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Development of E-Module Based on Problem Based Learning Assisted with Scratch Applications to Improve Students Computational Thinking Skills

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Abstract: This study aims to develop a valid, practical, and effective problem-based learning e-module to improve the computational thinking skills of fifth-grade elementary school students. The research method used was Research and Development, using the ADDIE development model. The research instruments used were validation questionnaires, practicality questionnaires for students and teachers, and pretest and posttest question sheets to measure students' abilities. While the data analysis technique to test the validity and practicality using a Likert scale, while the product effectiveness test was carried out using the Pretest-Posttest Control Group Design and analyzed using SPSS. The results of the research showed that the validity results based on lesson plans obtained a value of 94.44% (very valid), material expert validators 90.48% (very valid), linguists 92.86% (very valid), and media experts 89.6% (very valid). The practical results can be seen from the student response of 90.42% or very practical, and the teacher's response of 93,52 % or very practical. At the same time, the effectiveness test from the results of the pretest and posttest obtained that count> table, namely 15,499 > 1,711 and Sig (2-tailed) 0,000 <0.05, so it can be concluded that there is an average difference in students' computational thinking abilities from the results of the pretest to the results of the posttest in the experimental class. Furthermore, the effectiveness test based on N-gain was obtained at 60.6203 or 60.6%, including the quite effective category. So, the development of PBL-based e-modules assisted by scratch applications to improve the computational thinking skills of Grade V elementary school students is declared valid, practical, and effective.

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Introduction

Education is a basic milestone for someone in understanding and living life in this world. Education is a link in transferring knowledge to children. Education is one of the most important aspects of life. The Preamble to the 1945 Constitution and other laws have included educational goals and provisions. This goal is to teach students to become children with character, knowledge, broad-mindedness, expertise, and the ability to adapt to their peers. Enter the industrial revolution era 4.0 demands that the education system in the world, including in Indonesia, adapt and fulfill educational goals. That is because students will face more complex problems in the future and will need technical skills to solve them. Therefore, it is necessary to have technology-based learning to achieve learning objectives (Syafri Ahmad et al., 2022).

The technology-based learning process can be started by elementary school students who teach basic knowledge and skills to students so that introducing technology-based learning from an early age provides opportunities to develop students to the next level (Syafri Ahmad et al., 2022;Julia et al., 2020). The Government of Indonesia is trying to introduce various educational innovations that align with the development of science and technology, which has implications for increasing the professionalism of teachers and educators in the education sector. Quality education will ultimately increase the country's competitiveness by mastering science and technology (Gapsalamov, 2013; Maria, 2020). In line with that, educational development aims to develop children's ability to think critically, think in solving problems, and other abilities (Zen, 2019). With the help of the PBL model, students can think critically, find solutions to problems, and gain knowledge from the material being taught.

Ideally, learning asks students to be involved in every learning activity. The goal is for children to show their activeness and make demanding lessons meaningful; apart from that, children can also think in the direction of solving a problem (Deshpande et al., 2021). It has the same relation to current 21st-century learning, where children are dealing with learning activities through digitalization (Deshpande et al., 2021). It has the same relation to current 21st-century learning, where children are dealing with learning activities through digitalization (Orhan-Özen, 2022;Rais et al., 2021). Learning in the 21st century is a change towards PBM that is ready to face diverse and global needs; advances in technology and information are developing very rapidly, affecting all human domains, including education (Zakaria, 2021; Zehra, 2020). 21st-century skills are a reality in education, requiring educators to provide collaborative learning content (Ömer, 2023; Mıhladız, 2021).). The 21st-century learning content is 4C (Communiction, Collaboration, Critical Thinking andyProblem-Solving, and Creativity and Innovation) (Prayogi & Estetika, 2019).

The ability to think is an essential basis for one's life to achieve its goals; humans also need the ability to remember to communicate with others (S. Ahmad et al., 2019). The current ability that children also demand is high-order thinking. This ability shapes students to interpret, analyze, and manipulate information (Singh, 2020). HOTS refers to the ability to apply knowledge, skills, reasoning, reflection, problem-solving, decision-making, innovation, and creating something new (Shanti et al., 2022). Besides that, the ability to think is expected that children can find solutions to solving problems, solve problems in different ways, choose the right action, and choose the right strategy overall. This is adjusted to the subject matter listed in a curriculum The curriculum in question includes various things that students learn. The 2013 curriculum emphasizes character building because it provides students with provisions to become children with good and noble character. The 2013 curriculum explains how to improve attitudes, knowledge, and skills (Winarno, 2016). These three dimensions can be used by teachers as a basis for monitoring the success or failure of student learning (Majid, 2014). Teachers use this as a starting point for determining student output in learning, including in today's digital era. Teachers can use the digitalization era to present subject matter, for example, digital teaching materials or e-modules.

E-module is very important to use in today's digital era. Moreover, 3 years ago, we faced the condition of distance learning, which has made learning diverted to home (Rahmawati, 2022). The use of teaching materials developed should follow the objectives (Annisa & Fitria, 2021). Since then, many teachers or people who understand technology have created creativity to support the distance learning process, one of which is the electronic module. The E-module is designed in an electronic format and can be used on various

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devices, such as computers, laptops, and smartphones. It is essential because it will make it easier for teachers to distribute material that students can learn, especially in distance learning. In addition, using electronic modules also helps limit the use of paper (Wulandari et al., 2021). Electronic modules canudisplay text, images, animations and videos via electronic devices such as mobile phones (Charlina et al., 2022). This textbook serves as an effective, efficient, and interactive learning alternative. The module's existence should be a source of learning for students. Hopefully, it will make it easier to understand the concept of the subject (Imansari & Sunaryantiningsih, 2017). Teaching materials can be made using an application, namely Scratch, which is equipped to make simulations according to the maker's wishes using programming principles. This feature can be an active learning tool for students that involves thinking processes, including creative thinking. In addition, it can also help complement learning materials to encourage interaction in the learning process.

However, in reality, there are still some teachers who do not have the skills to use technology in learning activities. Teaching materials in the form of electronics have not been widely applied by teachers in learning. Factors that cause and various reasons for this to happen, including the first factor for teachers who have long teaching experience, namely the age factor. Senior teachers have minimal skills and experience in designing and even using technology during the learning process. On the other hand also from the availability of supporting tools. In addition to the use of technology, media such as images are also rarely used. This is in accordance with the preliminary study that was conducted at cluster VIII SD Kuranji District, Padang City (SDN 50 Kuranji, SDN 51 Kuranji and SDN 41 Kuranji in grade V SD). The author observes the literacy process taking place, set up that there's no literacy that utilizes tutoring accoutrements in the form of electronics that support learning piecemeal from the child's text, as well as worksheets. This has not materialized the child to think critically in solving problems and finding solutions. In the learning process students have not been directed to a problem that they must solve regarding the material being studied at that time. Students focus on the exercises in the student book and the limitations in the LKS. With the demands of the 21st century, children should be able to develop their computational mindset in dealing with learning material. So that the child is challenged to think of the answer. In addition to observations, the authors conducted curriculum analysis and also gave questionnaires to children to analyze the needs of teachingymaterials in thellearning process. This study aims to develop a valid, practical, and effective problem-based learning e-module to improve the computational thinking skills of fifth grade elementary school students.

E-module is very important to use in today's digital era. Moreover, 3 years ago, we faced the condition of distance learning, which has made learning diverted to home (Rahmawati, 2022). The use of teaching materials developed should follow the objectives (Annisa & Fitria, 2021). Since then, many teachers or people who understand technology have created creativity to support the distance learning process, one of which is the electronic module. The E-module is designed in an electronic format and can be used on various devices, such as computers, laptops, and smartphones. It is essential because it will make it easier for teachers to distribute material students can learn, especially in distance learning. In addition, using electronic modules also helps limit the use of paper (Wulandari et al., 2021). Electronic modules can display text, images, animations, and videos via electronic devices such as mobile phones (Charlina et al., 2022). This textbook serves as an effective, efficient, and interactive learning alternative. The module's existence should be a source of learning for students. Hopefully, it will make it easier to understand the concept of the subject (Imansari & Sunaryantiningsih, 2017). Teaching materials can be made using an application, namely Scratch, which is equipped to make simulations according to the maker's wishes using programming principles. This feature can be an active learning tool for students that involves thinking processes, including creative thinking. In addition, it can also help complement learning materials to encourage interaction in the learning process.

Research Method

The research employed developmental research. Research and Development (R&D) is a method that contains steps to make a product by testing the effectiveness of the product (Sugiyono, 2017). In this regard, one of the development models put forward is the ADDIE model. This ADDIE model has steps such as Analysis, Design, Development, Implementation and Evaluation (Molenda, 2003; Yuniastuti, 2021). The development research procedure contains the stages that must be carried out in each development. This research was a teaching material development research which is carried out in the following stages:

Step 1. Preliminary Studies

This development research was carried out based on certain considerations. A preliminary study conducted by researchers is to analyze the curriculum, analysis of student characteristics and analysis of student needs. Here the researcher distributed questionnaires to analyze students' needs for teaching materials. The author also conducted field studies in the form of observations at SD Negeri 50 Kuranji, SD Negeri 51 Kuranji and SD Negeri 41 Kuranji. Based on field studies, observations, and interviews that had been conducted, researchers obtained information that PBL-based e-modules had not been used in learning.

Step 2. Development

The development model was a procedure to design or develop interesting learning. The ADDIE development model maked products with clear and systematic steps. Thus, its implementation can help and facilitate the development of PBL-based e-modules because this proposal uses the ADDIE model in developing Problem-Based Learning E-Modules Assisted by the Scratch Application in Improving Computational Thinking Skills for Class V Elementary School Students, then the steps carried out in the form of:

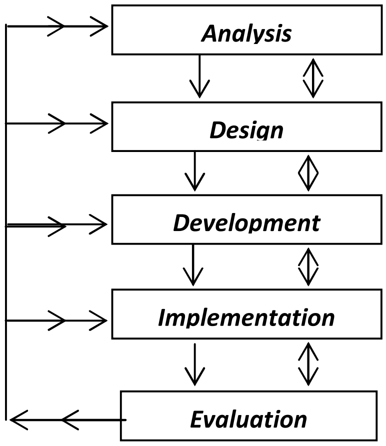

Chart 1. Addie Model Development Stage, as cited in (Molenda, 2003)

Analysis Stage

At this stage, the implementation of needs analysis, curriculum analysis, and analysis of student characteristics was carried out. This stage aims to identify problems and formulate goals. It can also identify whether or not it is necessary to develop learning methods based on feasibility indicators and general development conditions. Researchers identified that using teaching materials in school learning could have been optimally implemented, especially using PBL-based teaching materials. In addition, it is also important to consider the characteristics of students, goals, and experiences and how this can be useful in the learning process.

Design Stage

At this stage, it was carried out systematically, starting from preparing materials and designing or designing e-module products to be developed.

Development Stage

At this stage the aim is to produce products that are ready to be implemented into classroom learning, such as lesson plans, questionnaires and e-modules. Everything that has been developed will be revised based on input from the validator.

Implementation Stage

This stage includes the implementation of e-modules that have been designed previously and have obtained good validity results. The plans that have been prepared must be carried out properly. This stage was carried out by testing the product and getting practical results.

Practicality Test

A pilot test was carried out to test the product's practicality.

1) Individual Trial

This trial was carried out by four fifth-grade students at SDN 51 Kuranji. One child was taken from rank 1, two more children occupied the middle value, and one child occupied the last value.

2) Small Group Trial

Eight students in class V conducted the small group trial at SDN 51 Kuranji. These eight students were selected based on their problem-solving thinking skills while sitting in grade IV. Three high-ability students, three medium-ability students, and two lower-class students.

3) Limited Large Group Trial

A large limited group tryout was carried out in class V at SDN 50 Kuranji with 25 people.

Evaluation Stage

This stage was carried out by testing the effectiveness of using the product. This stage was carried out in three steps, covering the initial stage, namely giving a pretest; the second step was the learning process using modules in the experimental class and using textbooks in the control class, while the third stage or the final step, was giving a posttest which was also carried out in both classes.

Trial and Research Subjects

The test subjects in this study were fifth-grade students at SDN 41 Kuranji, Padang City, on Theme 6, sub-theme 2. Meanwhile, the subjects of the development research were as follows: 1) instrument validators; 2) expert validators (material experts, linguists and graphics experts); 3) fifth-grade students at state elementary school 50 Kuranji. Meanwhile, the researcher used the Scratch Application Assisted Problem Based Learning E-Module as a research object.

Research Instrument and Technique of Analysis

The research instruments used were validation questionnaires, practicality questionnaires for students and teachers, and pretest and posttest question sheets to measure students' abilities. The data analysis technique used in this study is calculating percentages of the respondent's answers. The number of correct answer scores for each aspect of the observation is divided by the answer score ideal for all aspects of the observation multiplied by 100% (Wahab et al., 2021). While the data analysis technique to test the validity and practicality using a Likert scale, while the product effectiveness test was carried out using the Pretest-Posttest Control Group Design and also analyzed using SPSS.

$$N - Gain = \frac{Skor\ Posttest - Skor\ Pretest}{Smaks - Skor\ Pretest} \text{ x } 100$$

Gain Score is done to determine the results of increasing the ability to think processing seen from the differences in the pretest and post-test results. First, the subject is given an initial test (pretest) and at the end of the lesson, a final test (posttest). After obtaining the completeness data of individual students, then determine the total number of students who achieve completeness. Comparing the pretest scores with the posttest

Results and Discussion

Result of Expert Validation

PBL-based e-modules assisted by scratch applications are assessed from material, language, and media aspects.

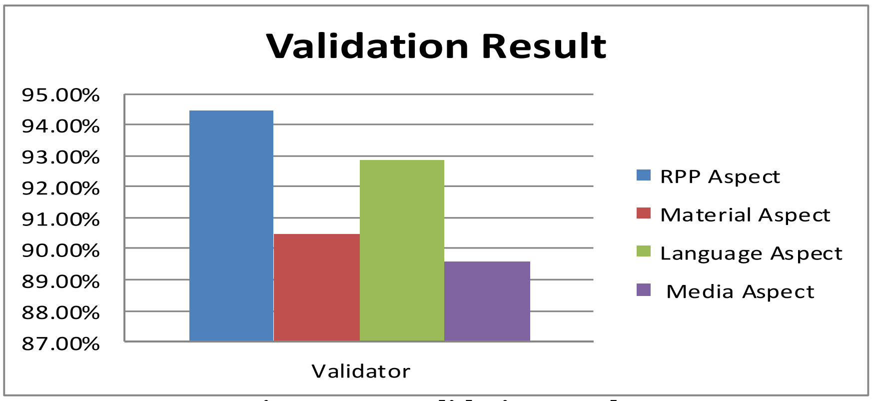

Diagram 1. Validation result

Based on the diagram above, it can be explained that the results of the validation assessment by the RPP expert validator obtained an average total score of 94.44% with a very valid category. The linguist validator obtained an average score of 92.86% in a very valid category. The results of the validation assessment by the material expert validator obtained an average total score of 90.48% with a very valid category. Furthermore, the expert media validator obtained an average of 89.6% with a very valid category. From the results of material, language, and media expert validation, the developed e-module can be tested in the field.

Test results of E-modul Practicality

After validating the e-module, the next step was testing the e-module. Trials were carried out to obtain direct input in the form of responses from students and teachers as target e-module users.

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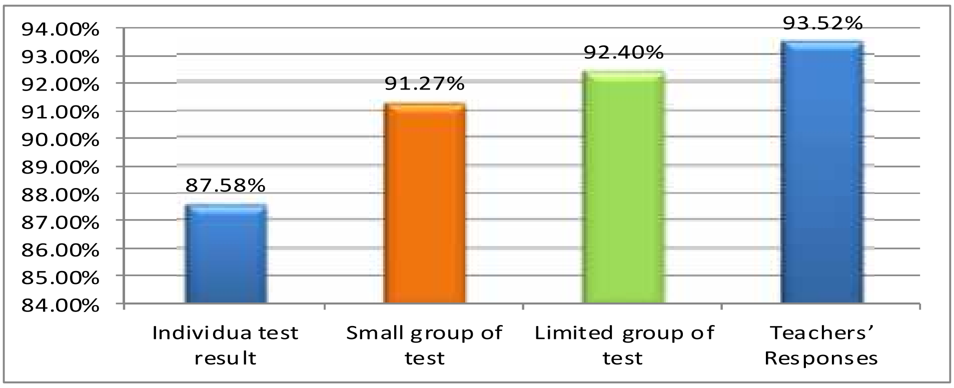

Diagram 2. Testing Results

Based on the diagram above, the results of individual student responses were 87.585, small groups were 91.27%, and large groups were limited to 92.40%. Furthermore, the teacher (educator) 's results in the trial and experimental classes obtained a total average of 93.52% with a very practical category. Thus, based on the results of the student response questionnaire and the teacher response questionnaire on the scratch application-assisted e-module used in theme 6, heat and the transfer as a whole is classified as very practical to use in elementary schools.

Stage of Evaluation

The evaluation phase consisted of the effectiveness test, which consists of three phases, the initial phase (pre-test), the second phase (learning process) and the third phase (post-test). According to the pretest-posttest control group design, the effectiveness of the developed product is analyzed according to the test results completed by the students. Two sample groups were employed in this design, the experimental group, using Young's modulus with the support of the scratch application, and the control group (using the national textbook).

Data analysis was carried out with the help of the SPSS 26 program. The following table briefly summarizes the pre-test and post-test data descriptions for the two sample groups.

Table 1. Data Description of Pretest and Posttest

DescriptiveyStatistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Pre-TestuEksperiment	25	42	77	56.96	9.528
Post-TestyEksperiment	25	73	96	83.12	6.078
Pre-Test Control	25	42	73	55.84	8.854
Post-TestyControl	25	65	88	77.28	6.242
Valid N (listwise)	25				

Students in the experimental class obtained an average pre-test score of 56.96 and a standard deviation of 9,528, with the lowest score of 42 and the highest score of 77. In contrast, students in the control class obtained an average pre-test of 55.84 and a standard deviation of deviations is 8,854, with the lowest score of 42 and the highest score of 73. Furthermore, the posttest results for students in the experimental class using the scratch application-assisted e-module obtained an average score of 83.12 and a standard deviation of 6,078, with the lowest score of 73 and the highest score of 96. Meanwhile, the control class obtained a posttest average of 77.28 and a standard deviation of 6.242, with the lowest score of 65 and the highest score of 88.

Table 2. Normality Test Results

Tests of Normality							
		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelas	Statistic	df	Sig.	Statistic	df	Sig.
Students' test results	Pretest Eksperiment	.127	25	.200*	.953	25	.296
	Posttest Eksperiment	.141	25	.200*	.956	25	.333
	Pretest Control	.157	25	.115	.945	25	.197
	Posttest Control	.164	25	.080	.939	25	.141
*. This is a lower bound of the true significance.							
a. Lilliefors Significance Correction							

It was explained that the significance of the normality test for the experimental class obtained a pre-test significance of 0.200 and a post-test of 0.200. In contrast, the normality test in the control class obtained a pre-test significance of 0.115 and a posttest of 0.080. It can be concluded that the experimental class and control class data were normally distributed because the data > 0.05.

Table 3. Homogeneity test Results

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Students' test results	Based on Mean	.042	1	48	.839
	Based on Median	.051	1	48	.823
	Based on Median and with adjusted df	.051	1	47.036	.823
	Based on trimmed mean	.047	1	48	.830

The Based on Meanysignificance value is 0.839 > 0.05. So, it can beyconcluded that the variance of the experimentalyclass and the control class obtained homogeneous data.

Table 4. T-Test of Computational Thinking Ability

PairedySamples Test									
		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pre-Test Eksperimen - Post-Test Eksperimen	-26.160	8.439	1.688	-29.644	-22.676	-15.499	24	.000
Pair 2	Pre-Test Kontrol - Post-Test Kontrol	-21.440	7.768	1.554	-24.646	-18.234	-13.800	24	.000

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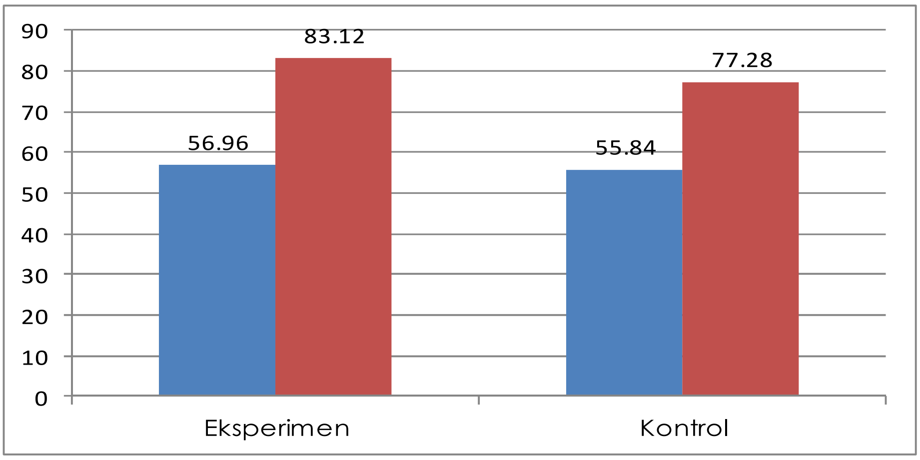
The significant value was Sig (2-tailed) 0.000 <0.05 while the comparison of tcount with ttable in the experimental class was 15,499 > 1,711. So there is a difference in the average test results of students' computational thinking skills for the experimental class pretest results with the experimental class posttest results. Furthermore, in the control class, the significance value was Sig (2-tailed) of 0.000 <0.05, and the comparison of tcount > ttable 13,800 > 1,711. So there is a difference in the average test results of students' computational thinking abilities for the pretest results with the posttest results in the control class.

To see how effectively the e-module can be used during the learning process in grade V elementary school, researchers measure it using the N-gain value. The N-gain value was calculated based on the difference between the average pretest value and the posttest value.



Picture 3. N-gain score of Computational Thinking Ability

Discussion

E-Modul Design

At this stage, the researcher made a plan that would be carried out after getting the initial data from the needs analysis results (Kuncahyono, 2018). After the analysis process, the initial product was designed as an attractive e-module, and the presentation is adjusted to students' abilities. The material contained in the e-module was also adapted to the needs of KD and the characteristics of students related to the daily lives of students. It follows the principle of developing e-modules, namely e-modules that are arranged according to the needs and learning objectives, and communicative language (Wahyuni & Yerimadesi, 2021).

This e-module was designed using the scratch application so that students were more interested in the animation in understanding the activities contained in this e-module. Students can access it on Android and laptops. In addition, there is also a user manual provided by the researcher. Learning using e-modules can be done repeatedly to understand all the material to foster learning motivation and independence, especially in improving students' computational thinking skills. That is because the e-module is equipped with instructions for use, IC, KD, indicators, learning objectives, concept maps, animations, materials, practicum activities, games, and evaluations.

Validity of E-Module

The feasibility of e-modules developed and obtained from the validation (assessment) results of material, language, and media experts. The validation results for the e-module by

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the RPP expert validator obtained an average of 94.44% with a very valid category. The material expert validator obtains an average total score of 90.48% or can be categorized as very valid. Furthermore, the validation by linguists obtained an average total score of 92.86% or was categorized as very valid. Furthermore, the assessment results by the media expert validator obtained an average total score of 89.6% or categorized as very valid. The e-module feasibility test is carried out so that researchers know how feasible this e-module can be used if the validator's assessment meets the percentage results ≥ 61% with valid to very valid categories (Asri & Dwiningsih, 2022; Maisarmah, 2022). Then the e-module is said to be suitable for use in the learning process.

The results of the validation (assessment) by material experts, linguists, and media experts show that the e-module design meets the validity or eligibility criteria (very valid). Even so, some improvements or revisions are still based on suggestions from material, language, and media experts. After improving the e-module, the researcher consulted and checked again with the expert validator. Based on the results of the consultation and re-examination by the validator, the e-module is declared feasible and can be tried out in schools.

Practical of E-Module

To see the practicality of the e-module, the researchers conducted field trials. Trials were conducted to analyze the suggestions and responses of students and teachers in using the product. The try-out was carried out in three stages; the first was an individual try-out conducted on 4 students at SDN 51 Kuranji who obtained an average total score of 87.58% which can be categorized as very practical. The next stage, namely small group trials consisting of 8 students who obtained an average total score of 91.27% or categorized as very practical. Furthermore, a limited group trial was conducted on 25 students at SDN 50 Kuranji who obtained an average total score of 92.40% or were classified as very practical.

Furthermore, the researcher also asked for responses from the fifth-grade elementary school teacher regarding the use of e-modules obtained from class teachers from the two test groups obtaining an average total score of 93.52%, or it can be categorized as very practical. It can be concluded that e-modules are very practical and can be used in the learning process in elementary schools.

E-Modul Effectiveness

For analysing the effectiveness of the developed product, it is done by comparing the computational thinking skills of students who use e-modules (experimental group) with students who use textbooks from schools (control group). In the early stages of Evaluation (Evaluation), the two sample groups were given a pre-test with the same level of questions; from the analysis results for the experimental class, students obtained an average of 56.96; for the control class, students obtained an average of 55.84.

In the next stage, learning was carried out using the e-module on theme 6 hot and its transfer and sub-theme 2. For students in the experimental class, learning used a Chromebook to access the e-module. Learning is carried out for approximately two weeks with 2 meetings. Because researchers conducted individual, small-group, and limited-group trials are in the first four weeks. The researcher directly carried out the learning process on hot material and its transfer with 5JP or 1 x learning time. At the first meeting, the researcher facilitated students to use Chromebooks to access the e-module and run all the animations. The researcher explains how to use it through in focus by providing instructions for use in the e-module. Furthermore, students can carry out learning independently by following the instructions that have been provided. At the end of each learning meeting, the researcher asks students to collect the results of the activities, including practicum.

Meanwhile, for control class students, the learning process uses textbooks available at school. At the time of learning, the researcher explained more, and for practicum activities only by making observations in printed books. After finishing the lesson, the researcher gave assignments to the students. The material has been studied according to a predetermined schedule. In the final stage of the evaluation of students, the two sample groups were given a posttest. After completion, the researcher analyzed the results of the pretest and posttest by conducting the t-test (paired simples test) using the SPSS 26 program. Comparison of tcount with ttable. In the experimental class, the value of tcount > ttable, where 15,499 > 1,711 and the significance level was Sig (2-tailed) 0,000 <0.05, so it can be concluded that there is a difference in the average pretest test results for the computational thinking abilities of experimental class students and class posttest results experiment. Furthermore, in the control class tcount > ttable 13,800 > 1,711 and for significance, namely Sig (2-tailed) of 0,000 <0.05, it can also be concluded that there is a difference in the average pretest results of computational thinking abilities with the posttest results of the control class. From the comparison of the results of the t-test, it can be concluded that there is a significant difference between the comparison of the t-test of the experimental class and the t-test of the control class, so it can be concluded that there is a difference between the increase in the computational thinking ability of the experimental class and the control class.

To test whether the learning process is effective or not, the researcher calculated the N-gain score. Based on the results of the calculation of the N-gain score test, it showed that the average value of the N-gain score for the experimental class (using the e-module) was 60.6203 or 60.6% included in the medium category based on the category of interpretation of the effectiveness of N-Gain if the N-Gain was between 56-75 it is categorized as quite effective (Rahmi et al., 2021). Meanwhile, the average N-gain score for the control class (using textbooks) was 48.1032 or 48.1%, included in the moderately less effective category.

The findings of this study are in line with the results of previous studies conducted by Nurfadilah (2022) who concluded that the development of e-modules is feasible and effective, and the student's responses are also good towards the use of e-modules. In addition, it can also improve students' computational thinking abilities to obtain an average n-gain value of 0.66 in the medium category. It is in line with the research of Khasyyatillah & Osman, (2019) concluded that the CT-S module has good validity, improves computational thinking skills, and can help students master learning objectives; further research conducted (Syah & Anistyasari, 2020) concluded that using the Scratch module can improve students' learning outcomes and computational thinking skills is good.

Conclusion

The results of this study showed that the validity results based on lesson plans obtained a value of 94.44% (very valid), material expert validators 90.48% (very valid), linguists 92.86% (very valid), and media experts 89.6% (very valid). The practical results could be seen from the student response of 90.42% or very practical, and the teacher's response of 93,52 % or very practical. At the same time, the effectiveness test from the results of the

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pretest and posttest obtained that tcount > ttable, namely 15,499 > 1,711 and Sig (2-tailed) 0,000 <0.05 so it can be concluded that there is an average difference in students' computational thinking abilities from the results of the pretest to the results of the posttest in the experimental class. Furthermore, the effectiveness test based on N-gain was obtained at 60.6203 or 60.6%, including the quite effective category. So the development of PBL-based e-modules assisted by scratch applications to improve the computational thinking skills of Grade V elementary school students is declared valid, practical, and effective.

Recommendation

The results of this study can be used by teachers in their classes as a tool in the learning process. They also should develop e-modules to complement other content materials. Principals, as policymakers, need to facilitate the development of these e-modules to improve students' computational thinking skills.

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