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Electronic Module with Scientific Approach in Training Students' Science Process Skills on Solid Elasticity Learning Material

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Abstract

One of the skills in physics learning required to face the challenges of the 21st century is science process skills. Science process skills are used to discover previous laws, concepts, principles, and theories and refute previous findings. Therefore, science process skills need to be developed complexly in teaching materials in the form of an electronic module. This research aims to produce a valid, practical, and effective electronic module with a scientific approach to the material of solid elasticity that can be used to train students' scientific process skills. The research and development (R&D) method was employed on twenty students from class XI MIPA 2 SMA Negeri 12 Banjarmasin using the ADDIE development model. The data was collected through electronic module validation instruments, learner questionnaires, learning achievement tests, and the achievement of science process skills. The research findings showed that (1) The validation of the electronic module was rated as good with an average score of 3.14; (2) The practicality of the electronic module obtained a practical category with an average score of 3.35; (3) The effectiveness of the electronic module was rated as moderate with an N-gain score of 0.63; (4) The achievement of students' science process skills reached good category with an average score of 3.15. Thus, the developed electronic module can train science process skills and be used in learning activities.

Keywords: Elasticity of Solid, Electronic Module; Science Process Skills

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INTRODUCTION

Education is essential for the development of human resources. The quality of human resources is the key to achieving the Golden Indonesia 2045 vision of a just and prosperous, secure and peaceful, technologically advanced, and globally integrated nation (Sari et al., 2020). Therefore, education must always be improved in accordance with its goals. Moreover, curriculum reform is anticipated to enhance the integrity of education. Educational institutions can still choose which curriculum to implement in their classrooms for the time being. The available curricula are the 2013 curriculum, the emergency curriculum, and Merdeka curriculum (Wiguna & Tristaningrat, 2022).

Physics is one of the Natural Sciences branches identical to natural events and phenomena, so studying it is essential. Physics is also closely related to life (Saripudin, 2009). Numerous students view physics as the most challenging subject, affecting their low learning achievement. Many abstract and difficult-to-understand questions contribute to the difficulty of learning physics (Salsabila, 2013). Learning achievement can be enhanced if a teacher encourages students to overcome existing weaknesses (Erina & Kuswanto, 2015). Teaching and learning require support from teachers, students, and schools. Science process skill is one of the most important skills that students must possess, particularly in physics or science classes (Mindawati & Nana, 2020).

Science process skills are one of the skills students need to develop their potential (Handayani et al., 2017). Activities related to science process skills include observation, deductive reasoning (formulating hypotheses and identifying variables), experimentation, inductive reasoning (analyzing data and drawing conclusions), and presentation (reporting experimental results) (Agustina et al., 2017). To train science process skills, physics teachers need competence to embody the nature of physics as a science process. Improving science process skills can indirectly affect progress in life skills, career, and technological capabilities to face the challenges of the 21st century (Ghaida et al., 2021).

Science process skills are the most essential aspect of studying physics. However, students' science process skills are not yet optimally trained. Based on the findings of an interview with one of the teachers at SMA Negeri 12 Banjarmasin, the students' science process skills remain relatively low. Prior learning was conducted online and centered on the teacher. In addition, the teachers execute experiments infrequently, so there are still aspects of the experimental worksheet that students do not comprehend. This is evident from the preliminary study test results, which indicate that students' science process skills remain inadequate. Only 7.14 percent of students can formulate problems; 7.14 percent can formulate hypotheses; 7.14 percent can identify and define operational variables; 14.29% can analyze data; and 7.14 percent can conclude. Therefore, students' science process skills require extensive instruction (Andiantosa, 2022). According to research by Handayani et al. (2017), the students' science process skills do not include generating hypotheses, identifying variables, defining operational variables, analyzing data, making predictions, and drawing conclusions.

The preliminary interview also showed that not all students collect assignments. In addition, the teaching materials are the books provided by the school library, yet students sometimes use the internet to support the learning materials. The utilization of physics teaching materials has not been optimized due to the use of complex language in the materials. Therefore, it is insufficient to help students learn independently if the teaching materials used in schools have not completely incorporated scientific stages. As a result, students tend to be passive in learning. This is evident because several students' physics test scores do not meet the Maximum Completion Criteria of 70 and must repeat the test. Given these circumstances, physics teachers should employ innovative, interesting, and appropriate learning models and utilize existing media as learning resources. Students' science process skills can be enhanced satisfactorily if they are active and motivated in physics learning (Saharsa et al., 2018). There is a need for teaching materials that foster students' scientific reasoning and critical thinking (Mellenia & Admoko, 2022).

The role of information and communication technology must also be incorporated into the 2013 curriculum learning activities to increase the effectiveness and efficiency of learning in the embodiment of ideal education. Due to the difficulties in implementing the 2013 curriculum, it is necessary to develop teaching materials, such as electronic modules (Aulia et al., 2021; Dewantara et al., 2021; Kusuma et al., 2022; Sulistyawati et al., 2019). Electronic modules must be developed with approaches, methods, or models to be more structured according to the learning stages (Misbah, Khairunnisa, et al., 2021; Misbah, Sasmita., et al., 2021).

One of the approaches applied in the 2013 curriculum is the scientific approach. This is in line with relevant research indicating that the scientific approach can assist students in linking learning materials with real life (Asyhari & Hartati, 2015; Nurhasanah et al., 2019; Sukiminiandari et al., 2015; Wulandari, 2020; Wulandari & Mundilarto., 2016; Zulkarnain et al., 2015). Electronic modules facilitate comprehension of teaching materials, specifically solid elasticity.

Learning using a scientific approach is a learning process designed to encourage students actively construct concepts, laws, or principles through learning stages that involve process skills such as observing, classifying, measuring, predicting, explaining, and concluding (Rahmiyati, 2018). According to Suryani et al. (2016), the scientific approach outlined in the electronic module can lead students to learn independently so that they can take the initiative with or without the assistance of others, to identify their own learning needs, determine their own learning goals, identify learning resources, implement their learning strategies, and evaluate their learning achievement. According to Puspitasari et al. (2019), electronic modules with a scientific approach can assist students in making connections between learning material and real life.

The elasticity of solids is taught in class XI of SMA Negeri 12 Banjarmasin during the odd semester of the 2013-revised curriculum. Basic competencies in this material include analyzing the elastic properties of materials encountered in daily life, conducting experiments on the elastic properties of a material, presenting the results, and interpreting their physical significance. The subtopics of elasticity of solids are elasticity of materials, Hooke's law, and spring arrangement. Concerning this research objective which is to train students in science process skills by taking into account the characteristics of students who rarely receive learning that stimulates them, an appropriate strategy is required for introducing and training science process skills. Due to students' unfamiliarity with science process skills, teachers are unable to provide students with direct opportunities to complete all the skills. Therefore, it is gradually and methodically trained. Practical applications of this material's concepts, principles, and laws are readily apparent in everyday life, such as catapults, swings, suspension bridges, plasticine, vehicle shock breaker, and springs, which they have almost certainly observed and even used. Therefore, students can readily relate the elasticity of solids to their daily lives.

This research aims to produce a valid, practical, and effective electronic module with a scientific approach to the material of solid elasticity that can be used to train students' science process skills.

METHOD

This research employed Research and Development. This research intended to develop a product, namely an electronic module with a scientific approach to the material of solid elasticity, to train students' science process skills.

The ADDIE development model was used to create electronic modules for this research. Analysis, Design, Development, Implementation, and Evaluation (ADDIE) is a product development concept. The proposed product is an electronic module. In this research, the ADDIE model was chosen because it has a systematic process with a clear framework for generating effective, creative, and efficient products, as well as steps that are simple to implement when creating electronic learning modules. Figure 1 depicts the ADDIE stages as a flowchart illustrating each stage's reciprocal relationship.

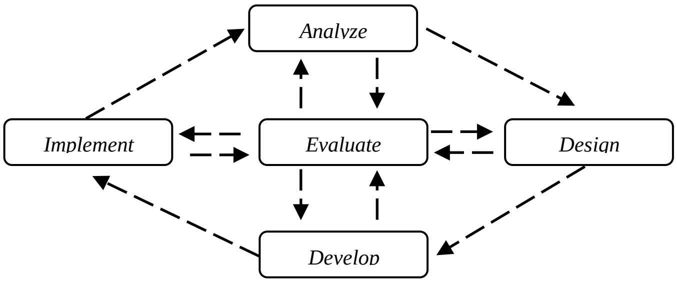

Figure 1 The reciprocal relationship between each stage of ADDIE (Sugiono, 2015)

ADDIE model stages are presented in Table 1.

Table 1 ADDIE Model Stages

Stages	Description
Analyze	Analyzing aims to discover what products need to be developed according to needs. The researchers conducted three stages of analysis: needs analysis, curriculum analysis, and students' characteristics analysis.
Design	This stage aims to design the learning process by translating desired learning outcomes into learning indicators. After establishing the learning objectives, the number of meetings, namely three with an allotment of 80 minutes per meeting, was determined. At the next meeting, the final test was administered.
Develop	This stage aims to integrate content with supporting media in the form of flipbooks and develop systematic guidelines for content creation to produce electronic modules that can be accessed via smartphone devices. The development process used web hosting services.
Implement	This aims to implement the developed electronic module to assess its feasibility. The validated electronic module was implemented in learning.
Evaluate	This stage aims to determine whether or not each activity stage and the electronic module follow the specifications. Evaluation entails analyzing students' science process skills' practicality, effectivity, and accomplishment.

The subject of this research is an electronic module with a scientific approach designed to train science process skills on solid elasticity materials, and the research object is the feasibility of electronic modules using a scientific approach to train science process skills on solid elasticity materials.

The feasibility of electronic modules refers to the quality of developed electronic modules in terms of their validity, practicality, and efficacy. Suppose the validity is at least rated as good. In that case, the practicality is at least rated as practical, and the efficacy is at least rated as moderate; electronic modules are deemed feasible. The validity of the electronic module is determined by the quality of the developed electronic module that demonstrates its compatibility with the desired outcomes. The validity is tested based on the validation results of academicians and practitioners using validation sheets categorized as very good, good, quite good, less good, and not good. The practicality of the electronic module means the accessibility of the electronic module in preparing, using, processing, interpreting, and administering it, which is determined based on the student response questionnaire. Furthermore, it is categorized as very practical, practical, quite practical, less practical, and impractical. The effectiveness of the electronic module is the level of success obtained after the implementation of the learning process using the developed electronic module. The effectiveness of the developed electronic module is based on the achievement of science process skills and supported by students' learning achievement in the form of pre-test and post-test. Furthermore, students' learning achievements are reviewed from the Normalized Gain (N-Gain) score between the pre-test and post-test and are expressed in high, medium, and low categories.

Achievement of science process skills is defined as the application of the science process skills indicators that are trained to discover new knowledge based on phenomena observed during experimental demonstration activities, such as formulating problems, making hypotheses, identifying variables, defining variables operationally, conducting experiments, analyzing data, and drawing conclusions. Utilizing the science process skills observation sheet, the level of the science process skills achievement is rated as either very good, good, quite good, less good, or not good. Science process skills are deemed accomplished if they are at least rated as good.

RESULT AND DISCUSSION

Analyze

The analysis was carried out to discover what products must be developed according to needs. The researchers conducted three stages of analysis: needs analysis, curriculum analysis, and students' characteristics analysis.

Needs Analysis

The needs analysis was carried out by conducting preliminary research at schools to determine what learning aids needed to be developed. At this point, an interview was conducted with the XI MIPA physics teacher regarding the student needs questionnaire. According to teacher interviews conducted at school, teachers and students require alternative learning materials. The learning methods and resources substantially affect students' comprehension and science process skills. Thus, the students' focus and enthusiasm for physics learning needs to be increased through the development of electronic module.

Curriculum Analysis

Curriculum analysis aims to examine physics materials in senior high school that follow the content standards and can be delivered via electronic modules. The curriculum used in SMA Negeri 12 Banjarmasin is the 2013 Revised curriculum with learning objectives referencing the Core Competencies (KI) and Basic Competencies (KD) included in the 2013 Curriculum. The basic competencies in physics class XI MIPA 2 at SMA Negeri 12 Banjarmasin are (3.2) analyzing the elasticity properties of materials in daily life and (4.2) conducting experiments on the elasticity properties of materials along with the presentation and application of experimental results. Next, the researchers formulated indicators and learning objectives that refer to the basic competencies to train science process skills from the beginning of learning activities to the end.

Analysis of Students' characteristics

The analysis of learner characteristics is carried out to determine the characteristics of students in class XI MIPA 2 SMA Negeri 12 Banjarmasin, which is primarily concerned with the thinking period of high school students. Students begin to think logically about abstract ideas, solve problems, evaluate hypotheses, and make decisions. Students in class XI MIPA 2 still need assistance building knowledge because they are not accustomed to doing so independently.

Resource analysis for problem-solving

The researchers collected technological resources that allow researchers to generate products in the form of electronic modules according to students' needs. At this stage, the researchers created an electronic module using the Flip Builder, which will be uploaded to a web page for online access.

Design

The researchers designed a framework for an electronic module that would be developed based on the results of the preceding analysis. The first step in the process of devising learning activities was to translate learning desired outcomes into learning indicators. After establishing the learning objectives, the number of meetings, namely three with an allotment of 80 minutes per meeting, was determined. At the next meeting, the final test was administered. In this phase, the researchers also add links to the resulting content to accomplish learning objectives.

Develop

This phase aims to integrate content with supporting media in the form of flipbooks and develop systematic guidelines for content creation to produce electronic modules that can be accessed via smartphone devices. The development process used web hosting services.

This study resulted in the development of an electronic module with an approach to solid elasticity material to train scientific process skills. The results of developing electronic modules were packaged into a website, which is then used to support the learning process in class XI SMA / MA, particularly at SMA Negeri 12 Banjarmasin.

The electronic module was created using the software Flip Builder. Flip Builder is one of the interactive media that makes it simple to incorporate various forms of animated media into a flipbook. The Flip Builder output includes HTML5, exe, rar, and app file extensions. The researchers published electronic modules online using HTML5 output. This online module is accessible at https://online.flipbuilder.com/bwmyv/bgok/ on a browser or software such as Android and iOS-based smartphone devices, laptops, and computers without the need for supplementary software or hardware so that it can be studied anywhere at any time. This electronic module maintains its layout, typefaces, images, and content presentation regardless of the device used to access it.

This electronic module is designed for three meetings containing solid elasticity sub-materials and experiments to train students' science process skills. The electronic module developed contains a cover, introduction, table of contents, instructions for use, concept map and keywords, material title and learning objectives, material content and sample questions, summary, self-evaluation, bibliography, glossary, and author's biography.

This electronic module was created following the direct instruction model, which employs lecture, demonstration, and drill techniques. Thus, each subtopic has learning objectives to be attained, motivation in the form of introductory questions in the form of images in the surrounding environment, teaching materials, example and practice questions, group-based worksheets, and summaries. At the end of each learning sub-matter, an assessment is administered to assess students' knowledge of the material covered and is accompanied by an answer key. Electronic modules designed with a scientific approach to train students' science process skills in seven indicators0: formulating problems, formulating hypotheses, identifying variables, operationally defining variables, conducting experiments, analyzing data, and drawing conclusions from data.

Validators then validated the developed device to assess its suitability for educational use. Three validators are anticipated to conduct device validation. To determine the practicality of the developed electronic module, the validation test was used. The validation test contains standard elements that must be present in the electronic module to be considered reliable and usable. The electronic module validation consists of some assessment components that evaluate the electronic module's content and appearance. Table 2 displays the calculation results for the electronic module validity test.

Table 2 The Result of The Electronic Module Validity Test

No.	Aspect	Validation	
		Average Score	Category
1	Content	3.27	Good
2	Face	3.00	Good
	Validity	3.14	Good
	Reliability	0.96	Very high

The results of content validity in Table 2 are rated as good because they satisfy six criteria: software engineering, organization, language, science process skills, scientific approaches, and evaluation. The first aspect of content validity, namely software engineering, received a good rating, indicating that all navigation buttons work properly, the application development software utilizes Flip Builder, and there are open-access web publications. This electronic module development can be accessed via a website page to prevent cache and storage overload, which result in excessive RAM and smartphone memory capacity since the software installed on a smartphone requires a minimum memory capacity of 50 MB for access. This is supported by (Kim et al., 2012) that the performance of storage on mobile devices has a significant impact on software performance. The software's performance and the health of the smartphone's battery are affected if the device's storage capacity is inadequate.

The second aspect of content validity, namely the organizational aspect, obtained a good category. This indicates that the content of the electronic module and the subchapter arrangement are organized, systematic, and consistent. The consistency of the material in the electronic module is intended to facilitate systematic and consistent thought processes among students.

The third aspect of content validity is a language that is deemed to be of high quality. This demonstrates that the language used is clear and follows the Refined Spelling (EYD), that there are no sentences with multiple meanings, and that it is simple to comprehend and consistent with the student's cognitive development. Following Prastowo (2015), electronic learning materials must be organized systematically using language that is simple to comprehend based on the student's level of knowledge.

Science process skills are the fourth aspect of content validity which obtained a good category. The electronic module assists students in formulating problems, hypotheses, identifying variables, operationally defining variables, conducting experiments, analyzing data, and drawing conclusions from data. This demonstrates that the electronic module's activities can assist students in meeting the criteria for science process skills.

The following aspect of content validity is the scientific approach categorized as good. The developed electronic module lists the skills of observation, questioning, information gathering, analysis, and conclusion. Aspects of the scientific approach are geared towards the worksheet, so the developed electronic module meets the criteria for the scientific approach and can be utilized.

The final aspect of content validity that is rated as good is evaluation. Set indicators and learning objectives serve as the basis for evaluation. According to Mahirah (2017), evaluation aims to determine the level of the student's performance during the learning process. Evaluation is used to assess the independent learning skills or accomplishments of students. Moreover, Tosuncuoglu (2018) stated that teachers must know the evaluation results to classify students, make corrections, provide feedback, and organize appropriate learning.

The results of the display validation in Table 2 are categorized as good because they satisfy four validity criteria: visual communication, format, attractiveness, and font shape and size. The first criterion for face validity is visual communication, which received a very good rating. The use of appealing layouts and hues is a crucial aspect of the electronic module display. The electronic module's layout is dominated by dark blue and bright yellow. Blue is conceptualized as a color that has a calming effect and relaxes the spirit, whereas yellow is a color containing optimism, enthusiasm, and joy. According to Wijayanti and Ghofur (2021), using yellow in electronic modules can stimulate students' mental and intellectual activities and enhance their individual analysis skills. This makes it possible for users to feel more encouraged by their mental activities when gazing at the electronic modules they employ.

The second aspect of face validity is the format that receives a good category in which the electronic module has used a column format corresponding to its shape and size, as well as a layout and typing format compatible with its format. The shape and size of the letters, the letter ratio between the title, subtitles, and content, and the correct use of capital letters are all easily readable. According to Gunawan (2017), an appropriate design is necessary to facilitate students' understanding and increase their interest in learning to influence learning achievement.

The third aspect of face validity, attractiveness, is rated as good. The attractive appearance of the electronic module front cover is one of its primary selling points. The front cover page features a combination of colors, including blue and yellow. Using an image of a shock breaker, the front cover of this electronic module references the elasticity of solids. Additionally, using images to convey material is presented attractively and clearly, making it simpler for students to comprehend and be interested in reading. This is consistent with Kasmaienezhadfard et al. (2015), who assert that using images in electronic modules has increased students' motivation and creativity to learn the presented text.

The fourth face validity is the font's shape and size, which obtained a good category. The shape and size of fonts are essential in the electronic module. According to Hojjati and Muniady (2014), the font displayed on the screen (computer or mobile device) is crucial for the readability of students. The greater the readability, the more quickly and easily students can comprehend the text.

The electronic module obtained validity with a good category based on content validity and face validity. The reliability assessment was obtained at 0.96 in the very high category. Thus, the developed electronic module is deemed good and can be tested in learning because it has fulfilled the predetermined aspects.

Implement

This is the stage of implementing the developed electronic module to assess its feasibility. The validated electronic module was implemented in learning at SMA Negeri 12 Banjarmasin after submitting a request for permission to conduct the research to the school's principal. Twenty students from class XI MIPA 2 SMA Negeri 12 Banjarmasin were asked to use the electronic module. Five meetings, with 2x40 minutes each, were devoted to using the electronic module by the researchers and students in the learning process. During the trial, the researchers taught the material about the electronic module based on the direct learning model.

Evaluate

Evaluation is determining whether or not each activity stage and the electronic module are following the specifications. Evaluation entails analyzing students' science process skills' practicality, effectivity, and accomplishment.

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The Practicality of The Electronic Module

The practicality of the electronic module was assessed using the student questionnaire. This questionnaire consists of 22 statements, both positive and negative statements. The practicality of the electronic module is evaluated from four aspects, namely, aspects of benefits, aspects of efficiency, aspects of accessibility, and aspects of science process skills. As explained by Alfianika (2018), practicality is used to determine the electronic module's usability level. The results of the developed electronic module's practicality are shown in Table 3.

Table 3 The Questionnaire Results of The Electronic Module Practicality

No	Assessment aspects	Average Score	Category
1	Benefit	3.31	Practical
2	Efficiency	3.36	Practical
3	Accessibility	3.38	Practical
4	Science process skill	3.36	Practical
	Average	3.35	
	Category	Practical	

The aspect of the benefits of the electronic modules based on the average score per aspect obtained a practicality score in the practical category. This demonstrates that the developed electronic module is beneficial because it can assist students in learning physics. This electronic module can also enhance the learning environment to motivate students to learn. The developed electronic module contains content that aligns with the learning objectives. It includes images, videos, icons, and text so that the electronic module contains more than just text. According to Najuah et al. (2020), students are directed to become active learners through the use of individualized learning materials, for they can initially learn the content of the materials.

The second factor is effectiveness, in which the electronic module is categorized as practical. This means that learning using the electronic module is efficient in terms of time, as it is designed to include hyperlinks on its icons, making it simpler for students to navigate to the page addressed by the link quickly. The developed electronic module consumes little battery power and data internet when in use, and it does not take long to load videos, images, links, or electronic module pages.

The third aspect, namely the accessibility of the electronic module, received a category of practical. This indicates that the developed electronic module is comparatively simple to use, as the language, paragraphs, and font size contained can facilitate students' comprehension of the provided learning material. In addition, students reported that the electronic modules were readily accessible on multiple networks (Wi-Fi, 3G, and 4G) at any time and from any location. With images, videos, and icons that are attractively packaged, students will find it simpler to comprehend the material and will be more interested in reading the contents.

The fourth aspect, namely science process skills, obtained a category of practical. The indicators devised for this aspect pertain to the use of electronic modules to train students' science process skills, such as encouraging them to observe, ask questions about everyday physical phenomena, and conduct and analyze experiments. The science process skills component of the electronic module indicates that the students, on average respond positively to using the electronic module to practice science process skills and comprehend the learning material.

The average score for all aspects of the student questionnaire is classified as practical. The practicality of the electronic module can be determined if the evaluation of the response questionnaire is classified as at least practical (Istikomah & Purwoko, 2020). Therefore, the electronic module devised based on four criteria, benefits, efficiency, accessibility, and science process skills, can be used for learning and benefit students.

Effectiveness of The Electronic Module

The effectiveness of the electronic module is measured using the learning achievement test in the form of a pre-test and post-test. This test is beneficial for determining students' learning achievement before and after learning using the developed electronic module. The test consisted of five essay questions at cognitive levels C4 and C5. This electronic module's effectiveness is determined using the average N-Gain score formula. Table 4 displays the comparative data analysis of student learning achievement before and after using the electronic module.

Table 4 The Comparison of Students' Learning Achievement

No	**Description**	***Pre-test***	***Post-test***
1	The highest score	24	89
2	The lowest score	0	38
3	The average score	7.85	65.90
4	The number of students with the passed score	0	10
	Total students	20	20

The pre-test results in Table 4 indicate an increase in learning achievement from the first to the third meeting for all students who participated in learning. Table 5 displays the results of the average N-Gain score regarding the effectiveness of the electronic module.

Table 5 The Results of The N-Gain Test

Pre-test average	**Post-test average**	**$\langle g \rangle$**	**Category**
7.85	65.90	0.63	Moderate

Few students' average pre-test and post-test scores exceed the KKM value established by the school, which is 70 on average. The lowest score on the pre-test was 0, and the highest score was 24. Some students could identify the known and dubious variables on this pre-test, but the majority were incorrect. Students have difficulty determining the appropriate formula to solve the problem because they cannot comprehend the questions. On the post-test, only ten out of twenty students, or roughly fifty percent, attained the KKM. The lowest score on the post-test was 38, and the highest score was 89. This demonstrates that the learning process using electronic modules has improved.

Lack of comprehension in analyzing high-level questions about physics concepts is one of the contributing factors to students' inadequacy. This is evident during the three-meeting learning process, as many students still have difficulty analyzing calculations and discussions involving multiple equations. This is consistent with Lahope et al. (2020), who state that students find it simpler to solve problems involving mathematical equations but struggle with physics-related mathematical equations, particularly those that require an understanding of the physical meaning and fundamental concepts. The difficulty of students to answer the test is also because more time is spent conducting experiments than teaching students how to solve physics problems. The test must be done individually, while the usual worksheets were done in groups over the three meetings, so the teacher cannot determine the individual students' level of comprehension. Due to time constraints, teachers did not emphasize example problems, which is one of the additional factors. Consequently, the guided questions presented in each subtopic cannot be answered simultaneously during the learning process. In addition, the teacher required students to study independently at home to master guided questions for which answer keys and formative assessments were provided.

Students' pre-test and post-test are compared using the N-Gain test calculation to assess the effectiveness. According to Wahab et al. (2021), the effectiveness can be measured using the normalized gain (N-Gain) equation. According to Table 5, the calculation of effectiveness using the N-Gain equation yielded a moderate category value of 0.63. Thus, it can be concluded that the electronic module is beneficial for physics learning, particularly for training science process skills in solid elasticity.

The results of each meeting's observation of students' science process skills follow. The first meeting did not evaluate problem formulation, hypothesis generation, and variable definition.

Table 6 The Achievement of Science Process Skills

No	Indicator	Meeting 1		Meeting 2		Meeting 3	
		Average	Category	Average	Category	Average	Category
1	Identifying problem (M1)			3.25	Good	4.00	Very Good
2	Formulating Hypothesis (M2)			3.00	Good	4.00	Very Good
3	Identifying variables (M3)			3.00	Good	3.63	Very Good
4	Operationally defining variables (M4)			2.50	Quite Good	3.50	Very Good
5	Conducting experiment (M5)	2.88	Good	3.63	Very Good	3.88	Very Good
6	Analyzing data (M6)	2.50	Quite Good	3.25	Good	3.75	Very Good
7	Drawing conclusion (M7)	2.25	Quite Good	3.25	Good	3.75	Very Good
Total Average of all students		2.54	Quite Good	3.13	Good	3.79	Very Good
Average of the three meetings		3.15				Good	

Table 6 showed that the achievement of science process skills in each group for the three meetings was 3.15 on average and was categorized as good. The average per-group score was 2.54 at the first meeting, categorized as quite good. Only three indicators were observed in assessing science process skills: conducting experiments, analyzing data, and drawing conclusions. This is because the experiments did not permit additional indicators to be measured. Indicator M5 in Table 6 is categorized as good, whereas indicators M6 and M7 are categorized as quite good. The students could answer indicator M5, but not all of the indicator's criteria were met. Then, for indicators M6 and M7, students continued to have difficulty responding. This is supported by Yunita and Nurita (2021), who revealed that data analysis skills are included in the form of integrated science process skills, for which a significant number of students still answer incorrectly due to the difficulty of working with these integrated skills. In addition, students' lack of mastery of the material is responsible for the low achievement of analyzing indicators and their errors in writing conclusions, namely that they are not consistent with the experiment's aims and their inability to convey conclusions.

The second meeting obtained an average score per group of 3.13 in the good category. The results of the evaluation of science process skills have improved. Students are becoming accustomed to constructing equipment and materials and reading measuring devices. Some students can correctly answer student worksheets containing indicators of science process skills, but there are still incorrect or missing points in each indicator. In addition, students frequently forget to write a question mark at the end of the question and continue to struggle with M4 and M6. Students were still perplexed regarding M6, which was performed during the experiment, and the variable's explanation. In addition, some students did not pay attention to the DOV explanation. In the section on data analysis, students can already create a table of calculation results. However, some groups still struggled to calculate the value between the manipulated variable and the response variable, and they still required instruction to identify patterns in the data. Overall, the average per group has increased since the first meeting. Aspects of students' unfamiliar science process skills can be enhanced through repetition and practice.

The average in the third meeting score was 3.79, with the very good category. Each indicator's assessment results for science process skills indicators have improved. Students were instructed to assemble tools and materials and read the measuring devices during the third meeting. In general, students can answer the worksheet correctly. However, a minority of students continue to make errors when answering the questions on each indicator of scientific process skills. At the previous meeting, students struggled with indicators M4 and M6. At the third meeting, however, most students could respond to DOV and analyze the data. Based on the outcomes of the three meetings listed above, it is evident that science process skills are trained and attained.

CONCLUSION

The electronic module, with a scientific approach to training students' science process skills on solid elasticity material, is appropriate for use in the learning process, according to the findings of the research and discussion. This is approved because the following indicators of feasibility are met: The validity of the electronic module reviewed from the validity sheet by three validators obtained a value of 3.14 with a good category, the practicality of the electronic module reviewed from the student questionnaire obtained a value of 3.35 with a practical category, the effectiveness of learning using the electronic module was determined by obtaining an N-gain value of 0.63 with a moderate category, the science process skills based on the observation sheet obtained a value of 3.15 with the category of good.

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