



Jurnal Ilmiah Pendidikan Citra Bakti

p-ISSN 2355-5106 || e-ISSN 2620-6641

<https://jurnal.citrabakti.ac.id/index.php/jil>



DEVELOPMENT OF A WEB-BASED TRIGONOMETRY E-MODULE WITH A MINDFUL LEARNING APPROACH

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Article History	Abstract
<p><i>Received:</i> January 9, 2025</p> <p><i>Accepted:</i> January 31, 2026</p> <p><i>Published:</i> February 25, 2026</p>	<p>This research aims to develop a web-based trigonometry learning medium using a mindful learning approach for Grade X students at SMK Hang Tuah Kediri. The study analyzes the feasibility, practicality, and effectiveness of the medium in supporting student learning outcomes. The method employed is Research and Development (R&D), adapting the ADDIE model. The research stages include needs analysis, design, product development, expert validation, and field testing with 17 Grade X students. Validation results showed a very high level of validity with a Gregory coefficient of 1.00. The medium was declared feasible without substantial revision as the material structure aligns with the Learning Path Objectives at SMK Hang Tuah Kediri. The depth of the material was considered highly relevant to basic competency indicators, achieving a perfect score in both content and construction aspects. In terms of practicality, student and teacher responses reached an average of 91.82%, categorized as highly practical. Meanwhile, the effectiveness of the medium, based on learning evaluation results, showed an average N-Gain value of 49.41%. This value falls within the 40–59% range, categorized as moderately effective. Pedagogically, this achievement indicates that the medium is capable of facilitating the transition of students' understanding of trigonometric concepts from basic to complex levels, although teacher guidance remains necessary for optimal results.</p> <p>Keywords: Mathematics Learning Media, Mindful Learning, Trigonometry, Website</p>

Abstrak. Penelitian ini bertujuan untuk mengembangkan media pembelajaran trigonometri berbasis web menggunakan pendekatan *mindful learning* untuk siswa kelas X di SMK Hang Tuah Kediri. Penelitian ini menganalisis kelayakan, kepraktisan, dan efektivitas media tersebut dalam mendukung hasil belajar siswa. Metode yang digunakan adalah *Research and Development* (R&D) dengan mengadaptasi model ADDIE. Tahapan penelitian meliputi analisis kebutuhan, perancangan, pengembangan produk, validasi ahli, serta uji coba lapangan yang melibatkan 17 siswa kelas X. Hasil validasi menunjukkan tingkat validitas yang sangat tinggi dengan koefisien Gregory sebesar 1,00. Media dinyatakan layak tanpa revisi substansial karena struktur materi telah selaras dengan Alur Tujuan Pembelajaran (ATP) di SMK Hang Tuah Kediri. Kedalaman materi dinilai sangat relevan terhadap indikator kompetensi dasar, serta memperoleh skor sempurna pada aspek isi maupun konstruksi. Dari sisi kepraktisan, respons siswa dan guru mencapai rata-rata 91,82% dan termasuk kategori sangat praktis. Sementara itu, efektivitas media berdasarkan hasil evaluasi pembelajaran menunjukkan nilai rata-rata N-Gain sebesar 49,41%. Nilai ini berada pada rentang 40–59% sehingga dikategorikan cukup efektif. Secara pedagogis, capaian ini mengindikasikan bahwa media mampu memfasilitasi transisi pemahaman siswa terhadap konsep trigonometri dari tingkat dasar menuju tingkat yang lebih kompleks, meskipun pendampingan guru tetap diperlukan untuk memperoleh hasil yang optimal.

Kata kunci: Media Pembelajaran Matematika, *Mindful Learning*, Trigonometri, Website

Background

Mathematics education plays a vital role in developing students' logical, analytical, and systematic thinking skills; however, it is frequently perceived as a difficult subject due to its abstract and symbolic nature. This perception negatively impacts student motivation, particularly in topics requiring deep understanding, such as trigonometry (Nugraha & Wardhani, 2022). Based on preliminary observations and problem identification questionnaires conducted with Grade X students at SMK Hang Tuah Kediri during the odd semester of the 2025/2026 academic year, significant barriers to learning mathematics were identified. Data revealed that 72% of students still struggle to understand basic trigonometric concepts and tend to memorize formulas without grasping their application essence. Furthermore, classroom activity observation instruments showed that 65% of students exhibited low enthusiasm and active participation. This condition indicates a need for innovative learning media that focus not only on technical content but also on students' learning awareness.

Trigonometry is an essential subject in the high school/vocational school curriculum as it forms the foundation for various disciplines such as physics, engineering, and informatics. However, the complexity of trigonometric concepts, functions, and identities causes students to emphasize formula memorization over deep conceptual understanding, leading to frequent application errors (Rahayu, 2021). These errors arise from weak inter-concept connections and students' low ability to make sense of their own thinking processes (Putra, 2023). Therefore, a learning strategy that encourages student awareness and active engagement is required.

One relevant alternative solution to address mathematics learning issues is the development of digital learning media. However, in practice, the utilization of digital media in mathematics classrooms remains limited, as teachers tend to rely on textbooks, whiteboards, and simple presentations as primary learning sources. This situation results in a less varied learning process that fails to fully accommodate students' diverse learning styles. In fact, developments in educational technology offer significant opportunities for using interactive digital media, such as web-based e-modules, which can be accessed anytime and anywhere according to student needs (Wulandari, 2022).

Web-based e-modules offer advantages by presenting learning materials more attractively and interactively through animations, instructional videos, and practice questions equipped with automatic feedback. These characteristics enable students to learn independently, actively, and contextually at their own pace (Firmansyah, 2021). Through automatic feedback, students can immediately identify errors and understand unmastered concepts, making the learning process more effective and understanding-oriented. Additionally, visual and interactive material presentation helps students conceptualize abstract mathematical ideas, including trigonometry, which has been traditionally considered difficult. The flexibility of access offered by web-based e-modules also supports continuous learning outside the classroom. According to Putri Hartini, Aan Nurfahrudianto, and Ika Santia (2025), e-modules function not only as material providers but also as learning tools that integrate text, images, videos, and interactive evaluations into a unified whole.

Furthermore, research by Ika Santia, Aprillia Dwi Handayani, Lina Rihatul Hima, and Aan Nurfahrudianto (2022) emphasizes that e-modules have great potential in developing mathematical thinking skills through a multiple representation approach. Thus, developing web-based e-modules is a strategic alternative for creating mathematics learning that is more effective and responsive to student needs.

For digital media to be used effectively, a learning approach suited to 21st-century characteristics is necessary, such as the Mindful Learning approach. According to Langer (as cited in Hidayani et al., 2025), Mindful Learning emphasizes full awareness in the learning process through active attention, cognitive flexibility, and openness to multiple perspectives. In mathematics, this approach encourages students to consciously understand their thinking processes rather than just memorizing formulas (Gunawan, 2020), while also helping to reduce math anxiety and improve concentration (Susanti, 2022).

The application of Mindful Learning facilitates more meaningful learning by treating mistakes as part of the thinking process and developing reflective, metacognitive skills and sensitivity to varied problem contexts. This can be optimized through web-based e-modules with interactive features that help students reflect on solution steps and relate learning to

real-world situations. Previous research shows that interactive e-modules significantly improve conceptual understanding (Lestari, 2022); however, many e-modules remain merely digitized versions of books without clear pedagogical innovation (Utami, 2022).

The novelty of this research lies in the integration of interactive simulation features and instant reflection mechanisms that explicitly distinguish it from conventional, static trigonometry e-modules. Unlike previous media, this e-module allows students to directly manipulate trigonometric variables through web-based visualizations to build intuitive understanding. Additionally, an evaluation feature provides automatic discussions of results immediately after completion, serving as a critical reflection tool for students to recognize their thinking errors. Through this combination of interactive simulation and responsive feedback, developing a web-based e-module with a Mindful Learning approach is a strategic step toward creating more active, reflective, and meaningful mathematics learning, as stated in the study titled "Development of a Web-Based Trigonometry E-Module with a Mindful Learning Approach for Grade X Students at SMK Hang Tuah Kediri."

This study aims to describe the development process of a web-based trigonometry e-module with a mindful learning approach and analyze user responses within the partner school environment. Specifically, this research is directed to answer two main questions: (1) How is the process of developing trigonometry learning media with a mindful learning approach through a series of trial stages and expert validation? and (2) How are the user responses at SMK Hang Tuah Kediri after the implementation of the web-based trigonometry e-module using a mindful learning approach? Through these objectives, this research is expected to contribute a learning medium that is not only instructionally valid but also practical and relevant to the psychological and cognitive needs of students in learning trigonometric concepts.

Method

This study employs the Research and Development (R&D) approach, a research method aimed at producing specific products while simultaneously testing their feasibility and effectiveness. According to Sugiyono (2020), R&D research differs from descriptive or experimental research because it does not merely focus on phenomenon analysis but results in tangible products such as learning media, curriculum tools, or evaluation instruments. Based on this premise, this research is directed toward the development of a web-based e-module learning medium designed to help students understand trigonometric concepts deeply, enhance learning focus, and foster cognitive awareness within the mathematical thinking process.

In developing web-based e-module learning media, the ADDIE model is frequently selected due to its simple yet comprehensive steps that represent the processes of Analysis, Design, Development, Implementation, and Evaluation. According to Lestari (2021), the ADDIE stages are highly relevant for digital media development as they emphasize iterative testing and revision. This ensures that the resulting product is valid, practical, and effective for use. The stages of the ADDIE model are illustrated in Figure 1 as follows:

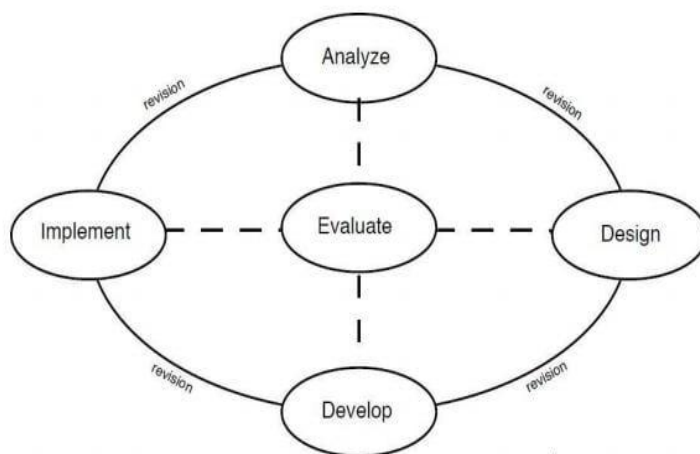


Figure 1. Stages of the ADDIE Development Model

The ADDIE model is implemented through five systematic main stages: analysis, design, development, implementation, and evaluation. In the analysis stage, the researcher identifies the needs and challenges of trigonometry learning at SMK Hang Tuah Kediri. The design stage involves drafting trigonometry materials aligned with the basic competencies and learning outcomes (*Capaian Pembelajaran*) of the *Kurikulum Merdeka* using a mindful learning approach, as well as designing the web-based e-module structure, including navigation, interface design, and interactive multimedia integration. Subsequently, the development stage is conducted by transforming the designs into an interactive e-module, which is then validated by material and media experts to assess content feasibility, design, and pedagogical alignment. The implementation stage is carried out through limited and field trials, with data collected via observations, questionnaires, and learning outcome tests. Finally, the evaluation stage aims to assess the quality of the e-module in terms of feasibility, practicality, and effectiveness, the results of which are used for product refinement.

Product testing is conducted to ensure the quality and feasibility of the learning media before wide-scale implementation. This procedure is divided into two parts: trial design and trial subjects. The trial design begins with expert validation to assess the content and construction feasibility of the product. The validation results serve as the basis for media improvement before being tested by users to gather response data through questionnaires.

The trial subjects in this study involve Grade X students of SMK Hang Tuah Kediri as direct users. The trials are conducted in two main phases: (1) a small-scale trial involving 11

students to evaluate understandability, ease of navigation, and initial engagement; and (2) a large-scale trial involving 17 students to obtain comprehensive data regarding the practicality and effectiveness of the e-module in the mathematics learning process. Assessments from both groups serve as the final foundation for refining the learning media to ensure it provides tangible benefits in supporting students' conceptual understanding.

This research and development study utilizes three primary data collection techniques: observation, interviews, and questionnaires. Observation is conducted to monitor mathematics learning conditions in Grade X at SMK Hang Tuah Kediri, specifically regarding the use of learning media for trigonometry. Interviews with mathematics teachers aim to gather information on student difficulties, media limitations, and expectations for the web-based e-module development. Questionnaires are distributed to students to obtain data on their responses, motivation, and perceptions toward the developed web-based e-module.

Data analysis includes media validity analysis and quantitative descriptive analysis using instruments such as material and media expert validation sheets, as well as student response questionnaires based on a Likert scale. The student response data is analyzed to determine user reactions to the web-based Mindful Learning media. The instrument grids for validation and user responses are presented in Tables 1 through 3.

Table 1. Validation Instrument Grid for Material Experts

No	Aspect	Assessment Indicators
1	Content Quality	Alignment with objectives, consistency with mindful learning concepts, relevance to real-life situations, and enhancement of student interest.
2	Language	Ease of understanding, sentence structure accuracy, linguistic effectiveness, appropriateness of mathematical terminology, and correct punctuation.

Table 2. Validation Instrument Grid for Media Experts

No	Aspect	Assessment Indicators
1	Visual Appearance (Aesthetics)	Visual forms, layout, color palette, typography, font types, clarity, and media composition.
2	Language	The language used is easy to understand.
3	Technical (Physical & Durability)	The size of the instructional media, the durability of the learning media, and its neat/organized appearance
4	Usability & Ease of Use	The user guide/manual for the media is easy to understand.
5	Content Quality	The developed media aligns with the learning objectives.

Table 3. Instrument Grid for User Response Questionnaires (Students & Teachers)

No	Aspect	Assessment Indicators
1	Content / Material	Descriptions of trigonometry, ease of media use, completeness of material, enhancement of memory retention, and understanding of trigonometric concepts.
2	Language	Ease of comprehension, clarity of information, use of simple fonts, and legible font sizes within the media.
3	Attractiveness	Media interface/appearance, encouraging students to think, enabling students to discover concepts independently, preventing boredom, motivating students to study seriously, increasing curiosity, and quality of images and design neatness.

The expert validation calculation scale and the resulting scores are categorized based on the criteria specified in the material and media validity criteria table.

Table 4. Validity Criteria for Material & Media

Percentage	Criteria
75% - 100%	Very Valid, usable without revision
50% - 75%	Valid, usable with minor revisions
25% - 50%	Less Valid, requires major revisions, not recommended for use
0% - 25%	Invalid, cannot be used

Source: Wulandari & Putra (2022)

The criteria for user responses (students and teachers) regarding the attractiveness of the media are as follows:

Table 5. User Response Criteria (Students & Teachers)

Percentage	Criteria
81% - 100%	Very Attractive
61% - 80%	Attractive
41% - 60%	Moderately Attractive
21% - 40%	Unattractive
0% - 20%	Very Unattractive

Source: Kurniawan & Hasanah, 2022

Student final scores are calculated using the following formula:

$$\text{Value} = \frac{\sum X}{\sum G} \times 100\%$$

Value : Final score obtained by the student

$\sum X$: Total score obtained by the student

$\sum G$: Maximum possible score on the instrument

Table 6. User Response Categories (Students & Teachers)

Score Range	Understanding Category
86 – 100	Very Good
71 – 85	Good
56 – 70	Fair
41 – 55	Poor
≤40	Very Poor

Result and Discussion

Result

In this stage, the researcher visited SMK Hang Tuah Kediri to directly observe the mathematics learning mechanisms, particularly regarding trigonometry in Grade X. Based on preliminary observations and an evaluation of the learning process, it was found that many students experience difficulties in understanding basic trigonometric concepts, such as trigonometric ratios, the relationship between angles and triangles, and their application in problem-solving. A needs analysis was also conducted through interviews with the Grade X mathematics teacher. The teacher stated that the learning media used were still limited to textbooks and static presentation slides. In addition to observations and interviews, the researcher performed a document analysis of Lesson Plans (RPP), daily test scores, and

final evaluation results for the Trigonometry topic. The students' average score was recorded at 68, which is below the Minimum Learning Mastery Standard of 75. This condition underscores the need for innovative learning media capable of enhancing conceptual understanding, learning engagement, and the quality of students' self-reflection.

Based on the results of the needs analysis, the researcher designed a solution by developing a learning medium focused on a web-based e-module. This module integrates a Mindful Learning approach to improve trigonometry concept comprehension for Grade X students at SMK Hang Tuah Kediri. The media design was structured through a systematic approach considering visual aspects, functionality, and learning flows that support the mindfulness process during the learning activity. The user interface (UI) design is presented in the following figures:

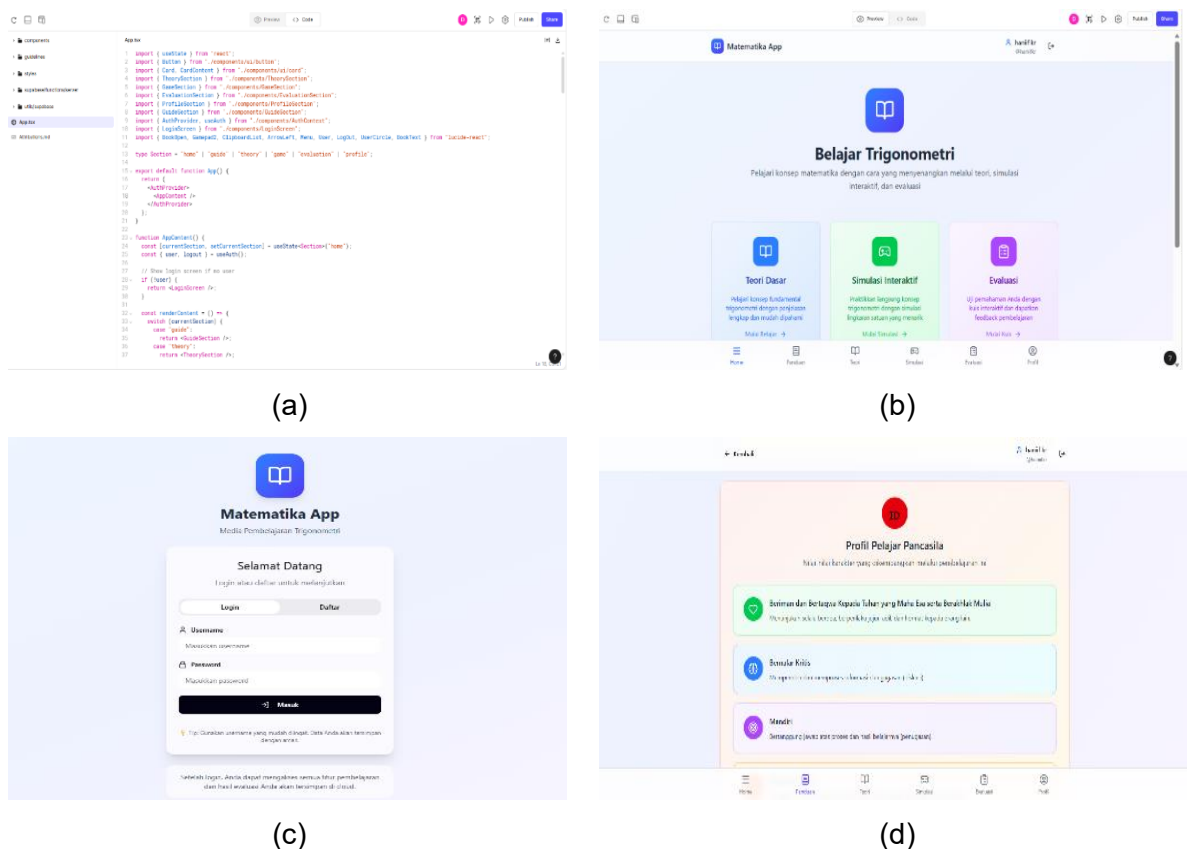


Figure 2. Initial Design of the Learning Media Development Process and Login Menu (a. Initial Design of the Learning Media Development Process and Login Menu)

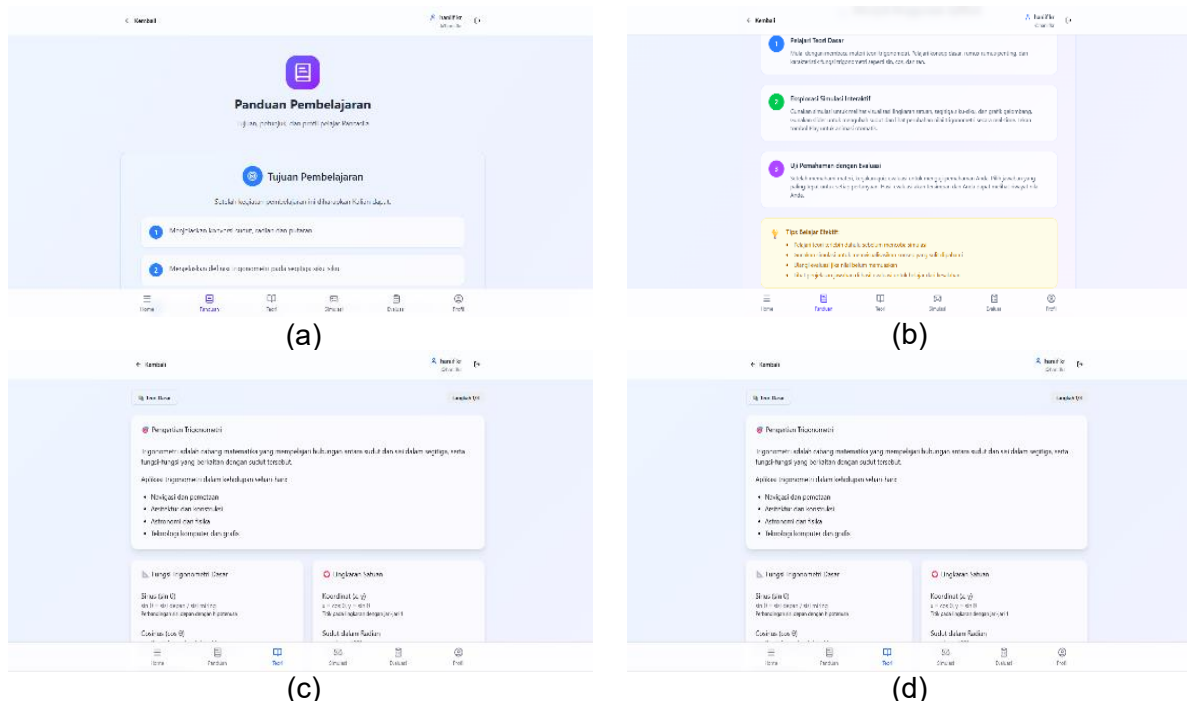


Figure 3. Initial Design of the Guide Page and Learning Materials (a. Guide Page, b. User Instructions, c. Learning Materials, d. Material Content)

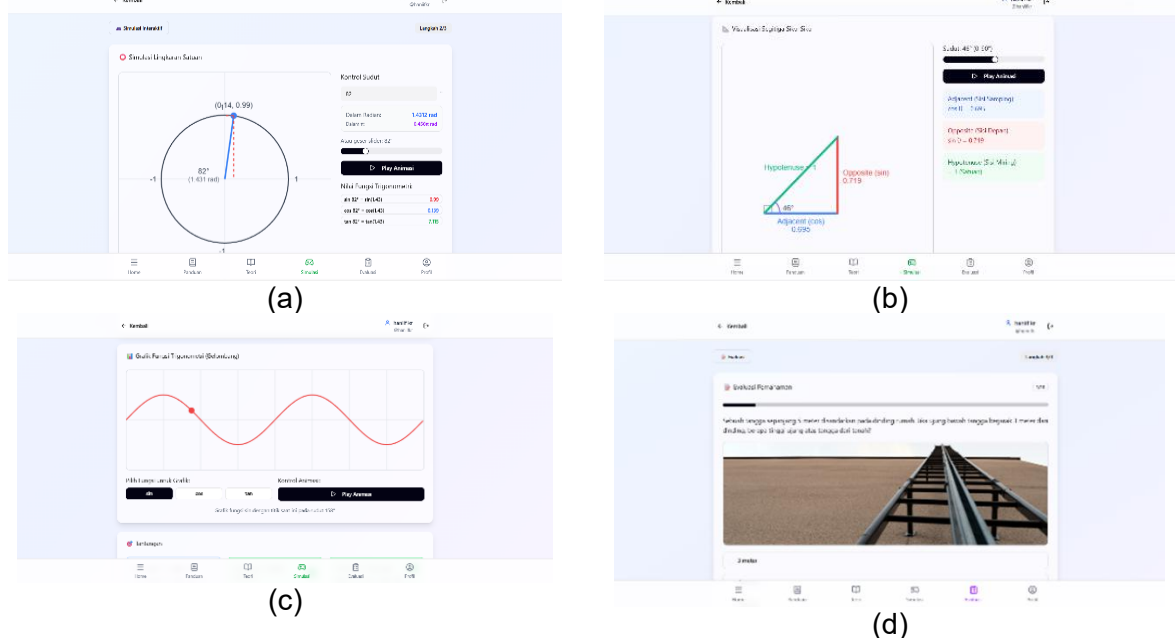


Figure 4. Initial Design of the Simulation Page and Learning Evaluation Questions (a. Circle Simulation, b. Triangle Simulation, c. Function Graph Simulation, d. Evaluation Questions)

In the development stage, the researcher constructed the e-module according to the pre-established design by integrating trigonometry materials, Mindful Learning principles, and interactive features designed to support student focus and engagement. The development was carried out using a responsive web-based e-module platform, ensuring accessibility via both laptops and mobile devices. This media design was then tested through a validation

process, encompassing both material and media aspects, with the objective of ensuring the validity and quality of the product before its implementation in the learning process.

Table 7. Material and Media Expert Validation Results

No	Validator	Material Validation		Media Validation	
		Total Score	Percentage	Total Score	Percentage
1	Validator 1	51	92,7%	56	96%
2	Validator 2	52	94,5%	55	91,6%

The validity analysis was conducted to determine the feasibility level of the web-based trigonometry learning media with a mindful learning approach before being tested on students. The validation process involved two validators for each expert domain (media and material); therefore, the Gregory validity test was employed as the analysis technique. This method is relevant for measuring the inter-rater agreement between two experts regarding each instrument item. The validity data analysis was performed by categorizing the assessment results from both validators into a cross-tabulation table according to Gregory's procedure, followed by the calculation of the validity coefficient.

Based on the calculation, the content validity coefficient for the material expert validation was found to be 1.00. Therefore, it can be concluded that the content within the learning media is categorized as Very Valid. Based on the calculation, the content validity coefficient for the media expert validation was found to be 1.00. Therefore, it can be concluded that the learning media is categorized as Very Valid.

In this study, the user responses (Students & Teachers) at SMK Hang Tuah Kediri significantly influenced the development of the web-based e-module used to support trigonometry learning. The following table presents the results of the user response assessments:

Table 8. User Response Results (Students)

No	Statement Item	Total Score
1	The e-module describes the observed trigonometry characteristics.	62
2	The e-module uses trigonometry examples from the surroundings.	64
3	The e-module media is easy to use in the learning process.	70
4	The material presented in the e-module is very comprehensive.	72
5	The material can be reviewed at any time to improve retention.	72
6	The e-module improves understanding of trigonometry topics.	65
7	The language used is clear and easy to understand.	69
8	The language used is simple and straightforward.	72
9	The fonts used are simple and easy to read.	64
10	The font size in the e-module is legible.	71
11	The material layout is attractive and easy to follow.	72
12	The visual images are attractive and very clear.	70
13	The e-module encourages me to think critically.	70
14	The e-module provides opportunities to discover concepts independently.	68
15	I feel happy studying the material using the e-module.	58

No	Statement Item	Total Score
16	I do not feel bored when using the e-module.	66
17	The e-module encourages seriousness in learning.	63
18	The e-module increases my enthusiasm for learning.	62
19	The e-module fosters curiosity about the subject matter.	60
20	The e-module facilitates easier understanding of the material.	64
21	The images and design neatness increase interest in learning.	64
22	The color selection in the e-module interface is good and attractive.	69
Average		66,68
Percentage		78,45%

The total score for each statement item in the student response questionnaire was calculated by summing the product of the response frequency for each Likert scale option and its corresponding weight (1 to 5). For instance, in the first statement item, the total score of 62 was obtained from the accumulation. This score then serves as the basis for calculating the overall average to determine the practicality percentage of the developed media.

Based on the processing of the student response questionnaire data, an average score of 66.68 out of a maximum score of 85 was obtained, resulting in a practicality percentage of 78%. Referring to the criteria table above, this value places the web-based trigonometry e-module with a mindful learning approach in the Practical category.

In detail, the linguistic aspects and visual interface received high appreciation with average scores above 70. However, affective aspects such as enjoyment (score 58) and curiosity (score 60) showed lower results compared to technical indicators. This indicates that while the media is functionally very easy to use and understand, further reinforcement in interactivity elements and motivational content is required to better enhance students' emotional engagement in independent learning.

Table 9. User Response Results (Teacher)

No	Assessment Aspect	Statement Items	Total Score	Maximum Score	Percentage
1	Material Suitability	1, 2, 4, 5, 6	23	25	92%
2	Linguistic Aspect	7, 8	10	10	100%
3	Legibility & Visuals	9, 10, 11, 12, 21, 22	27	30	90%
4	Pedagogical Benefits	3, 13, 14, 15, 16, 17, 18, 19, 20	41	45	91,1%
Overall Average			101	110	91,82%

Based on the categorization of aspects above, an average percentage of 91.82% was obtained, placing the e-module in the Very Practical category. The teacher provided a perfect score (100%) for the linguistic aspect, indicating that the language used in the e-module is exceptionally clear and easily understood by students. The aspects of material suitability (92%) and pedagogical benefits (91.1%) also received very high scores, confirming that this media facilitates the teacher in delivering material and is capable of fostering students' curiosity and enthusiasm for independent learning. Although the visual and legibility aspect

(90%) was slightly lower due to font size and typeface factors, the teacher overall assessed this e-module as a highly helpful instrument in reducing student boredom and encouraging active thinking in the classroom.

The effectiveness of the e-module in improving students' conceptual understanding was measured through evaluation tests integrated within the media. These tests consist of items designed to assess the mastery of trigonometry topics after students performed interactive simulations and studied the content in the e-module. The evaluation data from 17 students are presented in Table 10.

Table 10. Student Evaluation Results

No	Subject	Score	Percentage
1	S1	8	80%
2	S2	7	70%
3	S3	6	60%
4	S4	2	20%
5	S5	3	30%
6	S6	2	20%
7	S7	2	20%
8	S8	6	60%
9	S9	1	10%
10	S10	7	70%
11	S11	4	40%
12	S12	7	70%
13	S13	5	50%
14	S14	4	40%
15	S15	9	90%
16	S16	3	30%
17	S17	7	70%
Average		4,94	49,41%

Based on Table 10 above, the average score achieved by students is 49.41%. Individually, there is a wide variation in achievement, with the highest score reaching 90% while the lowest score stands at 10%. Referring to the established effectiveness criteria, the average value of 49.41% places the e-module in the Moderately Effective category. This result indicates that while the media has been able to facilitate some students in achieving a high level of understanding (as seen in students who scored above 70%), adjustments in learning strategies and the strengthening of scaffolding features are required to ensure more equitable mastery of the material among all students.

During the evaluation phase of the learning media, several strategic aspects were identified that need improvement to optimize the quality of the web-based e-module with a mindful learning approach. First, the integration of multimedia content, specifically relevant instructional videos, is necessary to support the visualization of abstract trigonometry concepts. Second, the effectiveness of this media is highly dependent on technical support

factors, such as the availability of adequate electronic devices (laptops, computers, or smartphones) and stable internet access. These infrastructural limitations have the potential to become significant barriers that could disrupt students' learning continuity when accessing the e-module. Therefore, providing equitable facilities and adding varied video content are crucial steps to minimize technical constraints and enrich students' independent learning experiences.

Discussion

The validity analysis using the Gregory formula involving two material experts and two media experts yielded a coefficient of 1.00, categorized as Highly Valid. This perfect score demonstrates absolute agreement among validators regarding the substantive quality and construction of the media, indicating that the product is ready for implementation without substantial revision. User responses at SMK Hang Tuah Kediri further reinforce these results; teachers provided a total score of 101 out of 110, or 91.82%, falling into the Very Practical category. Similarly, student responses reached a percentage of 78%, placing the media in the Practical category. This high level of practicality is driven by simple linguistic aspects and a visual design that supports student learning comfort.

Despite the high levels of validity and practicality, the media's effectiveness—as shown by the average student evaluation score of 49.41%—falls within the Moderately Effective category. There is a noticeable gap between the media quality, which users rated as excellent, and the learning outcomes, which have not yet reached their maximum potential. This is influenced by several factors, including limited duration of media usage and students' readiness to adopt independent learning models that demand high concentration. Furthermore, the difficulty level of evaluation items, which directly measure cognitive abilities without sufficient scaffolding within the e-module, presented a challenge for some students. These findings indicate that while the media assists in understanding basic concepts, its effectiveness depends heavily on the users' cognitive readiness, as emphasized by Sari & Nurhayati (2022), who stated that the effectiveness of digital media is significantly influenced by student readiness.

The implementation of the mindful learning approach in this e-module theoretically aims to enhance focus and learning awareness. This is realized through interactive simulation features that encourage students to engage in deep observation and problem-discussion features that serve as a means of self-reflection to identify cognitive errors. In accordance with Ellen Langer's theory, mindful learning requires students to be open to new information and to actively create cognitive categories. The "Moderately Effective" score reflects that the reflective features in the e-module, such as instant feedback, have begun to

trigger students' metacognitive processes, albeit inconsistently. To achieve higher effectiveness, teacher guidance is required to strengthen these reflective instructions. This aligns with Putra et al. (2023), who argue that the effectiveness of mathematics e-modules increases significantly when combined with mentoring strategies that support holistic student learning awareness.

Conclusion

Based on the research and development results, it can be concluded that the web-based trigonometry e-module with a mindful learning approach has fulfilled the criteria for high-quality learning media. The content validity results from both material and media experts yielded a Gregory coefficient of 1.00 (Categorized as Highly Valid), confirming that the content, interface, and functionality of the media are aligned with the intended instructional objectives. In terms of practicality, the product is considered highly user-friendly, with student response percentages reaching 78% (Practical) and teacher responses reaching 91.82% (Very Practical). These positive responses were driven by ease of access, linguistic clarity, and a visual design that assists students in understanding the material systematically. Meanwhile, the media's effectiveness, measured through the evaluation results of 17 tenth-grade students at SMK Hang Tuah Kediri, showed an average score of 49.41%. Based on the effectiveness criteria, this achievement places the e-module in the Moderately Effective category. This indicates that while the media is highly valid and practical for use, further reinforcement in the scaffolding of practice exercises and intensive guidance is necessary to optimize overall student learning outcomes.

Teachers can integrate this e-module as either an independent learning tool or a supplement to classroom instruction. The mindful learning approach embedded within the media allows teachers to act as facilitators, guiding students to engage in self-reflection through the available interactive features. For optimal results, it is recommended that teachers combine the use of the e-module with direct scaffolding strategies, particularly in evaluation sections with higher difficulty levels, to effectively bridge the gap in student understanding.

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