



# Development of Interactive Learning E-Modules in Geography Subjects in High School

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**Abstract:** This research aims to develop an interactive learning e-module in the Geography class XI phase F of high school and test the level of validity, practicality, and effectiveness of the developed product. This research uses a Research and Development (R&D) approach with the ADDIE development model which includes the stages of analysis, design, development, implementation, and evaluation. The research subjects involved media experts, material experts, linguists, Geography teachers, and grade XI students of SMA Negeri 1 Padang Gelugur. Data collection techniques use observation, interviews, questionnaires, and learning outcome tests. The data was analyzed descriptively, qualitatively, and quantitatively. The results of the study showed that the interactive learning e-module developed had a validity rate of 89.33% with a very feasible category. The practicality test showed a very practical category, with a percentage of 92% of teachers and 89.6% of students. The effectiveness test through the N-Gain calculation obtained a value of 0.58 (58%) which is in the effective category, showing an increase in student learning outcomes after using the e-module. Thus, the interactive learning e-module developed is declared valid, practical, and effective and suitable for use as a Geography learning medium in high school, especially in Natural Resources Management and its influence on life.

**Keywords:** ADDIE; Curriculum; E-modules; Independent; Interactive

## Introduction

The rapid development of technology has brought significant changes in various aspects of life, including the field of education, especially the learning process in secondary school (Maritsa et al., 2021; Wisudojati et al., 2024). Learning is no longer limited to textbooks and lecture methods, but is moving towards more interactive and engaging digital learning (Safera et al., 2025; Yetti & Ahyanuardi, 2020). In this context, educational technology areas have an important role in designing, developing, utilizing, managing, and assessing learning resources to create effective, efficient, and meaningful learning

One of the real implementations of the education technology area is the development of interactive learning e-modules. Interactive e-modules combine text, images, animations, videos, and interactive exercises

that can increase student engagement in the learning process (Adawiyah et al., 2020; Andriani & Dwiningsih, 2024; Hendrawensi et al., 2024; Kusumantoro et al., 2022). The development of this media is in line with the Independent Curriculum policy which emphasizes learning based on students' interests and talents, as stated in the Regulation of the Minister of Primary and Secondary Education Number 13 of 2025 (Nursalam et al., 2023), where students are given the freedom to choose subjects according to their interests, including Geography subjects.

Geography as a subject studies spatial phenomena on the earth's surface formed from human and environmental interaction (Hastuti, 2017; Larsen et al., 2022; Zolnik, 2009). Geography materials are conceptual and spatial, so they require learning media that is able to present visualization and direct interaction (Jo & Hong, 2020; Lasfika et al., 2022; Syafril & Junaidin, 2025).

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Therefore, the use of interactive learning e-modules is relevant to help students understand abstract and complex concepts in Geography learning in high school.

The current education curriculum in Indonesia also emphasizes strengthening 21st century competencies, such as critical thinking, creativity, communication, and collaboration (Haryani et al., 2021; Masjudin, 2024). The achievement of these competencies requires the use of learning media that is in accordance with the characteristics of the digital generation, is accessible, attractive, and is able to support independent learning. In this case, teachers are required to play the role of innovative facilitators and be able to make optimal use of learning technology.

However, conditions in the field show that Geography learning in high school is still dominated by conventional methods. Based on the results of initial observations and interviews with Geography teachers in 12 public high schools in Pasaman Regency, there are no schools that use interactive learning e-modules. The use of technology is still limited to textbooks, PowerPoint presentations, simple e-modules, and learning games, which have not yet fully supported the characteristics of Geography material.

The results of the interview also showed that more than 70% of students had difficulty understanding Geography material due to the limitations of the learning media used. In fact, Geography materials such as maps, lithospheric dynamics, distribution of flora and fauna, and natural resource management really need visualization and interaction so that they are easy to understand. The lack of use of interactive e-modules has an impact on low interest in learning and students' activeness in the learning process.

Research conducted by Arifin et al., (2024) and Jong et al. (2020), it shows that the use of interactive e-modules is able to increase students' interest in learning, understanding of concepts, and learning independence. E-modules developed interactively have proven to be feasible and effective as companion teaching materials, especially for materials that are complex and require in-depth understanding (Maghfiroh et al., 2024; Arifin et al., 2024; Adawiyah et al., 2020). This shows that the development of interactive e-modules has high relevance to the current needs of Geography learning.

Based on these problems, this research is important to be carried out as an effort to innovate technology-based learning that is in line with the demands of the Independent Curriculum and 21st century learning.

## Method

This research is a research and development that aims to produce an Interactive Learning E-module in High School Geography Subjects. The development

model used is ADDIE (Analysis, Design, Development, Implementation, and Evaluation) because it is systematic and suitable for the development of learning media (Adriani et al., 2020; Kuswandi et al., 2021).

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The design stage aims to prepare the initial design of the interactive learning E-module. At this stage, the structure of the E-module, storyboard, visual display, and selection of supporting media in the form of text, images, videos, and interactive quizzes are prepared. The initial draft of the E-module is consulted with the supervisor to obtain input before being further developed.

The development stage is carried out by realizing the design of the E-module according to the storyboard that has been designed. In addition, research instruments were developed in the form of validation sheets and practicality questionnaires. Product validation is carried out by three experts, namely media experts, material experts, and linguists. The validation results are used as a basis for revision until a suitable E-module is obtained, then a practical test is carried out on Geography students and teachers.

Validity test formula and practicality test (Sugiyono, 2018):

$$P = \frac{\sum x}{N} \times 100\% \quad (1)$$

The implementation stage is carried out by implementing an interactive learning E-module in Geography class XI phase F at SMA Negeri 1 Padang Gelugur. Students use the E-module independently through digital devices. Product effectiveness is measured through pretest and posttest using a one group pretest-posttest design.

Rumus efektivitas :

$$Effectiveness = \frac{Score\ obtained}{Maximum\ Score} \times 100\% \quad (2)$$

The evaluation stage was carried out to assess the validity, practicality, and effectiveness of the E-module. Evaluation involves expert assessment, teacher and student responses, and analysis of learning outcomes. Data were analyzed using qualitative and quantitative descriptive analysis, including percentage calculation and normalized gain (N-Gain).

$$G = \frac{Sp_{ost}}{Sm_{ax}} - \frac{Sp_{re}}{Sp_{re}} \quad (3)$$

The research subjects include lecturers from Padang State University as experts in media, materials, and languages, three Geography teachers, and students of class XI phase F of SMA Negeri 1 Padang Gelugur for the 2025/2026 school year. The object of the research is the E-module of interactive learning that was developed.

## Result and Discussion

### Analysis Stage

The analysis stage aims to identify the need for the development of interactive learning e-modules in Geography class XI phase F. The results of the curriculum analysis show that Geography learning at SMA Negeri 1 Padang Gelugur has implemented the Independent Curriculum, with learning outcomes that require analytical, contextual, and critical thinking skills, especially in Natural Resources Management and its influence on life.

Analysis of student characteristics shows that the majority of students have a visual learning style, a low level of activity and motivation to learn, and access to adequate digital devices. In addition, the needs analysis revealed that the learning resources used are still limited to textbooks and simple e-modules in PDF form, so they are not able to accommodate the learning needs of students who are active, independent, and technology-based. These findings confirm the need to develop interactive learning e-modules as a more effective and contextual Geography learning solution.

### Planning Stage

Based on the results of the analysis, the design stage is focused on the preparation of the structure and appearance of interactive learning e-modules. The e-modules are systematically designed that include introductory components, learning materials, interactive activities, evaluations, and conclusions. At this stage, a storyboard is prepared as a development guide that contains navigation flows, visual layouts, and multimedia integration.



Figure 1. Cover and material

The design of the e-module pays attention to the principles of readability, ease of navigation, and visual appeal by combining text, images, learning videos, interactive quizzes, and learning reflections. This design aims to support students' visual learning styles as well as encourage active involvement in Geography learning. Thus, the design stage produces a blueprint of e-modules that are ready to be developed technically.

### Development Stage

In the development stage, the design of the e-module is realized into a real product using the Canva application and Flip PDF Professional. The e-module is developed according to the storyboard by integrating Geography material that has been adjusted to the Learning Outcomes and Learning Objectives of the Independent Curriculum. In addition, research instruments were developed in the form of validity questionnaires and practicality questionnaires.

Table 1. Recapitulation of Validation Test Results

Assessment Aspect	Average Score %	Category
Media Expert	77	Worthy
Material Expert	95	Highly worth it
Language Expert	96	Highly worth it
Average	89.33	Highly worth it

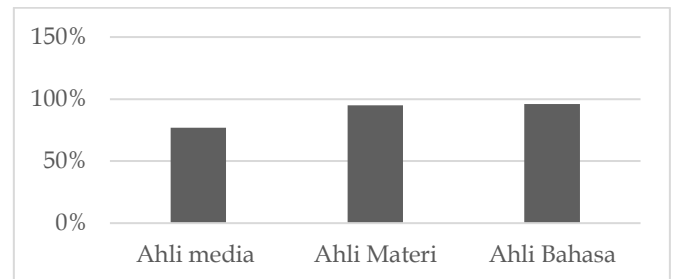


Figure 2. E-Module Validity Recapitulation Diagram

The results of the validity test showed that the interactive e-module was in the very feasible category with an average score of 89.33%. Validation by material experts and linguists obtained a very feasible category, while validation by media experts was in the feasible category. These findings are in line with research conducted by Auwaliyah et al. (2023) and Taufan et al. (2023) concluded that digital-based interactive e-modules developed through the expert validation stage were declared feasible to be used as Geography teaching materials. The similarity of these results shows that the e-module development process that pays attention to the feasibility of content, communicative language, and attractive and functional media design is an important factor in producing quality teaching materials. Thus, the developed interactive learning e-modules are not only theoretically feasible, but also have great potential to

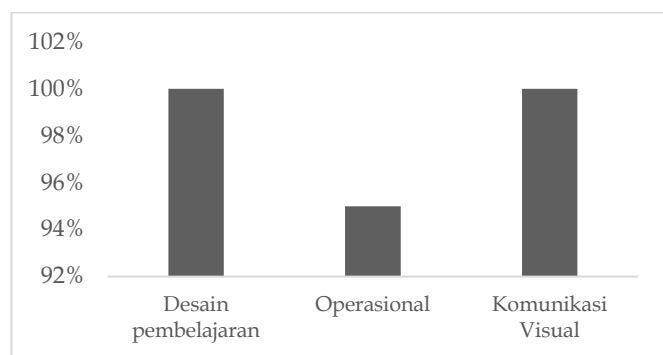
support more effective and meaningful Geography learning.

*Implementation Stage*

The implementation stage is carried out by implementing an interactive learning e-module in Geography learning class XI phase F at SMA Negeri 1 Padang Gelugur. Students use e-modules directly through digital devices in learning activities. This implementation aims to test the practicality and effectiveness of e-modules in real learning conditions.

**Table 2.** Practicality of E-Modules by Teachers

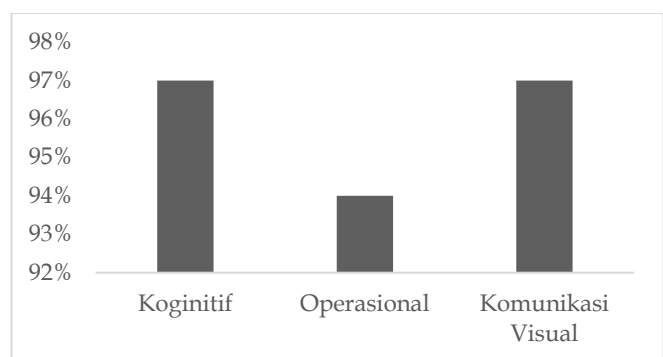
Aspects assessed	Percentage %	Criteria
Learning Design	100	Very practical
Operational	95	Very practical
Visual Communication	100	Very practical
Average	98,33	Very practical



**Figure 3.** Diagram of the results of the practicality of the e-module by the teacher

**Table 3.** Practicality of E-Modules by Students

Aspects assessed	Percentage	Criteria
Cognitif	97%	Very practical
Operational	94%	Very practical
Visual	97%	Very practical
Rata rata	96.00%	Very practical



**Figure 4.** Diagram of the results of the practicality of the e-module by the students

The results of the practicality test show that the e-module obtained a very practical category. The teacher's response showed an average score of 98.33%, while the

student's response was 96%. This is in line with research conducted by Huang et al. (2009) and Yani et al. (2022) which states that the digital-based Geography learning e-module obtains a very practical category based on the responses of teachers and students. The similarity of these results confirms that e-modules designed with attractive appearances, clear navigation, and systematic materials can improve user comfort in the learning process. Thus, the developed Geography learning e-module is not only feasible practically, but also has great potential to be used continuously as a companion teaching material in Geography learning in schools

*Evaluation Stage*

The evaluation stage was carried out to assess the effectiveness of interactive learning e-modules in improving student learning outcomes. The evaluation was carried out using a one group pretest-posttest design. The results of the analysis showed an increase in student learning outcomes after using the e-module, with an average N-Gain value of 0.58 (58%) which was in the category of quite effective. This is in line with research conducted by Sofyan et al. (2025) which also obtained an N-Gain value in the medium category, thus confirming that the interactive e-module is effectively used as a companion teaching material in Geography learning. In addition to improving learning outcomes, the response of teachers and students to the effectiveness of e-modules is in the very high category. These results show that interactive learning e-modules are not only effective in improving understanding of Geography concepts, but also able to increase students' activeness and motivation to learn. Based on the results of the evaluation, the e-module developed was declared valid, practical, and effective for use in Geography learning in high school.

**Conclusion**

This research produced an interactive learning e-module for Geography class XI phase F which was developed using the ADDIE model. The test results show that the developed e-module is very feasible. The practicality test by teachers and students showed a very practical category. In addition, the effectiveness test showed an N-Gain value of 0.58 (58%), which is included in the effective category, so that the e-module is proven to be able to improve student learning outcomes. Thus, this interactive learning e-module is declared valid, practical, and effective for use in learning Geography in high school.

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#### Author Contributions

The following statements should be used “Conceptualization, L.S and A.B.; methodology, L.S.; software, L.S.; validation, U.R., L.Z. and D.A.; formal analysis, L.S.; investigation, L.S.; resources, L.S.; data curation, L.S.; writing—original draft preparation, L.S.; visualization, L.S.; All authors have read and agreed to the published version of the manuscript.”

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#### Conflicts of Interest

The authors declare no conflict of interest.

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