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Development of Creative Problem Solving-Based E-Modules to Improve Student Motivation and Learning Outcomes

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Abstract: The research aims to develop an interactive electronic module based on Creative Problem Solving (CPS) about motion and force that is oriented towards improving students' motivation and learning outcomes. The development uses the Research and Development (R&D) model with the ADDIE model, which includes the stages of needs analysis, material design, validation, and practicality testing. The developed e-module contains various interactive features such as learning videos, reflection links, and contextual problem-solving activities that integrate the steps of CPS, namely understanding the problem, generating ideas, planning action, and implementing the solution. The results of validation by experts stated that the e-module is included in the very valid category, both in terms of content, pedagogy, appearance, language, and graphics, all of which are in the very valid category. Practical tests conducted by teachers and students proved that the e-module is included in the very practical category, is easy to use, and attractive for users. These findings indicate that the developed interactive e-module based on CPS is suitable for use in science learning to foster motivation and support the improvement of students' learning outcomes.

Keywords: Creative problem solving; E-Modules; Learning outcomes; Motivation

Introduction

Student success in learning is influenced by their motivation to learn, especially in science subjects, which require a lot of critical thinking and active participation in independent concept discovery. However, various studies show that junior high school students' motivation for science is still relatively low. Students often view science as a difficult subject, full of formulas, and not very relevant to everyday life (Putri et al., 2024; Nurkamfajriani et al., 2024; Wang, 2019; Purwaningsih et al., 2024; Purwati & Alberida, 2022). This condition leads to low student interest, activeness, and persistence in participating in learning, which ultimately leads to poor learning outcomes.

Motion and force are fundamental concepts in junior high school science, playing a crucial role in understanding everyday physical phenomena. However, various studies have shown that students often struggle to understand the relationship between force, mass, and acceleration because these concepts are abstract and require higher-order thinking skills (Thoyip & Maria, 2024; Tampubolon & Sipahutar, 2024; Asrial et al., 2020). Many students memorize formulas without understanding their meaning, resulting in low conceptual understanding (Sari & Mahrudin, 2022; Purwaningsih et al., 2024; Ananda & Usmeldi, 2023; Soyadi, 2015).

Therefore, new learning innovations are needed to increase student engagement and foster their curiosity. One useful option is the use of e-modules based on the Creative Problem Solving approach. CPS emphasizes student involvement in finding creative solutions to real-life problems through the stages of problem clarification, idea generation, evaluation, and solution implementation. Students are encouraged to think critically, creatively, and reflectively. This environment can increase intrinsic motivation because students feel they are directly participating in the teaching and learning process (Handayani et al., 2023; Widya et al.,

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2017; Kim et al., 2019; Chiang & Lee, 2016; Fitarahmawati & Suhartini, 2021; Sukma et al., 2023; Prem, 2020; Afriana et al., 2016).

Furthermore, using interactive e-modules as learning media makes learning more engaging and flexible. Multimedia features such as animations, simulations, and interactive links in e-modules have the ability to attract students' attention and curiosity. The main components of motivation are Attention, Relevance, Confidence, and Satisfaction (ARCS). E-modules also enable self-directed learning, provide immediate feedback, and encourage students to learn at their own pace (Maharani, 2025; Nurfarida et al., 2021; Putri et al., 2021; Anggelina & Sylvia, 2021; Triani & Asrizal, 2023; Tamubolon & Sipahutar, 2024; Millen & Supahar, 2023).

Based on the above description, this study aims to develop a Creative Problem Solving-based e-module oriented towards improving student motivation and learning outcomes. This research focuses on the validation and practicality testing (user responses) stages to assess the feasibility and practicality of the developed e-module. The results of this study are expected to contribute to the innovation of teaching materials that not only improve learning outcomes but also impact the character of Pancasila students who are cultured and have a national identity.

Method

The research used in this study was the type of Research and Development (R&D) with the ADDIE development model. However, this research was only conducted up to the Development stage, which includes expert validation and practicality testing by users, considering that the focus of the research is on the feasibility and ease of use of the learning materials, namely the electronic modules developed. The validity test aims to obtain a valid CPS-based e-module on the material of motion and force. The validity test was conducted by three experts. The validation sheet as a data collection instrument was given to the experts (validators) to determine the level of validity of each product developed. After validation, it was continued with practicality testing.

Practicality tests were conducted on several teachers and students as e-module users to obtain responses regarding ease of use, clarity of display, attractiveness, and the usefulness of the e-module in learning. Data were collected through a questionnaire and analyzed descriptively and quantitatively by calculating average scores and categorizing them.

Table 1. Validation Categories

Average score	Category
$3.50 < V \leq 4.00$	Very Valid
$3.00 < V \leq 3.50$	Valid
$V < 3.00$	Invalid

Table 2. Practicality Assessment by Teachers and Students

Average score	Category
$3.50 < P \leq 4.00$	Very Practical
$3.00 < P \leq 3.50$	Practical
$2.50 < P \leq 3.00$	Quite Practical
$2.50 > P$	Not Practical

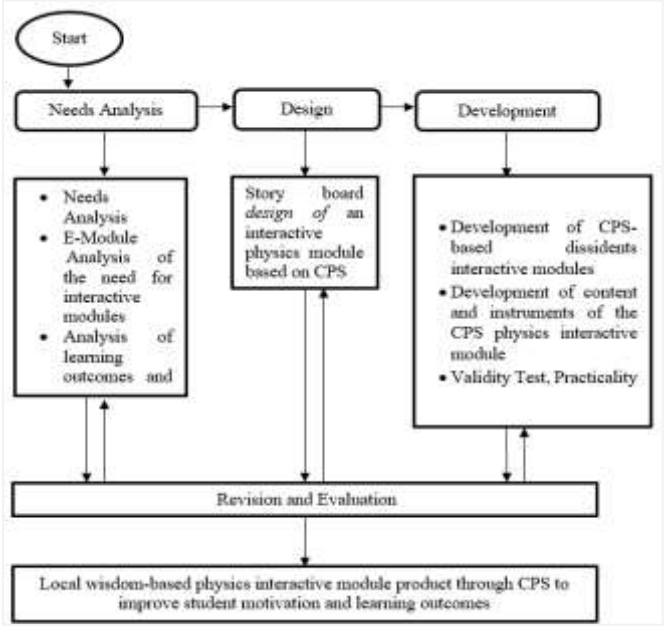

Figure 1. E-module development procedure

Results and Discussion

This creative problem-solving e-module is designed to boost student motivation and learning outcomes in the concepts of Motion and Force. The e-module is designed using an interactive digital platform that integrates text, video, images, QR codes, reflective quizzes, and problem-solving activities, all designed to stimulate student motivation and learning outcomes.

Analysis Stage

The purpose of this stage is to identify and analyze learning needs, student characteristics, and emerging problems in science learning. The needs analysis was conducted through interviews and a literature review related to low student learning motivation and learning outcomes. The analysis results indicated that science material was presented conventionally and did not utilize technology in the learning context. Based on the distributed needs analysis, students were passive and

felt uninterested in learning. Furthermore, the questionnaire results indicated that students would feel happy if learning utilized technology such as Android. The distributed needs analysis questionnaire was accompanied by questions about material that students considered difficult. Data showed that 78% of students agreed that the material on motion and force was difficult. One of the reasons why the material on motion and force was difficult to understand was because of the many formulas and abstractions (Maulidina & Khusaini, 2023).

Design Stage

Then the design stage was conducted to design an e-module based on Creative Problem Solving which contains four main stages, namely: clarifying the problem, generating ideas, developing solutions, and implementing solutions. The e-module is designed using an interactive platform that allows the integration of text, video, QR codes, animation, reflective quizzes, and student activities. In addition, the e-module is also designed by paying attention to ARCS (Attention, Relevance, Confidence, Satisfaction) motivation indicators as well as cognitive aspects of learning outcomes. Thus, the e-module is expected to be able to increase student motivation and learning outcomes.

Development Stage

This stage includes validation and practicality testing. The e-module is developed based on the established design. Integration of CPS, ARCS, and learning outcome components is a priority, and interactive features are crucial for the e-module's interactivity.

Validation results showed that the e-module obtained an average score of 3.83 and was categorized as highly valid. The validity of a module indicates that it is worthy of further testing (Rohim & Buchori, 2024). Furthermore, the e-module can also be used as a reference for independent learning (Kautsari et al., 2022). Furthermore, e-modules help students understand topics more effectively, improve their skills, and increase their desire to learn (Sholeh et al., 2023; Rudianto et al., 2022).

After the e-module was deemed valid, a practicality test was conducted with six teachers and fourteen junior high school students. The practicality test aimed to determine how practical the e-learning materials were for participating in teaching and learning activities. The results showed that the interactive e-module fell into the "very practical" category, achieving an average score of 3.80. Teachers stated that the e-module was easy to use, engaging, and helped facilitate contextual learning. Meanwhile, students assessed that the e-module made them more motivated to learn and improved their understanding of the material.

Table 3. Validity of CPS-based E-Modules

Aspects	Average	Category
Module Content Feasibility	3.78	Very Valid
Pedagogy	3.93	Very Valid
Feasibility of Module Presentation	3.87	Very Valid
Module Language Feasibility	3.78	Very Valid
Graphical Feasibility of Module	3.78	Very Valid
Average	3.83	Very Valid

Table 4. Practicality of E-Modules by Teachers

Aspects	Average	Category
User Ease	3.77	Very Practical
Material	3.86	Very Practical
Graphics	3.83	Very Practical
Language	3.75	Very Practical
Benefit	3.77	Very Practical
Average	3.80	Very Practical

Table 5. Practicality of e-modules by students

Aspects	Average	Category
Attractiveness	3.33	Practical
User Ease	3.77	Very Practical
Material	3.86	Very Practical
Graphics	3.83	Very Practical
Language	3.75	Very Practical
Benefit	3.77	Very Practical
Rata-rata	3.57	Very Practical

Table 4 shows the average overall score for the practicality test results by teachers was 3.80, which is considered very practical. Table 5 also shows the students' practicality score of 3.57, which is considered very practical. Therefore, the e-module is feasible for implementation.

Figure 2. CPS stages in the e-module

CPS emphasizes creative and critical thinking processes in solving contextual problems through four

main steps: understanding the problem, generating ideas, planning action, and implementing the solution (Widya et al., 2021). The application of CPS is particularly relevant to the topic of motion and force, as these concepts require a deep understanding of the relationships between physical variables and their application to everyday life phenomena.

Understanding the Problem

In the initial stage, students are confronted with real-world problem situations related to the phenomena of motion and force, including how friction affects the velocity of an object. Activities within the e-module help students identify the core of the problem and connect theoretical concepts to the empirical context. Through this process, students build a stronger conceptual understanding, which serves as the foundation for improved learning outcomes (Nuraeni & Rosana, 2023; Chou, 2019).

Generating Ideas

After understanding the problem, students are encouraged to generate various ideas or alternative solutions. For example, they formulate conjectures about the relationship between mass, force, and acceleration according to Newton's laws in the e-module. This divergent thinking activity encourages students to explore various possible answers, strengthening creative thinking and analytical skills (Widya et al., 2021). According to Hanaris (2023) and Achadah (2019), this stage of idea exploration also contributes to increased learning motivation because students feel actively involved in discovering knowledge.

Planning Action

This stage focuses on developing steps to test the ideas generated. In the context of motion and force, students can design simple experiments, for example, observing the effect of thrust on the acceleration of an object on a flat surface. This planning process trains students' scientific skills, such as formulating hypotheses, determining variables, and developing experimental procedures (Handayani et al., 2023). According to research by Widya et al. (2021), planning and implementing interactive activities like this helps students understand abstract physics concepts concretely, thereby developing science process skills and improving cognitive learning outcomes.

Implementing the Solution

In the final stage, students carry out the experimental plan, analyze the results, and draw conclusions based on the data obtained. The e-module on motion and force guides students in comparing experimental results with Newton's laws of theory to discover the relationship between force, mass, and acceleration. This activity not only strengthens conceptual understanding but also fosters scientific reflection and critical thinking skills (Ariaty et al., 2025). The concrete implementation of self-designed solutions provides a meaningful, hands-on learning experience that directly impacts learning outcomes.

The use of interactive modules has become a crucial innovation in 21st-century learning to enhance student motivation. These modules, in addition to textual content, also incorporate digital features such as barcodes, video links, animations, and interactive quizzes. This allows students to create rich and memorable learning experiences. These features directly contribute to the enhancement of ARCS components.

First, the attention aspect can be enhanced through engaging visual displays, the use of experimental videos, and interactive simulations accessed through barcodes or digital links. These digital media help arouse students' curiosity and keep them focused on learning (Jafnihirda et al., 2023). Second, the relevance aspect emerges when students perceive the material being studied as relevant to their real lives. The integration of contextual videos linked within interactive modules helps students understand that the concepts of motion and force actually occur in everyday life (Fitrian et al., 2025; Amri et al., 2025).

Figure 3. Interactive features on the e-module

Furthermore, the Confidence aspect increases because interactive e-modules allow students to learn independently with step-by-step guidance and automatic feedback from digital quizzes. Students can re-access the material and practice at their own pace, thus increasing confidence in their ability to understand the concepts (Maharani, 2025). Finally, the Satisfaction aspect is achieved when students feel successful in completing activities and receive rewards in the form of scores and positive feedback provided by the interactive

system. This creates intrinsic satisfaction that strengthens motivation to learn further (Dayanti et al., 2020).

Interactive e-modules can help students learn independently and exploratively through various digital features such as barcodes linked to experimental videos and interactive simulation links. These features make learning about motion and force more concrete, engaging, and cognitively challenging. E-modules are an innovative form of electronic learning material that helps students learn independently, interactively, and flexibly at their own pace (Thoyip & Maria, 2024). Through multimedia features such as instructional videos, animations, interactive quizzes, and external links, e-modules can facilitate learning styles, making the concepts learned easier to understand (Erawati et al., 2024).

Interactive e-modules that integrate various digital features are not only learning aids but also pedagogical instruments capable of fostering student motivation and learning outcomes comprehensively. This innovation aligns with the demands of modern learning, which is oriented towards independence, active engagement, and meaningful learning experiences. From a learning outcomes perspective, e-modules help students actively construct knowledge through digital exploration and direct feedback from available interactive activities. This supports meaningful learning, as proposed in constructivism theory, which states that learners build understanding through experience and reflection (Fathurrahman & Puspita, 2025). Furthermore, e-modules can increase student motivation and learning outcomes because they provide an engaging, relevant, and challenging learning experience.

Conclusion

This research produced an interactive electronic module assisted by Creative Problem Solving (CPS) for learning motion and force that was developed to the stage of validity and practicality. The validation results by experts showed that the e-module based on CPS principles was in the very valid category, both in terms of content, pedagogy, display, language, and graphics. The practicality test involving teachers and students also showed a very practical category, with positive responses to ease of use, attractive display, and integration of activities with the concept of graphs and forces that include: straight motion, acceleration, friction, and Newton's laws. Interactive features such as experimental videos, motion simulations, and reflective activities helped students understand the relationship between force and motion concretely. Thus, this CPS-based electronic module on motion and force material was declared suitable for use as an innovative science learning medium for the 21st century and has the potential to increase student motivation and learning outcomes.

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Author Contributions
The entire research team: Collect data, analyse data, and prepare articles for publication. All authors have read and approved the published version of the manuscript.

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Conflicts of Interest
All author declares that there is no conflict of interest.

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