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The Effectiveness of Developing Problem-Solving Oriented Digital E-Modules on Theme 7: Events in Life for Grade V Elementary School

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Abstract

This research aims to produce instructional materials in the form of a problem-solving oriented digital e-module for fifth-grade elementary school students on the theme "Events in Life" that are valid, practical, and effective. The type of research used is development research using the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. The subjects of the study are 26 fifth-grade students. The instrument used to measure the effectiveness of the problem-solving oriented digital e-module is a learning outcome test in the form of 10 essay questions. The effectiveness of the problem-solving oriented digital e-module is assessed based on the difference between pretest and post-test learning outcomes analyzed through N-Gain. The N-Gain analysis result is 0.77, which falls into the high category. Based on the N-Gain coefficient, it can be concluded that the problem-solving oriented digital e-module is effective. The findings in this research are that problem-solving oriented digital e-modules can be alternative teaching materials in science learning, can improve student learning outcomes, and are declared valid, practical and effective. The novelty lies in the material developed, namely the analysis of the influence of heat on changes in temperature and shape of objects in everyday life.
Keywords: ADDIE, E-module, Science Learning, Problem Solving, Events in Life Theme

Introduction

The 2013 Curriculum is an educational approach introduced by the Indonesian government in 2013. Its primary goal is to improve the quality of education in Indonesia by aligning the curriculum with contemporary developments and global needs (Wijayati & Widhiyoga, 2023). The 2013 Curriculum also emphasizes the use of technology in learning (Wiyono, 2015) and empowers teachers to become effective facilitators in the teaching and learning process. Thus, the 2013 Curriculum aims to produce graduates who possess skills and knowledge relevant to current demands, as well as strong personalities and the readiness to compete globally.

The development of problem-solving oriented e-modules has a crucial role in supporting the objectives of the 2013 Curriculum, which prioritizes competency-based education with a focus on developing critical, creative and analytical thinking skills. E-modules designed with a problem solving approach encourage students to be actively involved in the learning process (Wulandari et al., 2023) not only as passive recipients of information, but as independent problem solvers. In this context, students are invited to identify problems, analyze situations, formulate solutions, and evaluate the results (Purwanto et al., 2024).

This process is in line with the objectives of the 2013 Curriculum which emphasizes student-centered learning, where students are empowered to develop high-level thinking skills (Wahana, 2019). In addition, problem-solving oriented e-modules also enable more effective

technology integration (Priyanthi et al., 2017), utilizing interactive media, simulations and real-world scenarios that can be accessed independently by students. This not only makes learning more interesting and relevant, but also prepares students to better face the challenges of everyday life and the future. Thus, the development of e-modules of this kind is very important in creating a dynamic and effective learning environment, as well as directly supporting the achievement of core competencies mandated by the 2013 Curriculum.

One of the key aspects of 21st-century education is the application of technology to enhance the effectiveness of learning (Thana & Hanipah, 2023). Innovative changes in the education sector will continue to occur and evolve as we progress through the 21st century (Ma'ruf et al., 2021). In essence, the use of technology aims to help and simplify every activity, including in the classroom teaching system. Makes the learning process easier and improves students' mastery of the material, as well as changing conventional learning patterns (Puspita et al., 2023). With technology, teachers can design teaching that is more interesting and relevant for students. Online learning platforms, educational apps and digital resources provide access to global information and enable students to learn independently. Education that utilizes technology is not only about replacing traditional methods, but also about creating a learning environment that is responsive, inclusive, and prepares students to face future challenges with confidence (Fakhri, 2023).

Teaching materials not only serve as a guide for teachers in structuring instructional content but also as a source of information that provides a foundation for student understanding (Siregar et al., 2022). By including exercises, assignments, and tests, teaching materials help evaluate the level of student comprehension. Engaging, relevant, and student-interest-aligned teaching materials also have the potential to enhance motivation and learning outcomes (Mahmud, 2023).

E-modules are a form of digital teaching materials that are increasingly dominant in the context of modern education. E-modules play a significant role in transforming the learning paradigm by providing greater accessibility and facilitating distance learning (Oktaviani, 2021). The main advantage of e-modules is their flexibility, allowing students to learn anytime and anywhere according to their needs and preferences. This problem-solving oriented e-module uses multimedia such as YouTube videos, links and images which can make abstract concepts easier to understand. For example, through animated videos, students can see a visual simulation of a complex scientific process, so they can connect theory with practical applications. This helps students understand the context of the problem and develop more effective solutions. The interactivity of this e-module allows students to actively participate in the learning process, such as simulation features and LKPD which can encourage students to think critically and creatively in solving problems. This interactivity allows students to immediately see the impact of the choices or steps they take, providing a deeper and more meaningful learning experience.

Problem-solving is the mental process individuals use to identify, analyze, and find solutions to the problems they face. This involves steps such as gaining a deep understanding of the problem, gathering information, evaluating various solution options, and implementing actions to resolve the problem. Problem-solving can involve various skills, including creativity, logic, reasoning, and communication abilities (Rahmazatullaili et al., 2017). In the context of science learning, students are encouraged to understand natural phenomena, apply scientific concepts, and develop skills to analyze and solve problems.

The material indicators in this research focus on the ability to analyze the effect of heat on changes in temperature and shape of objects in daily life which is closely related to the importance of problem solving skills in science learning at the basic level. In the context of this

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learning, students are invited to understand the basic concepts of how heat can cause temperature changes and change the shape of objects, such as melting ice or evaporating water. This understanding is not only theoretical, but also practical, where students must be able to connect these concepts with phenomena they encounter every day.

Through a problem-solving approach, students can be given tasks that challenge them to find solutions to problems related to these concepts (Sumartini, 2016) for example, how to most efficiently melt ice on roads in winter or why ice cream melts faster under light. By involving students in the critical thinking process to solve real problems, they will understand the concepts of heat and changes in form more deeply, while developing their analytical and creative abilities.

This approach supports the achievement of the goals of the 2013 Curriculum, which emphasizes the development of high-level thinking skills such as analyzing and evaluating, as well as competency-based learning (Afrita & Darussyamsu, 2020). Thus, problem solving skills not only help students understand science material, but also prepare them to become individuals who are able to think critically and creatively in facing various challenges in real life, in line with the holistic objectives of the 2013 Curriculum.

Based on interviews with teachers and an analysis of the needs questionnaire for fifth-grade students at SD Inpres Perumnas I, it can be concluded that the use of e-modules as teaching materials in the learning process has not yet been implemented by teachers. Currently, the only learning resource used is the thematic package book for fifth grade. This situation leads to a lack of variety in the use of teaching materials during classroom learning. The student needs questionnaire also indicates that 60% of students have difficulty connecting science concepts, 53% of students struggle to understand the material without examples, and 83% of students want a book that can connect to the internet, play videos, and be more engaging than the thematic book.

The development of this problem-solving oriented e-module can overcome the difficulties faced by students by presenting real contexts in students' lives. For example, regarding heat and changes in the form of objects, the e-module presents the cooking process in the kitchen or natural phenomena such as ice melting under the heat of the sun. Relate science concepts to situations familiar to students so that it is easier for them to understand how these concepts function in real life. The next way is to use interactive multimedia such as using YouTube videos, links, images and simulations to explain difficult scientific concepts. Then facilitate independent exploration and experimentation so that students can carry out virtual experiments that allow them to explore science concepts without the limitations of space and time. Next, provide feedback and guidance to students when completing assignments or quizzes so that they understand the mistakes made and how to correct them.

Fifth-grade students at SD Inpres Perumnas I are proficient in digital literacy. This includes an understanding of how to use technological devices, the ability to navigate digital platforms, and basic skills in utilizing online resources. This is evidenced by the results of the student needs analysis questionnaire, where all 26 fifth-grade students (100%) indicated that they can use smartphones to access Google, WhatsApp, YouTube, and other educational applications.

Method

This research is a development study using the ADDIE development model. ADDIE stands for Analyze, Design, Develop, Implement, and Evaluate. The subjects of this study were 26 fifth-grade students. The instrument used in this research was an essay test consisting of

10 items, which had been validated by experts. Students were given pretest and posttest questions to assess the effectiveness of the problem-solving oriented digital e-module teaching materials developed. The student learning mastery results were calculated using the following formula:

$$X = \frac{\text{Number of students who achieved mastery}}{\text{Total number of students}} \times 100\%$$

Explanation:
X = Mastery Percentage

Next, the effectiveness test uses the interpretation (Widoyoko, 2014) with the effectiveness test table. It is considered effective if the student learning mastery meets a minimum criterion of 60% in the good category. This can be seen in the following table:

Table 1. Criteria for Mastery of Student Learning Test Results

No	Percentage	Criteria
1	$X \geq 80\%$	Very Good
2	$60\% \leq X < 80\%$	Good
3	$40\% \leq X < 60\%$	Sufficient
4	$20\% \leq X < 40\%$	Poor
5	$X \leq 20\%$	Very Poor

Source: (Widoyoko, 2014)

The scores from the pre-test and post-test are then tested using the N-gain formula. According to Hake (Wahab et al., 2021), the formula is

$$g = \frac{Sf - Si}{100 - Si}$$

Explanation:
g = N-gain
Sf = Score from the final test (Post-test)
Si = Score from the initial test (Pre-test)
100 = Maximum score

Table 2. N-gain Assessment Criteria

No	Score	Criteria
1	$g > 0{,}7$	High
2	$0{,}3 \leq g \leq 0{,}7$	Medium
3	$0 < g < 0{,}3$	Low
4	$g \leq 0$	Fail

Source: (Wahab et al., 2021)

Results

The stages conducted in this research are analysis, design, develop, implementation, and evaluation.

1. In the analysis stage

During this stage, the researcher identifies and analyzes problems such as needs analysis, curriculum analysis, and student characteristics analysis. The results of this analysis stage revealed issues that necessitated the development of problem-solving oriented digital e-modules.

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2. In the design stage:

This stage includes four steps: structuring the framework of the e-modules, gathering and selecting references, designing the layout and features of the e-modules, and developing assessment instruments for the e-modules. Below are some parts of the designed view of the digital e-module oriented towards problem-solving on theme 7: Events in Life for Grade V elementary school.

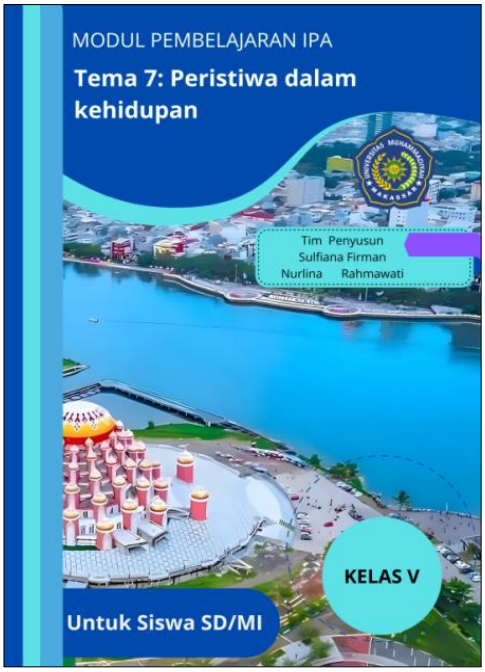


Figure 1. Digital E-Module Cover Display



Figure 2. Digital E-Module Table of Contents Display



Figure 3. User Guide Display of the Module



Figure 4. Display of Content Description Section

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Figure 5. Example Display of Practical Assignment

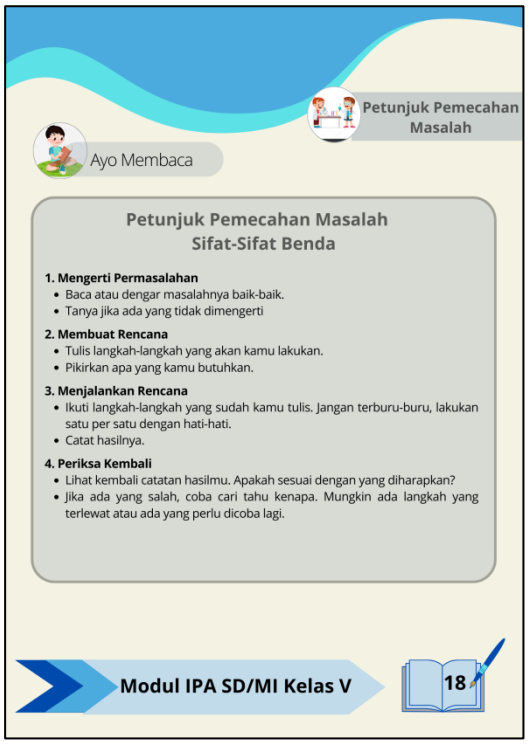


Figure 6. Example Display of Problem-Solving Instructions

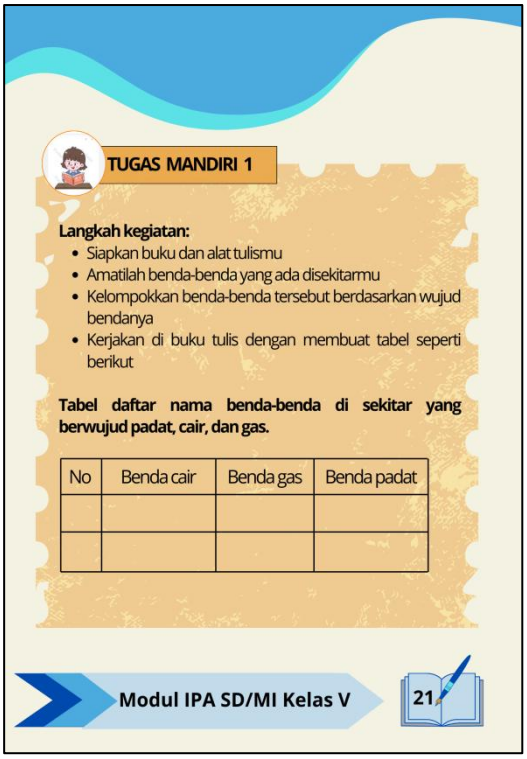


Figure 7. Example Section of Independent Task



Figure 8. Display of the References Section

3. Development Stage

In this stage, the research product and tools will be validated by experts to assess the validity of the designed product. The researcher will revise the research product and tools based

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on critiques and suggestions from the validators. The validated product is a problem-solving oriented digital e-module.

After the product and research tools are deemed valid, the researcher then conducts a field trial. The trial in this research involves a limited test with 26 fifth-grade students from SD Inpres Perumnas I. After conducting the trial, the researcher administers questionnaires to teachers and students to gather feedback on the e-module. The goal is to assess the practicality of the developed problem-solving oriented digital e-module.

4. Implementation Stage

At this stage the researcher gave a pretest to students before using the problem-solving oriented digital e-module. The pretest given was an essay with 10 questions to class V students at SD Inpres Perumnas I. Then, after implementing the e-module, the researcher again gave a posttest to class V students in the form of essay questions with 10 questions. Giving pretest-posttest to students aims to determine the level of effectiveness of the problem-solving oriented digital e-module that has been developed. The following is an analysis of data from the students' pretest and posttest

Table 3. Results of student learning completion

Statistical Data	Pre-test	Post-test	Mean Score
Highest Score	62	98	80
Lowest Score	35	70	52,5
Average Score	48,5	84	66,3
Passing (%)	-	88,5	-
Not Passing (%)	100	11,5	-
Classical Mastery	-	88,5	88,5

Source: (Widoyoko, 2014)

Based on table 3, it is known that the pretest score, namely before implementing the problem-solving oriented digital e-module, obtained the highest score for students with a score of 62, and the lowest score for students with a score of 35. The average student score was 48.5. Of the 26 students, none completed the pretest. In this case it can be said that all students did not reach the KKM score of 75.

Then the posttest score, namely after implementing the problem-solving oriented digital e-module, obtained the highest score for students with a score of 98, and the lowest score for students with a score of 70. The average student score was 84. The number of students who completed was 23 out of 26 students, while the number of students who did not completed as many as 3 out of 26 students. It was concluded that the average classical completeness of students was 88.5, which was in the good category.

Table 4. Results of students' average pretest-posttest scores

No	Pretest	Posttest	N-Gain	Category
1.	47,5	87,3	0,77	High

Source: (Wahab et al., 2021)

Based on table 4, it is known that the average student pretest is 47.5 and the student posttest is 87.3. The N-gain value from the students' pretest-posttest was 0.77 in the high category.

It is concluded in table 3 and table 4 that the problem solving oriented digital e-module is declared effective with students' classical mastery being 88.5 in the good category and the n-gain value from the students' pretest-posttest being 0.77 in the high category.

This problem-solving oriented digital e-module product was implemented in class in 6 meetings of 3 hours (3x45 minutes) attended by 26 students. The following is the

implementation schedule for the problem-solving oriented digital e-module implementation phase

Table 5. Schedule of implementation stages

No	Tanggal	Kegiatan	Materi	Alokasi Waktu
1.	20/05/2024	E-modul digital berorientasi pemecahan masalah	Sifat-sifat benda	3x45 menit
2.	21/05/2024	E-modul digital berorientasi pemecahan masalah	Sifat-sifat benda	3x45 menit
3.	22/05/2024	E-modul digital berorientasi pemecahan masalah	Perubahan wujud benda	3x45 menit
4.	27/05/2024	E-modul digital berorientasi pemecahan masalah	Perubahan wujud benda	3x45 menit
5.	28/05/2024	E-modul digital berorientasi pemecahan masalah	Kalor mengubah suhu benda	3x45 menit
6.	29/05/2024	E-modul digital berorientasi pemecahan masalah	Kalor mengubah suhu benda	3x45 menit

Source: (Data processed by researchers, 2024)

Learning activities are divided into three, namely introduction, core and conclusion. In the introductory stage the teacher opens with greetings, asks how the students are, and checks their attendance. then continued with prayer led by one of the students. The teacher then gives a brief explanation about the use of the e-module. Before starting to use the e-module, students are asked not to make noise or disturb other friends.

At the core activity stage the teacher starts by directing students to look at the table of contents in the e-module. This aims to ensure that students can easily find out the pages they will study. This step is important to provide an overall picture of the e-module structure and help students find the material in question quickly. Then the teacher asks students to focus on the e-module on their cellphones. Students are asked to start reading the material determined by the teacher. This ensures that every student is on the same page and ready to take on the next learning activity. E-modules contain various learning activities arranged sequentially to help students understand the material through direct experience. During the entire learning process, the teacher gives students the opportunity to ask questions if there are words or sentences they do not understand. Students can view the glossary in the e-module to find additional explanations.

At the closing activity stage the teacher asks students to answer the practice questions contained in the e-module. Students are asked to read the instructions carefully before starting to work on the questions. This step ensures that students understand the assignment given and can do it correctly. After students complete the practice questions, the teacher leads a reflection session with the students regarding the learning that has taken place. The teacher asks two reflective questions: "What have you learned today?" and "How did you feel during the lesson?" These questions help students to recall material learned, internalize their learning experiences, and provide feedback about how they felt during the learning process. The teacher then gives a brief explanation of the material that will be discussed at the next meeting. The class closed with a group prayer led by one of the students. This activity not only marks the end of the learning activity but also strengthens a sense of togetherness and an attitude of gratitude.

The following is a presentation of the results of implementing the problem-solving-oriented digital e-module that was developed

a. The first meeting

At the first meeting, students quite understood the learning instructions in the e-module, but the researcher also explained to students who were still confused.

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b. Second Meeting

The obstacle experienced during the first meeting was helping students adapt to the e-module format. Based on this, at the second meeting, students had begun to adapt to the e-module format. The obstacle experienced at the second meeting was that the lesson time was only 3 hours so that independent learning II could not be completed that day due to re-explaining independent learning I. Based on this, independent learning II was continued at the next meeting.

c. Third meeting

The third meeting of students has adapted to the e-module format, but the teacher still needs to provide explanations and directions if the students need them at any time. The obstacles experienced no longer exist. Learning is good and according to plan.

d. Fourth meeting

The fourth meeting of students has adapted to the e-module format, but the teacher still needs to provide explanations and directions if the students need them at any time. The obstacles experienced no longer exist. Learning was good and according to plan until the sixth meeting.

5. Evaluation Stage

The evaluation stage occurs throughout each of the above stages, known as formative evaluation, aimed at revision needs. For example, in the analysis stage, formative evaluation helps identify user needs and characteristics. In the design stage, formative evaluation ensures that the e-module plan and structure align with learning objectives. In the development stage, the e-module prototype is tested with students to obtain feedback on usability, interactivity, and practicality. Furthermore, in the implementation stage, formative evaluation monitors the implementation of the e-module in real learning situations to assess the effectiveness of the developed e-module.

Discussion

To see the level of effectiveness of problem-solving oriented digital e-modules, pretest-posttest results analysis was used. Problem-solving oriented digital e-modules can be declared effective if they meet the effectiveness indicators, namely learning completeness and N-gain, which states that the minimum level of effectiveness is 60% in the good category. Based on the students' pretest-posttest results, it shows that the problem-solving oriented digital e-module is stated to be practical with an average of classical completeness of 88.5 in the good category and the n-gain value from the students' pretest-posttest is 0.77 in the high category. Based on the explanation above, the researcher can conclude that the problem-solving oriented digital e-module is valid, practical and effective.

If we look at previous research, namely research conducted by Kimianti & Prasetyo (2019) in their research entitled "Development of science e-modules based on problem based learning to increase students' scientific literacy" the results of this research show that e-modules are suitable for use in science learning to improve scientific literacy skills. This is different from research carried out by researchers, because the research carried out by researchers is trying to develop digital e-modules oriented to problem solving in grade V elementary school science learning. Viewed from another perspective, previous research is related to research conducted by researchers, namely to develop science e-modules.

Second, research conducted by Dahlia et al (2023) in their research entitled "Development of discovery learning approach-oriented e-modules for class V science learning at SD Negeri 5 Palembang." The results of this research show that discovery learning approach-oriented e-modules are categorized as very valid. , practical and effective so that it can be used

in the learning process. This is different from research carried out by researchers, because the research carried out by researchers is trying to develop problem-solving oriented digital e-modules in grade V elementary school science learning. Viewed from another perspective, previous research is related to research conducted by researchers, namely at the same grade level.

Third, namely research conducted by Auliah et al (2022) in their research entitled "Development of electronic modules in science subjects on inquiry-based environmental pollution material." The results of this research indicate that inquiry-based e-modules are suitable for use by obtaining an average validation score of 84.5 % with very valid criteria. This is different from research carried out by researchers, because the research carried out by researchers is trying to develop problem-solving oriented digital e-modules in grade V elementary school science learning. Viewed from another perspective, previous research is related to research conducted by researchers, namely that the e-module developed is valid (feasible) to use with a validity level of 96% in the very high category.

Fourth, namely research conducted by Kaniyah et al (2022) in their research entitled "Development of a science learning e-module based on problem based learning to improve students' scientific literacy skills." The results of this research showed that the e-module developed was declared valid, practical, and effective for improving students' scientific literacy skills. This is different from research carried out by researchers, because the research carried out by researchers is trying to develop problem-solving oriented digital e-modules in grade V elementary school science learning. Viewed from another perspective, previous research is related to research conducted by researchers, namely that the e-module developed is declared valid, practical and effective.

The findings in this research are that problem-solving oriented digital e-modules can be an alternative teaching material in science learning Theme 7 Events in Life in Class V in elementary schools. This e-module can also improve student learning outcomes, and is declared valid, practical, and effective. The novelty lies in the material developed, namely the analysis of the influence of heat on changes in temperature and shape of objects in everyday life.

The limitation in this research is testing the product using limited trials. Therefore, it is hoped that future researchers will use extensive trials with different materials and grade levels.

Conclusion

The problem-solving oriented digital e-module was declared valid, practical and effective. This can be seen based on the results of students' pretest-posttest learning completeness. The average classical mastery of students is 88.5 in the very good category and the N-gain value from the students' pretest-posttest is 0.77 in the high category. The limitation in this research is that product testing uses limited trials. It is hoped that future researchers can develop problem-solving oriented digital e-modules by testing the product using extensive trials with different materials and grade levels.

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