Project-Based Learning Assessment Guidebook Project-Based Assessment with Design Approach Thinking

Putu Lanny Kristina Putri[1*], I Wayan Widiana[2], I Made Suarjana[3] ID

[1,2,3] Elementary School Teacher Education Study Program, Universitas Pendidikan Ganesha, Singaraja, Indonesia

ABSTRAK

Penelitian pengembangan ini dimotivasi oleh kurangnya kemampuan berpikir kritis matematika pada siswa kelas V SD. Permasalahan ini disebabkan oleh kurangnya pedoman yang memandu guru dalam proses pembelajaran dan penilaian, yang mengakibatkan pembelajaran menjadi monoton. Penelitian bertujuan menghasilkan buku panduan yang valid, praktis, dan efektif untuk meningkatkan kemampuan berpikir kritis matematika. Metode yang digunakan adalah penelitian pengembangan dengan model 4D (Four-D), melibatkan 4 ahli asesmen, 3 praktisi, dan 20 siswa kelas V SD sebagai subjek penelitian. Data dikumpulkan melalui metode tes dan non-tes, dengan instrumen berupa lembar angket/kuesioner dan tes. Analisis data dilakukan secara deskriptif kualitatif, kuantitatif, dan statistik inferensial. Hasil penelitian menunjukkan bahwa buku panduan asesmen mendapat validasi sangat baik dari para ahli, serta mendapat respon sangat baik dari guru dalam hal kepraktisan. Buku panduan ini juga terbukti secara signifikan meningkatkan kemampuan berpikir kritis matematika siswa kelas V. Dengan demikian, buku panduan asesmen berbasis proyek dengan pendekatan design thinking ini layak, praktis, dan efektif digunakan. Implikasi penelitian ini adalah buku panduan tersebut dapat menjadi pedoman bagi guru dalam melakukan penilaian.

ABSTRACT

This developmental research is motivated by the lack of critical thinking skills in mathematics among fifth-grade elementary school students. This issue arises from the absence of guidelines to assist teachers in the teaching and assessment process, resulting in a monotonous learning experience. The research aims to produce a valid, practical, and effective guidebook to enhance critical thinking skills in mathematics. The method employed is developmental research using the 4D (Four-D) model, involving 4 assessment experts, 3 practitioners, and 20 fifth-grade elementary school students as research subjects. Data are collected through both test and non-test methods, utilizing questionnaires and tests as instruments. Data analysis involves descriptive qualitative, quantitative, and inferential statistical analyses. The research findings indicate that the assessment guidebook receives excellent validation from experts and highly positive feedback from teachers regarding its practicality. Furthermore, the guidebook significantly improves the critical thinking skills of fifth-grade students in mathematics. Thus, the project-based assessment guidebook with a design thinking approach is deemed suitable, practical, and effective. The implication of this research is that the guidebook can serve as a reference for teachers in conducting assessments.

1. INTRODUCTION

Critical thinking skills are very necessary in the current 5.0 era because the information available is so abundant that it requires critical thinking skills to process data and differentiate whether the data received is valid or not (Khaira et al., 2022; Simsek, 2020). Critical thinking skills involve using knowledge to evaluate assumptions, make decisions, and investigate and conclude problems. In this context, it is explained that critical thinking skills are high-level abilities that enrich and hone individual thinking abilities to overcome challenges faced in solving problems (Ma'rifah & Mawardi, 2022; Setiyarini et al., 2020). One of the challenges in education is the low level of critical thinking skills. Several factors that hinder students' critical thinking abilities are limited exploration space. This means that students often do not have the opportunity to explore and find problems and solutions according to their characteristics, with the

*Corresponding author
E-mail addresses: lanny@undiksha.ac.id (Putu Lanny Kristina Putri)

teacher's role being more of a facilitator and guide. However, in reality, students often do not get enough opportunities to explore in the classroom during the learning process. Another factor is the use of monotonous learning methods, where teachers tend to rely on the lecture method. The use of this method does not allow students to think during the learning process, so their critical thinking skills are not honed or trained optimally (Berjamai & Davidi, 2020; Krejci et al., 2020). Seeing the problems and importance of critical thinking skills, therefore, at the elementary school level, students must have these abilities. These abilities must be honed from an early age so that later they have a strong foundation to overcome challenges in personal and academic life and become individuals who are more skilled, informed, and responsive to the world around them (Khaira et al., 2022; Norrizqa, 2021). Sharpening critical thinking skills from an early age is related to learning at the elementary school (SD) level, because with this increase in ability, students can learn to analyze information more carefully, formulate questions appropriately, and solve problems effectively. From this, they can build a strong learning foundation in various subjects at the elementary school level.

Mathematics is one of the subjects that is required to be studied in elementary school (Farapatana et al., 2019; Setiawan, 2020). Through exploring mathematical concepts, students are guided to develop an analytical mindset and fundamental evaluative abilities when formulating an appropriate solution. However, unfortunately, there is a gap between expectations and reality in developing students' critical thinking skills. Some people consider mathematics to be a subject that is difficult to understand and learn because the material is composed of neat concepts such as formulas. As a result, students often focus on memorizing concepts and formulas without being able to relate them to the real world. As a result, they have difficulty applying mathematical knowledge to solving real-world problems that require them to think critically (Fitrianti et al., 2020; Nurunnisa et al., 2022).

Considering the urgency and problems faced in developing critical thinking skills, efforts to improve these abilities in mathematics subjects include providing practice in solving mathematics problems (Kurniawati & Ekayanti, 2020; Maruti, 2022). Therefore, it can be said that action to develop more creative and innovative assessments is very necessary. If previously assessments were carried out conventionally using paper, now assessments are carried out using designs and must be able to measure 21st-century learning skills (Rigianti, 2020; Rosnaeni, 2021). When carrying out assessments, not only cognitive aspects are important but also other skills. One of the strategies teachers use is project assessment, where students are given project assignments to plan, collect data, organize information, analyze data, and present the results. This approach allows teachers to evaluate students' ability to apply knowledge and skills in real-world situations, which in turn helps improve their overall skills. Project-based assessments provide practical, problem-solving-oriented learning experiences, which are important for preparing students to face real-world challenges. By focusing on the practical application of knowledge and skills, students can develop their abilities in a more integrated and holistic way (Marmoah et al., 2022; Uslan et al., 2018). Project-based assessments need to be given during the learning process because they can help students develop high-level thinking skills such as critical thinking, problem-solving, and creative thinking (Motlhaka, 2020; Piotrowska et al., 2022). Teachers can use various approaches to integrate an assessment to make it more innovative and creative. Many approaches can be used by teachers, one of which is design thinking. Design thinking is a solution-based approach used to solve problems and is classified as a design tool. Using design thinking is able to overcome complex problems in several ways. The first is to understand individual needs; the second is to frame the problems that have been identified and are centered on the individual; and the third is to create various kinds of ideas in the session by brainstorming, building prototypes, and carrying out testing (Batmetan et al., 2021; Winarni et al., 2022). Design thinking can be used during the learning process. Flexibly, through the creation of a learning project created by the teacher, it will produce a creative and innovative learning process (Kasri et al., 2021; Made et al., 2022).

So by using this assessment, teachers can assess students more systematically and improve their critical thinking skills because the assessment is project-based. The instrument used is a description test in the form of problem-based story questions, which can guide them to think critically by solving problems in the questions (Arifah, 2020; Winarni et al., 2022). Development of a project-based assessment approach thinking This needs to be realized so that during the assessment process, teachers act comprehensively but rather focus on various aspects to assess students' skills from the process they go through when completing a given project. Therefore, the development of a project-based learning assessment guidebook with a project approach to design thinking to measure critical thinking skills. Mathematics is an interesting and relevant alternative for further exploration (Baderan, 2019; Wibowo et al., 2022). Development of a project-based assessment approach thinking This needs to be realized so that during the assessment process, teachers act comprehensively but rather focus on various aspects to assess students' skills from the process they go through when completing a given project. Therefore, the development of a project-based learning

assessment guidebook with a project approach to design thinking to measure critical thinking skills. Mathematics is an interesting and relevant alternative for further exploration.

Although there are still few, several studies have examined the development of assessment guidebooks. Several similar studies show that developing assessment rubrics helps teachers assess the level of students' critical thinking skills, from below standard to up to standard. Other research shows that the project assessment tools developed are practical and suitable for use, triggering student activity and enthusiasm in the learning process (Murdani, 2021; Uslan et al., 2018). Apart from that, science learning uses instruments with an approach to design thinking considered capable of measuring critical thinking abilities (Aurum & Surjono, 2021; Pobela et al., 2023). However, in previous research, there has been no specific study that discusses the development of project-based learning assessment guidebooks using a project-based approach to design thinking. The novelty of this study is focus on project-based learning assessment guidebooks based approach to design thinking.

The main aim of this research is to produce a project-based learning assessment guidebook with a design thinking approach that is not only valid and practical but also effective in improving the critical thinking skills of fifth-grade elementary school students in the field of mathematics. It is hoped that this guidebook can become a source of guidance that makes it easier for teachers to teach and evaluate in the classroom. By applying a design thinking approach, teachers are expected to be able to help students understand the material more deeply, improve their critical thinking skills, and develop collaboration and problem-solving skills. The essence of this approach is to provide a comprehensive and meaningful learning experience for students that does not only focus on mathematical concepts but also expands the development of broader thinking skills. Thus, this guidebook is not only a teaching aid but also a means of enriching students' learning experiences.

2. METHOD

This research uses a research or development approach research and development, by applying a 4D model consisting of stages Define, Design, Develop, and Disseminate. By using the 4D model, this research ensures that each stage of the development of the project-based learning assessment guidebook is well integrated (Lestari, 2018). Initial analysis and evaluation of learners help identify learning needs and goals. Product design is carried out by considering the principles of design thinking to ensure quality and effectiveness. Testing the validity and practicality of assessment instruments by experts helps ensure that the resulting guidebook can be used effectively in classroom learning contexts. The dissemination stage aims to ensure that the results of this development can be accessed and utilized by teachers and students in various schools. This research involved 4 assessment experts, 3 practitioners, and 20 fifth-grade elementary school students as the subjects involved. Meanwhile, the object of this research is the project-based assessment guidebook (project-based assessment) with approach design thinking. Non-test methods in the form of questionnaires and test methods in the form of essay test questions are the methods used to collect data. The questionnaire was used to obtain information from research subjects regarding the validity and practicality of the project-based assessment guidebook approach to design thinking. Questionnaire sheets, or questionnaires, and description tests were used as data collection instruments. The questionnaire sheet is in the form of a closed questionnaire using a rating scale. Meanwhile, the test used is in the form of story questions in the form of descriptions. Before the questionnaire is tested on respondents, the next step is to consult with the supervisor to obtain suggestions and input that can be used to improve the questionnaire that has been created. Once declared relevant, the questionnaire will be assessed for its suitability by experts until it is declared valid for use in testing the validity and practicality of the project-based assessment guidebook with design thinking. The instrument grid for assessment experts and practitioners can be seen in Table 1, dan Table 2.

Table 1. Assessment Expert Instrument Grid

Aspect		Indicator
Integration	a.	The relevance of learning assessment guidebooks.
	b.	Measurability of learning assessment guidebooks.
Suitability of assessment function	c.	Conformity to assessment principles.
Accuracy of assessment	d.	The level of difficulty and complexity of the evaluation questions.
	e.	The accuracy of the assessment with the abilities being measured.
	f.	Accuracy of learning stages with methods.
	g.	The accuracy of the assessment rubric with evaluation questions.
Reflection	d.	Feedback

Table 2. Practitioner Instrument Grid

No.	Aspect	Indikator
1	Presentation of assessment models	Technical quality of assessment
2	Quality of assessment models	Quality of material content in the assessment model
		Quality of questions based on HOTS questions

The data analysis process in this research involves various techniques, including qualitative, quantitative and inferential descriptive analysis. Qualitative analysis involves grouping interview results, media value criteria, comments, responses, criticism, and suggestions for improvements to improve the product. Meanwhile, quantitative analysis is used to assess product validity, practicality and effectiveness. Media validity is evaluated using a formula aiken, while practicality is assessed by percentage. Decisions based on validity and practicality refer to the scale conversion. The effectiveness test begins with a normality test using the formula Shapiro Wilk, followed by a homogeneity test using the formula Fisher or F test. After that, a hypothesis test is carried out using the correlated t-test formula. Finally, the formulation of hypotheses and conclusions are drawn through inferential descriptive analysis after effectiveness testing. This process ensures that the data is analyzed thoroughly and provides a solid basis for drawing relevant conclusions from the research.

3. RESULT AND DISCUSSION

Result

At SD Negeri 1 Penarukan, research was carried out on the development of a project-based assessment guidebook using a project approach design thinking, using a 4D model consisting of stages define (definition), design (planning), develop (development), and disseminate (deployment). The definition stage involves initial analysis, learners, tasks, concepts, and learning objectives to produce relevant results. First, students are passive when participating in learning and find it difficult to understand the concepts being taught. This problem is caused by teachers who rarely give project assignments to students because of teachers' limitations in creating a project-based assessment guide, so this has an impact on students' low critical thinking abilities. The characteristics of students have various critical thinking abilities. The tasks given include identifying the completion of existing tasks. The concept analysis used is spatial building material. Analysis of learning objectives formulated based on a summary of the results of task and concept analysis. The basic competencies and indicators of competency achievement are presented in Table 3.

Table 3. Basic Competencies and Indicators of Competency Achievement

No	Basic competencies	Dimensions of Critical Thinking Ability		Indicators of Competence Achievement
3.5	Explain and determine the volume of geometric figures using volume units (such as unit cubes).	Interpretation	3.5.1	Students understand volume units and the relationship between volume units.
			3.5.2	Students determine the volume of a cube using a unit cube.
			3.5.3	Students determine the volume of a block using a unit cube.
		Analysis	3.5.4	Identify the formula for the volume of a cube.
			3.5.5	Identify the formula for the volume of a block.
		Evaluation	3.5.6	Determine the volume of a cube.
			3.5.7	Determine the volume of a block shape.
		Inference	3.5.8	Solve problems related to the volume of blocks using volume units.

The second stage namely stages design (design) by creating an initial product, a project-based assessment guidebook with an approach to design thinking. The guidebook format consists of a front cover, foreword, and table of contents, Chapter 1 (introduction) includes background, target users, and how to use the guide. Chapter 2 (learning principles and assessment principles) includes an explanation of learning and assessment principles accompanied by examples of their implementation. Chapter 3 (learning planning and assessment) includes the formulation of Learning Outcomes (CP), Learning Objectives (TP), Learning Objective Flow (ATP), and learning and assessment planning which includes types, benefits, examples, and assessment techniques used by teachers. Chapter 4 (implementation of learning assessment) includes the

process of implementing learning as well as examples of evaluation questions using spatial building material. Chapter 5 (processing assessment results) includes the assessment rubric and scoring method, and the back cover contains a brief description of the guidebook and developer profile. The results of the guidebook design are presented in Figure 1.
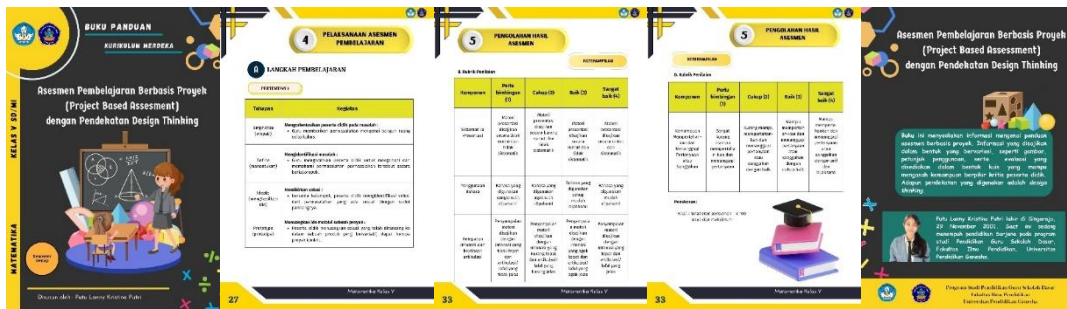

Figure 1. Guidebook Design Results

The third phase is the stage of development. At this stage, the validity of the assessment instrument is tested by experts so that it can be used to test its feasibility in the form of validity and practicality. After being tested by an assessment expert, the next step is to carry out trials to obtain assessments, suggestions, or input on the manual to revise or improve the product in a better direction. The results of product improvements can be seen at Table 4.

Tabel 4. Product Revision

No	Feedback, Suggestions and Comments	Product Images
1	Added question grid and assessment methods.	(Before Revision) (After Revision)

No	Feedback, Suggestions and Comments	Product Images
2	Further clarifying examples of project awards.	(Before Revision) (After Revision)
3	Add the words independent curriculum and the words final assignment to the front and back cover titles. Add the identity of the supervisor on the back cover.	(Before Revision) (After Revision)
4	Add a bibliography at the end of the page.	(Before Revision) (After Revision)

This stage produces an assessment guidebook which consists of a front cover, foreword, table of contents, Chapter 1 (introduction) including background, target users, and how to use the guide. Chapter 2 (learning principles and assessment principles) includes an explanation of learning and assessment principles accompanied by examples of their implementation. Chapter 3 (learning planning and assessment) includes the formulation of Learning Outcomes (CP), Learning Objectives (TP), Learning Objective Flow (ATP), and learning and assessment planning which includes types, benefits, examples and assessment techniques used by teachers. Chapter 4 (implementation of learning assessment) includes the process of implementing learning as well as examples of evaluation questions using spatial building material. Chapter 5 (processing assessment results) includes grids, assessment sheets, assessment rubrics, scoring methods, and assessment criteria. Next, the book will contain a bibliography, and a back cover containing a brief description of the guidebook, the name of the supervisor, and the developer profile.

Media validity test, namely validating the feasibility of assessments from project-based assessment guidebooks by validators who have expertise in their fields. Carrying out this test resulted in a calculation of 0.94 which is included in the very high category. These results are caused by the suitability of the assessment indicators with assessment components such as evaluation, assessment rubrics, and suitability with the material covered.

After validation of the guide was carried out, a practicality test was carried out by 2 class V teachers and 1 class VI teacher. The practitioner came from SD Negeri 1 Penarukan who used this product. The assessment results from the three practitioners obtained a calculation result of 96% with very good criteria. This is because the project-based assessment guidebook is easy to use, both in terms of ease of understanding in terms of instructions for use, material content, assessment rubrics, and question grids. Based on the results obtained, the project-based assessment guidebook is stated to be practical to apply in the learning process.The practicality test is obtained from the results of the questionnaire assessment by the teacher. The results of the recapitulation of product validity and practicality are presented in Table 5.

Table 5. Recapitulation of Validity and Practicality Data Analysis Results

No	Test Subjects	Test results (%)	Percentage Qualification
1	Learning Assessment Expert	94%	Very good
2	Practitioner (Teacher)	96%	Very good

The fourth stage on the process disseminate (deployment).At this stage the book is printed and distributed to test schools so that it can be used in class. The class teacher will later use the assessment guidebook during the learning process, while the researcher will make observations and record data on the observation sheet to improve the assessment. After learning is complete, students will do the post-test using the questions provided. The final stage is the effectiveness test. The results of the normality, homogeneity and t tests will be presented below Table 6, Table 7, and Table 8.

Table 6. Normality Test Results

Group	Shapiro-Wilk		
	Statistic	df	Sig.
PreTest	0.943	20	0.267
PostTest	0.949	20	0.355

Table 7. Homogeneity Test Results

Parameters		Levene Statistic	df1	df2	Sig.
Dependent Variable	Based on Mean	2.866	1	38	0.099

Table 8. T-Test Results Paired Samples Test

Pair		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	PreTest - PostTest	-38.150	8.969	2.006	-19.022	19	0.000

Based on the t-test, the significance value (2-tailed) is 0.000, which is smaller than 0.05 (5% significance level). Therefore, there is a significant difference in the mathematical critical thinking abilities

of class V students before learning using an assessment guidebook product and after learning using a project-based assessment guidebook product with a project approach design thinking.

Discussion

This research produced a project-based assessment guidebook. This guidebook is different from other guides because there is no specific guide for project-based assessment that uses this approach design thinking to improve the critical thinking skills in mathematics of fifth-grade elementary school students. As time goes by, there are various kinds of incoming information, so the ability to process existing data is needed whether it is valid or not. The ability that can be used is the ability to think critically, which with this ability can be used by students, especially in the world of education, to understand existing concepts or problems, then analyze them, formulate a solution, and draw conclusions from existing problems (Matsna et al., 2023; Nugroho & Setiawan, 2023).

Based on the presentation regarding the results of the validity, practicality, and effectiveness of the media being developed, it is known that the project-based learning assessment guidebook with design thinking is valid, practical, and effective. This is caused by fulfilling the criteria for quality learning media (Ristiana et al., 2019; R. N. Sari & Siswono, 2020). This guidebook is suitable to be applied as a guide in the learning process because the contents of the guide guide students to solve existing problems and make students active students, by constructivism theory. This theory provides opportunities for students to actively construct their understanding with the help of the teacher as a facilitator (Fitri, 2020; Masgumelar & Mustafa, 2021).

Although it is still rarely researched, the development of project-based learning assessment guidebooks is the subject of research attention. For example, in research entitled "Development of Critical Thinking Assessment in Project-Based Learning on Electrical Topics", it was found that teachers could more easily assess the level of students' critical thinking skills using the developed assessment rubric. The results reveal that this assessment can differentiate the level of students' critical thinking skills at levels below the standard, near the standard, and according to the standard.

Another study entitled "Development of Project Learning Assessment Tools on Environmental Pollution and Damage Material" shows that project learning assessment tools have valid, reliable, and practical characteristics. The validity value reaches V = 1 (100%), indicating a very high level of validity. Apart from that, this device is also considered reliable with a value of 0.85, indicating that this measuring instrument can be relied on to provide consistent results. Assessments by validators and practitioners also show good practical value, with scores of 3.76 and 3.84 respectively. The findings from these two studies illustrate that the development of a project-based learning assessment guidebook has the potential to make a significant contribution to improving assessment and learning in schools. With a valid, reliable, and practical guidebook, teachers can be more effective in assessing student skills and developing more project-oriented learning strategies. This helps create a deeper and more meaningful learning experience for students, as well as promotes the development of critical thinking and problem-solving skills (Murdani, 2021; Uslan et al., 2018). There are several reasons this guidebook has received excellent ratings from experts and users. Some of them will be discussed as follows.

First, the guidebook developed contains project assignments that can be given to students. The projects given are based on problems around us related to the concept of building space. Giving this project makes them active, because they are encouraged to be diligent and try hard to complete the existing project. Other researchers also revealed that giving projects during the learning process can make students more enthusiastic about participating in class learning. The spirit in question is being active in answering questions, concentrating and being agile in finding answers. In addition, during group discussions in solving problems, it was identified that students collaborated with their group friends which enabled them to understand and respect each other's differences of opinion (Hutapea & Simanjuntak, 2017; Suharti, 2021). It can be concluded that, by giving project assignments, it can lead students to collaborate with their fellow group friends, improve high analytical skills in understanding a concept or problem given by the teacher, and be active in participating in the learning process. This is because they are invited to question, rethink, and test their understanding (Halimi et al., 2021; Umardiyah, 2020).

Second, this guidebook contains assessment aspects such as grids, assessment rubrics, scoring methods, and assessment criteria. Some of these aspects are things that must be present in the assessment process because they can help teachers evaluate students' understanding and performance. Assessment rubrics function to provide clear guidance regarding expectations in assignments and can help teachers provide specific feedback. The question grid functions to ensure that the material is tested in a balanced and fair manner. The scoring method determines how appropriate grades are given. Meanwhile, the scoring criteria function as a reference in providing an objective assessment (Mashfufah & Utama, 2023; Pobela et al., 2023). In the guidebook, these aspects are easy to understand and relevant to the material and projects

as well as existing evaluation questions. By understanding this, the assessment process can be carried out more effectively and objectively, as well as providing feedback that is more meaningful to students.

Third, the guidebook developed contains evaluation questions in the form of descriptions. These questions are based on story questions that are relevant to the surrounding life and relate to the material raised, namely building space. Through story problems, students are invited to analyze complex situations, identify problems, and formulate solutions based on the information provided (Anggraini et al., 2022; Triyono et al., 2023). Problem-solving designed in the context of stories can enable students to learn to think analytically, consider points of view, and develop the critical skills needed to face real-world challenges. Fourth, the language used in this guidebook is relatively simple, so it explains the assessment and approach design thinking easy for teachers to understand. Clear language can help teachers understand the instructions or information presented without feeling confused or misunderstanding (Hasim, 2019; Safitri et al., 2022). The use of simple and effective language makes guidebooks an effective tool for conveying complex information.

The novelty of this research is that this guidebook contains elements of design thinking which is integrated with learning material. Design thinking can be implemented in the learning process flexibly, by creating a learning project created by the teacher so that it will create a creative and innovative learning process (Pursitasari et al., 2020; I. P. Sari et al., 2020). Limitations in this research are the scope of material, levels, and subjects developed in the media. The material used in the guidebook is building space and mathematics subjects for fifth-grade elementary school students. The number of subjects involved in implementing this media is 1 class with 20 students. Therefore, it is hoped that future research will use more diverse material and content and use more subjects.

This research has implications, namely the existence of a project-based assessment guidebook (project-based assessment) with approach design thinking with the very good category. This guidebook can help teachers develop project-based assessments that are more holistic and learning-oriented. Teachers can use this guide to plan and implement projects that are challenging, relevant, and learner-centered. By integrating approachesdesign thinking, teachers can guide students to increase their understanding of certain material, so that they have critical thinking. Apart from that, teachers can improve team collaboration skills in discussing to solve a problem.

4. CONCLUSION

Project-based assessment guidebook with an approach to design thinking can be said to be valid, practical, and effective for improving the critical thinking skills in mathematics of fifth-grade elementary school students, as proven by the results of assessments from experts, and practitioners, as well as increased results post-test. It is hoped that this assessment guidebook can be used by teachers in evaluating students' overall progress, enabling them to provide more meaningful feedback and supporting students' holistic development.

5. REFERENCES

Anggraini, N. P., Siagian, T. A., & Agustinsa, R. (2022). Analisis Kemampuan Berpikir Kritis Matematis Siswa Dalam Menyelesaikan Soal Berbasis Akm. *ALGORITMA: Journal of Mathematics Education*, *4*(1), 58–78. https://doi.org/10.15408/ajme.v4i1.25325.

Arifah, M. N. (2020). Model Asesmen Dalam Praktek Perancangan Media Pembelajaran Berbasis Desain Thinking. *Refleksi Pembelajaran Inovatif*, *2*(2). https://doi.org/10.20885/rpi.vol2.iss2.art1.

Aurum, E. V., & Surjono, H. D. (2021). The Development of Mobile Base Interactive Learning Multimedia For Critical Thinking Improvement. *Journal of Educational Science and Technology*, *7*(2), 174–187. https://doi.org/https://doi.org/10.26858/est.v0i0.15265.

Baderan, J. K. (2019). Pengembangan Soal High Order Thinking (Hot) Melalui Pembelajaran Berbasis Masalah Untuk Melatih Keterampilan Berpikir Kritis Peserta Didik Kelas Vi Sd. *Pedagogika*, *9*(2), 152–178. https://doi.org/10.37411/pedagogika.v9i2.63.

Batmetan, J. R., Komansilan, T., & Parera, A. (2021). Model Design Thinking Pada Perancangan Aplikasi Mobile Learning. *Ismart Edu: Jurnal Pendidikan Teknologi Informasi*, *1*(02), 23–30. https://doi.org/10.53682/ise.v1i02.719.

Berjamai, S., & Davidi, N. (2020). Kajian Faktor-Faktor Penghambat Keterampilan Pelajaran Bahasa Indonesia. *Literasi Pendidikan Dasar*, *1*(1), 1–49. https://doi.org/10.36928/jlpd.v1i1.1856.

Farapatana, E., Anwar, Y. S., & Abdillah, A. (2019). Pengembangan Komik Matematika dengan Metode Preview, Question, Read, Reflect, Recite, & Review (PQ4R) Pada Materi Lingkaran Kelas VIII SMP. *JTAM | Jurnal Teori Dan Aplikasi Matematika*, *3*(1), 01. https://doi.org/10.31764/jtam.v3i1.755.

Fitri, Y. (2020). Implementasi Penerapan Teori Konstruktivisme Dalam Proses Pembelajaran Di Sekolah Dasar. *SHEs: Conference Series*, *3*(4), 1300–1307. https://jurnal.uns.ac.id/SHES/article/view/55740.

Fitrianti, I., Handayani, D. E., & YP, S. (2020). Keefektifan Media Magic Box Terhadap Hasil Belajar Matematika Materi Jaring-Jaring Bangun Ruang Sederhana. *MIMBAR PGSD Undiksha*, *8*(2), 323–329. https://doi.org/10.23887/jjpgsd.v8i2.26677.

Halimi, A., Wijonarko, W., & Agustini, F. (2021). Analisis Pembelajaran Matematika Materi Bangun Ruang Kubus dan Balok dengan Menggunakan Model Konstruktivisme Berbasis Lingkungan. *Jurnal Ilmiah Pendidikan Profesi Guru*, *4*(1), 10–16. https://doi.org/10.23887/jippg.v4i1.29859.

Hasim, E. (2019). Perkembangan Bahasa Anak. *Pedagogika*, *9*(2), 195–206. https://doi.org/10.37411/pedagogika.v9i2.87.

Hutapea, J., & Simanjuntak, M. P. (2017). Pengaruh Model Pembelajaran Project Based Learning (Pjbl) Terhadap Hasil Belajar Siswa SMA. *INPAFI (Inovasi Pembelajaran Fisika)*, *5*(1), 183–193. https://doi.org/10.24114/inpafi.v5i1.6597.

Kasri, M. A., Novan, Y., & Ramadhani, I. A. (2021). Penerapan Model Design Thinking pada Pengembangan Media Pembelajaran Berbasis Macro Media Flash. *JURNAL PETISI (Pendidikan Teknologi Informasi)*, *2*(2), 60–71. https://doi.org/10.36232/jurnalpetisi.v2i2.1531.

Khaira, U., Indryani, I., & Rosyadi, A. F. (2022). The Development of an Android- Based Educational Game " Orang Kayo Hitam. *Innovative Journal of Curriculum and Educational Technology*, *11*(2), 65–75. https://doi.org/10.15294/IJCET.V11I2.57486.

Krejci, S. E., Ramroop-Butts, S., Torres, H. N., & Isokpehi, R. D. (2020). Visual literacy intervention for improving undergraduate student critical thinking of global sustainability issues. *Sustainability (Switzerland)*, *12*(23), 1–19. https://doi.org/10.3390/su122310209.

Kurniawati, D., & Ekayanti, A. (2020). Pentingnya Berpikir Kritis Dalam Pembelajaran Matematika. *Jurnal Penelitian Tindakan Kelas Dan Pengembangan Pembelajaran*, *3*(2), 112. http://jurnal.um-tapsel.ac.id/index.php/ptk/article/view/1892.

Lestari, N. (2018). Prosedural Mengadopsi Model 4D Dari Thiagarajan Suatu Studi Pengembangan LKM Bioteknologi Menggunakan Model PBL Bagi Mahasiswa. *Jurnal Ilmiah Teknologi FST Undana*, *12*(2), 56–65. https://ejurnal.undana.ac.id/jurnal_teknologi/article/view/1170.

Ma'rifah, M. Z., & Mawardi, M. (2022). Peningkatan Kemampuan Berpikir Kritis Siswa Menggunakan Hyflex Learning Berbantuan Wordwall. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *12*(3), 225–235. https://doi.org/10.24246/j.js.2022.v12.i3.p225-235.

Made, I., Dharma, A., Ayu, N., & Lestari, P. (2022). The Impact of Problem-based Learning Models on Social Studies Learning Outcomes and Critical Thinking Skills for Fifth Grade Elementary School Students. *Jurnal Ilmiah Sekolah Dasar*, *6*(2), 263–269. https://doi.org/10.23887/JISD.V6I2.46140.

Marmoah, S.-, Istiyati, S.-, Supianto, S., Mahfud, H., & Sukarno, S. (2022). Penilaian Berbasis Proyek Di Sekolah Dasar. *Jurnal Pengabdian Masyarakat Borneo*, *6*(2), 174–181. https://doi.org/10.35334/jpmb.v6i2.2745.

Maruti, E. S. (2022). Ketahanan Literasi Anak-Anak di Masa Pandemi melalui Aplikasi Let's Read (Children's Literacy Resilience in a Pandemic Period Through the Let's Read Application. *Indonesian Language Education and Literature*, *7*(2), 247. https://doi.org/10.24235/ileal.v7i2.9298.

Masgumelar, N. K., & Mustafa, P. S. (2021). Teori Belajar Konstruktivisme dan Implikasinya dalam Pendidikan. *GHAITSA: Islamic Education Journal*, *2*(1), 49–57. https://doi.org/10.62159/ghaitsa.v2i1.188.

Mashfufah, A., & Utama, C. (2023). Edukasi Pengembangan Asesmen Pembelajaran Berbasis Proyek bagi Guru Sekolah Dasar. *Bubungan Tinggi: Jurnal Pengabdian Masyarakat*, *5*(2), 670–678. https://doi.org/10.20527/btjpm.v5i2.6868.

Matsna, M., Sulistyorini, R., & Dewi, N. R. (2023). Peningakatan Kemampuan Berpikir Kritis Peserta Didik Kelas Viid Smpn 19 Semarang Materi Ekologi Melalui Problem Based Learning Berbasis Socio-Scientific Issue. *In Proceeding Seminar Nasional IPA*, *373*, 373–380. https://proceeding.unnes.ac.id/snipa/article/view/2319.

Motlhaka, H. (2020). Blackboard collaborated-based instruction in an academic writing class: sociocultural perspectives of learning. *Electronic Journal of E-Learning*, *18*(4), 337–346. https://doi.org/10.34190/EJEL.20.18.4.006.

Murdani, E. (2021). Pengembangan Asesmen Berpikir Kritis dalam Pembelajaran Berbasis Proyek Pada Topik Kelistrikan. *Seminar Nasional Pendidikan IPA Tahun 2021*. https://conference.unsri.ac.id/index.php/semnasipa/article/view/2363.

Norrizqa, H. (2021). Berpikir Kritis dalam Pembelajaran IPA. *Prosiding Seminar Nasional Pendidikan IPA*, 147–154. http://jbse.ulm.ac.id/index.php/PMPIPA/article/view/37.

Nugroho, B. A., & Setiawan, I. (2023). Meningkatkan Kemampuan Berpikir Matematika dan Pemecahan Masalah melalui Strategi Pembelajaran Interaktif. *In SANTIKA: Seminar Nasional Tadris Matematika*, 404–416. https://proceeding.uingusdur.ac.id/index.php/santika/article/view/1400.

Nurunnisa, M., Nuryadi, N. P., & Solihat, S. (2022). Perancangan User Interface Aplikasi Aritmatika Tingkat Rendah Menggunakan Metode Design Thinking. *Jurnal Ilmu-Ilmu Informatika Dan Manajemen STMIK*, *16*(1), 85–94. https://journal.unsap.ac.id/index.php/infomans/article/view/413.

Piotrowska, I., Cichoń, M., Sypniewski, J., & Abramowicz, D. (2022). Application of Inquiry-Based Science Education, Anticipatory Learning Strategy, and Project-Based Learning Strategies. *In Didactic Strategies and Resources for Innovative Geography Teaching*, 23–50. https://doi.org/10.4018/978-1-7998-9598-5.ch002.

Pobela, F., Rawis, J. A. M., & Sumilat, J. M. (2023). Assessment Pembelajaran Berbasis Proyek pada Siswa Kelas IV SD. *Edukatif : Jurnal Ilmu Pendidikan*, *5*(2), 1174–1183. https://doi.org/10.31004/edukatif.v5i2.4985.

Pursitasari, I. D., Suhardi, E., Putra, A. P., & Rachman, I. (2020). Enhancement of student's critical thinking skill through science context-based inquiry learning. *Jurnal Pendidikan IPA Indonesia*, *9*(1), 97–105. https://doi.org/10.15294/jpii.v9i1.21884.

Rigianti, H. A. (2020). Kendala Pembelajaran Daring Guru Sekolah Dasar Di Kabupaten Banjarnegara. *Elementary School Education Journal*, *7*, 297–302. https://journal.upy.ac.id/index.php/es/article/view/768.

Ristiana, E., Irfan, & Muhiddin. (2019). Pengembangan Media Pembelajaran IPA Berbasis Powerpoint Konsep Organ Pernapasan pada Manusia dan Hewan Kelas V Sekolah Dasar. *Indonesian Journal of Primary Education*, *3*(2), 16–27. https://ejournal.upi.edu/index.php/IJPE/article/view/21765.

Rosnaeni, R. (2021). Karakteristik dan Asesmen Pembelajaran Abad 21. *Jurnal Basicedu*, *5*(5), 4341–4350. https://doi.org/10.31004/basicedu.v5i5.1548.

Safitri, A., Rusmiati, M. N., Fauziyyah, H., & Prihantini. (2022). Pentingnya Memahami Karakteristik Peserta Didik Sekolah Dasar untuk Meningkatkan Efektivitas Belajar dalam Mata Pelajaran Bahasa Indonesia. *Jurnal Pendidikan Tambusai*, *6*(2), 9333–9339. https://jptam.org/index.php/jptam/article/view/3886.

Sari, I. P., Kartina, A. H., Pratiwi, A. M., Oktariana, F., Nasrulloh, M. F., & Zain, S. A. (2020). Implementasi Metode Pendekatan Design Thinking dalam Pembuatan Aplikasi. *Edsence: Jurnal Pendidikan Multimedia*, *2*(1), 45–55. https://www.academia.edu/download/66398690/pdf.pdf.

Sari, R. N., & Siswono, T. Y. E. (2020). Pengembangan Media Pembelajaran Matematika Berbasis Media Sosial Instagram Pada Materi Lingkaran Di SMP. *Jurnal Ilmiah Pendidikan Matematika*, *9*(1), 120–127. https://ejournal.unesa.ac.id/index.php/mathedunesa/article/download/32940/pdf.

Setiawan, A. (2020). Pengembangan Modul Pembelajaran Matematika Berbasis Masalah Untuk Meningkatkan Kemampuan Pemecahan Masalah Dan Kreativitas Siswa Kelas IV SD Di Gugus I Wonosari. *Journal Mathematics Education Sigma [JMES]*, *03*(1), 7–15. https://osf.io/preprints/inarxiv/ftyu6/.

Setiyarini, E., Wiyono, H. J., & Rahayuningsih, S. (2020). Profil Kemampuan Berpikir Kritis Siswa Dalam Memecahkan Masalah Matematika Ditinjau Gender. *Jurnal Ilmiah Pendidikan Matematika Volume*, *05*(01), 70–83. http://repository.unim.ac.id/1800/.

Simsek, M. R. (2020). Towards emancipatory L2 instruction: exploring significant learning outcomes from collabora-tive digital storytelling. *International Journal of Educational Methodology*, *6*(3), 555–569. https://doi.org/10.12973/ijem.6.3.555.

Suharti. (2021). Peningkatan Hasil Belajar IPA Materi Energi dan Perubahannya dengan Menggunakan Metode Proyek. *Journal of Education Informatic Technology and Science*, *3*(2), 51–60. https://doi.org/10.37859/jeits.v3i2.2799.

Taufik Ridwan, Afika, Endang Hidayat, Diky Zakaria, G. L. N. (2022). Pembuatan Big Book Digital Menggunakan Metode Design Thinking Untuk Media Pembelajaran Membaca Pada Anak. *Metodik Didaktik: Jurnal Pendidikan Ke-SD-An*, *17*(1), 30–34. https://ejournal.upi.edu/index.php/MetodikDidaktik/article/view/30289.

Triyono, A., Murdiasih, D., Tinggi, S., Ilmu, K., & Kusumanegara, P. (2023). *Meningkatkan Kemampuan Berpikir Siswa Kelas V Dalam Menyelesaikan Soal Cerita Matematika Melalui Pendekatan*. *3*(1), 51–64. https://doi.org/10.37680/basica.v3i1.3667.

Umardiyah, F. (2020). Penerapan Pembelajaran Konsrtuktivisme Menggunakan Media Benda Konkret untuk Meningkatkan Hasil Belajar Siswa Pada Materi Geometri Bangun Ruang di SDN Karangmojo II. *Eduscope*, *05*(02), 85–90. https://doi.org/10.32764/eduscope.v5i2.824.

Uslan, U., K, I. B., & Muh, A. S. (2018). Pengembangan Perangkat Asesmen Pembelajaran Proyek Pada Materi Perkembangbiakan Tumbuhan. *Jurnal Ilmiah Profesi Pendidikan*, *3*(1), 103–112.

https://doi.org/10.29303/jipp.v3i1.58.

Wibowo, D. C., Peri, M., Sairo Awang, I., Maro Rayo, K., & Persada Khatulistiwa Sintang, S. (2022). Analisis Kemampuan Berpikir Kritis Siswa Dalam Menyelesaikan SOAL Cerita Pada Mata Pelajaran Matematika. *Jurnal Ilmiah Aquinas*, *5*(1), 152–161. http://repository.persadakhatulistiwa.ac.id/454/1/1651-Article Text-4976-1-10-20220205.pdf.

Winarni, R., Slamet, S. Y., & Syawaludin, A. (2022). Development of Indonesian language text books with multiculturalism and character education to improve traditional poetry writing skills. *European Journal of Educational Research*, *10*(1), 455–466. https://doi.org/10.12973/EU-JER.10.1.455.