



Development of LKPD IPAS Using QR-Code with Discovery Learning Model to Improve Students' Critical Thinking Class V Elementary School

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Abstract: This study aims to develop a Science Student Worksheet (LKPD) based on QR-Code using the Discovery Learning model to enhance elementary students' critical thinking skills. The research employed a Research and Development (R&D) approach using the ADDIE model, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation. The developed LKPD was validated by material, media, and language experts, resulting in an average validity score of 92%, indicating it is "very valid." Practicality testing involved teachers and students, yielding scores of 93% and 95%, respectively, which fall under the "very practical" category. The effectiveness of the LKPD was assessed through pre-test and post-test results on students' critical thinking skills. The average post-test score reached 85.8, showing the LKPD effectively improved students' critical thinking. In addition, students showed high engagement when using the QR-Code feature, which provided easy access to additional digital learning resources. Overall, the QR-Code-based LKPD with the Discovery Learning model is valid, practical, and effective, making it a relevant instructional tool to support active learning and improve the quality of science education in elementary schools.

Keywords: Critical thinking; Discovery learning; Elementary school; LKPD; QR-Code

Introduction

Basic education plays an important role in forming the foundation of 21st century thinking skills which are essential for students' future lives (Putra et al., 2020). One of the main skills that must be developed from an early age is critical thinking skills (Nur DS- et al., 2024; Widayastuti, 2018). These skills enable students to analyze information, evaluate evidence, and make decisions logically and responsibly (Lusidawaty et al., 2020; Prasrihamni et al., 2022; D. R. Putri et al., 2025). Therefore, learning at the elementary school level is not enough to only emphasize mastery of concepts, but must

also be directed at developing high-level thinking skills that are contextual and applicable.

In the context of the Independent Curriculum, learning Natural and Social Sciences (IPAS) is an important tool in strengthening critical thinking skills (Dias-Oliveira et al., 2024; Fanani et al., 2025; Sartika et al., 2023). Science combines aspects of natural and social sciences, requiring students to understand phenomena, observe their surroundings, and find solutions to real problems in everyday life (Purba et al., 2023; Raja et al., 2025). Through this subject, students are encouraged to think scientifically and logically in dealing with various

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problems that are relevant to their world (Aminatun, 2023; Hermawati et al., 2025).

However, the reality on the ground shows that the science learning process in many elementary schools is still dominated by a conventional teacher-centered approach (Sartika et al., 2023; Taqiyah et al., 2023). Lecture methods and non-contextual written assignments are still common practices in teaching and learning activities (Changwong, 2018; Safitri et al., 2023). As a result, students tend to be passive and are not encouraged to explore information independently or develop their critical thinking skills optimally (Banat, 2023). The gap between learning approaches and curriculum demands is one of the causes of low literacy and critical thinking skills in elementary school students (Tanriverdi et al., 2010).

To answer these challenges, a more innovative and participatory learning approach is needed (Kamaluddin et al., 2019). One relevant learning model is Discovery Learning (Sihaloho 2023). This model emphasizes active student involvement in the process of discovering concepts through exploratory stages such as observing, collecting data, verifying, and concluding information (Aldalur et al., 2023). Through Discovery Learning, students not only become recipients of information, but also become active subjects who construct their own understanding through meaningful learning experiences (Yudho et al., 2023).

In science subjects, the application of the Discovery Learning model is very appropriate because the material presented is often closely related to natural and social phenomena in the surrounding environment (Taji et al., 2023). This model provides space for students to learn contextually, while fostering curiosity and critical thinking skills (Rizki et al., 2021). However, the implementation of Discovery Learning has not been fully optimal due to the limited learning media that can support students' discovery processes independently and collaboratively (Damayanti et al., 2024).

One of the learning media commonly used in elementary schools is the Student Worksheet (LKPD) (Kurnia et al., 2020). LKPD serves as a guide for student learning activities, both individually and in groups (Amijaya et al., 2018; Rizki et al., 2021). However, most of the LKPDs used are still conventional and only contain practice questions or written assignments without stimulating high-level thinking processes (Andayani, 2020; Ndruru, 2024). LKPD like this does not support exploration and does not facilitate students in actively discovering concepts, especially in the context of Discovery Learning which demands deeper cognitive involvement.

On the other hand, elementary school students today are accustomed to using digital technology in their daily lives (Hardika et al., 2024). They have a high

interest in visual and interactive content (Yeni et al., 2019). Therefore, the use of technology in learning can be the right strategy to bridge the needs of students with a more active learning approach. One form of technology integration that is practical and easy to use is through QR-Code, which allows students to access various digital learning resources directly and quickly.

The integration of QR-Code is an innovative solution that combines print and digital media (Rahmah et al., 2023). By scanning the QR-Code available in each section of the LKPD, students can connect with learning videos, interactive simulations, dynamic images, or digital quizzes relevant to the topic being studied (Widanti et al., 2024). This not only makes learning more interesting and enjoyable, but also provides a more in-depth and varied learning experience (Anggraeni et al., 2022). QR-Code also allows learning to be differentiated because students can learn according to their own pace and learning style (Utami et al., 2024).

QR-Code-based LKPDs designed according to the stages of Discovery Learning including stimulus, problem identification, data collection, data processing, verification, and generalization will help students build concepts through direct experience and rich sources of information (M. A. Putri et al., 2025). The use of this media encourages students to think critically when observing phenomena, asking questions, testing hypotheses, and concluding information found (Husna et al., 2023). The development of LKPD like this is not only an interesting learning tool, but also effective in supporting the strengthening of critical thinking competencies in accordance with the demands of the 21st century curriculum (Chalsum et al., 2023; Wahyuni et al., 2025).

Several previous studies have shown that technology-based learning media such as e-LKPD and QR-Code are effective in increasing student motivation, engagement, and learning outcomes (Pertiwi et al., 2022; Rahmawati & Suyatna, 2023). However, the development of IPAS LKPD, which explicitly combines the Discovery Learning model with QR-Code technology, is still very limited, especially at the elementary school level (Az-Zahra et al. 2025). Therefore, the development of this LKPD is expected to be an innovative, interactive, and contextual learning alternative, as well as being able to improve the critical thinking skills of grade V elementary school students optimally and sustainably.

Based on this description, it can be concluded that the development of learning media that is innovative, interactive, and in accordance with the characteristics and needs of elementary school students is needed. The development of QR-Code-based IPAS LKPD with the Discovery Learning model is a strategic solution to answer current learning challenges, especially in

improving students' critical thinking skills. The combination of discovery approaches and digital technology is expected to be able to create a learning experience that is fun, meaningful, and relevant to the world of students. Therefore, this research is important to produce a valid, practical, and effective LKPD product to be used in elementary school class V science learning.

Method

This research method uses a Research and Development (R&D) approach to design and test the effectiveness of QR-Code-themed Science LKPD with the Discovery Learning model in improving critical thinking skills of fifth grade elementary school students (Creswell, 2017; Latief, 2009). R&D method is used to produce educational products and test their effectiveness. R&D approach is a systematic process in designing, developing, and validating educational products (Sugiyono, 2019, 2020). In this context, the development of LKPD is aimed at creating innovative learning media that are interactive, contextual, and based on digital technology (QR-Code), and support critical thinking skills through the Discovery Learning stages. This study specifically examines the validity, practicality, and effectiveness of the LKPD developed.

The development of LKPD follows the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model. In the Analysis stage, identification of students' needs for interactive and contextual learning media, characteristics of grade V students, and the science curriculum that emphasizes high-level thinking skills is carried out.

Table 1. Instrument Validation Results

Aspect	Criteria	Average
Instrument	Clarity of filling instructions	4
	Indicators with development objectives	4
	Readability and understandability of items	5
	Relevance of indicators to the Discovery Learning model	5
	Compliance with critical thinking aspects	5
Amount		23.0
Average		4.60
Percentage		92%

In the instrument aspect, validation was conducted to measure the clarity and relevance of indicators with the development objectives. The assessment results showed an average score of 4.60 or 92%, which is included in the "Very Valid" category. This indicates that the assessment instrument used is appropriate for

evaluating the quality and effectiveness of LKPD, and reflects its relationship with the Discovery Learning model and students' critical thinking skills. The validity data of the research instrument can be seen in Table 1.

The media aspect is assessed based on visual quality, consistency of QR-Code usage, ease of navigation, and media suitability with Discovery Learning content. The results show an average score of 4.50 or equivalent to 90%. Although in the "Very Good" category, there are several suggestions for improvement from the validator, such as improving the visual layout and optimizing the use of QR-Code to enrich students' learning experience interactively. The data from the media validity test results are presented in table 2:

Table 2. Media Validation Results

Aspect	Criteria	Average
Media	Visual display quality and aesthetics	4.80
	Consistency of QR-Code usage	4.40
	Ease of LKPD navigation (structured, logical)	4.20
	Overall Function	4.60
Amount		18.0
Average		4.50
Percentage		90%

In terms of language, validation shows that the language used in the LKPD is in accordance with the level of cognitive development of elementary school students. The average score obtained was 4.57 or 91%, included in the "Very Good" category. The validator provided small notes regarding the use of terms to be more consistent and improvements to certain sentence structures to be more communicative for students. The data from the language validity test are presented in table 3.

Table 3. Language Validation Results

Aspect	Criteria	Average
Language	Language Suitability	4.60
	Clarity of sentences and grammatical structure	4.50
	Consistency of terms and spelling usage	4.60
Amount		13.7
Average		4.57
Percentage		91%

The material aspect shows an average score of 4.51 or 90%, placing it in the "Very Good" category. This assessment includes the suitability of the IPS material to the curriculum, the relevance of activities to the Discovery Learning approach, and the ability of the material to foster students' critical thinking skills. Suggestions for improvement provided include strengthening the relationship between sub-materials and enriching the real context so that students can more

easily relate the material to everyday life. The data from the material validity test results are presented in table 4.

Table 4. Material Validation Results

Aspect	Criteria	Average
Material	Suitability of IPAS material with the curriculum	4.60
	Relevance of activities to Discovery Learning	4.66
	QR-Code integration for concept reinforcement	4.50
	Critical thinking skills booster	4.40
	The relationship between sub-materials and the integration of content	4.30
	Meaningfulness and contextualization in everyday life	4.60
Amount		27.06
Average		4.51
Percentage		90%

Result and Discussion

The LKPD that has been declared valid and revised based on input from experts (validators) is then used in the learning process by conducting a practicality test on teachers and students. This study was conducted in April 2025 involving 26 students. The practicality test of teacher responses was carried out by four grade V teachers at SDN Balai Ahad which included 3 assessment aspects. The average assessment results given by educators were 93%. Referring to the practicality criteria category, the results of the practicality of educator responses are included in the "Very Practical" category. The results in table 5.

Table 5. Educator Practicality Test Results

Aspect	Criteria	Average
Practicality	Convenience	4.50
	Efficiency	5
	Benefit	4.50
Amount		14.0
Percentage		93%

Table 6. Practicality Test Results in Small Groups

Aspect	Name	Average
Small Group Test	KK	4.88
	MY	4.88
	TT	4.88
Average		4.88
Percentage		98%

The small group practicality test was conducted by 3 elementary school students with 17 assessments with the assessment results of 98% falling into the "Very Practical" category. The results of the small group practicality test can be seen in Table 6.

The large group practicality test was conducted by 23 students covering 16 aspects with an assessment result of 93% falling into the "very practical" category. The results of the large group practicality test can be seen in Table 7.

Table 7. Practicality Test Results in Large Groups

Aspect	Name	Average
Large Group Test	AB	4.35
	CD	4.28
	EF	4.40
	GH	4.50
	IJ	4.42
	KL	4.38
	MN	4.30
	OP	4.48
	QR	4.46
	ST	4.33
	UV	4.29
	WX	4.31
	YZ	4.27
	AY	4.36
	YW	4.25
	CA	4.39
PD	4.20	
EC	4.44	
YA	4.40	
AY	4.76	
YY	4.76	
Average		4.36
Percentage		93%

The results of the effectiveness of using the QR-Code patterned Science LKPD with the Discovery Learning model in basic science learning can be assessed as effective, both from the results of students' critical thinking skills. The assessment was carried out with a written test used as an instrument to measure the understanding of basic science concepts, so that it can be known to what extent students' competencies have increased after participating in learning with the QR-Code patterned Science LKPD with the Discovery Learning model. Data on the pre-test and post-test results of grade V students at SDN Balai Ahad can be seen in Table 8. The effectiveness results show that the QR-Code patterned Science LKPD with the Discovery Learning model has an effectiveness of 85.8 with a very effective category.

The validation results of the Student Worksheet (LKPD) by material, media, and language experts showed a validity level of 92%, placing the LKPD in the "very valid" category. This indicates that the LKPD has met quality standards in terms of content, grammar, and attractive and easy-to-use visual appearance. This success is in line with the opinion of Borg & Gall (1998) who stated that learning products must go through a validation process by experts to ensure the quality and

suitability of the material before being widely implemented. The practicality test involving teachers and students also obtained very satisfactory results, with practicality scores of 93% and 95%, respectively. In addition, the effectiveness results showed that the Science LKPD with a QR-Code pattern with the Discovery Learning model had an effectiveness of 85.8, which is categorized as very effective. These results are consistent with the theory of Muhajirah (2020) which emphasizes the importance of active and exploratory learning to improve high-level thinking skills, including critical thinking. The Discovery Learning model used in this LKPD allows students to learn independently and discover concepts through interactive learning resources, thereby significantly increasing their understanding and engagement.

Table 8. Student Effectiveness Test Results

Name	Pre test	Post test
AB	65	80
CD	50	65
EF	55	75
GH	30	50
IJ	50	65
KL	75	90
MN	60	80
OP	55	75
QR	40	60
ST	35	55
UV	45	70
WX	55	75
YZ	35	60
AY	70	80
YW	50	70
CA	50	75
PD	55	75
EC	70	85
YA	70	85
AY	80	90
YY	65	80
Amount	1425	1870
Percentage	57	85.8

The use of QR-Code as a motif and access to additional information in LKPD is an innovation that is very relevant to the development of current learning technology. QR-Code makes it easy for students to access digital learning resources quickly and attractively, Interactive multimedia can increase student motivation and learning effectiveness. In addition, the use of this technology also supports students' visual and kinesthetic learning styles, thus helping students who have different learning preferences to still be able to understand the material well (Mayer, 2024). The results of this study provide evidence that the development of LKPD with a technological approach and active learning models can have a significant positive impact on the

quality of learning at the elementary school level. Learning that integrates technology must continue to be developed in order to be able to adapt to the needs of today's digital generation (Efgivia et al., 2021). Therefore, it is recommended that developers of learning materials continue to develop more varied interactive features and conduct continuous evaluations to improve the quality and effectiveness of LKPD, especially in the context of improving students' critical thinking skills.

Conclusion

The development of the Science Student Worksheet (LKPD) themed with QR-Code and the Discovery Learning model was successfully implemented through systematic stages. Validation results from material, media, and language experts showed a validity level of 92%, placing the LKPD in the "very valid" category in terms of content relevance, language clarity, and visual design. The practicality test involving teachers and students yielded scores of 93% and 95%, respectively, indicating that the LKPD is very practical and user-friendly. Students showed enthusiasm when using the QR-Code feature, which facilitated independent learning and easy access to additional information. In terms of effectiveness, the average post-test score reached 85.8, indicating that the LKPD is highly effective in improving students' critical thinking skills. Overall, the QR-Code-based Science LKPD with the Discovery Learning model is valid, practical, and effective, making it a relevant and innovative learning tool to support active learning and improve the quality of elementary science education.

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Author Contribution

Conceptualization, R.Y and F.Y.J; methodology, R.Y and F.Y.J; validation, A.H and J.; formal analysis, UR; investigation, R.Y and F.Y.J; resources, R.Y and F.Y.J.; data curation, R.Y and F.Y.J; writing – original draft preparation, A.H and J; writing – review and editing, R.Y and F.Y.J; visualization, R.Y and F.Y.J All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

This research has no conflict of interest.

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