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The Project-Based Learning Assessment Guide (Project-Based Learning) is oriented towards Phenomenon-Based Learning

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ABSTRAK

Kurang optimal penggunaan terhadap asesmen pembelajaran yang menyebabkan rendahnya kemampuan berpikir komputasi peserta didik. Penelitian ini bertujuan untuk mengembangkan panduan asesmen pembelajaran berbasis proyek berorientasi phenomenon based learning untuk siswa kelas IV sekolah dasar pada mata pelajaran Matematika dan menganalisis validitas, kepraktisan, dan keefektifan panduan asesmen pembelajaran berbasis proyek berorientasi phenomenon based learning. Penelitian ini tergolong ke dalam jenis penelitian pengembangan dengan menggunakan model ADDIE. Subjek yang terlibat dalam penelitian ini diantaranya 4 ahli asesmen pembelajaran, 3 praktisi guru, dan 29 siswa kelas IV. Penelitian ini menggunakan teknik pengumpulan data yaitu kuesioner/angket dan tes. Teknik analisis data menggunakan analisis deskriptif, kualitatif, kuantitatif, dan statistik inferensial. Hasil penelitian ini adalah hasil validasi oleh ahli asesmen pembelajaran memperoleh kualifikasi sangat baik, hasil uji kepraktisan oleh guru memperoleh kualifikasi sangat baik, dan hasil uji keefektifan panduan asesmen pembelajaran berbasis proyek berorientasi phenomenon based learning menunjukkan adanya perbedaan yang signifikan pada kemampuan berpikir komputasi siswa kelas IV pada mata pelajaran Matematika sebelum dan sesudah mengikuti pembelajaran. Berdasarkan penelitian tersebut dapat disimpulkan bahwa panduan asesmen pembelajaran berbasis proyek berorientasi phenomenon based learning efektif digunakan karena panduan asesmen pembelajaran ini dapat membantu guru dalam melaksanakan asesmen pembelajaran. Implikasi dari penelitian ini adalah untuk meningkatkan kemampuan berpikir komputasi siswa kelas IV sekolah dasar pada mata pelajaran matematika.

ABSTRACT

Less than optimal use of learning assessments results in low students' computational thinking abilities. This research aims to develop a project-based learning assessment guide oriented to phenomenon-based learning for fourth-grade elementary school students in the Mathematics subject and to analyze the validity, practicality, and effectiveness of the project-based learning assessment guide oriented to phenomenon-based learning. This research is classified as development research using the ADDIE model. The subjects involved in this research included 4 learning assessment experts, 3 teacher practitioners, and 29 grade IV students. This research uses data collection techniques, namely questionnaires and tests. Data analysis techniques include descriptive, qualitative, quantitative, and inferential statistics. The results of this research are the results of validation by a learning assessment expert who obtained very good qualifications, the results of the practicality test by the teacher who obtained very good qualifications, and the results of the effectiveness test of the project-based learning assessment guide oriented to phenomenon-based learning, which showed that there was a significant difference in the computational thinking abilities of class IV students. In mathematics subjects before and after taking part in the lesson. Based on this research, the project-based learning assessment guide, which is oriented towards phenomenon-based learning, is effective because this learning assessment guide can help teachers carry out learning assessments. This research aims to improve the computational thinking skills of fourth-grade elementary school students in mathematics subjects.

1. INTRODUCTION

Mathematics learning is a teaching and learning process built by teachers to develop students' creative thinking and improve their abilities to construct new knowledge in an effort to improve their mastery of mathematical material. Mathematics as a vehicle for education can not only be used to achieve one goal, for example, to make students smarter, but can also shape students' personalities and develop certain skills (Fahlevi & Yuliani, 2021; Puspita & Dewi, 2021). Mathematics is taught at every level of education to prepare students to be able to face an increasingly advanced and rapidly developing world (Fadillah et al., 2022; Suandi, 2022). This requires the world of education to be able to design curriculum

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and learning so that students have the skills to be globally competitive. One of the skills that supports mathematics learning is computational thinking.

Computational thinking is a concept or way to observe problems, and find solutions to these problems by applying computer science technology (Maksum et al., 2022; Nur et al., 2021). By thinking computationally, someone will be able to observe problems, solve problems and develop solutions to solve problems. Computational thinking is also a process of solving problems using logic in a gradual and systematic manner, and this ability is not only important in computer programming, but is also very much needed by students in various fields, including mathematics (Avizenna et al., 2022; Fitriani et al., 2021). Computational thinking can make it easier for students to make decisions and solve various mathematical problems. Computational thinking skills include four things, namely: decomposition, pattern recognition, abstraction, and algorithms (Cahdriyana & Richardo, 2020; Debby, 2018). Mathematical computational thinking is needed as a way to solve problems in everyday life. This ability needs to be possessed and developed by studentsat schoolthrough the mathematics learning curriculum to improve the ability to systematize problems and solve them (Cahdriyana & Richardo, 2020; Mania, 2021). Computational thinking skills can help improve learning outcomes in each lesson content, one of which is learning outcomes in Mathematics lesson content. It is therefore important to have an understanding of the extent to which students are ready to apply mathematics in understanding important problems and solving meaningful problems.

Computational thinking skills help students to improve problem solving abilities, improve logical thinking and analytical abilities. However, facts found in the field during observations of learning activities at SD Negeri 1 Perean Kangin show that students' computational thinking skills are still low and must be maximized. When students are faced with real problems, students cannot determine what action to take (Rahayu & Osman, 2019; Rara et al., 2022). This is also supported by Indonesia's mathematics score as stated in PISA 2018 which is still at the lowest level and this level has decreased from the previous year. The scores stated in PISA 2018 are 371 for reading scores, 379 for Mathematics scores, and 396 for Science scores. As an effort to develop computational thinking in solving mathematical problems, students need to be given mathematical problems that accommodate computational thinking skills. Low abilitythinkcomputing is caused by the low level and lack of training students' computational thinking skills at school, especially in Mathematics learning. Meanwhile, the computational thinking process is thinking in a structural way in solving problems. The low level of computational thinking when seen from the initial tests given, shows that students are still using general procedures when carrying out the given solution process. Judging from the test, it can also be seen that the computational thinking skills achieved by students are still based on pattern thinking only, meanwhile decomposition, abstraction, and algorithmic thinking are not yet visible, because there are stages in solving students' problems that are less complete and logically systematic (Lestari & Annizar, 2020; Mania, 2021).

Based on the problems above, improvements need to be made in the field of Mathematics Education to improve students' thinking abilities, especially computational thinking skills. One of them is by improving the existing assessments or assessment systems in schools. Basically, assessment is an integral tool usedasa tool to see and analyze whether students have achieved the expected learning outcomes and find out whether the learning process is in accordance with the objectives or still requires development and improvement. Assessment is expected to be an instrument for quality assurance, quality control and improvement of the quality of the education system (Prayoga et al., 2022; Subakti et al., 2021). Assessment is often a problem faced by educators, especially in developing computational thinking assessments, which are still lacking and assessment instruments specifically designed to train computational thinking skills are not yet available, so it is necessary to develop computational thinking assessment guidelines (Alti et al., 2021; Kintan, 2021). This assessment can provide important information about the extent to which a person has computational thinking skills. Apart from that, assessment can be used in an educational context to assess the extent to which the curriculum and teaching methods can be effective in developing students' computational thinking skills. This can help teachers and educational institutions evaluate the effectiveness of learning programs and make improvements if necessary. It can also be used to measure learning outcomes in a computational thinking context and may involve measuring improvements in problem-solving abilities.

Computational thinking skills are able to form a framework of thinking for students who are able to solve problems by forming effective and efficient solutions based on the knowledge and information that has been obtained (Harmini et al., 2020; Mania, 2021). The importance of developing this ability or aspect considering the current facts in the world of education cannot be separated from the ability to think computationally in solving a problem. The importance of adapting assessments to the competencies being measured has implications for the development of various learning assessments, one of which is a project-based assessment guide oriented to phenomenon based learning. The project-based assessment guide is an assessment development that originates from project-based learning. Project-based assessments are carried out on tasks that must be completed within a certain time period.The use of project-based assessments can increase student learning independence (Ananda & Maemonah, 2022; Jayadiningrat et al., 2022). From this it can be said that the project-based assessment guide is a form of assessment that requires students to use the knowledge they have, then integrate it into a project, apply it to everyday life, and transfer various information and skills into a project (Wibowo et al., 2022; Windy, 2021).Teachers can use various orientations to integrate an assessment to make it more innovative and creative.

One thing that can be used by teachers to improve computational thinking skills is a project-based learning assessment guide oriented toward phenomenon-based learning. Phenomenon based learning, or what is called a phenomenon-based learning model, is learning that uses phenomena or events that are frequently encountered or actually occur around students as a source of appropriate learning for teachers to improve students' commutative thinking abilities. Phenomenon-based learning is learning that is based on phenomena that exist in everyday life, where students will play an active role in creating an understanding of these phenomena and solving the problems given (Culadiene et al., 2023; Widiana, et al., 2023). Assessment with a phenomenon-based learning (PBL) orientation has significant urgency in the context of modern education. Phenomenon based learning is learning that focuses on understanding concepts through investigating real world phenomena or events. PBL-based assessment ensures that what is taught is relevant to the real world (Oktaviana & Haryadi, 2020; Pratiwi et al., 2021). This helps students see the relevance of the subject matter to problems and events in their daily lives. When students are involved in solving real-world problems and investigating interesting phenomena, they tend to be more motivated.

Several previous studies have stated that PBL-based assessments can maintain student motivation and help them see the value in learning (Sylvia et al., 2019). Application of the based learning *phenomenon: based learning* can improve students' critical thinking abilities (Pratiwi et al., 2021). The development of LKPD based on phenomenon-based learning can increase students' active role and build self-confidence by explaining what they see and experience in everyday life (Andriani et al., 2022; Resty et al., 2024). Other research states that phenomenon-based learning-oriented project-based learning assessments are valid and suitable for use in the learning process (Culadiene et al., 2023; Widiana et al., 2023). This can be seen in the increased motivation and activeness of students in learning. This development research is focused on this study with the aim of producing a phenomenon-based learning-oriented project-based learning assessment guide that is valid, practical, and effectively used to improve the computational thinking skills of fourth grade elementary school students in the subject of mathematics. A project-based learning assessment guide oriented toward phenomenon-based learning helps teachers create an effective learning process. By using phenomena as a focal point, learning becomes more relevant and interesting for students, phenomena provide a real context for understanding learning concepts and being able to see how the knowledge learned can be applied in the context of everyday life. This product also has a function as a reference that can help teachers make assessment easier in class.

2. METHODS

This research is development research using the ADDIE (Analyze, Design, Development, Implementation, and Evaluation) model with the aim of developing a learning assessment guide that is effective for use in mathematics learning. The needs analysis stage is intended to identify target user needs. The design stage is intended to design a project-based learning assessment guide oriented toward phenomenon-based learning. The development stage leads to the development of learning assessment guide products and the implementation of a series of tests. The implementation stage takes the form of a field trial to determine the effectiveness of the product. The evaluation stage is carried out to carry out reflections on development activities and draw conclusions regarding the effectiveness of the learning assessment guide being developed. The subjects involved in this research consisted of learning assessment experts, teacher practitioners, and fourth-grade elementary school students. The experts involved validated the guide that has been successfully developed by providing comments, suggestions for improvement, and assessment scores. Meanwhile, the teachers involved aim to find out the practicality of the product, and the students are involved. Collect data on students' computational thinking abilities after using the learning assessment guide, which will later be analyzed to determine the effectiveness of the product. The data collection method in this research consists of questionnaires and tests. A questionnaire was used to collect product validity data and reviews from experts and teachers. Meanwhile, the test method is used to collect data on students' computational thinking abilities, which are then analyzed to determine the effectiveness of the product. The indicators used in questionnaires and tests are adjusted to the needs of the data to be collected. The instrument grid used in this research is presented in Table 1, and Table 2.

Table 1. The Learning Assessment Expert Instrument Grid

Aspect	Indicator
Integration	a. The relevance of learning assessment guidelines. b. Measurability of learning assessment guidelines.
Suitability of Assessment Function	c. Conformity to assessment principles.
Accuracy of Assessment	d. The level of difficulty and complexity of the questions. e. Accuracy of question items with indicators. f. Accurate use of elements in the guide. g. Accuracy of the answer key to the question. h. Accuracy of content.
Informative	i. Complete guide. j. Ease of access to information. k. Grammar
Reflection	l. Feedback

Table 2. The Practitioner Instrument Grid

No.	Aspect	Indicator
1	Assessment Presentation	Quality of Assessment
2	Quality of Assessment	Quality of Assessment Content Quality of Questions Based on HOTS Questions

The data analysis method in this research consists of qualitative and quantitative analysis. Qualitative analysis is used to present the results of the review in the form of comments and suggestions from the subjects involved. Meanwhile, quantitative analysis is used to explain the assessment data that has been collected in the form of numbers and data on students' computational thinking abilities. Quantitative analysis consists of descriptive and inferential statistics. Inferential statistics are in the form of analysis prerequisite tests, which include normality, homogeneity, and hypothesis testing using the univariate T test to determine whether the project-based learning assessment guide oriented towards phenomenon-based learning is effectively used in learning.

3. RESULT AND DISCUSSION

Results

The result of product development in this research is a project-based learning assessment guide oriented toward phenomenon-based learning. This research is based on the ADDIE development model, which consists of analysis, design, development, implementation, and evaluation stages. The first stage, namely, analysis is carried out by extracting information related to data on the need for developing learning assessment guidelines. Based on the findings at the analysis stage, it can be identified that teachers and students need a learning assessment guide that supports students' computational thinking skills. The project-based learning assessment guide oriented to phenomenon-based learning that was developed can help students improve their computational thinking skills for class IV SD. Negeri Perean Kangin.

The second stage, namely the design stage, is the activity of designing a project-based learning assessment guide oriented to phenomenon-based learning for class IV in mathematics subjects. After the product design is complete, guidance is provided to the supervisor to get input or suggestions. The input and suggestions given by the supervisor are used to improve the guide design that has been created. After the design stage is complete and has been improved based on input from the supervisor, proceed to the next stage. The third stage, namely development, contains activities to develop learning assessment guide products. The learning assessment guide is made with the main material being paper measuring 21 cm x 29.7 cm (A4). The project-based learning assessment guide oriented towards phenomenon-based learning consists of a front cover page, a foreword, a list of contents, Chapter 1 (introduction) includes an explanation regarding the background, target users, and how to use the learning assessment guide. Chapter 2 (Learning and Assessment Principles) includes explanations regarding learning principles and assessment principles, along with examples. Chapter 3 (learning planning and assessment) includes the process of formulating learning outcomes (CP), learning objectives (TP), learning objective flow (ATP), and learning planning and assessment; Chapter 4 (implementation of learning and assessment) covers the learning process based on the project-based learning stage; and Chapter 5 (processing assessment results) includes assessment instrument grids, assessment rubrics, and assessment criteria; back cover. The results of the project-based learning assessment guide design oriented to phenomenon-based learning are shown in Figure 1.

Figure 1. The Project-Based Learning Assessment Guide: Product-Oriented to Phenomenon Based Learning

After developing a project-based learning assessment guide product oriented towards phenomenon-based learning, it is then tested by learning assessment experts and teacher practitioners to obtain an assessment of the product that has been developed. Testing the validity of the learning assessment guide was carried out by carrying out a media assessment involving four experts as assessment experts. After the assessment was carried out by the four expert lecturers, the assessment data was then analyzed using the Aiken Validity formula to determine the feasibility index and eligibility qualifications for the learning assessment guide. In summary, the results of Aiken's analysis can be seen in Table 3.

Table 3. The Assessment Guide Validity Test Results

Item	Evaluator (Assessment Expert)				S1	S2	S3	S4	∑s	V	Note
	I	II	III	IV							
Items 1-20	94	89	98	97	74	69	78	77	298	0.93	High Validity

Based on Table 3, it is known that the learning assessment guide obtained an overall assessment validity index of 0.93 and falls into the range ≥0.8, so that the product developed has very high validity. From these calculations, it can be stated that the learning assessment guide has very high validity qualifications. Implementation of the practicality test of this development research involves teachers as practitioners who use media. The results of the practicality test of the Learning Assessment Guide are then analyzed to determine the practicality of the product being developed. Data analysis was carried out by calculating the percentage of scores obtained through assessment sheets by experts. The data was then converted using a four-scale achievement level PAP conversion table to determine the practicality qualifications of the media being developed. The practical test results can be seen in Table 4.

Table 4. The Teacher Practitioner Test Results

Teacher Practicality Test Results	Score
Total score	72
Ideal maximum score	75
Percentage (amount/SMI x 100%)	96%

Based on the results of the analysis of assessments by practitioners, the average percentage obtained, namely practicality by teachers, was 96%. The percentage results fall into the range 76% - 100%. According to the PAP achievement level conversion table, if the overall percentage is in the range of 76% - 100%, then the teacher's practicality is stated to be in the very good category. This condition indicates that the Learning Assessment Guide is declared practical for use with very good qualifications. In the fourth stage, namely the implementation stage, after the phenomenon-based learning-oriented project-based learning assessment guide has been declared suitable for use in the learning process, a trial is carried out, which is then used as a basis for determining the effectiveness of the phenomenon-based learning-oriented project-based learning assessment guide on class students' computational thinking abilities. IV Elementary School in mathematics subjects. The fifth stage, namely evaluation, is the final stage carried out to obtain feedback or reflection on the learning assessment being developed. Regarding the results of normality, homogeneity, and hypothesis tests, they are presented in Table 5, Table 6, and Table 7.

Table 5. The Normality Test Results

	Class	Shapiro-Wilk		
		Statistics	df	Sig.
Computational Thinking Ability Test Results	Pre-Test	0.933	29	0.067
	Post-Test	0.961	29	0.353

Based on the normality test of the data distribution, the significance value in the Shapiro-Wilk column was found to be 0.067. These results show that the significance value in this column is greater than 0.05 (5% significance level). This means that the scores resulting from students' computational thinking abilities after implementing the project-based assessment guide oriented to phenomenon-based learning are normally distributed.

Table 6. The Variance Homogeneity Test Results

Variable			
Levene Statistics	df1	df2	Sig.
0.945	1	56	0.335

The results of the homogeneity of variance test of the effectiveness test data in this research, using the help of the IBM SPSS Statistics 22 for Windows program, show that the significance value is 0.335. Based on these results, it can be seen that the Sig. > 0.05. So it can be concluded that the variance of the data is homogeneous. All analytical prerequisites related to the Paired Sample T-Test analysis have been fulfilled, so that the Paired Sample T-Test analysis can be used to test the hypothesis of this research.

Table 7. Hypothesis Testing Results

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre Test - Post Test	-17.51724	3.57192	0.66329	-18.87593	-16.15856	-26,410	28	,000

Based on the results of the Paired Sample T-Test analysis using the IBM SPSS Statistics 22 for Windows program, a significance value (Sig. 2-tailed) of 0.000 was obtained. Based on these results, it can be seen that the Sig. <0.05. So it can be concluded that H0 is rejected and Ha is accepted. In other words, there is a significant difference in the computational thinking abilities of fourth grade elementary school students in mathematics subjects before and after taking part in learning using project-based learning assessments oriented to phenomenon-based learning. Thus, the use of project-based assessment guides oriented toward phenomenon-based learning is effective in improving students' computational thinking abilities.

Discussion

This development research produced a product in the form of a project-based assessment guide oriented to phenomenon-based learning that can be used by teachers as a reference in designing appropriate learning and assessments to measure and improve students' computational thinking abilities. This learning assessment guide raises material on mathematics content, namely Lowest Common Multiple and Highest Common Factor. The results of this development research show that there is a significant difference in the computational thinking abilities of fourth grade students in mathematics subjects before and after taking part in learning using a project-based learning assessment guide oriented to phenomenon-based learning. Thus, the use of project-based assessment guides oriented toward phenomenon-based learning is effective in improving the results of students' computational thinking abilities. The results of this research can be described as follows

First, a phenomenon based learning oriented project based learning assessment guide was developed to assist teachers by providing a framework for the assessment process. With this project-based learning assessment guide oriented to phenomenon based learning, it can help teachers provide direction for integrating aspects of creativity into the curriculum and daily learning, thus providing the encouragement needed to improve students' computational thinking abilities (Andriani et al., 2022; Widiana et al., 2023). This learning assessment guide contains learning steps based on Project Based Learning which consists of the stage of determining basic questions, namely the educator compiling and conveying a theme or topic of questions related to a problem and inviting students to discuss finding solutions, designing a project plan, namely the educator ensures that each participant divided into groups and knowing the procedures for making projects, preparing a schedule for making projects, namely educators preparing a schedule for making projects and dividing them into stages to facilitate implementation, monitoring the implementation of project-based learning, namely educators monitoring participation and involvement of participants also observing the development of the designed project, testing the results namely the educator discusses the project carried out by the participant then assesses it, evaluates the experience, namely the educator carries out an evaluation and provides input or follow-up direction regarding the project carried out by the student. These learning steps that have been adapted to project-based learning are an effort to support learning that encourages students to improve their computational problem solving abilities. The process of developing learning assessment guide products in this research follows the ADDIE development model.

The ADDIE model was chosen rationally. This model is a systematic learning design model that is developed or arranged programmatically with a systematic sequence of activities. The ADDIE model is structured with activity stages that are systematic and easy to understand. The development of teaching material products uses the ADDIE model, which consists of five stages: analysis (activities analyzing needs), design (designing learning assessment guide products), development (developing learning assessment guides that have been designed), implementation (implementing the results of developing learning assessment guides), and evaluation (evaluation to provide feedback to developers). So, a product that is valid and suitable for use can be produced (Carolin et al., 2020; Pramana et al., 2020). The product development stage begins with the analysis and design stage. At this stage, the process of analyzing the needs of teachers and students, as well as the characteristics of students, is carried out in order to find the assessment guide product that is needed and expected by educators and teachers. Based on the results of the analysis that has been carried out, it is used as a basis for the learning assessment guide product design process, which is then continued with an expert testing process to obtain suggestions and input. So that later the input received can be used to improve the design of the learning assessment guide being developed.

Second, the results of the validity of the project-based learning assessment guide oriented towards phenomenon-based learning, which is in the development stage (development), obtained very good qualifications in terms of the results of the validity test of the learning assessment expert. Based on learning assessment theory, the project-based learning assessment guide oriented to phenomenon-based learning is of very good quality and is suitable for implementation in the learning process. This learning assessment guide is prepared based on the principles of learning assessment. Third, the practicality of the project-based learning assessment guide oriented towards phenomenon-based learning, which is in the development stage, is very well qualified and worthy of being implemented in the learning process. The teacher conveyed that the use of this project-based assessment guide oriented towards phenomenon-based learning can increase the effectiveness of learning because it emphasizes the application of knowledge in real-life contexts. Phenomenon-based learning- and project-based learning assessment guides allow students to learn in real-world contexts that have direct relevance to their daily lives (Andriani et al., 2022; Dalitatul, 2019). This makes learning more meaningful because students can see the connection between academic concepts and real-life situations, and they are trained to be able to solve problems from various points of view. With the availability of adequate learning assessment guides, it is hoped that learning can run efficiently and effectively and ultimately be able to improve students' computational thinking abilities (Rahayu & Osman, 2019; Ulya et al., 2022). The use of project-based learning assessment guides oriented toward phenomenon-based learning can effectively improve the computational thinking abilities of fourth grade elementary school students in mathematics subjects. By using project-based learning oriented to phenomenon-based learning in solving problems in mathematics learning.

Fourth, the results of the effectiveness test which are at the implementation stage are carried out by Paired T-Test analysis/correlated sample t-test. It can be concluded that there is a significant difference in the computational thinking abilities of fourth grade elementary school students in Mathematics subjects before and after taking part in learning using the assessment guide. Project-oriented phenomenon based learning. Thus, the use of project-based assessment guides oriented to phenomenon based learning is effective in improving students' computational thinking abilities. Based on the results of validity, practicality and effectiveness, the project-based learning assessment guide oriented to phenomenon based learning can be said to be one of the learning innovations that can be developed to improve students' computational thinking abilities. The advantage of the project-based learning assessment guide oriented to phenomenon based learning compared to similar products that have been developed previously is that in this guide it is combined with project-based learning oriented to phenomenon based learning, this project-based learning requires active involvement of students in solving problems and searching solution for a given project, this can increase student motivation. Students learning through projects can develop a variety of skills, such as problem solving, communication, and critical thinking (Dewi et al., 2020; Kustiaman, 2016). This phenomenon based learning oriented project based learning assessment guide allows students to learn in a relevant and meaningful context, because the learning material is connected to real world phenomena, this helps students see the connection between theory and everyday life applications (Culadiene et al., 2023; Pratiwi et al., 2021).

The results of research on learning assessment guides for improving students' computational thinking skills are supported by several relevant studies. One of them is research entitled Education Development of Project-Based Learning Assessment Guides for Elementary School Teachers. This research states that assessment will be useful for improving learning activities and making decisions regarding achieving learning success (Pratiwi et al., 2021). The results of the validity of the students' computational thinking skills questions were declared valid and very suitable to be used as an assessment of computational thinking skills. The use of learning tools based on phenomenon based learning is able to overcome the phenomenon of learning loss because it is able to provide meaningful understanding to students, thereby making it easier to understand the material (Andriani et al., 2022; Resty et al., 2024). PBL-based assessments can keep students motivated and help them see the value in learning (Sylvia et al., 2019). Other research states that phenomenon-based learning-oriented project-based learning assessments are valid and suitable for use in the learning process (Culadiene et al., 2023; Widiana et al., 2023). Based on these findings, it can be said that project-based learning assessments oriented to phenomenon-based learning provide a positive impact on the learning process. The limitations of this research lie in the scope of material, level, and learning content raised in the learning assessment guide. This learning assessment guide is only limited to material on mathematics content, namely Lowest Common Multiple and Highest Common Factor, and the number of subjects involved in testing effectiveness is only 1 class, totaling 29 people using One Group Pre-Test-Post-Test research.

Implementation of this development research can have implications for improving the quality of learning, which also refers to students' computational thinking abilities. The project-based learning assessment guide oriented to phenomenon-based learning for fourth grade elementary school students in mathematics is designed in the form of a concrete product so that it can be used as a learning assessment guide that can be used repeatedly, practically, and is able to increase references and insight for teachers regarding the development of assessment guides similar learning (Mania, 2021; Pratiwi et al., 2021). It is hoped that teachers can develop learning assessment guides that innovate in assessment techniques that are appropriate to educational developments and student needs. For students, this phenomenon-based learning-oriented project-based learning assessment guide can help them understand and relate lesson material to real phenomena. Develop deeper understanding because students see the connection between the theory studied and everyday life situations. This learning assessment guide product can be used by teachers and students in the learning process, so it is effective in improving students' computational thinking skills skills (Ananda & Maemonah, 2022; Cahdriyana & Richardo, 2020). As well as the development of a project-based learning assessment guide oriented towards phenomenon-based learning, it can be used as a reference in developing similar products in an effort to improve the quality of learning.

4. CONCLUSION

The development of a phenomenon-based learning-oriented project-based learning assessment guide for fourth grade elementary school students in mathematics has produced a product that is valid, practical, and effective for use in the learning process as an effort to make it easier for students to understand the material, improve the quality of learning outcomes, and improve students' computational thinking abilities.

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