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Practicality Analysis of Project-Based Learning Electronic Modules to Facilitate Students' Creative Thinking Skills with the Help of the Heyzine Application on Climate Change Material

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ABSTRACT

21st-century learning is often associated with the term 4C skills: critical thinking, creativity, collaboration, and communication. Creative thinking is one of the skills that students must have in 21st-century learning. Based on a preliminary study, it was found that students' creative thinking skills are still in the very low category, especially on climate change material. This needs to be followed up for student success in 21st-century learning. One alternative solution that might be able to overcome this problem is to develop teaching materials in the form of project-based electronic modules to facilitate students' creative thinking skills on climate change material. The purpose of this study was to determine the practicality of project-based electronic modules to facilitate students' creative thinking skills on climate change material by teachers and students. This study used the Research and Development (R&D) method with a 4D development model limited to the development stage, which includes definition, design, and development. The object of this study was a project-based electronic module. Data collection in this study was validity measurement data by three experts from UNP and practicality measurement data by teachers and students. The data obtained were then analyzed using validity analysis techniques with Moment Kappa (k) and product practicality analysis. The results of the validity assessment of the electronic module based on project-based learning obtained a score of 0.87 in the very valid category. Furthermore, the results of the practicality assessment of the electronic module based on project-based learning by teachers with an average score (0.9) and students obtained an average score (0.91). The results of this study indicate that the electronic module based on project-based learning to facilitate students' creative thinking abilities assisted by the heyzine application on the climate change material developed is very valid and very practical to use in the physics learning process, especially on climate change material.

Keywords: Creative Thinking, Electronic Modules, Project Based Learning, Practicality

I. INTRODUCTION

The paradigm transition inherent in 21st-century learning emphasizes that students must master the four Cs: critical thinking and problem-solving, creativity and innovation, and collaboration [1]. Without mastering these four skills, students will struggle to adapt to the rapid developments of the times, due to the constant emergence of global challenges, one of which is the increasingly advanced learning process [2]. Furthermore, [3] states that one of the skills students must master is creative thinking.

Creative thinking is the ability to create new things through imagination and creativity, both artistically and intellectually [4]. According to [5], the importance of creative thinking is to help students in various ways, especially in conducting in-depth analysis of new ideas, making wise choices, successfully finding solutions to complex problems, and arriving at logical conclusions about the problems they face. Therefore, creative thinking skills are very important for students to master, especially in the learning process

Students with higher creative thinking skills tend to be able to analyze various problems in everyday life and can produce ideas in the form of solutions to problems faced in the environment around their homes [6]. In line with the opinion [7] explains that students with very low creative thinking skills tend to have difficulty in

solving problems and finding effective solutions to these problems. However, in reality, the creative thinking skills of students at the high school level are still in the low category [8].

Based on preliminary research data conducted at a high school in Solok Regency, namely SMAN 1 Kubung, this preliminary study examined students' creative thinking skills. The results showed that students' creative thinking skills were still in the very low category, with an average score of 36. The low level of students' creative thinking skills is caused by knowledge transfer patterns that do not consider students' creative thinking abilities [9]. The physics learning process in schools is often still teacher-centered and dependent on textbooks [10]. This requires special attention in developing students' quality skills, as it can hinder their future success [11]. Therefore, efforts to address this issue require teaching materials that can facilitate students' creative thinking skills.

Teaching materials are all forms of learning materials that are systematically and planned to assist teachers and students during the teaching and learning process [12]. Educators have the opportunity to innovate in developing effective teaching materials to foster students' abilities, particularly creative thinking [13]. One innovation teachers can implement in developing teaching materials is modules. Modules are structured teaching materials, using language that is easily understood by students and based on learning outcomes and the applicable curriculum [14].

The latest technological developments have also significantly influenced the development of teaching materials, including teaching modules used in the learning process [15]. One form of implementation is the implementation of electronic modules, which convert printed teaching materials into electronic form, so that learning becomes active and more interactive [16]. In addition, according to [17], the importance of teaching materials such as electronic modules, also has great potential to increase the effectiveness of learning and facilitate students' creative thinking abilities. However, this potential can be realized optimally by using the right learning model.

There are various types of innovative learning models that can be applied by teachers during the teaching and learning process, such as problem-based learning models, project-based learning models, cooperative learning models, blended learning, and discovery learning models [18]. The use of these innovative learning models aims to create learning that is initially still conventional that involves students in active participation through collaboration and involvement in creative and innovative learning [19]. One of the innovative learning models that can be applied and facilitate creative thinking skills is project-based learning, because students can correlate creative thinking skills because in its application, through a series of learning syntaxes that start from determining basic questions to evaluating learning experiences [20]. Collaboration between project-based learning models and electronic modules has great potential because project-based learning models also aim to develop student learning experiences in several areas, such as collaboration and creativity development, which are 21st-century skills [21]. However, in developing electronic modules based on project-based learning to facilitate students' creative thinking skills, applications are needed that make the learning process more interactive.

One application that can be used to develop electronic modules is heyzine [22]. Heyzine has many additional interactive features not found in other applications, such as images, text, and additional learning videos that can support students' creative thinking skills. It's free and doesn't require additional costs [23]. Furthermore, heyzine also has supporting features with additional audio that can increase students' motivation and creativity in learning [24]. Therefore, heyzine is one application that can help create an interactive learning process in today's technological era.

Based on the urgency described, practical project-based electronic modules are urgently needed to facilitate students' creative thinking skills, supported by the heyzine application, on climate change. Furthermore, this study also aims to assess the extent to which project-based electronic modules meet practicality criteria, which include four aspects: readability and clarity of the material, usability and ease of use, attractiveness, and appropriate time allocation. This research is expected to support interactive learning processes and enhance students' creative thinking skills in physics learning.

II. METHOD

The type of research applied is development research, also known as Research and Development (R&D). The research design used in this development is the 4D model (Define, Design, Develop, Disseminate) proposed by [25] . This research design is limited to the Develop stage. This model was chosen based on the consideration that the 4D model research design is systematic and based on the theoretical basis of educational product design,

so that the resulting product meets the criteria of practicality. The 4-D model functions as a guideline for developing electronic modules based on project-based learning. At the define stage, an analysis of the teaching materials used is carried out through teacher interviews, an analysis of student characteristics, and an analysis of students' creative thinking abilities. At the design stage, electronic modules are designed in the form of a storyboard.

The development stage involves assessing the practicality of the electronic module products. Furthermore, the practicality test component, referring to [26], assesses readability and clarity of the material, achievability and ease of use, attractiveness, and appropriate time allocation. The readability and clarity components include: easy-to-understand language, sentences that avoid multiple interpretations, coherent and systematic presentation of the material, and appropriateness of explanations to the learning material. The achievability and ease of use component includes: easy-to-use electronic modules, clear instructions, clear learning flow, and assignments that align with required abilities. The attractiveness component includes an attractive appearance, supportive colors and images, and a presentation that is not boring. The time allocation component includes the appropriateness of the time used in learning, the appropriateness of learning time activities, and the appropriateness of the length of the material to the time available.

The development stage of this research involved the validity assessment sheet and the practicality assessment sheet. The practicality sheets were designed based on the components used. Practicality assessments were conducted by three experts who are physics education lecturers at the Faculty of Mathematics and Natural Sciences, Padang State University. Furthermore, the practicality assessment was tested by three physics teachers and 30 students at SMAN 1 Kubung, Solok Regency. Practicality assessments used data collection using a Likert scale of 1-5. The Likert scale used is explained in Table 1 by [27]

Table 1. Likert Scale Practicality

Category	Likert Scale
Stongly Agree	1
Disagree	2
Neutral	3
Don’t Agree	4
Strongly Disagree	5

(Source: Ref [27])

Based on Table 1, the electronic module assessment uses a scale of 1 to 5. Each score on the scale has a specific meaning, indicating the level of suitability of the practicality of the electronic module components as assessed by validators, practitioners, and students, ranging from strongly disagree to strongly agree. By using this Likert scale, researchers can obtain more measurable and objective data to determine the feasibility of the developed electronic learning modules.

The practicality data obtained were analyzed using a modified categorical assessment [28]. The results of the practitioner and student assessments of each statement were then analyzed using the Cohen Kappa formula. At the end of the data processing, a kappa moment was generated, describing the level of validity and practicality of the developed electronic modules. The kappa moment formula used is shown in equation 1.

$$\text{Kappa Moment } (k) = \frac{P_0 - P_e}{1 - P_e} \qquad (1)$$

After obtaining the assessor agreement index from practitioners, and students, the index value categories were determined. The results of determining the practicality categories in the electronic module based on the Decision Category Based on Kappa Moment (k) are shown in Table 2.

Table 2. Decision Categories Based on Kappa Moment (k)

Interval	Category
0.81 - 1.00	Very Practical
0.61 - 0.80	Practical
0.41 - 0.60	Quite Practical
0.21 - 0.40	Less Practical
0.01 - 0.20	Very Less Practical
0. 00	Impractical

(Source: Ref [28])

Based on the practicality of the Kappa Moment Index, it can be classified into six categories: impractical, very impractical, less practical, quite practical, practical, and very practical. Decisions based on the kappa value (k) are used to determine the level of practicality of an instrument based on the assessment of practitioners and students. The higher the kappa value, the higher the level of practicality and quality of the electronic module

being assessed. The kappa value range of 0.81 to 1.00 indicates a very practical category, meaning the electronic module is very easy to use without revision, up to a value of 0.00 is classified as impractical.

III. RESULTS AND DISCUSSION

RESULTS

These research results are based on the stages of the 4D development model, which include (define, design, develop, and disseminate), limited to the development stage in the development of practical electronic modules.

1. Define stage

The first analysis examined students' creative thinking skills. Next, 30 students were given a creative thinking test on climate change, complete with creative thinking indicators according to [29]: flexibility, originality, elaboration, and fluency. The analysis showed an average score of 36, which is in the very low category. This indicates that students' creative thinking skills need to be further improved, especially on climate change material. Low creative thinking skills will impact student learning outcomes [30]. The results of the analysis of students' creative thinking skills are presented in Table 3.

Table 3. Results of Students' Creative Thinking Abilities

No	Indicator	Score (%)	Category
1	Flexibility	41	Very Low
2	Originality	31	Very Low
3	Elaboration	34	Very Low
4	Fluency	30	Very Low

The second analysis of teacher interviews identified three components assessed: physics learning, the use of learning models, and teachers' perspectives on digital learning. Based on the teacher interviews, it was clear that there is a significant gap between the demands of 21st-century learning and the learning process at school, which is still dominated by conventional learning approaches. The learning process should develop students' critical thinking, creativity, and collaboration skills, making learning more active and less passive. This condition is one factor contributing to students' low creative thinking skills, as learning is still dominated by conventional approaches [31].

The second analysis, which examined student characteristics, involved questionnaires from 30 students. The questionnaire analysis consisted of five aspects: student background (LBS), student learning interests (MIBS), student learning motivation (MOBS), student learning styles (GBS), and digital learning (PD). The results of the determination of student characteristics can be seen in Figure 1.

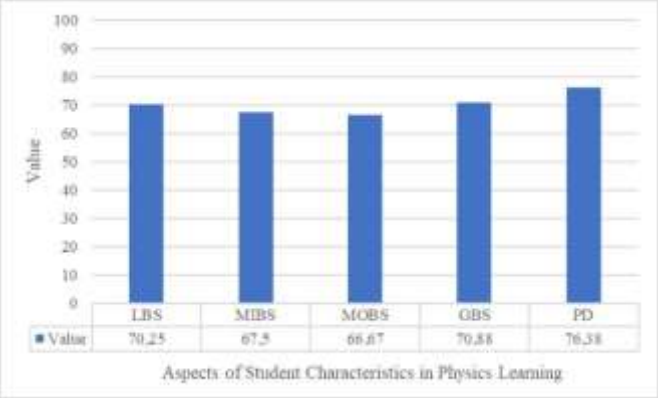


Fig. 1. Results of Analysis of Students' Characteristics in Physics Learning

Based on the data in Figure 1, it shows that the student background aspect obtained an average score of 70.25, this indicates that the initial condition of the students is in the fairly good category. Student learning interest obtained a score of 67.5. Student learning motivation obtained a score of 66.67. Student learning styles obtained a score of 70.88. Digital learning obtained a score of 76.38. So it is necessary to update teaching materials such as electronic modules based on project based learning. This can be seen from the learning styles of students who tend to be visual and kinesthetic, and students also support digital learning.

Furthermore, teachers have implemented a project-based learning model, but its implementation is still less than optimal due to the diverse student population, the lack of tools needed to design projects, and limited time, which makes the project-based learning model less effective. To address this issue, teaching materials are needed that can foster independent learning at home for students. These teaching materials include electronic modules

that can facilitate students' creative thinking skills and project-based learning models that align with creative thinking. In line with students' preferences for visual and kinesthetic learning, and their support for digital learning, project-based electronic modules are needed to facilitate students' creative thinking skills and serve as an alternative resource for addressing the problems outlined in the initial analysis.

2. Design stage

The initial design is carried out by creating a design in the form of a storyboard and an Electronic Modules product design. The design in the form of a storyboard is arranged based on the define stage, then continued to create a design in the form of electronic modules. The Electronic Modules developed in this study consist of a cover page which includes (electronic module title, material name, class level, author's name, curriculum logo, university logo, and Ministry of Education and Culture), main menu, foreword, table of contents, list of figures, list of tables, introduction which includes (instructions for using electronic modules, project based learning model syntax, learning outcomes, learning objectives, indicators of achievement of learning objectives, and concept maps), learning activities which include (indicators of achievement of learning objectives, instructions for learning activities, material descriptions, learning videos, practice questions, student worksheets, and summaries), final evaluation, glossary, answer key, bibliography, and author's biodata.

This design was saved in PDF format and then inserted into the Heyzine application to create an electronic module. The initial design developed resulted in a project-based electronic module on climate change, designed interactively, systematically, and contextually to support 21st-century learning. Thus, this electronic module is expected to increase student engagement, facilitate creative thinking skills, and support the development of digital teaching materials that are innovative, adaptive, and relevant to global challenges.

3. Development stage

The electronic module development stages included creating the electronic module, validating the electronic module by three expert validators, then revising it according to the expert validators' instructions, and implementing it by teachers and students.

a) Validity test

The results of the development phase are validation assessments conducted by three expert lecturers from the Faculty of Mathematics and Natural Sciences, State University of Padang. The indicators assessed in product validation include material substance, visual communication display, learning design, software utilization, project-based learning model, and creative thinking skills. The answer choices on the validation sheet use a Likert scale to gauge the expert lecturers' opinions on the developed electronic modules. The results of the validity assessment for the material substance aspect are presented in Table 4.

Table 4. Validity in the Material Substance Aspect

Material Substance	k	Category
Truth	0.93	Very valid
Coverage	0.78	Very valid
Currentity	0.89	Very valid
Readability	0.93	Very valid
Average	0.88	Very valid

Based on the data in Table 4, it shows that the results of the validity assessment on the substance aspect of the electronic modules material developed obtained validation assessment results with an average of 0.88 in the very valid category. In the truth aspect, it obtained a score of 0.98 in the very valid category, this explains that the content of the material in the electronic modules has been compiled scientifically correctly. The material coverage aspect obtained a score of 0.78 in valid, indicating that the material presented in the electronic modules is complete and has been adjusted to the competencies targeted in the learning process. The contemporary aspect obtained a score of 0.89 in the very valid category. This can increase the relevance of learning, facilitate student understanding, encourage scientific literacy through real contexts, and students can put forward new ideas on issues that occur in their living environment [32]. The readability aspect obtained a score of 0.93 in the very valid category, meaning the material is easy to read and understand.

Next, the validity assessment for the visual communication display aspect, consisting of navigation, fonts, colors, and. layout. The results of the validity assessment for the visual communication display aspect are presented in Table 5.

Table 5. Validity in the Visual Communication Display Aspect

Visual Communication Display	k	Category
Navigation	0.93	Very valid
Font	0.93	Very valid
Color	0.93	Very valid
Layout	0.93	Very valid

Average	0.93	Very valid

Based on the data in Table 5, the validity of the visual communication display aspect of the developed electronic modules obtained a validation assessment with an average of 0.93 in the very high category across all assessment aspects. The navigation aspect obtained a score of 0.93 in the very high category, indicating that the navigation contained in the electronic modules is clear and effective. Clear navigation in the electronic modules can provide an interesting and interactive learning experience that is consistent with the learning principles [33]. The font aspect obtained a score of 0.93 in the very valid category, indicating that the fonts used in the electronic modules are appropriate. The color aspect obtained a score of 0.93 in the very valid category, indicating that the use of color in the electronic modules is appropriate. These results indicate that the use of appropriate color in the E-Module can create enjoyable learning [34]. The layout aspect obtained a score of 0.93 in the very valid category, indicating that the layout is appropriate and attractive. The results of the validity assessment of the learning design aspect are presented in Table 6.

Table 6. Validity in the Learning Design Aspect

Learning Design	k	Category
Title	0.93	Very valid
Learning Outcomes	0.93	Very valid
Learning Objectives	0.93	Very valid
Learning Materials	0.75	Valid
Exercise or Evaluation	0.64	Valid
Composition	0.84	Very valid
References	0.77	Valid
Average	0.85	Very valid

Based on the data in Table 6, the validity of the learning design in the developed electronic modules obtained an average validation assessment result of 0.85 in the very valid category in all assessment aspects. The title component aspect obtained a score of 0.93 in the very valid category. The learning outcomes aspect obtained a score of 0.93 in the very valid category. The learning objectives aspect obtained a score of 0.93 in the very valid category, indicating that the formulated learning objectives are clear and operational. The learning materials aspect obtained a score of 0.75 in the valid category, meaning that the learning materials have been arranged systematically. Furthermore, the exercise or evaluation aspect scored 0.64 in the valid category, meaning that the exercises or evaluations presented in the electronic modules are in accordance with the indicators of achieving learning objectives. The arrangement aspect obtained a score of 0.84 in the very valid category, meaning that the arrangement such as instructions for using the electronic modules is presented clearly. The reference aspect obtained a score of 0.77 in the valid category, indicating that the references used support the accuracy of the material presented. After that, the results of the validity assessment of the software utilization aspect are presented in Table 7.

Table 7. Validity in the Software Utilization Aspect

Software Utilization	k	Category
Interactivity	0.93	Very valid
Supporting	0.93	Very valid
Originality	0.75	Valid
Average	0.87	Very valid

Based on the data in Table 7, the validity of the software utilization aspect of the developed electronic modules shows that the validation assessment results have an average of 0.87 in the very valid category in all assessment aspects. The interactivity aspect obtained a score of 0.93 in the very valid category, indicating that the electronic modules has been able to facilitate user interaction effectively. The supporting software aspect obtained a score of 0.93 in the very valid category. The originality aspect obtained a score of 0.75 in the valid category, meaning that the electronic modules used for learning displays novelty or innovation. The results of the validity assessment on the project-based learning model aspect are presented in Table 8.

Table 8. Validity in the Project-Based Learning Model Aspect

Project-Based Learning Model	k	Category
Basic Questions	0.93	Very valid
Creating Project Design	0.93	Very valid
Developing Project Schedule	0.93	Very valid
Monitoring Project Progress	0.75	Valid
Result Testing	0.64	Valid
Evaluating Experience	0.84	Very valid
Average	0.84	Very valid

Based on the data in Table 8, the validity of the project-based learning model aspect of the developed E-Module shows that the validation assessment results have an average of 0.82, in the very valid category. The fundamental questions aspect obtained a score of 0.93, indicating that fundamental questions are able to encourage students to think creatively. The project design aspect obtained a score of 0.93, indicating that the project planning stages are presented clearly and structured. The project schedule aspect obtained a score of 0.93, meaning that the project activity schedule is presented realistically. Furthermore, the monitoring and project progress aspect obtained a score of 0.75, indicating that the project implementation monitoring process is presented clearly. The results of the results testing aspect obtained a score of 0.64, indicating that the electronic modules facilitates the process of analyzing results and discussing projects well. The experience evaluation aspect obtained a score of 0.84, indicating that the learning evaluation activities are appropriate. The results of the validation assessment on the creative thinking ability aspect are presented in Table 9.

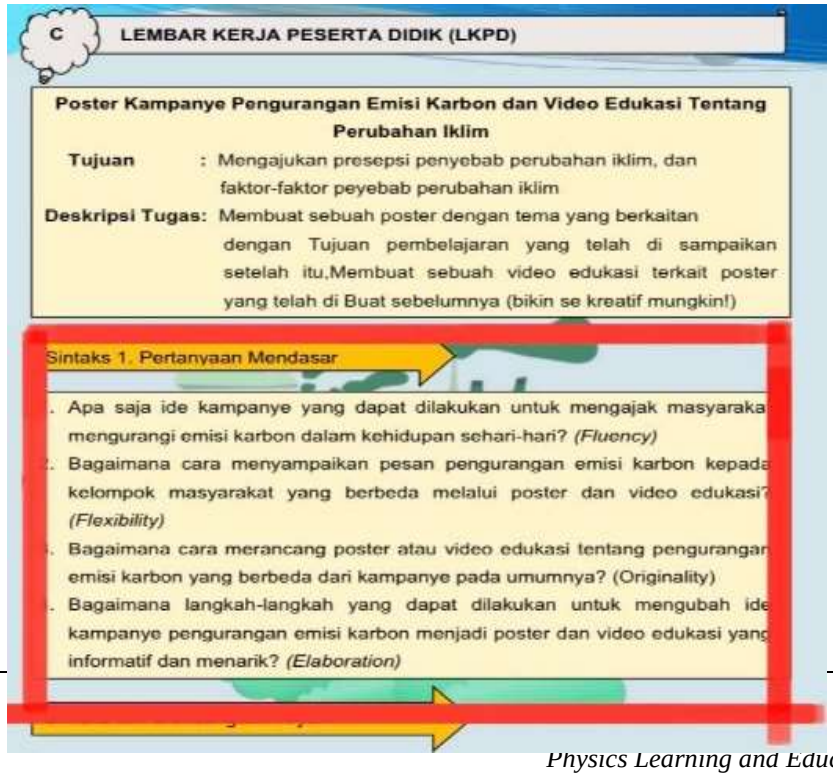
Table 9. Validity in the Creative Thinking Skills Aspect

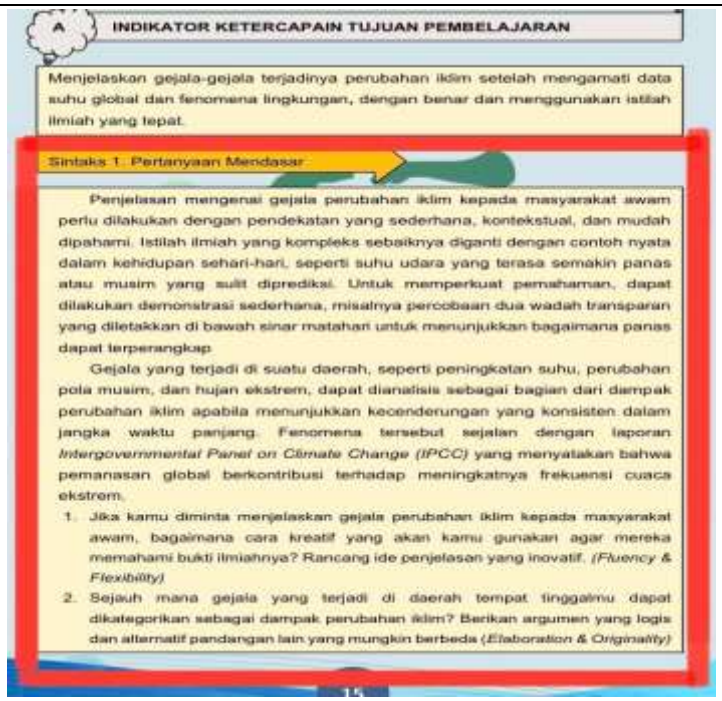
Creative Thinking Skills	k	Category
Ability to Provide Ideas Correctly and Appropriately	0.89	Very valid
Ability to Solve Problems in More Than One Way	0.75	Valid
Ability to Provide Different Answer	0.78	Valid
Ability to Elaborate on Correct and Appropriate Answers	0.84	Very valid
Average	0.81	Very valid

Based on the data in Table 9, the validity of the project-based learning model aspect of the developed electronic modules shows that the validation assessment results have an average of 0.81 in the very valid category in all assessment aspects. The aspect of the ability to provide ideas correctly and appropriately obtained a score of 0.89, indicating that learning activities encourage students to put forward ideas. The aspect of the ability to solve problems in more than one way obtained a score of 0.75, indicating that the questions or tasks presented in the electronic modules allow for the emergence of various solution strategies. The aspect of the skill of providing different answers obtained a score of 0.78, meaning that learning activities encourage students to produce diverse answers. Furthermore, the aspect of the ability to detail the correct answer obtained a score of 0.84, indicating that learning facilitates students in developing answers logically and clearly.

After the validity assessment was conducted, revisions were made based on the validator's suggestions. These revisions were made to ensure the electronic module met students' needs during the learning process. The following are the improvements or revisions made based on comments and suggestions from the validator or expert. The results of the revisions are presented in Table 10.

Table 10. Revision of Learning Activities in Electronic Modules

Before Revision
The first stage, namely the fundamental questions of the project-based learning model, is found on the student worksheet.


After Revision
The first stage of the project-based learning model, the fundamental question, needs to be restructured before the lesson begins. This aims to encourage students to think about ideas and projects related to their daily lives. This fundamental question is combined with indicators of creative thinking to also encourage students to think creatively effectively. Therefore, electronic modules become a solution in facilitating students' creative thinking skills, because each step of the learning activity is linked to the creative thinking indicators and the appropriate stages of the project-based learning model.


b) Practicality test

The practicality test for electronic modules was conducted on three physics teachers at SMAN 1 Kubung and 30 students. The first practicality test was conducted by teachers to assess the extent to which electronic modules can be used in the learning process from an educator's perspective. Teachers were asked to study the content, instructions, and learning activities designed in the electronic modules. Furthermore, teachers were given instructions on how to fill out the practicality test questionnaire. Through this practicality test, teachers' responses to the electronic modules were obtained based on four aspects of practicality assessment: readability and clarity of the material, usability and ease of use, attractiveness, and suitability of time allocation. The complete results of data processing and data calculations are shown in Figure 2.

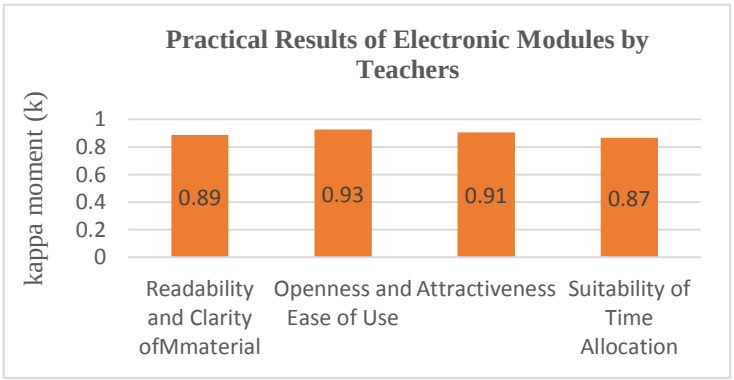


Fig. 2. Practical Results of Electronic Modules by Teachers

Based on the data in Figure 2, it shows that the practicality value of electronic modules by teachers obtained an average value for each aspect of the practicality assessment in the very practical category. As for the readability and clarity of the material, the practicality assessment results were 0.89 in the very practical category. The usability and ease of use aspects obtained a practicality assessment result of 0.93 in the very practical category. The attractiveness aspect obtained a practicality assessment result of 0.91 in the very practical category. The time allocation suitability aspect obtained a practicality assessment result of 0.87 in the very practical category. Overall, the average results of the practicality assessment of electronic modules developed by teachers obtained a kappa moment (k) of 0.9 with a practicality level in the very practical category.

Next, a practicality test was conducted on 30 students. The practicality test was conducted in several stages. First, the electronic modules link was distributed to students for use in the learning process. Students were given instructions on how to use the electronic modules so they understood how to access the features contained in the electronic modules, read, and follow the steps provided therein. The next stage was for students to study the material and complete the learning activities contained in the e-module. Through this practicality test, students' responses to the electronic modules were obtained based on four aspects of practicality assessment: readability and clarity of the material, usability and ease of use, attractiveness, and appropriateness of time allocation. The complete results of data processing and data calculations are shown in Figure 3.

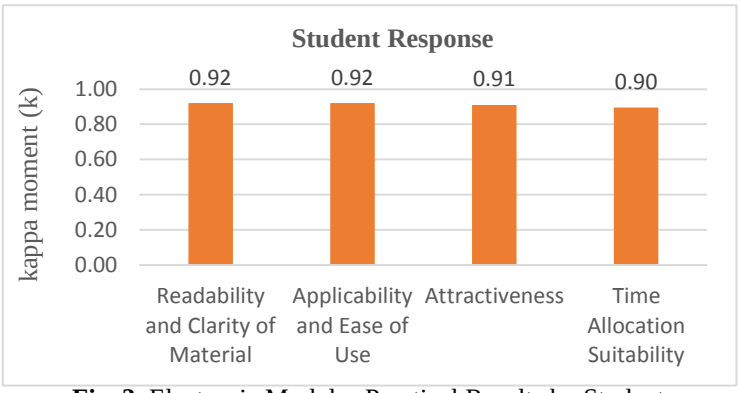


Fig. 3. Electronic Modules Practical Results by Students

Based on the data in Figure 3, it can be seen that the practicality score of the electronic module developed by students obtained an average score for each practicality assessment aspect in the very practical category. For the readability and clarity of the material, the practicality score was 0.92, categorized as very practical. The ease of use and usefulness score was 0.92, categorized as very practical. The attractiveness score was 0.91, categorized as very practical. The appropriateness of time allocation score was 0.90, categorized as very practical. Overall, the average practicality score for the electronic modules developed by students obtained a kappa moment (k) of 0.91, categorizing as very practical.

DISCUSSION

This study aimed to determine the practicality of the developed product, namely electronic modules based on project-based learning modules to facilitate students' creative thinking skills with the help of the heyzine application on climate change material. Furthermore, the research model used in developing this product was the 4D. The analysis stage obtained some information about the teaching materials used by teachers during the learning process, as well as an analysis of student characteristics regarding digital learning. This aligns with [35] opinion that analysis is important for identifying key issues and determining aspects that need to be developed to address the problems faced to ensure the teaching materials meet the needs of students and teachers.

In the design phase, the product is designed in the form of a storyboard, which is then designed according to the storyboard. According to [36] storyboards serve to identify product needs before the product design process begins. The development phase then includes validity assessment and practicality tests to produce a valid and practical product that meets student needs during the learning process. According to opinion [37] it is explained that the validity and practicality stages aim to assess the product so that the product developed is appropriate to the problem and can overcome the problem.

The validity test assessed several aspects, including material substance, visual communication display, learning design, software utilization, project-based learning model, and creative thinking skills. The validity assessment was also based on the electronic module structure as outlined by the Ministry of Education and

Culture (2017). The validity assessment results for the material substance aspect obtained an average validity score of 0.88, categorized as very valid. This indicates that the electronic modules are structured correctly and the material presented in the electronic is complete and meets student needs. The visual communication display aspect obtained an average validity score of 0.93, indicating that the navigation, fonts, colors, and layout of the electronic modules are clear, effective, and easy to understand for users. In line with the opinion [38] explaining that clear visual communication displays in electronic modules can provide interactive learning and learning that is not boring.

Learning design aspect received a validity assessment with an average score of 0.85, indicating that the title, learning outcomes, learning objectives, learning materials, and references contained in the electronic modules are clear, operational, and measurable with students' abilities. The software utilization aspect received a validity assessment with an average score of 0.87 in the very valid category. The project-based learning model aspect received a validity assessment with an average score of 0.82 in the valid category. The creative thinking ability aspect received a validity assessment with an average score of 0.81 in the valid category, indicating that the presentation in the electronic modules already contains indicators of creative thinking ability clearly and measurably.

Furthermore, the practicality test was conducted by observing several aspects, including readability and clarity of the material, usability and ease of use, attractiveness, and appropriateness of time allocation. The purpose of the practicality test was to measure the usefulness and ease of use of the developed electronic modules. According to [39], the practicality test is very necessary because it measures whether the developed product can address existing problems in schools and is also useful during the learning process. The practicality test of the electronics module was conducted on three physics teachers at SMAN 1 Kubung and 30 students.

The practicality test results for the readability and clarity of the material by teachers obtained an average score of 0.89, categorized as very practical. This indicates that the language, sentence presentation, and explanations of the material contained in the electronic module are appropriate and easy to understand. This indicates that the electronic module has a level of readability and clarity that is very practical for learning [40]. The usability and ease of use aspect obtained an average practicality test score of 0.93, categorized as very practical. This is in line with [41] findings, indicating that the instructions for using the electronic modules are easy to understand and the material is easy to understand.

The attractiveness aspect obtained an average practicality test score of 0.91, categorized as very practical. According to [42], the attractiveness of the electronic modules includes the layout, clarity of writing, and sentence structure, making them attractive to users. The appropriateness of time allocation aspect obtained an average practicality test score of 0.87, categorized as very practical. Overall, the average results of the practicality assessment of the electronic modules developed by teachers obtained a kappa moment (k) of 0.9 with a practicality level in the very practical category.

The practicality test by students has aspects that include, readability and clarity of the material, usability and ease of use, attractiveness, and suitability of time allocation. The assessment of the practicality test on the aspects of readability and clarity of the material obtained an average score of 0.92 in the very practical category, informing that the material presented in the electronic modules is clear and easy to understand by students, in line with the findings [43] which stated that very clear material will make it easier for students to understand the learning material. The results of the practicality test on the aspects of usability and ease of use obtained an average score of 0.92 in the very practical category, indicating that the additional features contained in the electronic modules are easy to understand by students. In line with the findings [44] electronic modules are easy to understand and do not require a long time to adapt to their use by students.

The attractiveness aspect obtained a practicality test score of 0.91, which indicates that the use of colors and features contained in the electronic module makes students interested in learning. The aspect of the suitability of time allocation obtained a practicality test score with an average score of 0.90, which indicates that students can study independently at home without requiring prior explanation from the teacher. This project-based learning-based electronic module is very practical because it is designed with systematic project-based learning stages, making it easier for students to learn independently, and combined with appropriate creative thinking indicators. The implementation of electronic modules on the heyzine application is also an attractiveness assessment because hyzine has features that are very easy for students to understand.

This research also has limitations that will ultimately affect the product development results. The first limitation lies in the project-based learning electronic modules designed to facilitate students' creative thinking skills, which only cover climate change. To address this issue, future research could expand to include other materials to assess the effectiveness of these electronic modules on learning, particularly in facilitating students'

creative thinking skills. The second limitation of this study is the development of the electronic modules, which was limited to the practicality testing stage for teachers and students. This limitation arose because the researchers' limited time did not allow for further development. Future research could be conducted with other researchers to conduct an effectiveness test to address the limitations of this study, which only tested the validity and practicality of the product.

IV. CONCLUSION

The results of this study conclude that the project-based electronic learning module to facilitate students' creative thinking skills, assisted by the heyzine application on climate change material, is very practical to support physics learning, especially climate change. This finding also aims to be a source of interactive alternative teaching materials for teachers in facilitating students' creative thinking skills, especially on climate change material. For further research, it can be expanded to assess the effectiveness of this electronic module on learning, especially in facilitating students' creative thinking skills on climate change material.

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