

MODIS Learning Media: An Effort to Enhance Students' Self-Regulated Learning and Critical Thinking

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Abstract

The role of learning media in the world of education has an important role in improving students' self-regulated learning and critical thinking skills. This research and development aim to create a MODIS learning media through validation by media experts and material experts to improve self-regulated learning and critical thinking on the elements of Basic Job Skills, K3, and Work Culture, Data and Information material topics, class X MPLB. This research and development use the ADDIE model, namely analyze, design, development, implementation, and evaluation. This research and development collected quantitative and qualitative data, the subjects of the trial included 35 students of class X MPLB at SMK Negeri 1 Malang. The data analysis technique of self-regulated learning and critical thinking uses the average value of the percentage. This research and development produce MODIS learning media assisted by google sites with various features that are integrated with materials and assignments that will provide a more varied learning experience. Research and development show that the validation results of material experts and media experts are very feasible to use so that they can significantly increase students' self-regulated learning and critical thinking in learning.

Keywords: Critical Thinking, Google Sites, Learning Media, MODIS Learning Media, Self-Regulated Learning.

1. Introduction

The transformation of learning media in global education has shifted from static tools to interactive digital ecosystems that support the student-centered learning paradigm (Do et al., 2023). Modern learning media now plays a role as the main driver of critical thinking skills (Critical Thinking) through problem-based learning scenarios that encourage the analysis and synthesis of information (Inayah et al., 2023). This is essential to prevent cognitive processes that are mere memorization and ensure students achieve deep conceptual understanding through adaptive media (Sudarma, 2025). On the other hand, the integration of technology in learning media is basically closely related to the development of Self-Regulated Learning (SRL) or learning independence which is very crucial for the academic sustainability of students (Febrianasari et al., 2024).

In a world flooded by the unfiltered flow of information, an individual's ability to organize, monitor, and evaluate his or her own learning process becomes a key competency that determines long-term success. Technology-based learning media provides exceptional access flexibility, allowing students to set their own learning rhythm (self-pacing), select the resources that are most relevant to their needs, and conduct regular self-reflection through the various interactive features available (Nadiroh et al., 2022). Now, learning media has become an ecosystem to train high-level thinking. Educators need to create sophisticated media as well



as educate to help students face the challenges of the times. This digital exploration will later form students who are critical, logical, and able to make decisions based on data (Damayanti et al., 2026). SRL through digital media forms independent learners, so that the synergy between modern media, critical thinking, and SRL is the main key to producing a superior generation that is ready to compete globally (Rochmawati & Chuuriyah, 2021).

The urgency in improving Self-Regulated Learning (SRL) and students' critical thinking skills at SMKN 1 Malang is based on the results of interviews with teachers and students on April 6, 2026 which shows that the implementation of the national curriculum that encourages differentiated learning is still not running optimally. The learning process in the classroom is still dominated by lecture methods and the use of media that is limited to standard textbooks and PPTs, so that two-way interaction between teachers and students becomes less effective. The limitation of interaction space is what ultimately hinders the development of students' learning independence and critical skills. This condition is emphasized by preliminary study data that captures the low achievement of these two aspects in schools. The low level of self-regulated learning is only about 35% indicated by weak learning motivation, students' inability to set learning goals and design independent learning activities, and lack of understanding in conditioning the surrounding environment that supports concentration.

The weakness of critical thinking skills is only about 37% seen from students who have difficulty answering basic questions, are unable to include strong arguments or supporting evidence, and have difficulty in drawing logical conclusions. In addition, they tend to copy answers without understanding, are unable to offer alternative solutions, and have difficulty re-evaluating or rearticulating reasoning-based answers (problem-solving) using their own language. In addition, the reality in the field is that there are still technical obstacles that often hinder the effectiveness of the learning process in the classroom. A common phenomenon is that students tend to take spontaneous pictures of material exposures or ask the teacher to stop the explanation temporarily just because they haven't finished taking notes. This action not only disrupts the teacher's teaching rhythm, but also breaks the flow of thought of other students who are listening. The habit of sharing material through instant messaging like WhatsApp often results in an unorganized accumulation of image files and consumes students' phone storage space. This condition reflects an inefficient learning process because material is difficult to find when needed for independent learning.

Facing today's increasingly diverse learning needs, a new media innovation called MODIS (*Media Pembelajaran Online Berdiferensiasi untuk Siswa*, or Differentiated Online Learning Media for Students) has emerged with the help of Google sites. MODIS is here because every student is unique, they have different ways of learning, interests, and abilities. While previous studies have widely utilized Google Sites for developing differentiated learning media, most existing platforms focus strictly on content delivery without actively tracking or structuring the students' autonomous processes. MODIS addresses this gap by introducing a distinct novelty through the seamless integration of a self-monitoring checklist feature directly within the responsive web layout, allowing vocational students to systematically regulate their learning pace.

Furthermore, unlike conventional differentiated media that treat self-regulation and analytical skills separately, MODIS is specifically engineered to bridge Self-Regulated Learning (SRL) with an integrated Higher Order Thinking Skills (HOTS)-based critical thinking assessment design. This dual-functioning framework ensures that students do not merely navigate tailored multimedia materials passively, but are dynamically driven to analyze, evaluate, and independently reflect on their problem-solving outcomes. By accommodating visual, auditory, and kinesthetic learning styles, MODIS ensures that

differences in abilities between students are no longer an obstacle. The platform is deliberately built on Google Sites to guarantee easy, universal access via cellphones or computers. Consequently, MODIS transforms passive listening into an active, self-directed learning experience that helps students improve their problem-solving skills and autonomy. By providing a neat, structured, and accessible learning resource center online, classroom time can be efficiently reallocated for in-depth discussions and meaningful interactions, thereby increasing overall learning effectiveness.

Seeing these various problems, this research is very important to be carried out as a strategic step to improve the quality of learning in real terms. The main focus of this research is not just to present new technologies, but to change the passive and reactive learning culture to be more productive and organized. By providing MODIS as an integrated material container, teachers can save instructional time that was previously wasted waiting for students to take notes, so that the focus of learning can be shifted to strengthening critical thinking skills. In addition, this research contributes to providing practical solutions for the management of students' cognitive load through easy access to information. Through this approach, it is hoped that a harmonization will be created between individual student needs and the efficiency of teachers' teaching time, which will ultimately increase students' motivation and independence in continuous learning.

2. Literature Review

In the modern educational paradigm, learning media has transformed from just a one-way information delivery tool to an interactive digital ecosystem that supports a student-centered learning approach (Stuart et al., 2020). Effective learning media is designed not only to distribute materials, but also to accommodate the diversity of students' learning styles, both visual, auditory, and kinesthetic through differentiated approaches (Sulasmiyatningsih et al., 2025). The integration of website-based technology allows for the creation of an adaptive, neat, and structured learning environment (Maulana et al., 2022). This is crucial to prevent cognitive processes that are limited to memorization alone, as well as encourage students to achieve deeper and more meaningful conceptual understanding through flexible access to information that is not tied to conventional classrooms (Sugara, 2025).

Self-Regulated Learning (SRL) is an essential competency in which learners are actively able to forethink, monitor performance, and self-reflect on their own learning process (Lanio et al., 2025). The use of innovative learning media has a strong attachment to the development of SRL (Kinasih et al., 2026). Through digital media, students are given the freedom to determine their own learning rhythm (self-pacing) and select the resources that are most relevant to their cognitive needs (Chen & Bonner, 2020). The availability of self-monitoring instruments in the media such as the task completion confirmation feature serves as a metacognitive stimulus that encourages increased intrinsic motivation and more orderly, focused, and disciplined learning behaviors (Stephen & Rockinson-Szapkiw, 2021).

Critical thinking is a high-level cognitive skill that involves the ability to analyze arguments, evaluate evidence, formulate basic explanations, and develop problem solving strategies logically and systematically (Wartono et al., 2017). In the context of education, students are required not to just passively receive information, but to be able to synthesize data and offer alternative solutions based on reasoning (problem-solving). Learning media plays a role as the main driver of this reasoning power by providing a portion of evaluation based on Higher Order Thinking Skills (HOTS) (Maghfirah et al., 2026). Through the visualization of concrete concepts and the availability of diverse literacy resources, students'

cognitive load can be well managed so that they can focus on in-depth analysis and evaluation of information.

Digital learning media, self-regulated learning, and critical thinking are conceptually conceptualized to share an interconnected and mutually supportive relationship. When a learning medium is able to facilitate independence (SRL), students will get used to conditioning their learning space independently before activities in the classroom begin. This independence automatically saves instructional time that would normally be wasted on the process of recording or mechanically transferring basic knowledge. The time efficiency can then be transferred to in-depth discussion activities that stimulate a high level of thinking. In other words, differentiated learning media acts as a foundation that shapes students to become independent learners, where independence is an essential space for the growth of logical, tactical, and critical analysis processes in dealing with various problem solving.

3. Methods

This study uses the Research and Development (R&D) method with the ADDIE development model which is carried out through five main phases. First, analyzing the needs in class X MPLB 3 SMK Negeri 1 Malang related to the lack of differentiated media and the low ability of critical thinking and SRL of students in conventional learning. Design, designing the MODIS media structure on Google sites, mapping materials according to learning styles (VAK), as well as compiling expert validation instruments and user response questionnaires. Development, producing media on Google sites by integrating differentiated multimedia content and navigation features that support student learning independence. Implementation, conducting expert validation, product revisions, and small group trials on 6 students of class X MPLB 3 to measure the feasibility and availability of media. Evaluation, assessing the effectiveness of media in improving students' critical thinking and SRL skills, and making final product improvements based on the results of the trial.

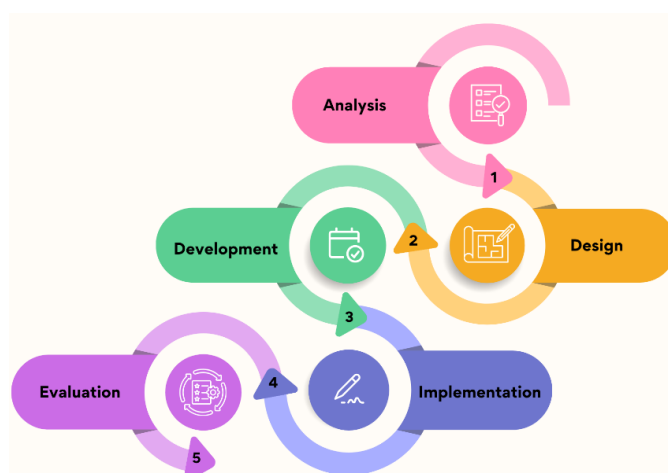


Figure 1. ADDIE Research and Development Model Stage

This research and development apply a dual data collection approach, namely qualitative and quantitative. Qualitative data was collected through interview techniques and a compilation of suggestions and inputs contained in validation instruments by material experts, media experts, and student response questionnaires at the small group trial stage. Meanwhile, quantitative data was obtained from the results of the assessment of the average score on the validation questionnaire and the trial questionnaire. Regarding the specific

variables, Self-regulated learning (SRL) data was collected through questionnaires filled out by observers and students, which were then processed using percentage descriptive analysis techniques. The ability to think critically is measured through the acquisition of post-test average scores before and after learning using MODIS learning media.

The students' critical thinking skills were measured using identical question sets for both the pre-test and post-test to ensure consistency in the difficulty level across the evaluation. Given the open-ended nature of the 10 HOTS essay questions, the grading process was conducted by the primary researcher. To eliminate subjectivity and ensure rigorous objectivity, the evaluation strictly adhered to a predefined, standardized scoring rubric utilizing a 1-5 scale matrix for each item. This validated evaluation guide clearly outlined specific rubrics, indicators, and criteria for every proficiency tier, thereby minimizing individual assessment bias during the essay scoring process.

4. Results and Discussion

4.1. Research Results

The product produced in this research and development is MODIS (Differentiated Online Learning Media for Students), a learning media assisted by Google sites for elements of Basic Job Skills, K3, and Work Culture, Data and Information material topics. This learning medium can be accessed in full online by visiting the link (<https://sites.google.com/students.um.ac.id/modis/beranda>).

The MODIS display supports the device's adaptive feature (responsive design), which means that the size will automatically adjust when opened via a mobile phone, tablet, or PC. In it, all the material has been processed in such a way that it is more structured and interesting without burdening the user to download the document. To encourage students' self-regulated learning, this platform is equipped with various multimedia learning instruments such as images, videos, audio, mind maps, PowerPoints, materials. In addition, the MODIS learning media is also equipped with an assignment checklist feature that will help students monitor their learning progress. An illustration of the appearance of the MODIS application can be seen in Figure 2 below.

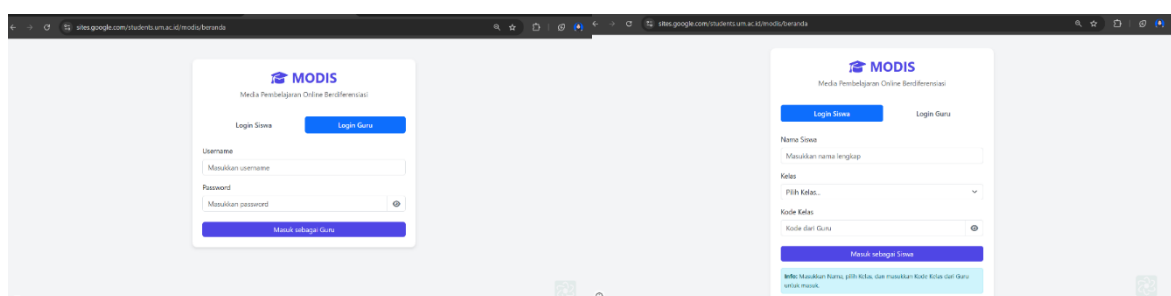


Figure 2. Initial view of the MODIS app

Figure 2 shows some multimedia content on MODIS learning media developed to improve students' self-regulated learning, including 1) PDF and PPT extension materials, 2) audio recordings of explanatory podcasts, 3) learning videos, and 4) visualization of concepts in the form of images and mind maps. Subject matter is delivered through a combination of text, audio, and visuals to support the fulfillment of students' diverse learning styles. The use of audio podcasts and learning videos serves to clarify abstract or procedural material through voice explanations and practical illustrations. Meanwhile, mind map content and interactive images are also inserted that can map the material in a concise manner to increase students'

interest and memory. Documents in the form of PDFs and PPTs are also provided so that students can explore literacy materials independently and in a structured manner. This MODIS learning media is also equipped with post-test questions to measure students' critical thinking skills after the learning series is completed. Here is the appearance of the assignment page on the MODIS learning media.

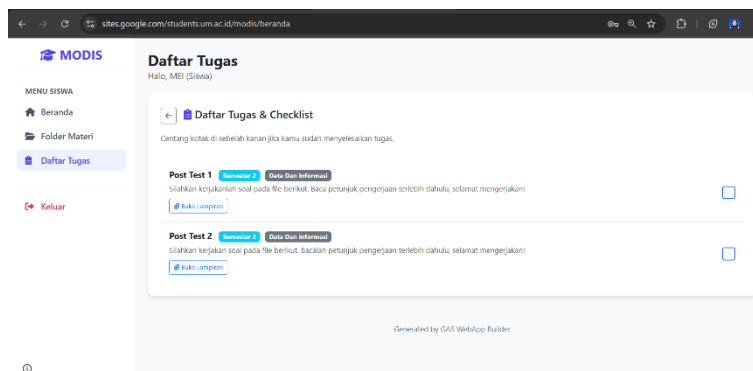


Figure 3. MODIS Application Task Menu Display

Figure 3 shows an assignment page that contains post-test questions for students to work on. Students can measure their critical thinking skills through a post-test instrument consisting of 10 essay questions based on HOTS (Higher Order Thinking Skills). To facilitate learning management, the MODIS application is equipped with a feature where after students finish working and submitting their assignments, they can tick the checklist box available in the application as a form of confirmation of self-completion. Furthermore, the MODIS learning media was tested on the feasibility level of its product based on the results of validation of material expert, media expert, and student response questionnaires at the small group trial stage. All data from the questionnaire that has been filled out is then analyzed using the percentage descriptive method. The following is a presentation of the validation results from material expert.

Table 1. Material Expert Validation Results

No.	Aspects	Percentage (%)	Criteria
1.	Content Eligibility	82%	Very decent, very good, usable, without repair
2.	Contextual Eligibility	80%	Worthy, good, usable, no repair
3.	Language Qualifications	87%	Very decent, very good, usable, without repair
Average		83%	Very decent, very good, usable, without repair

Source: Processed by researcher (2026)

Based on Table 1, MODIS learning media products are validated by material expert who have met the specified qualification criteria, namely teacher teaching Data and Information material topics with a minimum educational qualification of S1 and more than 3 years of teaching experience. The validation results showed that the Content Feasibility aspect obtained a percentage of 82% with very feasible and excellent criteria (can be used without improvement), which consisted of indicators of material breadth, depth of material, completeness of material, accuracy of concept or definition, accuracy of facts or symbols or symbols, accuracy of terms, accuracy of examples, accuracy of presentation, and suitability and accuracy of illustrations. For the Language Feasibility aspect, this application obtained

the highest achievement of 87% with very feasible and excellent criteria (can be used without improvement), which include sentence effectiveness, accuracy of sentence structure, vocabulary, understanding of messages or information, spelling accuracy, grammatical accuracy, consistency in the use of symbols or icons, ease of reading messages. Meanwhile, the Contextual Feasibility aspect received an assessment of 80% with feasible and good criteria (can be used without improvement). This contextual aspect obtained the lowest percentage compared to other aspects because there were still shortcomings in interrupting the perception of illustrations and examples in the media with the real situation faced by students.

The validator also provided notes in the form of suggestions and inputs where in general this MODIS learning media has been developed very well, but the presentation of the material is more dominant in the text so that the visual appearance of learning can still be developed to be more interesting and interactive. Thus, it can be concluded that this MODIS learning media product as a whole is very feasible, very good, and can be directly used during the learning process on the topic of Data and Information material to improve self-regulated learning and critical thinking of students. For the validation results from media expert, it can be seen in Table 2.

Table 2. Media Expert Validation Results

No.	Aspects	Percentage (%)	Criteria
1.	Graphic Qualification	95%	Very decent, very good, usable, without repair
2.	Media Quality	93.3%	Very decent, very good, usable, without repair
3.	Layout Media	86.7%	Very decent, very good, usable, without repair
Average		91.7%	Very decent, very good, usable, without repair

Source: Processed by researcher (2026)

Table 2 shows that the MODIS learning media product has been validated by media expert, namely a lecturer in Office Administration Education at the Universitas Negeri Malang who has expertise in learning media development, has taught for more than 3 years, and has a minimum S2 degree. The overall validation results showed very feasible criteria with a total average gain of 91.7%. In detail, the Graphic Feasibility aspect received the highest score with an average of 95%, which means that the shape, color, and size of the letters are clear and appropriate, have a consistent flow of material, and the structure of the text is in accordance with the student's level of education.

Furthermore, the Media Quality aspect obtained an average score of 93.3% which includes indicators of clarity and suitability of images, videos, writing, and sound quality within the platform. Meanwhile, the Media Layout aspect received an average of 86.7% which included the placement of consistent menu layout/buttons/feature elements, good and clear image or video quality, and the animations used were attractive and in accordance with the material.

Media expert also provides suggestions and inputs to add learning achievement indicators and user analytics, as well as add a student learning progress dashboard. Based on these recommendations, trials limited to small groups can be carried out after improvements or revisions from material experts and media experts. Here are the results of the limited trial:

Table 3. User Trial Validation Results

No.	Aspects	Percentage (%)
1.	Facilities	89.2
2.	Benefits	83.3
3.	Attractiveness	82.2
Average		84.9

Source: Processed by researcher (2026)

The results of user trials have been carried out on 6 students with low, medium, and high ability. Furthermore, a study was conducted on a large group including 35 students X MPLB 3. The study was conducted to find out whether students' self-regulated learning and critical thinking increased both before and after using development products. The following table 4 shows the results of improving students' self-regulated learning:

Table 4. Self-Regulated Learning Outcome Data

Indicator	Sub Indicators	Before	After
Metacognitive	1) Able to make a study plan such as determining what to learn, determining study time, and determining learning steps to achieve good learning outcomes	57.3%	84.1%
	2) Able to set what they want to achieve after studying, and can set learning goals according to what they like and need		
	3) Be able to find out the improvement in their understanding after studying and check if the learning goals are achieved		
	4) Able to assess whether their learning activities are effective and improve their learning activities to be more effective		
Motivational	1) Able to complete tasks without depending on others and have the confidence to be able to complete tasks	57.3%	84%
	2) They do not feel objections or complain if they give them tasks and consider tasks to be responsibilities that they must complete well		
	3) Listening carefully when the teacher explains so that you understand the material being taught, and relearn it when studying at home		
Behavior	1) Ability to choose a learning model according to your interests	57.4%	89.3%
	2) Able to adjust the learning environment to be conducive		
	3) Able to make the learning environment conducive so that learning becomes more focused and effective		
Average		57.3%	85.8%

Source: Processed by researcher (2026)

Based on the data in Table 4, there was a significant increase in students' self-regulated learning abilities after using MODIS media, with a total average increase of 28.5%. Specifically, in the Metacognitive indicator, there was an increase of 26.8%, in the

Motivational indicator there was an increase of 26.7%, and in the Behavior indicator, the highest spike was recorded reaching 31.9%. A significant percentage increase in all these indicators proves that the use of MODIS media is very effective in triggering student learning independence, both in terms of metacognitive planning, motivational encouragement, and more conducive learning behavior regulation.

The critical thinking test is carried out by providing a pre-test and post-test based on critical thinking indicators and cognitive levels C4-C6 to students to find out the difference in critical thinking in the form of grades obtained before and after participating in learning using MODIS learning media. The results of the analysis of the average critical thinking are presented in Table 5.

Table 5. Critical Thinking Outcome Data

Indicator	Before	After
Elementary Clarification	82.57%	90.86%
Basic Support	80.29%	87.71%
Inferring	82%	87.14%
Advance Clarification	80.29%	86%
Strategy and Tactics	81.71%	90.86%
Average	81.37%	88.51%

Source: Processed by researcher (2026)

Based on the data in Table 5, there was a noticeable increase in students' critical thinking skills after utilizing MODIS learning media, where the overall average increased by 7.14%. If analyzed on each indicator, the highest post-trial achievement was achieved simultaneously by the Elementary Clarification aspect which increased by 8.29% and the Strategy and Tactics aspect which experienced the highest jump of 9.15%. This indicates that students become much more capable in providing basic explanations and determining strategies and tactics for solving problems. Furthermore, an increase also occurred in the Basic Support indicator by 7.42%, followed by the Inferring (Inferring) indicator which increased by 5.14%, and the Advance Clarification indicator with an increase of 5.71%. The consistency of growth in all lines proves that the integration of structured materials and the presentation of HOTS-based evaluation instruments in MODIS media are effective in triggering and sharpening students' critical thinking on the topic of data and information materials.

4.2. Discussion

This research and development have succeeded in producing a MODIS (Differentiated Online Learning Media for Students) learning media product, an innovative learning media based on Google sites which is specifically designed for the elements of Basic Job Skills, K3, and Work Culture on the topic of Data and Information material. This development product is present as a form of tactical solution to overcome various technical obstacles that have hindered the effectiveness of the conventional learning process in class X MPLB 3 SMK Negeri 1 Malang, including low learning independence and students' critical thinking skills. As a comprehensive digital platform ecosystem, MODIS is equipped with a variety of interactive features and rich multimedia learning instruments, including PDF and PPT extension material documents, material recordings in the form of audio podcasts explaining, interactive learning video shows, to concrete concept visualizations through images and mind maps.

The diversity of multimedia content forms is deliberately integrated to facilitate and accommodate the fulfillment of unique and different student learning styles, both visual, auditory, and direct or kinesthetic practice types (Mardatillah SD & Nora, 2025). In addition, in order to stimulate competence self-regulated learning, MODIS also features checklist box

assignments as a means of confirming the completion of independent assignments for students to monitor their learning progress periodically, and are equipped with sheets Post-test which consists of 10 essay-based questions Higher Order Thinking Skills (HOTS) to test the acuity of their critical thinking (Sivakumar & Boon, 2026). The main advantage of the MODIS application lies in its flexible accessibility level because it is supported by the device's adaptive features (Responsive Design) which makes the display automatically adjust proportionally when opened via a mobile phone, tablet, or PC without overloading the storage memory of the student's device with unstructured download files. Through this structural advantage, MODIS has proven to be able to shift students' passive-reactive learning habits into a much more productive and organized independent learning culture, while helping teachers save instructional time allocation in the classroom to be diverted to meaningful in-depth discussion activities to realize the harmonization of continuous learning.

MODIS as a modern instructional tool based on Google sites is validly proven through the accumulation of quantitative assessments of experts and positive responses from students at the small group trial stage. Based on the results of validation data processing by material experts, this digital platform obtained a very high percentage achievement in terms of language feasibility of 87% and content feasibility of 82%, where both are categorized as very feasible and very good so that they are ready to be used in the field without requiring fundamental improvements. However, the contextual feasibility aspect recorded the lowest number of 80%, which was caused by a small lack of alignment of material illustrations with the real situation faced by students, accompanied by constructive suggestions from validators to reduce the intensity of text exposure through the reinforcement of interactive visual elements. On the other hand, a comprehensive assessment from media experts further strengthens the validity of the product with a total average achievement of 91.7%, which means it is very feasible. In detail, the graphic feasibility aspect pocketed the highest score of 95% thanks to the accuracy of font selection and color alignment, followed by the media quality aspect of 93.3% and media layout layout of 86.7%.

In order to improve the functionality of this online learning system, media experts provide strategic recommendations to insert learning achievement indicators, user analytics, and visual dashboards to monitor student learning progress in real-time. After revision based on expert input, MODIS was implemented in a limited group trial involving 6 students with heterogeneous academic ability characteristics. User responses show an exceptional level of acceptability with an average achievement of total satisfaction reaching 84.9%. Specifically, the operational ease indicator achieved the highest percentage of 89.2%, followed consistently by the indicator of material usefulness at 83.3%, and the level of media attractiveness at 82.2%. The high accumulation of feasibility assessments from validators synchronized with user satisfaction confirms that the MODIS application is very practical, adaptive, and functional for students to use in the digital learning ecosystem.

The results of interviews with subject teachers confirmed that the implementation of the MODIS application brought major changes to the dynamics and learning culture in the classroom. Before utilizing MODIS, teachers often faced technical obstacles in the form of low student learning independence; They tend to be passive, often ask for explanations to be stopped in order to take notes, and take spontaneous photographs of material exposures, thus breaking the flow of thought and disrupting the instructional rhythm (Pratama & Musliman, 2025). In addition, the habit of sharing files via instant messaging triggers an unorganized accumulation of documents on their phones. However, post-use of MODIS, teachers identified a real transformation where students became much more independent, focused, and organized as the material center became centralized online (Faruq et al., 2024). The positive

shift is synchronized with quantitative data comparing student responses, where the index self-regulated learning (SRL) jumped dramatically from an initial average of 57.3% before intervention to 85.8% after media use, meaning a net increase of 28.5%. The highest spike was seen in the behavioral indicator which reached 89.3%, proving that students are now able to condition their learning environment independently and effectively. Through this data synergy, it is proven that MODIS has succeeded in reducing students' cognitive load while saving teachers' teaching time to be diverted to in-depth discussions (Mustapa et al., 2025).

Significant increase in the index self-regulated learning (SRL) students prove that MODIS is effective in fostering structured learning independence through a differentiated approach. This success cannot be separated from the integration of adaptive features in the application that are directly able to stimulate the three main phases of the SRL cycle, namely planning (forethought), monitoring (Performance Control), and self-evaluation (self-reflection) (Satrio & Wibawanta, 2021). Presence of features checklist box Assignments provide space for students to monitor their learning progress periodically, set assignment completion targets independently, and manage study time allocation more efficiently.

In addition, the ease of access to a wide variety of learning content formats ranging from audio podcasts, interactive videos, to mind map visualizations gives students the freedom to choose the learning strategies that best suit their own cognitive preferences and learning styles. This flexibility psychologically enhances a sense of belonging (sense of ownership) students to their academic processes, so that they no longer depend entirely on the conventional instruction of teachers in the classroom (Stefani & Haryudo, 2023). High achievement in the behavioral indicator, which touched 89.3%, confirms that students have been able to condition their digital learning environment productively and responsibly. Thus, MODIS does not only function as a medium for conveying material information, but also acts as a metacognitive instrument that transforms students into active, disciplined, and adaptive lifelong learners.

In addition to its success in increasing learning independence, the implementation of MODIS learning media has also been proven to make a very significant contribution to sharpening critical thinking skills (Critical Thinking) students. Based on the results of the evaluation through pre-test and post-test instruments referring to the cognitive level C4–C6, there was a significant increase in the average overall value of critical thinking skills by 7.14%, from an initial average of 81.37% before the intervention to 88.51% after intensive media use. The growth of cognitive competence that is evenly distributed across all lines reflects that the integration of structured materials and evaluation instruments in MODIS is able to trigger and sharpen students' reasoning power.

In detail, the highest post-trial achievement was achieved simultaneously by the Elementary Clarification (providing a basic explanation) which increased by 8.29% to 90.86%, as well as the Strategy and Tactics (managing strategies and tactics) which recorded the highest net growth surge of 9.15% to touch 90.86%. This positive trend indicates that students are now much more capable, logical, and tactical in providing basic explanations and determining systematic problem-solving strategies related to data and information topics. Consistency of ability improvement is also seen in the indicators Basic Support which increased by 7.42% to 87.71%, the indicator Advance Clarification with an increase of 5.71% to 86%, as well as the Inferring (concluding) which grew by 5.14% to 87.14%. This cumulative success is driven by the existence of 10 essay-based questions. Higher Order Thinking Skills (HOTS) on the MODIS assignment page, which optimally challenges students to analyze, synthesize, and evaluate problems in depth, instead of conducting a learning process that is merely passive memorization. Through a concise visualization of interactive mind maps and

supporting images, students' cognitive load can be well managed, making memory easier and accelerating deep conceptual understanding (Sukmawati et al., 2023). Thus, MODIS has proven to be effective as a metacognitive instrument that transforms students' critical thinking skills to be sharper, structured, and ready to face the challenges of the times.

5. Conclusion

Based on the entire series of research and development stages that have been carried out, it can be concluded that this research has succeeded in producing MODIS (Differentiated Online Learning Media for Students) based on Google sites that is valid, practical, and effective in boosting critical thinking skills and self-regulated learning) students on the elements of Basic Job Skills, K3, and Work Culture on the topic of Data and Information material. Even though it is considered very feasible, this platform still has several notes from validators and education practitioners that are the basis for product evaluation. Material validators provide constructive suggestions to minimize exposure to material text that is too dense and dominant, and strengthen interactive visual elements to optimize contextual feasibility so that material illustrations are much more aligned with real-world situations in the field. On the other hand, media experts recommend the addition of learning achievement indicators, user analytics trackers, and visual dashboards to monitor student learning progress periodically and directly. This structural weakness is an open opportunity for further research to be developed, for example by integrating a learning management system equipped with dynamic cognitive tracking features, sharpening contextual illustrations based on real case studies, and enrichment of more immersive multimedia interactive media to realize the sustainability of an adaptive digital learning ecosystem.

Despite its positive outcomes, several critical limitations of this study must be acknowledged. First, because MODIS operates entirely as an online platform, its implementation was heavily dependent on internet connectivity, which posed a challenge due to the limited school WiFi network infrastructure. Second, the scope of the field trial was constrained to a single class, specifically class X MPLB 3, which limits the immediate generalizability of the results to a broader student population. Lastly, the instructional content available within the MODIS platform is currently limited to just one material topic. Therefore, future research should focus on expanding the platform's versatility by developing an offline-accessible mode or progressive web application (PWA) to mitigate connectivity barriers. Future studies should also scale up the research design by involving multiple classes or schools across a wider geographical area and expanding the repository to encompass a more comprehensive array of learning topics within the curriculum.

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