

DEVELOPMENT OF DIFFERENTIATED LEARNING E-MODULES TO IMPROVE FIFTH GRADE SOCIAL STUDIES LEARNING OUTCOMES

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Abstract

This study aims to develop an E-module based on differentiated learning and to examine its validity, practicality, and effectiveness in improving elementary school students' social studies learning outcomes. The research is motivated by the limited use of technology in social studies instruction and the absence of digital modules that align with students' characteristics and learning styles. The study employs a Research and Development (R&D) method using the 4D model, which includes the stages of Define, Design, Develop, and Disseminate. The research subjects consist of experimental and control class students, teachers as respondents, and expert validators in content, media, and language. Data were collected through observation, questionnaires, tests, interviews, and documentation. The results show that the developed E-module is highly valid based on expert assessments, very practical according to teacher and student responses, and effective in improving social studies learning outcomes, with an average N-Gain score of 77.88 categorized as high. This e-module is suitable for use as an alternative teaching material in social studies learning in elementary schools.

Keywords: E-module; Differentiated Learning; Learning outcomes; Social Studies

Abstrak

Penelitian ini bertujuan untuk mengembangkan E-modul berbasis pembelajaran berdiferensiasi serta menguji validitas, kepraktisan, dan efektivitasnya dalam meningkatkan hasil belajar IPS siswa sekolah dasar. Latar belakang penelitian ini didasari oleh rendahnya pemanfaatan teknologi dalam pembelajaran IPS dan belum tersedianya modul digital yang sesuai dengan karakteristik serta gaya belajar siswa. Metode penelitian yang digunakan adalah Research and Development (R&D) dengan model 4D (Define, Design, Develop, dan Disseminate). Subjek penelitian meliputi siswa kelas eksperimen dan kontrol, guru sebagai responden, serta validator ahli materi, media, dan bahasa. Data dikumpulkan melalui observasi, angket, tes, wawancara, dan dokumentasi. Hasil penelitian menunjukkan bahwa E-modul yang dikembangkan sangat valid berdasarkan penilaian para ahli, sangat praktis menurut respon guru dan siswa, serta efektif meningkatkan hasil belajar IPS dengan skor N-Gain rata-rata sebesar 77,88 pada kategori tinggi. E-modul ini layak digunakan sebagai bahan ajar alternatif dalam pembelajaran IPS di sekolah dasar.

Kata Kunci: E-modul; Pembelajaran Berdiferensiasi; Hasil belajar; IPS

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Introduction

The rapid development of Information and Communication Technology (ICT) in the digital era requires the education sector to continuously adapt by creating learning experiences that are more engaging, meaningful, and relevant to students' needs. Teachers, as facilitators of learning, are expected to utilize technology innovatively so that the learning process is no longer confined to textbook-based activities. However, in reality, many elementary school learning activities remain conventional, dominated by lectures and the use of general learning resources provided by the government that are less contextual. Consequently, the learning process

becomes monotonous, less interactive, and unable to accommodate students' diverse learning styles (Sape et al., 2024).

This condition is also evident from observations conducted in Class VC of SD Negeri 02 Percontohan Bukittinggi. The Social Studies (IPS) learning process was still dominated by reading textbooks and question–answer sessions without innovative or engaging media. As a result, students' motivation was low, and many struggled to understand abstract concepts in Social Studies. The average student learning outcome was 64.07, below the Minimum Mastery Criteria (KKTP) of 75, with 18 out of 27 students failing to meet the standard. These data clearly show an empirical gap between learning expectations and actual classroom conditions, highlighting the urgent need for innovative instructional media and design.

Moreover, the diversity of students' learning styles presents an additional challenge. Non-cognitive diagnostic assessments revealed significant variation among students with visual, auditory, kinesthetic, and mixed learning preferences. Conventional printed modules do not sufficiently accommodate these differences. For instance, auditory learners tend to lose focus when exposed only to textual materials, while kinesthetic learners struggle to understand concepts through passive activities. This situation reinforces the need for learning media that are interactive and differentiated to meet diverse learner needs.

To address these challenges, developing differentiated learning e-modules emerges as a potential solution. Differentiated learning, as defined by Herwina (2021), is an instructional approach that adapts learning content, processes, and products according to students' readiness, interests, and learning profiles. This approach has been proven to increase engagement, improve learning outcomes, and reduce disparities among students. Supported by ICT, differentiation principles can be integrated into interactive e-modules through multimedia features, adaptive exercises, and flexible access that allow students to learn at their own pace and revisit materials as needed.

Previous studies have demonstrated the effectiveness of both e-modules and differentiated learning. Katrina et al. (2025) showed that interactive e-modules in mathematics improved students' conceptual understanding. Aeni and Widodo (2022) found that multimedia-based e-modules enhanced motivation through engaging visuals. Gymnastiar (2024) emphasized that differentiated instruction fosters active participation based on students' levels of understanding. Meanwhile, Wahyuni and Haryanti (2024) confirmed that the integration of differentiation principles with digital technology creates more inclusive and personalized learning environments.

However, most of these empirical studies focus on science-related subjects such as mathematics and natural sciences. Research integrating differentiation-based e-modules in elementary Social Studies remains limited, even though this subject requires media capable of concretizing abstract social concepts and accommodating diverse learning styles. This research gap underlines the importance of developing differentiated e-modules specifically designed for Social Studies at the elementary level.

Theoretically, this study is grounded in the integration of differentiated learning theory and technology-based instructional media design. The conceptual relationship among the key variables can be described as follows:



Figure 1. The conceptual relationship among the key variables

This framework emphasizes that digital media serve not merely as visual aids but as pedagogical tools for realizing adaptive and learner-centered instruction.

Based on this rationale, this study aims to develop a differentiated learning e-module for fifth-grade Social Studies with measurable objectives including validity, practicality, and effectiveness. It is expected that this e-module will not only address the empirical challenges observed at SD Negeri 02 Percontohan Bukittinggi but also contribute theoretically to the advancement of adaptive digital learning media in elementary education.

Research Methods

This study employed a Research and Development (R&D) approach to produce and evaluate a differentiated learning-based e-module aimed at improving fifth-grade students' Social Studies outcomes. The R&D method was chosen because it not only develops educational products but also tests their validity, practicality, and effectiveness in real classroom contexts (Sugiyono, 2018). The development process followed the 4D model (Define, Design, Develop, and Disseminate)(Waruwu, 2024).

Define Stage

The definition stage aims to establish learning objectives according to the curriculum and formulate product development requirements. Activities include front-end analysis to identify basic learning problems, student analysis to determine learning characteristics, and concept analysis to systematically organize material. Furthermore, task analysis is conducted to determine learning activities and objectives are formulated as the basis for test development. This overall analysis forms the basis for developing relevant and effective differentiated learning-based e-modules.

Design Stage

This stage aims to design E-modules in accordance with predetermined formats, producing an initial prototype as the basis for development. In the context of e-module development, this stage is carried out to create e-modules or textbooks in accordance with the content framework resulting from the curriculum and materials analysis. This stage encompasses the planning and implementation stages.

Development Stage

The development phase focuses on producing a differentiated learning-based E-module that is valid, practical, and effective through expert validation and subsequent revisions. Furthermore, a trial was conducted on grade VC students of SD Negeri 02 Percontohan Kota Bukittinggi through observation, questionnaires, and learning outcome tests to assess the e-module's practicality and effectiveness in social studies learning.

Dissemination Stage

The Disseminate stage aims to examine the effectiveness and applicability of the differentiated learning-based E-module on a broader scale through activities of socialization, limited distribution, and implementation in several elementary schools. This stage was conducted in three schools: SD Negeri 18 Tarok Dipo, SD Negeri 06 Pulai Anak Air, and SD Negeri 02 Aur Kuning. The schools were selected using a purposive sampling technique based

on curriculum similarity, technological infrastructure readiness, and the active involvement of teachers in ICT-based learning.

The dissemination process was designed in alignment with the principles of differentiated learning, which include: (1) identifying students' learning needs; (2) adapting materials according to students' ability levels and interests; (3) selecting varied instructional strategies; (4) providing diverse learning resources; (5) determining flexible assessment forms; (6) offering additional support for students in need; and (7) involving parents in supporting students' learning at home.

The research subjects at this stage included fifth-grade students as the primary users of the E-module, teachers as learning implementers and respondents in the practicality test and Focus Group Discussion (FGD), as well as media, content, and language experts as validators in the validation phase. The research sample was divided into three groups: (1) a small group trial involving six fifth-grade students from SD Negeri 18 Tarok Dipo with heterogeneous ability levels (high, medium, low); (2) a large group trial involving 28 fifth-grade students from SD Negeri 02 Percontohan, Bukittinggi City, as the main experimental site; and (3) an FGD session attended by six teachers from three partner schools SD Negeri 06 Pulau Anak Air, SD Negeri 02 Aur Kuning, and SD Negeri 18 Tarok Dipo.

The dissemination activities were carried out over four meetings, each lasting 2 × 35 minutes. During the process, direct interactions among researchers, teachers, and students were facilitated through technical assistance to ensure optimal use of the E-module. Data were collected through observations, questionnaires, and interviews to evaluate the feasibility of implementation and the level of acceptance of the E-module across various school contexts.

The following diagram illustrates the systematic flow of research and development procedures for the differentiated learning-based E-module:

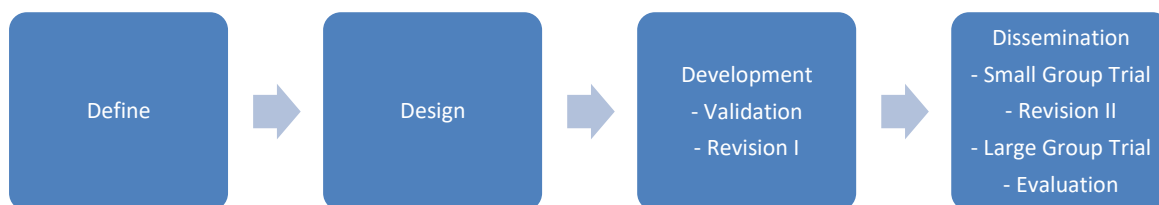


Figure 2. The systematic flow of research and development procedures for the differentiated learning-based E-module

The research employed several instruments to collect data on the validity, practicality, and effectiveness of the differentiated learning-based E-module. These instruments consisted of (1) validation sheets for subject matter, media, and language experts; (2) practicality questionnaires for teachers and students; and (3) cognitive learning outcome tests comprising multiple-choice and essay items.

The expert validation instruments were designed to assess the E-module in terms of content, media design, and linguistic appropriateness. Each validation sheet contained six to seven assessment items per expert domain: the media expert instrument included six items covering aspects such as general appearance, layout, readability, accessibility, and supporting visuals; the material expert instrument comprised three items focused on curriculum conformity, material quality, and supporting visuals; and the language expert instrument consisted of seven items related to readability, sentence structure, linguistic rules, and communicative clarity. The validation process was conducted using a Likert scale with four response options.

The practicality instruments included two sets of questionnaires (one for students and one for teachers) administered after the learning activities. The student practicality questionnaire consisted of four indicators (visual display, motivation and learning atmosphere, understanding of material, and ease of use) with 16 total items. The teacher practicality questionnaire contained four indicators (language, ease of use, material relevance, and visual appeal) comprising 12 total items. All questionnaire items used a four-point Likert scale.

The effectiveness instrument consisted of a learning outcome test developed to evaluate students' mastery of the topic "Explaining the Location and Geographical Conditions of Indonesia Using Conventional or Digital Maps." The test comprised 20 multiple-choice items and 5 essay questions designed to measure knowledge comprehension, application, and analysis levels. Effectiveness testing was conducted through a pretest–posttest design. The research instruments were subjected to reliability testing prior to use. Reliability coefficients were calculated using Cronbach's Alpha. The reliability results demonstrated high consistency across instruments, with coefficients of 0.91

This study used quantitative and qualitative approaches to analyze data obtained from the development and trial of differentiated learning-based e-modules in elementary schools. Quantitative analysis focused on measuring the validity, practicality, and effectiveness of the e-module, while qualitative analysis (derived from observation notes, teacher comments, and student feedback) was used to support and interpret the quantitative findings more comprehensively.

E-module Validity Test. The validity of the E-module was analyzed through expert assessment using a questionnaire instrument, then the results were calculated using the validation percentage formula to obtain the product feasibility value (Rama et al., 2022):

$$P = \frac{NP}{SM} \times 100\%$$

Information:

P = Percentage

NP = The value that obtained

SM = Score maximum

Expert validation results were analyzed using a Likert scale to determine the E-module's validity and feasibility.

Table 1. E-module Development Validity Categories

Evaluation	Category
86% - 100%	Very Valid
71% - 85%	Valid
51% - 70%	Less Valid
≤50%	Invalid

Practicality Test. The practicality of the E-module was assessed through educator and student questionnaires, analyzed using a practicality percentage formula (Rama et al., 2022):

$$NP = \frac{R}{SM} \times 100\%$$

Information:

- NP = Value percentage sought
- R = Score acquisition
- SM = Score maximum

After observing the educator and student response questionnaires, the next step was to find the average score for the practicality assessment of the e-module. The product's practicality criteria are as follows:

Table 2. E-module Practicality Categories

Range %	Category
81% - 100%	Very Practical
61% - 80%	Practical
41% - 60%	Quite Practical
21% - 40%	Less practical
≤ 20%	Impractical

Effectiveness test. The effectiveness of the differentiated learning-based E-module was evaluated using pretests and posttests to measure improvements in students' social studies outcomes. The N-Gain was chosen because it effectively measures the relative improvement in learning outcomes, accounting for students' initial performance levels. This allows for fairer comparisons across heterogeneous student groups, which aligns with the principles of differentiated learning (Rama et al., 2022).

$$N\text{-Gain} = (\text{Posttest Score} - \text{Pretest Score}) / (\text{Maximum Score} - \text{Pretest Score})$$

Information :

Posttest score = final test scores

Pretest score = initial test scores

Maximum score = ideal maximum score (100)

To determine the level of improvement in student learning outcomes, the Normalized Gain (N-Gain) value is used. This value is analyzed based on the following criteria:

Table 3. Interpretation of N-Gain

N-Gain	Criteria
N-Gain > 0.7	Tall
0.3 ≤ N-Gain < 0.7	Currently
N-Gain < 0.3	Low

Based on these criteria, an e-module can be considered suitable for use if the majority of students achieve moderate or higher performance improvement. The effectiveness classification is outlined in the following table as a reference for assessment. The results obtained will be interpreted based on the following table.

Table 4. Effectiveness Interval Categories

N-Gain Percentage Interval	Effectiveness Criteria
N-Gain Percentage < 40%	Ineffective
40% ≤ N-Gain Percentage < 55%	Less Effective
56% ≤ N-Gain Percentage ≤ 75%	Quite Effective
N-Gain Percentage > 76%	Effective

Hypothesis Testing. The normality test was conducted to determine the distribution of data in the experimental and control classes. According to Nurhaswinda et al., 2025, a normality test must be performed before hypothesis testing, using SPSS 16.0 with Kolmogorov-Smirnov. Data is said to be normal if the significance value is > 0.05, while a value < 0.05 indicates an abnormal distribution. Furthermore, a homogeneity test is used to determine the similarity of variance between sample groups with the Levene test via SPSS 16.0. Data is declared homogeneous if the significance value is > 0.05. After fulfilling the prerequisites, an effectiveness test is conducted by analyzing learning outcomes through pretest and posttest. Hypothesis testing is carried out using an independent sample T-test via SPSS 16.0 to see the significant effect. If Sig. (2-tailed) < 0.05, then H₀ is rejected and H_a is accepted.

Result and Discussion

This study produced a differentiated learning-based E-module to enhance fifth-grade students' social studies outcomes. The product includes structured social studies material, interactive learning activities, differentiated practice questions, and formative assessments, thus supporting active student engagement and enhancing learning effectiveness.

Define Stage Results

The definition phase aims to establish the basis for developing an E-module based on differentiated learning on the topic of Indonesia's Geographical Location. Front-end analysis shows that social studies learning is still dominated by lecture methods, the use of printed modules, and conventional questions, making it less interactive and unable to accommodate differences in student learning styles. Data on learning outcomes for class VC of SD Negeri 02 Percontohan Kota Bukittinggi shows an average score of 64.07, below the KKTP of 75, with 18 out of 27 students not completing the course. Teacher interviews confirmed the limitations of learning media and the need for interactive and flexible E-modules. Student analysis shows a diversity of learning styles (visual, auditory, kinesthetic) and readiness to use digital technology, with motivation increasing when learning is interesting and participatory. Concept analysis formulates three main materials, namely the geographical location of Indonesia, neighboring countries, and the use of conventional and digital maps. Task analysis produces a systematically integrated visual, auditory, and kinesthetic activity design, so that the E-module is able to support contextual, interactive learning, and is tailored to student needs. The define stage identified the need for an interactive, differentiated e-module that accommodates diverse learning styles and improves social studies achievement.

Instrument preparation. The research instruments used included expert validation instruments, practicality questionnaires, and effectiveness instruments. The expert validation instrument consisted of three aspects: material validation to assess the suitability of the content to the curriculum and conceptual validity; media validation to assess the appearance, animation, audio, and integration of the media with the content; and language validation to assess the linguistic aspects of the E-module. The practicality instrument, in the form of a questionnaire, was used to measure teacher and student responses regarding the readability, interest, ease of understanding, and interactivity of the E-module. The effectiveness instrument, consisting of

pretest and posttest items in the form of multiple-choice and essay questions, was developed based on learning indicators and tested on students outside the research sample to assess its validity and reliability.

Designing Media

During the design phase, e-modules were developed with attention to content, presentation, and the integration of differentiated learning. The module structure was systematically structured, encompassing objectives, concept maps, materials, interactive activities, reflections, and a glossary. Visual designs were enhanced through Canva, supported by video, interactive maps, audio, and digital exploration. Differentiation was applied to content, process, and product to accommodate the learning styles of visual, auditory, and kinesthetic students.

This stage produced validated instruments and a structured e-module design integrating differentiated learning principles.

Develop Phase Results

The development stage is the third stage in the 4D development model, focusing on product refinement through expert validation, limited trials, and media effectiveness testing. At this stage, the previously designed e-module is further developed to ensure that the final product is valid, practical, and effective in improving elementary school students' social studies learning outcomes. This stage is divided into four main parts:

Media Development Results (E-module). The Indonesian Geographical Location e-module for fifth-grade elementary school was developed using differentiated learning using Canva Education, presenting an interactive layout integrating conventional and digital maps to enhance student understanding. The developed e-module can be seen in the following image:

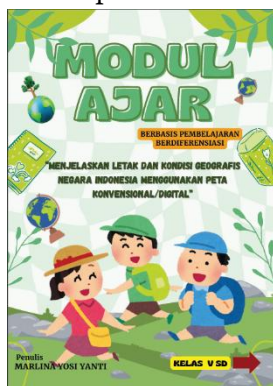


Figure 3. E-module Cover

This figure displays the front cover of the differentiated learning-based e-module entitled “*Geographical Location of Indonesia.*” The cover design utilizes Canva Education with a thematic illustration of Indonesia’s map, intended to attract students’ attention and visually represent the learning topic.

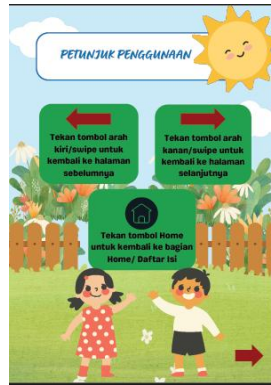


Figure 4. Instructions for Use Section

This section provides operational guidelines for both teachers and students on how to navigate and use the e-module. It includes steps for accessing materials, completing interactive activities, and submitting reflection tasks through digital links, ensuring ease of use and independent learning.



Figure 5. General Information

This part introduces essential information such as learning topics, target competencies, and estimated study time. It serves as an orientation page that helps learners understand the scope and learning objectives before engaging with the material.



Figure 6. Differentiation Mapping

This figure illustrates the mapping of differentiation strategies applied in the e-module. It shows how content, process, and product differentiation are structured to accommodate visual,

auditory, and kinesthetic learning styles, allowing students to choose learning pathways according to their preferences and readiness.



Figure 7. Learning Objectives

This section outlines specific learning objectives aligned with the Independent Curriculum’s Learning Outcomes (CP) and Learning Objectives (ATP) for Grade V social studies. It guides students toward achieving cognitive, affective, and psychomotor competencies through measurable indicators.



Figure 8. Learning Activities

This figure presents examples of interactive learning activities provided in the e-module, such as digital map exploration, audio explanations, and hands-on practice tasks. Each activity is differentiated to promote active learning, collaboration, and deeper understanding of Indonesia’s geographical characteristics.

Table 5. Results of E-module Validation by Media Experts

No.	Rated aspect	Validity Value (%)	Category
1.	General Appearance and Visual Appeal	100.00	Very Valid
2.	E-module layout and components	87.5	Very Valid
3.	Suitability with elementary school student learning	100.00	Very Valid

4.	Text Readability	100.00	Very Valid
5.	Ease of access and navigation	100.00	Very Valid
6.	Supporting Visual Media	83.33	Very Valid
Average		95	Very Valid

Based on Table 5, the validity assessment of the E-module by media experts on the material "Explaining the location and geographical conditions of Indonesia using conventional or digital maps" for grade V elementary school obtained an average score of 95%, categorized as very valid. This indicates that the E-module meets validity criteria across all assessed aspects, including design, layout, readability, accessibility, navigation, and supporting visuals, making it suitable for classroom use in the learning process.

Table 6. Results of E-module Validation by Material Experts

No.	Rated aspect	Validity Value (%)	Category
1.	Conformity with curriculum and learning	90	Very Valid
2.	Quality of presentation of material	96.42	Very Valid
3.	Supporting visual media	100.00	Very Valid
Average		94.64	Very Valid

Table 6 shows that the material expert validation of the e-module achieved an average score of 94.64%, classified as very valid. This demonstrates that the e-module aligns with curriculum requirements, presents quality material, and is supported by appropriate visuals, thereby making it feasible for classroom implementation.

Table 7. Results of E-module Validation by Language Experts

No.	Rated aspect	Validity Value (%)	Category
1.	Text readability	100.00	Very Valid
2.	Effectiveness of Description	100.00	Very Valid
3.	Sentence Structure	100.00	Very Valid
4.	Conformity with Indonesian language rules	75.00	Valid
5.	Suitability to student level	100.00	Very Valid
6.	Communicative	100.00	Very Valid
7.	Clarity of meaning	100.00	Very Valid
Average		96.42	Very Valid

Based on Table 7, it can be seen that the validity results of the E-module by linguists for the material "Explaining the location and geographical conditions of Indonesia using conventional or digital maps" for grade V elementary school have an average value of 96.42% with a very valid category. This indicates that the developed E-module is valid for all aspects of the language assessed and can be used in the classroom for the learning process.

Focus Group Discussion (FGD). Focus Group Discussion (FGD) was conducted as a validation stage of the E-module, involving six teachers from three different elementary schools, including representatives of the fifth-grade homeroom teachers. This activity was conducted at one of the elementary schools, namely SDN 02 Aur Kuning, which was attended by 6 teachers

as participants where there were representatives from the three fifth-grade homeroom teachers from SD Negeri 06 Pulau Anak Air, SD Negeri 02 Aur Kuning, and SD Negeri 18 Tarok Dipo along with researchers as presenters. The activity discussed the operational use of the E-module and its relevance in learning. Validation was carried out through the distribution of questionnaires covering four main aspects, namely material, language, presentation, and media, to obtain comprehensive input.

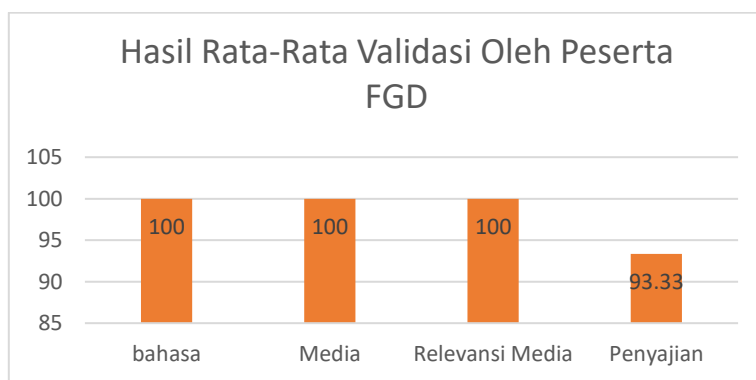


Figure 9. Validity Test Graph by FGD Participants

The Figure 9. shows the FGD participants’ validation results of the differentiated learning-based Social Studies e-module. The language, media, and media relevance aspects achieved a 100% (very valid) score, while the presentation aspect scored 93.33% (very valid).an overall average score of 96.96%, categorized as very valid, indicating its feasibility for use in the learning process.

Practicality testing was conducted by collecting responses from students and educators to assess the practical use of the designed teaching materials, based on the data obtained. Both questionnaires were completed after the learning process was completed.

Student practicality testing was conducted in two stages: a small group trial (6 students with heterogeneous abilities) and a large group trial (28 students). The results of both trials are summarized in Table 8.

Table 8. Results of the Student Practicality Questionnaire (Small Group Trial)

No.	Rated aspect	Small Group (%)	Large Group (%)	Average (%)	Category
1.	Visual Display	91.66	95.83	93.75	Very Practical
2.	Motivation and Learning Atmosphere	91.66	96.88	94.27	Very Practical
3.	Understanding of Material	86.11	96.73	91.42	Very practical
4.	Ease of Use	83.33	95.54	89.44	Very practical
Average		88.89	96.33	92.61	Very practical

The combined data indicate that the practicality value increased from the small group (88.89%) to the large group trial (96.33%), with an overall mean of 92.61%, categorized as *very practical*. These findings suggest that the e-module is easy to operate, visually engaging, and

supports students' motivation and comprehension effectively in both limited and broader classroom contexts.

In addition to students, practicality testing was also conducted with teachers to obtain professional judgments on usability and instructional quality. The results are presented in Table 9.

Table 9. Practicality Questionnaire Results (Teacher Responses)

No.	Rated aspect	Practicality Value (%)	Category
1.	Language	100.00	Very Practical
2.	Ease of Use	100.00	Very practical
3.	Relevance of Material	100.00	Very practical
4.	Visual Appeal	93.33	Very practical
Average		97.14	Very practical

Table 10 shows that teachers rated the e-module's practicality at 97.14%, categorized as very practical. Overall, respondents assessed that the developed e-module was easy and practical to use.

Table 10. Classical Completion of Students

Trial Activities	Completed	Not Completed	Classical Completion (%)
Pretest	4	24	14.28
Posttest	24	4	85.71

The effectiveness test of the differentiated learning-based E-module was conducted through a pretest and posttest to assess the improvement in student learning outcomes. The pretest was administered before the learning to determine students' initial abilities, which showed low results, with only 4 out of 28 students, or 14.28%, achieving the completion criteria. Furthermore, learning was carried out using a developed E-module, adapted to visual, auditory, and kinesthetic learning styles. After the learning was completed, students took a posttest to assess the differences in abilities before and after using the E-module. The posttest results showed a significant improvement, with classical completion increasing to 85.71%, proving the effectiveness of the E-module in improving understanding of social studies concepts.

Table 12. N-Gain Measurement Results

Trial Activities	Average Score	Average N-Gain(%)	Criteria
Pretest	52.14	77.88	Effective
Posttest	88.21		

The N-Gain analysis in Table 12 shows that the differentiated learning-based E-module for fifth-grade students is effective, with an average score of 77.88 categorized as effective. This demonstrates its ability to enhance students' social studies understanding while supporting adaptive learning aligned with diverse learning styles.

Table 13. Output of the Independent Sample T-Test on post-test data of science learning outcomes of students in the experimental group and control group

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Standard Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Data	Equal variances assumed	4,085	.050	7,967	40	.000	20,952	2,630	15,637	26,268
	Equal variances not assumed			7,967	32,833	.000	20,952	2,630	15,601	26,304

Based on the output results above, it is known that the significance value (Sig. 2-tailed) is 0.000, which is smaller than $\alpha = 0.05$. This indicates that there is a significant difference between the average social studies learning outcomes of students who use E-modules based on differentiated learning and those who use conventional learning. Thus, it can be concluded that E-modules based on differentiated learning on social studies material about the geographical location of Indonesia using conventional and digital maps for grade V Elementary Schools have proven effective in improving student learning outcomes.

The developed e-module is very valid, very practical, and highly effective in improving social studies outcomes and accommodating learner diversity.

Disseminate Stage

Following the validation, practicality, and effectiveness tests, the next stage was dissemination. In this study, dissemination was conducted on a limited scale by introducing the differentiated learning-based E-module to the Educator Working Group (KKG) in three elementary schools in Bukittinggi City: SD Negeri 06 Pulau Anak Air, SD Negeri 02 Aur Kuning, and SD Negeri 18 Tarok Dipo.

The research findings indicate that the development of a differentiated learning-based E-module for fifth-grade students was carried out systematically, emphasizing validity, practicality, and effectiveness. The E-module demonstrated a high level of validity, with an overall expert validation score of 95.35%, signifying its strong alignment with the Learning Outcomes (CP) and Learning Objectives (ATP) of the Independent Curriculum. Material experts confirmed that the content was presented contextually and was relevant to students' real-life experiences, while language experts highlighted that the language used was clear, communicative, and age-appropriate, thus supporting students' independent learning. Media experts also evaluated the design aspects—such as layout, interactivity, and illustrations—as highly suitable for elementary students' characteristics. These results are consistent with the findings of Fridayanti et al. (2022), who found that learning media designed to accommodate individual learning needs and supported by engaging visuals tend to be valid, practical, and effective in improving learning outcomes. Accordingly, the developed E-module fulfills the characteristics of high-quality teaching materials as outlined by Taqiya Muslimah and

Prabawati (2022), namely being *self-instructional*, *self-contained*, *stand-alone*, *adaptive*, and *user-friendly*.

In terms of practicality, both teachers and students responded very positively to the use of the differentiated E-module. The practicality score reached 96.33% from students and 97.14% from teachers, indicating a *very practical* category. Teachers noted that the E-module facilitated classroom management in heterogeneous learning environments by integrating differentiation in content, process, and product. For instance, a single module provided core, enrichment, and remedial materials, allowing teachers to adapt instruction according to students' readiness and learning profiles. Students reported that the E-module was interesting and allowed flexibility in choosing learning paths according to their learning styles and interests. This aligns with the studies of Gymnastiar (2024) and Armadhani & Utama (2024), which emphasize that differentiated learning media enhance engagement and motivation by accommodating diverse learning needs. Therefore, the developed E-module is not only practical but also adaptive to the varied contexts of classroom learning.

Regarding effectiveness, the implementation of the differentiated E-module significantly improved students' learning outcomes. The N-Gain analysis yielded an average score of 77.68 (high category), indicating a substantial increase in conceptual understanding, while the independent sample t-test produced a *p-value* of 0.000 (< 0.05), confirming a significant difference compared to conventional learning. These results demonstrate that differentiation in content, process, and product contributes to students' cognitive, affective, and psychomotor development. In the cognitive domain, students were able to identify Indonesia's geographical and astronomical locations, distinguish between conventional and digital maps, and explain the relationship between geography, climate, and socio-cultural diversity. In the affective domain, students showed greater curiosity and appreciation for national diversity, while in the psychomotor domain, they demonstrated proficiency in using both printed and digital maps (e.g., Google Maps) for coordinate reading, distance measurement, and spatial exploration. These findings are in line with Christiawan & Ganesha (2025), who found that interactive media can significantly enhance students' understanding of geography, as well as Santoso et al. (2025), who reported that digital maps effectively improve students' spatial and analytical skills. Furthermore, Saraswati et al. (2025) emphasized that digital learning materials tailored to students' abilities increase both engagement and learning effectiveness.

Compared to previous research, this study contributes an innovative approach by integrating content, process, and product differentiation into a single social studies E-module, thereby providing students with varied learning pathways that align with their preferences and readiness levels. Consequently, this E-module not only reinforces theoretical perspectives on differentiated learning (Sitorus, 2025) but also offers practical benefits for teachers in managing diverse classroom contexts in elementary education.

From a theoretical standpoint, the success of the differentiated learning-based E-module can be interpreted through constructivist theory (Piaget, Bruner), which posits that learners construct knowledge actively through meaningful experiences (Mandar & Sihono, 2025). The E-module facilitates such experiences through exploration activities, digital interaction, and contextual problem-solving. In addition, Vygotsky's social learning theory supports this finding, emphasizing that students' knowledge construction occurs through interaction with teachers and peers within the Zone of Proximal Development (ZPD), which fosters collaborative meaning-making (Kusuma et al., 2025).

However, this study also has certain limitations that should be acknowledged. The research was conducted within a limited sample size and focused on specific schools, which

may restrict the generalizability of the findings. Additionally, the practicality data were heavily based on teacher and student self-reports, which might introduce subjective bias. Future studies should consider broader implementation across diverse regions and include objective performance-based assessments to strengthen the evidence base for the effectiveness of differentiated learning-based E-modules.

Conclusion

The differentiated learning-based E-module for fifth-grade elementary school social studies (IPS) on the topic “Explaining Indonesia’s Geographical Location Using Conventional and Digital Maps” has been proven to meet the criteria of validity, practicality, and effectiveness. From the validity aspect, the E-module achieved a very valid category with an average validation score of 95.35%, encompassing high ratings in content, presentation, language, and graphics. In terms of practicality, both teachers and students assessed the E-module as very practical, with average practicality scores of 97.14% and 96.33%, respectively. The E-module was considered easy to use, efficient in learning time, and well-suited to the varied learning needs of both students and teachers. From the effectiveness aspect, the learning outcomes showed significant improvement, with an average N-Gain score of 77.68 (high category). Statistical analysis using an independent sample t-test produced a significance value of 0.000 (< 0.05), confirming that students who used the E-module performed significantly better than those who learned through conventional methods. These results affirm that the differentiated learning-based E-module effectively enhances conceptual understanding, engagement, and learning outcomes in social studies learning.

The implications of this study demonstrate that the developed E-module not only enriches social studies learning resources but also strengthens spatial literacy, critical thinking skills, and student motivation through its interactive, adaptive, and visually engaging design that accommodates various learning styles. Theoretically, this research reinforces the constructivist learning framework, which emphasizes active knowledge construction through contextual and meaningful experiences, as well as Vygotsky’s social learning theory that highlights the importance of interaction within the Zone of Proximal Development (ZPD) in promoting deeper understanding. Practically, the E-module provides a model for teachers to implement differentiated instruction effectively in heterogeneous classrooms, thereby supporting inclusive and student-centered learning. For future research, it is recommended to conduct broader trials involving larger and more diverse student samples across different regions to strengthen the generalizability of the findings.

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