a learning experience that is more motivating for students to be actively involved in the learning process.

In the following graphic aspect assessment, the percentage value of 90.10% in the "very valid" category comes from the opening display, core display, closing display, and typography. The opening appearance presents a preface, table of contents, and instructions for use in the e-module. In addition, the appearance of the content, which includes the presentation of excellent and explicit material, icons that connect to videos, games, articles, and the latest TNUK news, is presented as needed in the e-module. Competency tests and research activities are presented interactively by utilizing word walls. In the closing view, a summary, glossary, and table of contents are offered, as well as a brief bio of the author as complementary information in the e-module.

The assessment for the learning aspect obtained a percentage value of 91.67% in the "very valid" category sourced from media flexibility. Namely, the future of images, videos, and games in the e-module is easily accessible. In research-based e-modules, pictures and descriptions of each material in the lesson are presented. Videos are displayed with captions and explained with additional illustrations to be more easily seen by readers when looking for videos on a page in the e-module. Winatha (2018) said that the most appropriate effort so that students can quickly apply these skills is with videos because videos can illustrate a process precisely and can be played repeatedly. The use of videos effectively focuses student attention because it presents visuals and audio as a whole without breaking student concentration. In the learning aspect, input from the validator is needed to consider the duration of time the video is displayed within the existing class hours at school so that learning can be carried out correctly.

Teaching Materials Expert Validation

The purpose of teaching materials expert validation is to find out the assessment and opinions regarding the content of the material, language, graphics or appearance, and learning presented in the research-based e-module. The teaching materials expert assessment results obtained a percentage value of 91.55% in the "very valid" category derived from the average of 4 aspects assessed, as shown in Table 8. At the product revision stage, suggestions for improvement are made, and input is obtained from teaching materials experts. The explanation of the suggestions and revisions can be seen in Table 9.

The results of the assessment for the feasibility aspect of the content by educators emphasize answering the needs that have been carried out at the needs analysis stage related to the role of science learning oriented to the material presented according to CC, BC, and learning indicators, material structure and material evaluation obtained a score of 90.28% with the category "very valid". In research-based e-modules, the material is packaged attractively using language characteristic of junior high school students. It is presented with supporting images and videos to make it easier for students to understand the material. This aligns with Siddiq et al. (2020) that to increase students' awareness of the environment, students need to be given exciting motivation and then guided to make observations. In addition, the material presented is complete by applying the connected integration model because the connected integration model is a cohesive model that connects concepts in BC with concepts in other BC so that they see problems not only from one field of study that students will have a broader picture. In addition, students can develop concepts and solve problems (Kristina et al., 2022).

The assessment results for the linguistic aspect get a percentage value of 88.89% with the category "very valid" sourced from appropriate indicators of language use in e-modules, namely referring to the accuracy of spelling and grammar in the preparation of material in e-modules. This is in line with Arlinah et al. (2020) that in supporting the effectiveness of language, it is necessary to have the proper vocabulary clarity so that it is easy for students to understand. In addition, interactive language in research-based e-modules can encourage students to study e-modules thoroughly, which means that the language used can cause a sense of pleasure when students read it, namely by giving students questions, for example with the question "Do you know why rhinos are categorized as endemic animals?". This is in line with what Purnanto & Mustadi (2016), that the use of language in teaching materials must stimulate students to question something further and look for answers independently from textbooks and other sources of information.

The assessment results for the graphic/display aspect by educators emphasized answering the needs that had been carried out at the needs analysis stage related to the role of science-oriented learning in schools, so a score of 93.06% was obtained with the category "very valid". In the e-module, the images and writing are very well designed to foster the motivation and curiosity of readers. In addition, the layout of the e-module is structured and neat in terms of the material presented in each paragraph, which is supported by pictures, videos, or illustrations that illustrate the material. The presentation of videos in e-modules in the form of links that are given information to make it easier for readers to understand the material. This is because e-modules can also include links equipped with animations and moving images to create a new and not dull learning experience (Hafsah et al., 2016).

In the results of the validation by teaching materials experts, there are suggestions to pay attention to the duration of the video about the existing class hours at school. Therefore, the author checks the footage on the e-module so that learning can use the e-module with efficient time. Furthermore, in the e-module, the font is simple and consistent, which makes writing easy to read. It does not use many decorative features, so readers can more easily understand the content. This is in line with Fausih & Danang (2015) that consistency is a trait that in the use of fonts and other components is the same and not different from modules in general.

The assessment results for the learning aspect are oriented towards three indicators, so a value of 93.98% is obtained with the category "very valid". The e-module also focuses on conducting simple conservation activities, such as running a simple inventory of the surrounding environment and making straightforward observations of animals. It is

intended that students can know the meaning of environmental literacy as a whole and respect their surrounding environment, which aligns with Ibrohim (2015), that environmental learning is also expected to increase the meaningfulness of science learning and respect for the surrounding environment. In this case, the validator provides input to present the classification of one-horned rhinos in the e-module to add students' insights into using the e-module during learning.

D. Conclusion

Based on developing a research-based e-module on the theme of conservation that integrates environmental literacy and information from observations in TNUK that expert validators have validated get the results of an average value of 88.04%. The conservation theme research-based e-module is very valid when viewed from the predetermined categories. It can be tested further because product revisions have been made based on validator suggestions and input so that it can be used by teachers and students at the VII grade junior high school level as supporting teaching materials to train students' environmental literacy.

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