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MODISS as a Differentiated Learning Support to Improve Student Learning Outcomes

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Abstract
This study aims to develop MODISS (Interactive Digital Module for Integrated Social-Emotional Learning) as a supporting media for differentiated learning strategies to enhance student learning outcomes. MODISS is an offline interactive media featuring videos, animations, interactive buttons, and interactive assessments. The offline operation of MODISS is designed to accommodate schools located in areas with limited signal access and minimize data usage for students. This innovation employs the ADDIE model of research and development, which consists of five stages: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation. The analysis and development of MODISS were conducted at SMPN 3 Pesawaran and SMPN Satap 5 Pesawaran. MODISS was designed using MS Office PowerPoint, Canva, ISpring, and Website 2 APK Builder v.5.1.0.1, and subsequently validated by practitioners. Prior to development, MODISS underwent readability and usability testing, yielding excellent results. It also underwent field trials to assess its practicality, which demonstrated a very practical outcome. Based on the assessment analysis, significant improvements in student learning outcomes were observed after the use of MODISS.

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INTRODUCTION

The rapid advancement of technology has profoundly influenced the educational landscape, driving a significant shift toward digitalization. This transformation necessitates the development of learning methods utilizing electronic media, both online and offline (Zhao et al., 2021). However, the implementation of educational digitalization faces substantial barriers, particularly in rural areas where inadequate infrastructure and limited internet access persist (UNESCO, 2023). This digital divide creates an inequitable learning environment, preventing many schools from harnessing the potential of digital tools.

In response to these challenges and the need for educational recovery post-pandemic, the Indonesian government has introduced the Merdeka Curriculum (Kemendikbudristek, 2022). This curriculum emphasizes flexible, independent, and meaningful learning, aligning with the pedagogical philosophy of differentiated instruction. Differentiated instruction is a proactive approach where teachers design learning experiences that respond to the varying readiness levels, interests, and learning profiles of students in academically diverse classrooms (Tomlinson, 2017). Its successful implementation, as shown by Suwartiningsih (2021), can lead to improved student learning outcomes, even in core subjects like science.

This student-centered paradigm positions teachers as facilitators, requiring them to continuously enhance their competencies, particularly in integrating social-emotional aspects into learning. Social-Emotional Learning (SEL) is the process through which individuals acquire and apply the knowledge, skills, and attitudes to understand and manage emotions, set and achieve positive goals, feel and show empathy for others, establish and maintain positive relationships, and make responsible decisions (Collaborative for Academic, Social, and Emotional Learning [CASEL], 2015; Elias et al., 2015). The integration of SEL is not an ancillary activity but a foundational component that fosters the interpersonal skills, empathy, collaboration, and emotional regulation necessary for a supportive classroom environment (CASEL, 2012). Extensive meta-analyses have confirmed that well-implemented SEL programs lead to significant improvements in academic achievement, alongside positive social and behavioral outcomes (Durlak et al., 2011; Taylor et al., 2017).

Despite these compelling educational ideals, observations at SMPN 3 Pesawaran and SMPN Satap 5 Pesawaran reveal a different reality. Science learning (IPA) remains predominantly teacher-centered. Limited time and classroom facilities hinder students' mastery of the curriculum, especially in conceptually demanding topics like Temperature and Its Changes. Understanding this topic requires students to grasp abstract principles and their application in daily life, a process often fraught with misconceptions and learning difficulties (Vosniadou, 2019). The mismatch between a uniform teaching strategy and the diverse ways students process such complex information is a critical factor contributing to low learning outcomes (Irwandani et al., 2017). This challenge is both cognitive and affective; students may struggle not only with the content but also with a lack of

motivation and self-efficacy when facing difficult scientific concepts.

To address this multifaceted problem, a solution is needed that is both digitally accessible and pedagogically sound. The effectiveness of digital modules in enhancing the understanding of scientific concepts has been demonstrated in previous studies (Diansah & Asyhari, 2020; Rahmat et al., 2019). Furthermore, the strategic use of multimedia elements is crucial. The Cognitive Theory of Multimedia Learning (Mayer, 2020; Sorden, 2010) posits that people learn more deeply from words and pictures than from words alone. This is supported by the Dual Coding Theory (Clark & Paivio, 1991; Nachiappan, 2013), which suggests that visual and verbal information are processed through distinct channels, and the simultaneous presentation through both channels can facilitate more robust learning. Videos, in particular, have been recognized as highly effective tools for explaining complex processes and enhancing the learning experience (Dzara et al., 2020). The integration of interactive elements, such as those developed using hyperlinks in platforms like PowerPoint, can transform static content into an engaging learning environment (Irwandani et al., 2017; Wabdillah, 2016).

Therefore, this research aims to develop "MODISS (Interactive Digital Module for Integrated Social-Emotional Learning)" as a support for differentiated learning strategies to enhance student learning outcomes. MODISS is conceived as an offline, interactive digital module featuring videos, animations, interactive buttons, and assessments. Its offline functionality directly addresses infrastructure limitations, while its design is grounded in multimedia learning principles (Mayer, 2020; Sorden, 2010) and Dual Coding Theory (Clark & Paivio, 1991). By embedding SEL competencies (CASEL, 2015) directly into the science content and providing multiple pathways for engagement, MODISS is designed to create an inclusive and effective learning environment that accommodates diverse learning styles and improves conceptual understanding of temperature and its changes.

METODE

In this study, a mixed-method approach was employed. This type of research is categorized as Research and Development (R&D), aimed at developing a product, namely an interactive digital module integrated with social-emotional learning.

The research was conducted at SMPN 3 Pesawaran and SMPN Satap 5 Pesawaran. SMPN 3 Pesawaran is located in the center of the Kedondong subdistrict, Pesawaran Regency, and is equipped with adequate

facilities. SMPN Satap 5 Pesawaran is situated on the slopes of Mount Pahumungan, Way Kepayang, Kedondong, Pesawaran, and is a school with limited learning facilities and no internet access. The research was conducted from September 2022 to June 2023.

The subjects of this study were students from SMPN 3 Pesawaran and SMPN Satap 5 Pesawaran, selected using purposive sampling technique. The chosen participants were seventh-grade students, selected after a discussion between the research team and the science teachers.

The development steps of MODISS followed the ADDIE model, which consists of five stages: (1) Analyze, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation. This development model was selected because its steps align with the research design aimed at producing MODISS that is effective in improving student learning outcomes.

The instruments used in this study included questionnaires and tests. The questionnaires were used during the pre-research phase, product validation, and to assess student responses in testing the practicality of MODISS. The testing method was employed to assess the effectiveness of MODISS as a tool to support differentiated learning.

RESULT AND DISSCUSSION

Result

The product validity test was conducted using a validation questionnaire completed by one expert and two practitioners. This validation test was performed to assess the validity of the content and design of the MODISS interface.

Table 1. Result of Validity Expert

Validator	Validation	Score	Criteria
Validator Expert	Content Validity	3,36	Valid
	Design Validity	3,46	Valid
Validator 1	Content Validity	3,52	Very Valid
	Design Validity	3,45	Valid
Validator 2	Content Validity	3,52	Very Valid
	Design Validity	3,48	Very Valid
	Content Validity	**3,46**	**Valid**
	Design Validity	**3,46**	**Valid**

Based on the analysis of the expert validation results, which included content and design tests, MODISS can be considered suitable for use, with certain improvements. The innovative product has been completed and tested in a one-on-one evaluation by fifteen students as users, to assess the readability and ease of use of MODISS in supporting differentiated learning strategies. The results of this test are documented in Table 2 and Figure1.

Table 2. Recapitulation of One-to-One Evaluation

Aspect	Score	Kriteria
Readability	3,41	Very Good
Convenience	3,52	Very Good

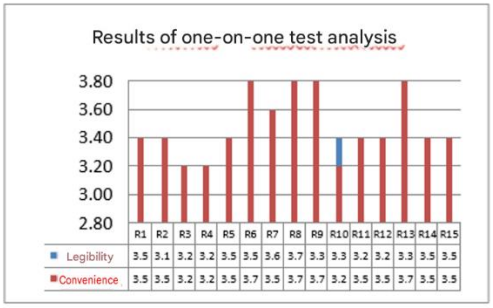

Figure 1. Graph One-to-One Evaluation

According to Table 2 and Figure 1, the average score from the one-on-one test was 3.47, which can be qualitatively concluded as

excellent. Every aspect of readability, including font variation, layout design, image quality, as well as the clarity and logic of the language used, received excellent scores. The ease of use aspects, which include user instructions, content flow, content coverage, and clarity of the material, all received excellent scores. The results of the one-on-one test, with excellent outcomes, indicate that no revisions are needed for the MODISS product.

An evaluation was conducted through field testing of MODISS, using students as respondents to measure the practicality and effectiveness of the product. The results of the practicality test of MODISS are documented in Table 3.

Table 3. Result of Responds Students

Aspect	Score	Criteria
Effectivity	3,53	Very Practical
Attractiveness	3,51	Very Practical
Efficiency	3,62	Very Practical
Convenience	3,52	Very Practical

The average student response score for MODISS reached 3.55, indicating that students' responses to MODISS, which supports differentiated learning strategies, reflect a high level of practicality.

The effectiveness of MODISS in improving student learning outcomes was tested in two class groups: the control group and the experimental group. The control group received instruction without the use of MODISS, while the experimental group used MODISS in their learning. The improvement in student learning outcomes in both the control and experimental groups is documented in Table 4 and Figure 2.

Tabel 4. Result of Effective Testing

Class	Average	
	Pretest	*Posttest*
Exsperiment	34,32	75,70
Control	41,06	62,65

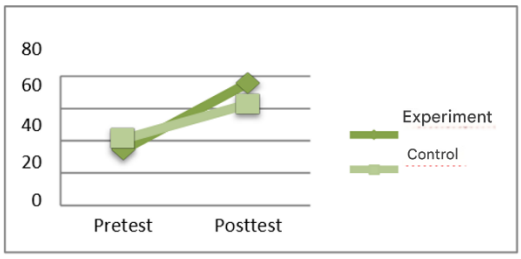

Figure 2. Graph of Effective Testing

Based on Figure 2, it is evident that the experimental group experienced a significant improvement in learning outcomes after using MODISS to support differentiated learning strategies.

Discussion

The aim of this research and development is to produce an interactive digital module integrated with social-emotional competencies to support differentiated learning and enhance student learning outcomes. The specifications of MODISS include learning materials, social-emotional learning (SEL) content, videos, animations, interactive buttons, and menus.

(a) (b) (c)

Figure 3. (a)Cover, (b) *Video*, (c) Display of Menu

The audiovisual presentation packaged in a single interactive application can encourage students to build meaningful connections with the content presented, thereby fostering the development of new knowledge aligned with the learning objectives (Sorden, 2010:11). This aligns with the cognitive theory of multimedia learning, particularly the dual coding theory, which posits that humans process information through two separate channels for visual and auditory information. When information is presented to the eyes (such as animations, videos, or text on a screen), an individual processes it through the visual channel. When information is presented to the ears (such as narration or nonverbal sounds), it is processed through the auditory channel (Sorden, 2010:12). The learning process conducted by the teacher can be more effectively absorbed by students when information is presented simultaneously through both channels, in accordance with the dual coding theory (Nachiappan, 2013:14).

MODISS is created using hyperlinks in MS PowerPoint, making the display interactive and capable of presenting multiple learning materials through interactive learning media (Irwandani et al., 2017:127). The educational videos integrated into MODISS are highly effective as a key contributor to enhancing the learning experience and improving the quality of understanding of physics concepts (Diansah & Asyhari, 2020:7; Dzara et al., 2020:970). The videos in MODISS are supported by dual coding learning theory, where students process learning through two distinct channels, meaning the processing of learning that involves both images and words occurs through separate pathways (Clark & Paivio, 1991:177).

(a) (b) (c)

Figure 4. (a) Cover of Competition, (b) PSE, (c) Interactive Mode

Several studies have shown that Social-Emotional Learning (SEL) has a positive effect on academic performance, physical health, and the enhancement of citizenship. The most common approach to SEL is training teachers to explicitly deliver social-emotional lessons and then finding opportunities to reinforce students' thinking. SEL instruction can be integrated into the curriculum through content areas such as academic subjects. The integration of SEL in MODISS is supported by the CASEL framework, which defines social-emotional competencies as the ability to understand and manage emotions, set and achieve positive goals, show empathy for others, establish and maintain positive relationships, and make responsible decisions (CASEL, 2012:191).

Differentiated instruction is a process or philosophy of effective teaching that provides diverse ways for all students in a heterogeneous classroom community to understand new information. This includes methods for: acquiring content, processing, constructing, or

reasoning ideas, and developing learning products and assessment measures, ensuring that all students, regardless of their diverse backgrounds and abilities, can learn effectively. Differentiated learning uses multiple approaches in content, process, and product. In a differentiated classroom, teachers will focus on three key elements: (1) Content (input), which refers to what students learn, (2) Process, which is how students will obtain information and form ideas about what they are learning, and (3) Product (output), which refers to how students will demonstrate what they have learned. MODISS is designed to support differentiated learning in the content and process elements. MODISS is modified and adapted based on assessments conducted in alignment with students' readiness, interests, and learning profiles.

MODISS is valid for supporting differentiated learning, as indicated by the content and design validity results. The content validity score of 3.48 indicates a very valid category. The implementation of differentiated learning allows students to better engage actively in the learning process based on their readiness levels, interests, and individual learning profiles (Suwartiningsih, 2021:91).

The practicality of MODISS is evident from the student responses as users of the interactive application. The student response score for the product reached 3.55, categorized as highly practical. The use of Android-based applications in learning can enhance motivation and creativity, enabling students to develop their own concepts in learning (Rahmat et al., 2019:120; Wabdillah, 2016:62).

MODISS is easy to distribute via WhatsApp, data cables, or email. It can be used by teachers to deliver materials and conduct assessments without the constraints of space and time. Another benefit of MODISS is its facilitation of differentiated learning, supporting the different learning styles of students.

A limitation in the product development process was the challenge of embedding large video files into the application, as well as the inability to support the integration of test instrument outputs, making it difficult to combine everything into a single MODISS application.

CONCLUSION

Based on the results and discussion of the study, it can be concluded that MODISS is valid and practical for supporting differentiated learning, as evidenced by the validity and practicality tests. MODISS is considered effective based on the improvement in student learning outcomes at SMPN 3 Pesawaran and SMPN Satap 5 Pesawaran.

Suggestions for future researchers include reducing the size of videos when creating interactive applications to ensure that the resulting application is lightweight and easy to operate. Additionally, the creation of digital test instruments integrated into the application should ensure that the output supports the application, making it easier to implement.

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