



Development of E-Module Using ROPES Strategy Assisted with Sigil Software to Improve Students' Critical Thinking Skills

Agus Sugiarto^{1*}, Rody Putra Sartika², Nur Ihsan HL³, Syarifuddin⁴

^{1*}Geography Education, ²Chemistry Education, Education and Teacher Training Faculty, Universitas Tanjungpura

³Bahasa Indonesia Education, Education and Teacher Training Faculty, Universitas Sembilanbelas November Kolaka

⁴Physics Education, Education and Teacher Training Faculty, Universitas Halu Oleo

*Corresponding Author. Email: agusnepster@fkip.untan.ac.id

Abstract: This study aims to develop an E-module with the ROPES (Review, Overview, Presentation, Exercise, summary) strategy assisted by Sigil software on elasticity and Hooke's Law to improve the critical thinking skills of class XI high school students that are valid, practical and effective. This method of research and development with the ADDIE model. The research instrument consisted of pretest-posttest questions, validation sheets, learning implementation sheets, teacher response questionnaires, and student responses. Data analysis techniques were analyzed descriptively and inferentially. The results of the study were known: 1) the validation results by three educational expert validators on the E-module with the ROPES strategy assisted by Sigil software are declared valid in terms of constructs and content with an average score of 0.85 in the very valid category so that it can be applied in learning activities, 2) the practicality of the E-module with the ROPES strategy assisted by Sigil software was measured by learning implementation sheets and questionnaires for teacher and student responses. The implementation sheet showed the average score for the limited trial class of 3.5 with the good category and the broad trial class of 3.65 with the very good category. The student response questionnaire showed the mean score for the limited trial was obtained at 83.5%, which was included in the very good category, and the broad trial and 87%, which was included in the very good category, and the teacher response questionnaire showed the average score for the limited trial. Furthermore, the broad test obtained an average result of 83% with the category very good, so the e-module was practical for learning at school. 3) the effectiveness of the E-module with the ROPES strategy assisted by Sigil software in terms of pretest-posttest questions obtained the criteria for the limited test N-Gain value of 0.68 with the Medium category and the broad test N-Gain 0.71 with the High category, supported by independent test results -samples-test which shows that there is a significant difference in learning achievement before and after using the E-module. It is concluded that the E-module with the ROPES strategy assisted by Sigil software effectively improves students' critical thinking skills in learning.

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Introduction

The module was a book written with the aim that students could learn on their own with or without teacher guidance (Depdiknas, 2008). With the module, students can achieve and complete their learning materials by studying individually. With the module, students can control the ability and intensity of learning. Modules can be studied anywhere. suggests that



the presentation of modules can be transformed into electronic form, so they were given the term electronic modules, or what are known as e-modules. The learning process with e-modules makes students no longer dependent on the teacher as the only source of information, so student-centred learning was created to master concepts and principles and have the skills to develop knowledge and self-confidence as provisions for continuing education at a higher level and developing science and technology. Physics learning was expected to foster students' critical thinking and analytical skills in discovering concepts and solving physics problems they find (Andri Estining Sejati, Syarifuddin, et al., 2021).

Learning in the 21st century, according to the 21st-century learning partnership, has been developed with input from educational experts stating that students use knowledge, skills, and support systems to succeed in work, life, and citizenship. Learning and innovation skills must be prepared and owned by students to face an increasingly complex life and work environment. There are four aspects: creativity, innovation, critical thinking and problem-solving, communication, and collaboration (Djidu et al., 2021; Rahayu et al., 2019)

Based on research results from Betaria et al. (2014) for four indicators of critical thinking skills in 50 class XI students, it is known that the average ability of students to work on questions in each indicator is only 14%. Students' critical thinking skills, namely, 28.00% of students are able in indicators to identify the reasons stated, 10.67% of students are capable in the indicator of agreement between sources; 11.33% of students are able in indicators to conclude explanations, conclusions, and hypotheses; and 6.00% of students are able in the indicator to choose criteria to consider possible solutions. The implication is that students' cognitive abilities and critical thinking skills are still relatively low, so there must be efforts to improve them through learning innovations.

Learning in the 21st century through ICT is an alternative to education. This learning will attract students' attention to increase their creative interest and critical thinking power. Module teaching materials that were operated in multimedia devices, known as mobile learning, are seen as capable of overcoming problems of interest in learning, critical thinking skills, mastery of student learning concepts, utilizing existing student smartphone devices, and can save time and money on students so that the devices this is practical (Ikhsan et al., 2017). One of the uses of technology in physics learning is using smartphones as learning media to display electronic physics modules (e-modules) with the help of sigil software. Research conducted by Maharani et al. (2015) found that Sigil software has more complete features than other software.

Based on the results of interviews with teachers in physics studies, the teacher has made teaching materials such as modules for some materials. However, the material on elasticity and Hooke's law has yet to be made available. Besides that, no special modules for elasticity and Hooke's law material exist. The teacher does not do modules oriented towards specific learning strategies to improve students' critical thinking skills. The teacher only does modules so that they become a guide for students' independent learning resources because the teacher does not fully understand the indicators of critical thinking and does not know the media that can make e-modules practical and effective.

The facts found in schools show that they are still theoretical in studying physics and must develop critical thinking skills. Students' enthusiasm in answering questions posed by the teacher is still limited in theory and has yet to show development under their potential and abilities. In addition, some students still find it challenging to work in groups, communicate, and solve problems when examples of real problems are presented. They have not been able to decide on the right solution to a problem.



The ROPES learning strategy has often been used, as is done by Un et al. (2020) to improve science process skills and obtain good results where the gains obtained are in the moderate category. The student's critical thinking skills can be developed by selecting appropriate learning strategies. Lohmay et al. (2016) state ROPES (Review, Overview, Presentation, Exercise, Summary) is a learning strategy adapted from various learning strategies oriented towards empowering students' thinking abilities (reasoning, communication, and connections) so that they develop a more optimal level. But the ROPES learning strategy this time uses sigil software learning assistance media in developing part of the learning tool in the form of e-modules to improve critical thinking skills.

Based on some of the descriptions above, the researcher developed teaching materials in the form of modules that can improve critical thinking skills as a source of independent learning for students to improve student's critical thinking skills. This module was developed using the ROPES learning strategy (Review, Overview, Presentation, Exercise, summary). Such learning allows students to convey, do exercises, and conclude something they have learned and can learn independently and reason. This study aimed to develop the e-module with the ROPES strategy (review, overview, presentation, exercise, summary) assisted by Sigil software on elasticity material and Hooke's law to improve critical thinking skills in the class XI high school students.

Research Method

The research method used was research and development with the ADDIE model. The research instrument consisted of pretest-posttest questions, validation sheets, learning implementation sheets, teacher response questionnaires, and student responses. The product being developed was teaching materials in E-modules with the ROPES strategy assisted by sigil software on elasticity and Hooke's Law for class XI SMA. Three validators carried out the validity test to validate the E-module, which was developed with two aspects of assessment, namely construct and content. The validation results were calculated using the following V'Aiken equation (Aiken, 1985).

$$V = \frac{\sum s}{n(c - 1)}$$

The results of the known validity can be matched with the criteria in Table 1 below.

Table 1. Validation Criteria

Validation Results	Validation Criteria
$0.81 < V \leq 1.00$	Very valid
$0.61 < V \leq 0.80$	Valid
$0.41 < V \leq 0.60$	Quite valid
$0.21 < V \leq 0.40$	Less valid
$0.00 < V \leq 0.20$	Very invalid

The developed e-module was tested at SMA Negeri 3 Pasarwajo class XI MIA 1 and MIA 2 on September 6 – 22, 2021. The results obtained were analyzed descriptively and inferentially.

Results and Discussion

The development stage begins with analysis to obtain information about the characteristics of students, problems that arise during learning, and other supporting media to support critical thinking skills in learning. Obtained by most class XI high school students aged 16-17 years. According to Piaget, at this age, students' intellectual development is at the formal operational stage (Harianto et al., 2019). At this stage, students can think logically and

rationally and have started to think abstractly. Task analysis and concept analysis were also carried out in the form of an analysis of the Physics syllabus for SMA Class XI odd semester, especially on the material on elasticity and Hooke's Law, which includes core competence (KI) and basic competence (KD) 3.7 and achievement indicators on elasticity and Hooke's Law material.

After the analysis phase, the next step was to design the developed product, namely the E-module with the ROPES strategy assisted by sigil software. E-modules designed at the design stage are then developed using Sigil software to be further validated by three validators in terms of construct and content to produce valid E-modules so that they can be implemented in learning activities. The book design was the process to be done the development of learning sources (HL et al., 2020, 2023; Saputra et al., 2021).

Table 2. The Result of Construct and Content Validation Analysis

Construct and Content	Average	Category
Average	0.81	Very Valid
Final Indeks	0.85	Very Valid

After being validated, the E-module was tested on a limited basis and widely to determine the practicality and effectiveness of the E-module being developed. Effectiveness is the final step to developing a good module (Hartini et al., 2018; Purnamasari et al., 2019). The results of the effectiveness analysis can be seen in Table 3, Table 4, and Table 5 below.

Table 3. The Analysis Results of Limited and Extensive Trials Pretest-Posttest Values

Class	Pretest		Posttest		Average Value	G
	N	N	N	N		
limited trial	13	13	11.5	70.6	0.68	
wide trials	20	20	13.9	74.46	0.71	

Table 4. The Analysis Results of Pretest and Posttest Values using The t-test

Class	Pretest		Posttest		Average Value	Sig (2tailed)
	N	N	N	N		
limited trial	13	13	11.5	70.6	0.000	
wide trials	20	20	13.9	74.46	0.000	

Table 5. The Analysis Results of Indicators of Critical Thinking Skills

Nu	Critical Thinking Indicator	Class	Results		<g>	Criteria
			Pre	Post		
1	Analyze arguments	UT	25	100	1	high
		UL	22.5	100	1	high
2	Ask and answer clarifying questions	UT	21.1	94.2	0.92	high
		UL	21.2	91.2	0.88	high
3	Induce and consider the results of induction	UT	19.2	65.3	0.57	currently
		UL	20	66.8	0.58	currently
4	Make and determine the results of the consideration	UT	0	32.6	0.32	currently
		UL	0	62.5	0.62	currently
5	Define an action	UT	0	68.2	0.68	currently
		UL	10	66.8	0.63	currently

The results of the practicality analysis were obtained through the implementation of learning sheets and the responses of teachers and students in the limited trial class and the wide trial class. The analysis results can be seen in Table 6 and Table 7.

Table 6. The Analysis Results of The KBM Implementation Sheet

Implementation of learning strategies	limited trial		wide trials	
	Meeting		Meeting	
	1	2	1	2

Average	3.6	3.4	3.6	3.7
Final Average	3.5		3.65	
Criteria	Good		Very Good	

Table 7. The Analysis Results of Teacher and Student Responses

Aspects of Construction and Content	limited trial		wide trials	
	Teacher	Student	Teacher	Student
N	1	13	1	20
Average	83%	85.3%	83%	87.8%
Category	Very Good		Very Good	

With the help of sigil software, the ROPES strategy-oriented E-module development process uses the ADDIE research model design, which consists of 5 stages: analysis, design, development, implementation, and evaluation. The e-module being developed is an E-module that can be run via a smartphone with the Reasily application or via a PC/laptop with Azardi software.

The initial stage in making the E-module is to carry out an initial analysis of the fundamental problems faced by students and teachers in learning activities, assessing the characteristics of students, conducting task analysis, analyzing concepts, and learning objectives to be achieved to obtain information related to students who already able to think logically, rationally, and have started to think abstractly. According to Piaget, at this stage, students have begun to be able to imagine roles as adults (Harianto et al., 2019; Sukariasih et al., 2019). In addition, students could use their knowledge to relate to new knowledge. Therefore, an E-module with the ROPES strategy assisted by sigil software was developed to train students' reasoning and critical thinking skills.

The next stage was designing the display arrangement of the E-module while still paying attention to the learning curriculum standards used. The next step is to develop an array of E-modules designed into Sigil Software and prepare materials and instruments needed to develop ROPES strategy-oriented E-modules assisted by sigil software in the form of soft files with the ePub extension. After completing the above steps, namely, the ROPES strategy-oriented E-module product assisted by sigil software on elasticity and Hooke's Law for Class XI high school. Three validators validated the developed e-module regarding its construct and content before being implemented in learning. After going through the validation process, the E-module was tested on a limited basis to assess the effectiveness and practicality of the E-module that had been developed. Evaluating the validity, effectiveness, and practicality of the E-module will obtain the feasibility level of the ROPES strategy-oriented E-module assisted by sigil software on the materials of elasticity and Hooke's Law that have been developed.

The development of the ROPES strategy-oriented E-module assisted by sigil software is based on the standard E-module format by the Ministry of Education and Culture, Directorate of SMA, Directorate General of PAUD, DIKDAS, and DIKMEN in 2020. The lesson plan format was adopted from the lesson plan format given by the physics subject teacher at SMAN 3 Pasarwajo. The ROPES strategy-oriented e-module assisted by sigil software on elasticity and Hooke's Law consists of 2 meetings, each with 4 hours of lessons. The developed e-module focuses on problem-solving by discussing each learning activity as a characteristic of the developed e-module to make it easier for students to think critically. The developed e-module is validated first in terms of construct and terms of content by three validators before being implemented to assess the validity of the E-module. Construction evaluation is carried out to assess the validation of the E-module in terms of the E-module's appearance, the E-module arrangement, and the E-module layout. The content assessment is



carried out to assess the validation of the E-module from the information aspect or the content of the material presented in the E-module. The validators assess the module as the experts' suggestion (Ensiyawatin et al., 2021).

The results of the validator assessment, as presented in Table 2, obtained an average validity for the constructed aspect of 0.91 in the "Very valid" category. At the same time, the average validity for the content aspect also obtained a value of 0.81 in the "Very valid" category. Based on this acquisition, the final average value or agreement index on the validity of the ROPES strategy-oriented E-module assisted by sigil software on elasticity and Hooke's Law is 0.85 in the "Very valid" category. Based on these results, the ROPES strategy-oriented E-module assisted by sigil software on elasticity and Hooke's Law was valid and can be applied in learning activities.

Learning the ROPES strategy implementation sheet assessed the usability of the ROPES strategy-oriented E-module, aided by sigil software, and the distribution of response questionnaires to students and teachers. Student and teacher response questionnaires aim to find out student and teacher responses to the ROPES strategy-oriented E-module assisted by sigil software that has been developed. The student response questionnaire sheet consisted of 15 statement items, while the teacher's response questionnaire contained 25. Students and teachers will fill in these statement items by ticking one of the five available Likert scale columns. The five categories of the Likert scale in this assessment consist of Strongly Agree, Agree, Fairly Agree, Disagree, and Strongly Disagree. The results of the analysis of implementation sheets and the responses of students and teachers to the developed ROPES strategy-oriented E-module assisted by sigil software are used as a practical reference for the ROPES strategy-oriented E-module teaching materials assisted by sigil software on the subject matter of elasticity and Hooke's Law.

In the limited trial class regarding the implementation of learning strategies, Table 6 shows good results, namely 3.5 with the "Good" criteria. In the broad trial class related to the implementation of learning strategies, Table 4.16 shows very good results, namely 3.65 with the "Good" criteria. According to Ratumanan & Laurens, (2011), the criteria for evaluating the implementation of the learning model are said to be very good if the score interval is 3.6

P 4. Based on these results, it can be concluded that implementing the E-module with the ROPES strategy assisted by sigil software is practically used in learning physics on elasticity and Hooke's Law. The response analysis results in the limited trial class and the wide trial class Table 7 show the same response results, namely very good from students and physics subject teachers towards the E-module oriented ROPES strategy assisted by sigil software. Based on Table 7 regarding the results of student responses related to the practicality of the ROPES strategy-oriented E-module assisted by sigil software, students responded very well, as seen from the average scores of 85.3% and 87.8%, which were included in the category "Very Good."

The acquisition of a high score indicates that the ROPES strategy-oriented E-module assisted by sigil software is attractive and easy to use by students. Likewise, Table 7 regarding the results of the responses of physics subject teachers regarding the practicality of the ROPES strategy-oriented E-module assisted by sigil software shows the results that the teacher responded very well, as seen from the average score obtained of 83%, which is included in the "Good" category very." The acquisition of a high score indicates that the ROPES strategy-oriented E-module assisted by sigil software can be used in learning activities at school. Based on the results of the responses of students and teachers of physics subjects obtained on the assessment of the ROPES strategy-oriented E-module assisted by sigil software that has been developed, it can be concluded that the ROPES strategy-oriented



E-module assisted by sigil software on the subject matter of elasticity and practical Hooke's Law for use in learning.

The final stage after the ROPES strategy-oriented E-module assisted by sigil software is declared feasible is the implementation stage to assess the effectiveness of the software-aided ROPES strategy-oriented E-module that has been developed by measuring differences in student test results on the subject matter of elasticity and Hooke's Law before and after treatment. The test questions given are adjusted to indicators of critical thinking skills so that the scores obtained are intended to measure the improvement of students' critical thinking skills. The test was one way to know the effectiveness of learning (Sejati et al., 2017, 2020).

The effectiveness test of the E-module is carried out by giving students a pretest and posttest on elasticity and Hooke's Law. The pretest is given to students before giving treatment which aims to measure students' initial abilities on the subject matter of elasticity that have been studied with subject teachers with conventional teaching materials at the beginning of the odd semester of class XI. The posttest was given to students after giving treatment in the form of learning using ROPES strategy-oriented E-module teaching materials assisted by sigil software on the subject matter of elasticity and Hooke's Law in the middle of the odd semester. Giving a posttest aims to measure the final ability of students on the subject matter of elasticity and Hooke's Law. The students' final abilities are then compared with the student's initial abilities to find out the increase in students' critical thinking skills.

The student's critical thinking skills test consisted of 7 essay questions which were tested on a limited basis, and the wide trial consisted of 5 item indicators. The question indicators developed originate from the essential competencies determined in the Class XI physics syllabus. All indicators are declared complete if they meet the KKM determined to be

70. Data on students' critical thinking skills test results for the pretest and posttest limited pilot classes are described in Table 5. In contrast, the acquisition of students' critical thinking skills tests results for the pretest and posttest trial classes area is described in Table 5.

Table 3 shows that none of the 13 students met the specified KKM when the pretest was carried out. The average pretest score obtained was 11.5. Then after being given learning by applying the ROPES strategy-oriented E-module assisted by sigil software, the results showed that there was an increase in students' critical thinking skills so that the indicators on the subject matter of elasticity and Hooke's Law fulfilled the KKM determined by the average posttest score obtained at 70.6 which shows the completeness of the learning indicators. The n-gain value is 0.68 in the "Medium" category. The pretest-posttest average value of the limited trial class was then analyzed using the paired-samples t-test to see the difference between the results of the scores before and after using the ROPES strategy-oriented E-module product assisted by sigil software so that a sig. (2-tailed) value was found equal to 0.000, where <0.05 . It is concluded that there is a difference in the pretest-posttest average scores on students' critical thinking skills using E-modules with the ROPES strategy assisted by sigil software.

Furthermore, the analysis results in the wide trial class in Table 4 show that none of the 20 students met the specified KKM when the pretest was carried out. The average pretest value obtained was 13.9. Then after being given learning by applying the ROPES strategy-oriented E-module assisted by sigil software, the results showed that there was an increase in students' critical thinking skills so that the indicators on the subject matter of elasticity and Hooke's Law met the specified KKM with an average posttest score obtained of 74.46 which indicates the completeness of learning indicators. The n-gain value was obtained at 0.71 with the "high" category.



The pretest-posttest mean scores for the broad trial class were then analyzed using the paired-samples t-test to see the difference between the results before and after using the ROPES strategy-oriented E-module product assisted by sigil software so that a sig. (2-tailed) value was found of 0.000, where <0.05 . It is concluded that there is a difference in the pretest-posttest average scores on students' critical thinking skills using E-modules with the ROPES strategy assisted by sigil software. The final analysis to see the significance of the difference in the mean posttest scores of the limited trial class and the wide trial class through the independent-samples t-test found sig. (2-tailed) values of 0.010 and 0.026 where <0.05 , it is concluded that there is a significant difference between the posttest average scores of limited trial classes and broad trials of students' critical thinking skills through using E-modules with the ROPES strategy assisted by sigil software. The results show that the ROPES strategy-oriented E-module assisted by sigil software on elasticity and Hooke's law effectively improves students' critical thinking skills on elasticity and Hooke's law.

The success of the E-module in improving students' critical thinking skills is also influenced by the use of the ROPES learning strategy (Review, Overview, Presentation, Exercise, summary). Wijaya & Wijaya (2022) explained that ROPES was a strategy that can provide opportunities for students to increase creativity individually and in groups, with the ability to do analysis, presentation, and conclusion. Furthermore, Sejati et al. (2019) suggest that the teaching methods commonly used by teachers in this approach include discussion and assignment methods, discussions to solve problems are carried out by a small group of students, between four to five people, with the direction and guidance of the teacher. The E-module with the ROPES strategy invites students to work together through discussions on the tasks in each E-module meeting. The existence of cooperation between students influences critical thinking skills. This result was to the results of research by Anderson et al. (2001) that students who work together also play a role in increasing their critical thinking.

In this study, five indicators of critical thinking skills were used. Indicators of students' critical thinking skills in each aspect are explained as follows. Based on Table 5, analyzing arguments showed an increase in the indicators of analyzing arguments in the limited trial and wide trial classes. Based on data from the analysis of students' answers, the same gain value was obtained for the indicator of analyzing arguments of 1 in the limited trial class and the wide trial class. The gain value in both classes is included in the high category. Hidayati et al. (2017) suggest that students with analytical competence will be more competent and able to identify inferential relationships between statements, questions, concepts, and descriptions in expressing beliefs, judgments, experiences, reasons, and information. The posttest results show that the E-module with the ROPES strategy assisted by sigil software in learning can stimulate critical thinking skills on indicators of analyzing arguments. This result aligns with Umar & Ahmad (2010) that media in learning has an essential role in improving critical thinking skills.

The indicator asking and answering clarifying questions based on Table 5 showed an increase in the indicators of asking and answering questions in the limited trial and wide trial classes. Based on the data from the analysis of students' answers, a gain value was obtained for the indicators asking and answering clarification questions of 0.92 in the limited trial class and a gain of 0.88 in the wide trial class. The gain value in both classes is included in the high category. According to Sari et al. (2019), some students are already able when faced with a problem that requires linking several concepts.

The indicator inducing and considering the results induction based on Table 5, there was an increase in the indicators of inducing and considering the results of induction in the limited class trials and wide trials. Inducing indicators and considering results Based on data



from the results of the analysis of students' answers, the gain value for the indicators inducing and considering the results of induction is 0.57 in the limited trial class and a gain of 0.58 in the wide trial class. The gain value in both classes is included in the medium category. Improved indicators induce and consider the results of induction because there are many experiments/practicums in learning. This result was from Sejati et al. (2022, 2021) that the ability to conclude could be developed through practicum activities. Using the practicum method contained in the E-module with the ROPES strategy assisted by sigil software, students are trained to investigate and conclude the results of their investigations.

The indicator making and determining the results of the considerations based on Table 5, there was an increase in the indicators for making and determining the results of the considerations in the limited trial class and wide trial. Based on the data from the analysis of students' answers, a gain value was obtained for the indicators of making and determining the results of consideration of 0.32 in the limited trial class and a gain of 0.62 in the wide trial class. The gain value in both classes is included in the medium category. Discussions on E-modules with the ROPES strategy, assisted by sigil software and good communication, can train students' decision-making in problem-solving so that students' critical thinking skills increase. Sejati et al. (2017) explain that problem-solving decision-making must refer to concrete reasons and good feedback in group communication.

The indicator determining an action based on Table 5 shows an increase in indicators determining action in the limited and wide trial classes. Based on data from the analysis of student's answers, the gain value for the indicator determining action is 0.68 in the limited trial class and a gain of 0.63 in the wide trial class. The gain value in both classes is included in the medium category. Improving critical thinking skills on this indicator must be integrated with the use of E-modules with the ROPES strategy assisted by sigil software. Students' critical thinking skills will be sharpened with questions requiring critical thinking in the E-module. They will be qualified to explore the most applicable solutions in the classroom and real-life contexts (Kasmiati et al., 2020).

Based on the descriptions of each indicator of critical thinking above, it can be concluded that there is an increase in critical thinking skills after the implementation of Physics learning using E-modules with the ROPES strategy assisted by sigil software with the dominant category "moderate." This result was relevant to research conducted by Yana et al. (2019), which stated that in implementing the ROPES learning strategy, students learn together through discussions to become free and active, showing their creativity in studying and presenting the material as developing reasoning and communication skills. This result was to Anderson et al. (2001) that students who work together also increase their critical thinking.

Conclusion

Based on the results of data analysis and discussion, it can be concluded that the ROPES strategy-oriented E-module assisted by Sigil software that has been developed was declared feasible (valid, practical, effective) for use in learning the subject matter of elasticity and Hooke's Law at SMA/MA Class XI level. This feasibility was shown by the analysis of the validator's assessment which achieved an average validity of 0.85 in the "very valid" category. The practicality of the E-module was obtained through the results of the analysis of the implementation of learning as well as the response of teachers and students both in the limited trial class and the wide trial so that the learning implementation results are 3.5 in the "good" category in the limited trial class and the wide trial class of 3.65 categorized as "very good." The responses of teachers and students were respectively in the "very good" category



with percentages of 83%, 85.3%, and 87.8%. The effectiveness of the E-module was obtained through the learning achievement of students with n-gain in the limited trial class of 0.68 in the "medium" category and the wide trial class of 0.71 in the "high" category. This effectiveness is supported by the results of the paired-samples t-test, which shows that there is a difference between the value of students' critical thinking skills before and after using the ROPES-oriented E-module product assisted by sigil software as well as the results of the independent-samples t test where the value of sig(2-tailed) <0.05 indicates that there is significance the difference between the value of students' critical thinking skills in the limited trial class and the broad trial class before and after using the ROPES oriented E-module product assisted by sigil software.

Recommendation

Recommendation that can be given in connection with the research done are as follows. This research is not perfect, so it needs to be improved for the effectiveness and utilization of use value by using the method used is conceptualization. For teachers, this research should be used as a learning medium, namely E-module-based teaching materials, to make learning more efficient. For students, the developed ROPES-oriented E-module teaching materials assisted by sigil software can be used as an alternative to independent learning.

References

- Aiken, L. R. (1985). Three Coefficients for Analyzing the Reliability and Validity of Ratings. *Educational and Psychological Measurement*, 45(1), 131–142. <https://doi.org/10.1177/0013164485451012>
- Anderson, T., Howe, C., Soden, R., Halliday, J., & Low, J. (2001). Peer interaction and the learning of critical thinking skills in further education students. *Instructional Science*, 29(1), 1–32. <https://doi.org/10.1023/A:1026471702353/METRIC>
- Betaria, G., Dan, S., & Simarmata, U. (2014). Pengaruh Model Pembelajaran Ropes (Review, Overview, Presentation, Exercise, Summary) Berbantu Audio Visual Terhadap hasil Belajar Siswa Pada Materikalor di Kelas X Semester II SMA N 11 Medan T.P. 2013/2014. *INPAFI (Inovasi Pembelajaran Fisika)*, 2(3). <https://doi.org/10.24114/INPAFI.V2I3.1989>
- Depdiknas. (2008). *Panduan Pengembangan Bahan Ajar*. Departemen Pendidikan Nasional
- Djidu, H., Mashuri, S., Nasruddin, N., Sejati, A. E., Rasmuin, R., Ugi, L. E., & Arua, A. La. (2021). Online learning in the post-Covid-19 pandemic era: Is our higher education ready for it? *Jurnal Penelitian Dan Pengkajian Ilmu Pendidikan: E-Saintika*, 5(2), 139–151. <https://doi.org/10.36312/esaintika.v5i2.47>
- Ensiyawatin, A. Z., Sumarmi, & Astina, I. K. (2021). Development of Supplementary Contextual Teaching Materials Based on Ecotourism and Natural Resource Management. *IOP Conference Series: Earth and Environmental Science*, 747(1), 012007. <https://doi.org/10.1088/1755-1315/747/1/012007>
- Hariato, E., Nursalam, L. O., Ikhsan, F. A., Zakaria, Z., Damhuri, D., & Sejati, A. E. (2019). The compatibility of outdoor study application of environmental subject using psychological theories of intelligence and meaningful learning in senior high school. *Geosfera Indonesia*, 4(2), 201–216. <https://doi.org/10.19184/geosi.v4i2.9903>
- Hartini, S., Firdausi, S., Misbah, M., & Sulaeman, N. F. (2018). The Development of Physics Teaching Materials Based on Local Wisdom to Train Saraba Kawa Character. *Jurnal Pendidikan IPA Indonesia*, 7(2), 130–137. <https://doi.org/10.15294/jpii.v7i2.14249>
- Hidayati, D. N., Amaluddin, L. O., & Surdin, S. (2017). The Effect Guided Inquiry to Critical



- Thinking Ability to Build Student Character in Geography Subject. *1st International Conference on Geography and Education (ICGE 2016)*, 367–371. <https://doi.org/10.2991/icge-16.2017.71>
- HL, N. I., Nasaruddin, & Sejati, A. E. (2023). Pengembangan Bahan Ajar Evaluasi Pembelajaran Berbasis Project Pada Fakultas Keguruan dan Ilmu Pendidikan Universitas Sembilanbelas November Kolaka. *JKP: Jurnal Khasanah Pendidikan*, 1(2). <https://asianpublisher.id/journal/index.php/jkp/article/view/77>
- HL, N. I., Saputra, I. G. P. ., Sejati, A. E., & Syarifuddin. (2020). Developing teaching material Bajo's local wisdom sea preservation Thomson-Brooks/Cole Model. *JPI*, 9(3), 355–367. <https://doi.org/10.23887/jpi-undiksha.v9i3.23234>
- Ikhsan, F. A., Kurnianto, F. A., Apriyanto, B., & Nurdin, E. A. (2017). Efforts to Improve The Competency of Professionalism Teacher in Jember Regency. *Geosfera Indonesia*, 1(1), 16–21. <https://doi.org/10.19184/geosi.v1i1.6191>
- Kasmiati, S., Purbaningsih, Y., Hasan, M., Sejati, A. E., & Chairuddin, C. (2020). The effect basic training to student's environmental awareness character. *Proceeding of USN Kolaka-ADRI International Conference on Sustainable Coastal-Community Development*, 1(0), 64–68. <https://doi.org/10.31327/ICUSN-ADRI.V1I0.1140>
- Lohmay, I., Setyosari, P., Nyoman Sudana Degeng, I., & Kuswandi, D. (2016). The Influence of Application of ROPES and Problem-Based Learning Model in Group Counseling Viewed from Basic Skills of Student Counseling towards Problem Solving Skills. *International Conference on Education: Education in The 21st Century: Responding to Current Issues*, 0(0), 412–424. <http://pasca.um.ac.id/conferences/index.php/ice/article/view/56>
- Maharani, P., Alqodri, F., Aldhea, R., & Cahya, D. (2015). Pemanfaatan Software Sigil Sebagai Media Pembelajaran E-Learning yang Mudah, Murah dan User Friendly Dengan Format Epub Sebagai Sumber Materi. *Semnasteknomedia Online*, 3(1), 3-5–25. <https://ojs.amikom.ac.id/index.php/semnasteknomedia/article/view/862>
- Purnamasari, H., Asrori, A., & Warneri, W. (2019). The Development of Learning Module in Social Knowledge on Economic Activity Based on Living Value Education of Responsibility Value. *JETL (Journal of Education, Teaching and Learning)*, 4(2), 389–394. <https://doi.org/10.26737/jetl.v4i2.1922>
- Rahayu, A., Nuryani, P., & Riyadi, A. R. (2019). Penerapan model pembelajaran savi untuk meningkatkan aktivitas belajar siswa. *Jurnal Pendidikan Guru Sekolah Dasar*, 4(2), 102–111.
- Rahmawati, F. (2016). E-Learning Implementation: Its Opportunities and Drawbacks Perceived by EFL Students. *Journal of Foreign Language Teaching and Learning*, 1(1), 1–15. <https://doi.org/10.18196/ftl.111>
- Ratumanan, T. ., & LaurensT. (2011). *Penilaian hasil belajar pada tingkat satuan pendidikan*. Unesa University Press. <https://scholar.google.com/scholar?cluster=1736800015027963375&hl=en&oi=scholar>
- Saputra, I. G. P. E., Sejati, A. E., & Nurazmi, N. (2021). Development of Virtual Laboratory System Using EWB and Zoom Cloud in Dynamic Electricity Practicum as a Learning Solution in the Covid-19 Pandemic. *Jurnal Pendidikan Fisika*, 9(3), 262–272. <https://doi.org/10.26618/jpf.v9i3.6066>
- Sari, R. M., Sumarmi, Komang Astina, I., Utomo, D. H., & Ridhwan. (2019). Measuring Students Scientific Learning Perception and Critical Thinking Skill Using Paper-Based Testing: School and Gender Differences. *International Journal of Emerging*



- Technologies in Learning (IJET)*, 14(19), 132–149.
<https://doi.org/10.3991/IJET.V14I19.10968>
- Sejati, A. E., Amaluddin, L. O., Hidayati, D. N., Kasmiasi, S., Sumarmi, S., & Ruja, I. N. (2017). The effect of outdoor study on the geography scientific paper writing ability to construct student character in senior high school. *Proceedings of the 5th SEA-DR (South East Asia Development Research) International Conference 2017 (SEADRIC 2017)*, 104–108. <https://doi.org/10.2991/seadric-17.2017.22>
- Sejati, A.E., Kasmiasi, S., & Ikhsan, F. A. (2019). The relationship between learning process interactions and student's learning outcomes in environmental sustainability matter geography-social science education subject. *IOP Conference Series: Earth and Environmental Science*, 382(1). <https://doi.org/10.1088/1755-1315/382/1/012026>
- Sejati, A.E., Nasarudin, N., & Ikhsan, F. A. (2020). The effect outdoor study to the students activeness in senior high school. *Geographica*, 1(1), 7–12. <http://usnsj.com/index.php/geographica/article/view/1016>
- Sejati, A.E., Nursalam, L. O., Hariyanto, E., Sailan, Z., Hasan, S., & Arisona. (2021). Gerakan Tanam 1000 Pohon untuk Membentuk Karakter Peduli Lingkungan di Universitas Sembilanbelas November Kolaka. *Sasambo: Jurnal Abdimas (Journal of Community Service)*, 3(3), 175–182. <https://doi.org/10.36312/SASAMBO.V3I3.597>
- Sejati, A.E., Nursalam, L. O., Takasi, L. R., Hariyanto, E., Hasan, S., & Kasmiasi, S. (2022). Penanaman Mangrove di Pantai By Pass Kolaka untuk Membangun Karakter Peduli Lingkungan Pesisir dan Pantai Mahasiswa. *Lambung Inovasi: Jurnal Pengabdian Kepada Masyarakat*, 7(3), 304–311. <https://doi.org/10.36312/LINOV.V7I3.789>
- Sejati, A.E., Syarifuddin, S., Nasruddin, N., Miftachurohmah, N., Nursalam, L. O., & Hariyanto, E. (2021). The Effectiveness of Guided Inquiry Learning Model with Edmodo Assisted to Facilitate Critical Thinking Skills. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, 9(2), 204–219. <https://doi.org/10.33394/j-ps.v9i2.4260>
- Sukariasih, L., Saputra, I. G. P. E., Ikhsan, F. A., Sejati, A. E., & Nisa, K. (2019). Improving the learning outcomes of knowledge and inquiry skill domain on third grade students of smp negeri 14 Kendari through the guided inquiry learning model assisted by science kit. *Geosfera Indonesia*, 4(2), 175–187. <https://doi.org/10.19184/geosi.v4i2.10097>
- Umar, I. N., & Ahmad, N. H. (2010). Trainee teachers' critical thinking in an online discussion forum: A content analysis. *Malaysian Journal of Learning & Instruction*, 7, 75–91. <https://e-journal.uum.edu.my/index.php/mjli/article/view/7620>
- Un, V. M., Hudha, M. N., & Pranata, K. B. (2020). Pengaruh Model Pembelajaran ROPES (Review, Overview, Presentation, Exercise, Summary) Terhadap Keaktifan dan Prestasi Belajar Siswa Fisika. *DIFFRACTION: Journal for Physics Education and Applied Physics*, 2(1), 38–43. <https://doi.org/10.37058/DIFFRACTION.V2I1.1791>
- Wijaya, A., & Wijaya, A. M. (2022). Efektivitas Strategi Pembelajaran Ropes dalam Meningkatkan Motivasi Belajar Peserta Didik pada Mata Pelajaran Sejarah. *MUKADIMAH: Jurnal Pendidikan, Sejarah, Dan Ilmu-Ilmu Sosial*, 6(1), 145–150. <https://doi.org/10.30743/mkd.v6i1.5914>
- Yana, A. U., Antasari, L., & Kurniawan, B. R. (2019). Analisis Pemahaman Konsep Gelombang Mekanik Melalui Aplikasi Online Quizizz. *Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education)*, 7(2), 143–152. <https://doi.org/10.24815/jpsi.v7i2.14284>