



Development of a Smart Box based on discovery learning to increase the learning interest of elementary school students

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Abstract

This study aims to develop Smart Box media for Natural and Social Sciences learning using the ADDIE model. A needs analysis revealed that students struggled with abstract concepts and required interactive media to enhance understanding. The Smart Box was designed as an interactive multimedia tool combining visuals, audio, and manipulative activities to support active learning. Validation by experts in media, material, and language showed high validity scores: media (88.33%), material (89.58%), and language (92.5%). These scores assess aspects of design, feasibility, accuracy, relevance, readability, and clarity. Field trials involving students yielded a very positive response with a score of 96%, evaluating comprehension, attractiveness, ease of use, and usefulness. The results indicate that the Smart Box media is feasible, engaging, and effective in improving student motivation, conceptual understanding, and active participation in social studies learning. This study suggests that Smart Box media has strong potential as an innovative learning tool, specifically for natural and social sciences in elementary education.

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1. Introduction

The learning process is a fundamental aspect of educational success, especially when students are actively involved in exploring, reflecting on, and understanding the subject matter. However, every student has a unique learning style, and to accommodate this diversity, the use of interactive and engaging learning media becomes crucial. As stated by Masdar Limbong et al. (2022), interactive media can cater to various learning styles and support students' interests and abilities, leading to more dynamic and enjoyable learning activities. Likewise, Jamilah and Faizah (2021) emphasized that interesting media can foster students' learning motivation and improve comprehension of the material presented.

In Islam, the importance of using effective means of communication in education is reflected in QS An-Nahl verse 44, which explains how messages are conveyed through clear signs and scriptures. The verse states: *"We have sent*



down to you the Qur'an, so that you may explain to mankind what has been revealed to them and so that they may think" (QS An-Nahl, 16: 44).

This verse highlights the significance of utilizing various tools to deliver messages clearly. In the context of 21st-century education, learning media serve not only as information delivery tools but also as means to motivate and impress upon students the values and knowledge being conveyed. According to Faizah and Khairiyah (2019), learning media act as intermediaries between teachers and students to facilitate communication and understanding.

Instructional media thus play a vital role in holistically developing elementary students' competencies. Through media, students are better able to concretize abstract concepts, relate learning to real-life situations, and cultivate critical and analytical thinking (Andriievaska, Olefirenko and Ostapenko, 2022). When aligned with students' developmental characteristics, engaging media can significantly improve motivation, participation, and learning outcomes (Ruma Bay *et al.*, 2022; Nasir and Fatonah, 2023). Moreover, active learning-based media help foster essential 21st-century skills such as creativity, collaboration, and communication (Israel and Juanillo-Tumamos, 2023).

In response to these needs, the Independent Curriculum in Indonesia emphasizes the importance of fostering student-centered learning environments by integrating 21st-century competencies. Teachers are expected to act as facilitators who accommodate individual differences through relevant and compelling media (Nofitasari *et al.*, 2023). Particularly in natural and social sciences learning, which merges science and social studies into one subject, the use of interactive media is crucial to promote project-based learning, inquiry, and meaningful engagement with students' daily experiences (Suhelayani *et al.*, 2023).

However, based on observations and interviews with the fourth-grade teacher at Madrasah Ibtidaiyah Al Hidayah Betoyo Kauman, one of the key challenges in implementing effective learning was the limited and monotonous use of media. Teachers primarily used video-based materials without integrating student-centered activities. As a result, students showed low motivation and passive behavior during lessons. This situation hindered the development of 21st-century skills such as critical thinking and communication (Saavedra and Opfer, 2012; Sujarwo, 2022).

A learning style questionnaire conducted among 21 students in the class revealed a diverse set of preferences: 48% were visual learners, 24% auditory, and 29% kinesthetic. This diversity highlights the need for inclusive learning media that actively involves students with different learning styles. Further, a media needs analysis indicated that 91.25% of students agreed or strongly agreed with the importance of developing Smart Box media to support their learning. These findings demonstrate the urgency of designing media that is

responsive, interactive, and capable of enhancing learning motivation and conceptual understanding.

Smart Box media has been widely studied and proven to be valid, practical, and impactful in enhancing the learning process. Studies by Sukaryanti et al. (2023) confirmed its feasibility and effectiveness, while Munawaroh et al. (2023) reported highly positive student responses. Similarly, Tirtoni et al. (2019) found that it improved student activity and critical thinking. These findings consistently support Smart Box as a promising tool for increasing student engagement and learning outcomes. Despite these strengths, no previous studies have integrated Smart Box with the Discovery Learning model. This research fills that gap by combining the interactive features of Smart Box with the inquiry-based approach of Discovery Learning to foster more active, independent, and meaningful learning experiences.

However, none of these previous studies have developed Smart Box media integrated with the discovery learning model. This is the novelty of the current research. The Smart Box developed in this study is a multimedia learning tool in the form of a cube, creatively designed like a gift box and embedded with the principles of discovery learning. In addition to providing engaging audiovisual content, this media is equipped with barcodes that link to websites containing material on cultural diversity. These features support students in independently exploring the learning material, thereby encouraging active participation and deepening understanding. The combination of interactive technology and discovery-based instruction makes this Smart Box a more innovative and student-centered learning medium compared to previous versions.

Discovery Learning is firmly grounded in constructivist theory, which emphasizes that learning is an active and student-centered process where learners construct knowledge through interaction with their environment and personal experiences (Saputro and Pakpahan, 2021; Quoc and Van, 2023). This model encourages higher-order thinking by guiding students through a series of inquiry-based steps: providing stimulation, identifying problems, collecting and processing data, verifying findings, and drawing conclusions (Prasetyo and Abduh, 2021). Designed to activate student involvement, Discovery Learning facilitates learning through exploration and self-investigation (Lee and Yeung, 2022). Integrating this model with Smart Box—an interactive, multimedia learning tool—empowers students to explore content more independently, thereby enhancing engagement and deepening conceptual understanding.

Therefore, this study aims to design and develop a Smart Box integrated with the Discovery Learning model to support fourth-grade learning on the *Indonesiaku Kaya Budaya* topic. It also seeks to evaluate the media's feasibility, attractiveness, and effectiveness in enhancing students' activity, independence, and conceptual understanding. The findings are expected to contribute to the

development of innovative learning media in elementary education and provide practical guidance for teachers in delivering meaningful and engaging science learning experiences.

2. Methods

This development research was conducted from January 7, 2024, to May 18, 2024, at Madrasah Ibtidaiyah Al Hidayah Betoyo, Manyar, Gresik, East Java, Indonesia. The research aimed to produce Smart Box media development products for class IV science learning that are both valid and interesting. This development research employs the ADDIE development model. The stages in the ADDIE model development research consist of five stages: analyze, design, develop, implement, and evaluate (Branson *et al.*, 1975; Branch, 2010).

Validation in this development research was obtained from learning material experts, learning design/media experts, and language experts. The experimental subjects in the research were 36 students as test subjects in three stages (5 children for individual trials, 10 children for small group trials, and 21 children for field trials) and science learning practitioners.

The instruments used to collect data in this development research are based on observations, interviews, and questionnaires using the four-point Likert scale formula (Pradana and Mawardi, 2021). Observations are conducted to identify classroom problems by focusing on students' attention, participation, and responses to current learning activities and media. Interviews with teachers and school staff explore topics such as the implementation of the learning process, the availability and use of media, and the characteristics and learning needs of students.

The questionnaires are designed to assess several aspects: (1) student characteristics, (2) expert evaluations (covering content accuracy, instructional design, language use, and media feasibility), (3) feedback from individual, small group, and field trials, and (4) the attractiveness and usability of the Smart Box media. All instruments are developed based on relevant literature and aligned with the research objectives. The instrument development process includes expert validation from specialists in educational media and subject content. Revisions are made based on expert input to ensure the relevance, clarity, and reliability of each item. Validated instruments are then tested with a small group of students and practitioners to evaluate their practicality and effectiveness before broader implementation.

The data analysis techniques used in this development research are qualitative descriptive analysis and quantitative descriptive analysis. The qualitative descriptive analysis was obtained from observations and interviews with respondents, presented as narratives containing critical feedback and suggestions. This input served as a basis for evaluating the development of the

Smart Box media in the science learning topic Indonesiaku Kaya Budaya for fourth-grade students. Meanwhile, the quantitative descriptive analysis was used to measure the validity level of the learning media. The validity of the Smart Box media for the Indonesiaku Kaya Budaya topic in grade IV was assessed by expert validators in the fields of subject content and media design.

The media validation data were obtained from experts who provided input to improve the developed learning media. These inputs were analyzed using percentage-based criteria of media feasibility (Meishinta *et al.*, 2023). The results of the validation were interpreted using the following qualifications: if the achievement level is below 40%, the media is categorized as "inadequate" and deemed not feasible, requiring major revisions. A score between 41% and 60% indicates a "sufficient" qualification, which also requires revision. If the achievement level reaches 61%–80%, the media is considered "good" and feasible, but still needs improvement. Meanwhile, a score between 81%–100% places the media in the "outstanding" category, meaning it is highly feasible and does not require revision (Astuti and Andayani, 2023). Likewise, media attractiveness was assessed based on percentage levels, with results categorized as follows: less than 40% is "poor" (not appealing), 41%–60% is "sufficient" (less appealing), 61%–80% is "good" (appealing), and 81%–100% is "outstanding" (exceptionally appealing) (Meishinta *et al.*, 2023).

3. Results

3.1 Analysis of students, media needs, learning objectives, and contents

The analysis stage was the initial phase conducted before designing the Smart Box media. The results of students' performance analysis, conducted through classroom observations at Madrasah Ibtidaiyah Al Hidayah Betoyo, revealed problems in the learning of natural and social sciences for fourth-grade students. The findings indicated limited and monotonous use of media, with learning primarily centered on teacher explanations. This led to students struggling to understand the material. The student analysis showed that many students had difficulty grasping abstract concepts.

The analysis of students' learning styles was conducted through a questionnaire consisting of three criteria: visual, auditory, and kinesthetic. The results showed that 10 students had a visual learning style, 5 were auditory learners, and 6 were kinesthetic learners. Furthermore, a needs analysis for learning media was carried out using a questionnaire. Of the 21 students, two "somewhat agreed", 15 "agreed", and 4 "strongly agreed" on the need for Smart Box learning media.

The analysis of learning objectives included identifying specific learning outcomes, goals, and achievement indicators for science learning in Chapter 6, Indonesiaku Kaya Budaya, for fourth-grade students. These objectives were then

used as the basis for media development. The material analysis covered three topics in Chapter 6: Topic A—unique habits of people in the local community, Topic B—Indonesia's cultural richness, and Topic C—the benefits and preservation of cultural diversity.

3.2 Design of Smart Box based on discovery learning

The second stage of the research involved the design phase, which aimed to formulate clear learning goals by aligning the instructional design with the needs identified during the previous analysis stage. At this point, the development focused on creating a product that highlights Indonesia's Kaya Budaya. To support students' understanding, the product was equipped with barcodes that link to interactive content, enabling learning through direct experience. The design also accommodated diverse learning styles, ensuring accessibility and engagement for all students.

The Smart Box was created using the Canva Pro application, which enabled the visual design of learning content in a rectangular format, later assembled into a physical box. Several steps were carried out during this stage. First, the development team determined the materials and dimensions for the media. The initial inner and outer design schemes are illustrated in Figures 2 and 3, which laid the foundation for the subsequent development stages.

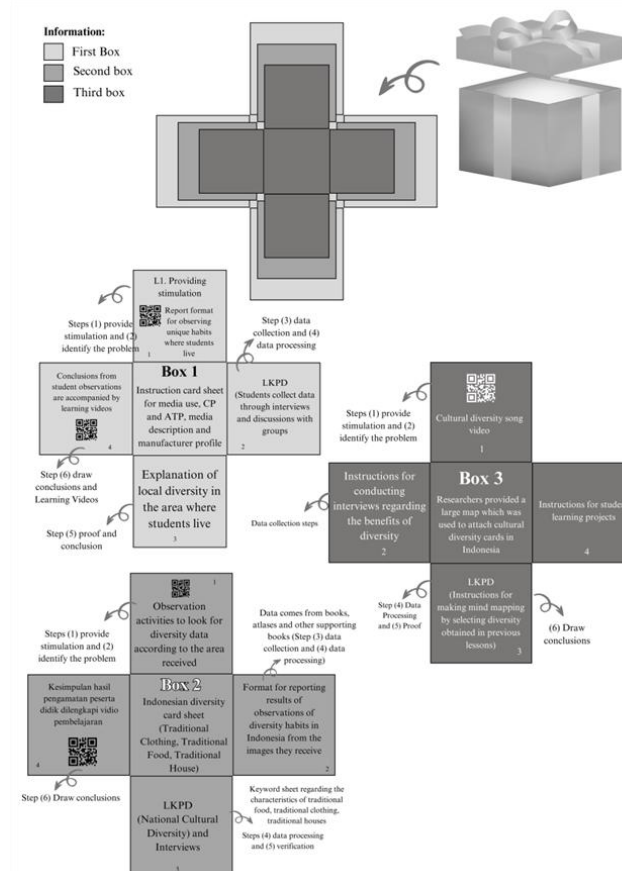


Fig. 1. Inner scheme of smart box media development.

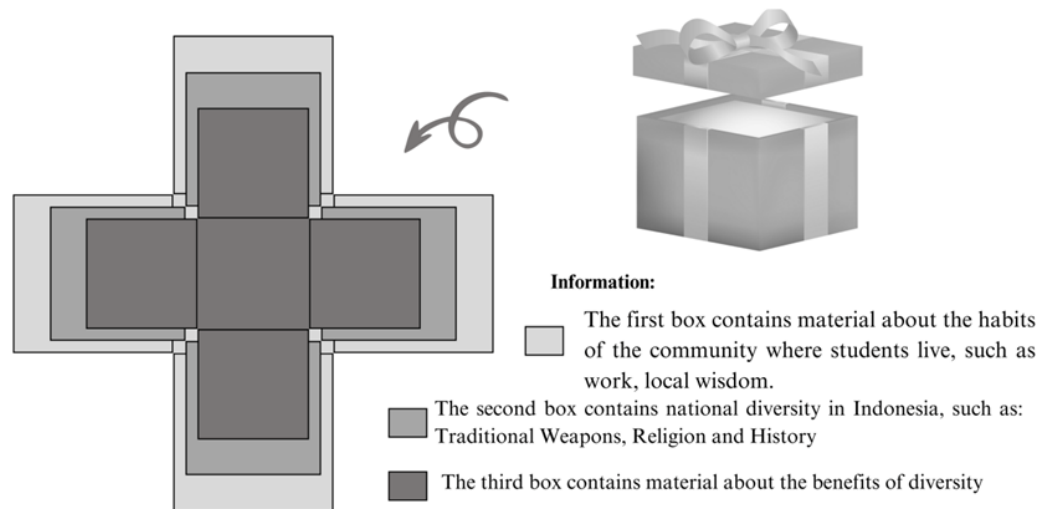


Fig. 2. Outer scheme of smart box media development.

After establishing the basic design, the team proceeded to compile the instructional content in accordance with the curriculum and targeted learning objectives, particularly those aligned with the Discovery Learning model. The content was adapted to suit the cognitive development of Grade IV elementary students and was presented in an engaging and interactive format. This was followed by the development of supporting features, including student activity sheets, clear instructions for media usage, and barcodes linked to animated educational videos that enrich the learning experience.

Next, a physical prototype of the Smart Box was produced using hardboard as the primary material. The completed exterior and interior appearances of the box are shown in Figure 4 and Figure 5, respectively. The final version of the media product is shown in Figure 6 and can be accessed via the following link: <https://bit.ly/Bahan-Media-SmartBox>.



Fig. 3. The outside of the Smart Box



Fig. 4. Inside the Smart Box



Fig. 5. Physical appearance of the Smart Box

To complete the design stage, an initial trial was conducted to evaluate the product's feasibility, visual and functional quality, and its effectiveness in enhancing students' comprehension. Each procedure in this stage was implemented systematically to ensure that the Smart Box was not only visually appealing but also a practical and effective learning tool that supports interactive, meaningful learning rooted in the richness of Indonesia's Kaya Budaya.

3.3 Development of the Smart Box based on discovery learning

The third stage of the research was the development phase, where the finalized product design—Smart Box—was realized and prepared for evaluation by expert validators. At this stage, both qualitative data (in the form of input and suggestions) and quantitative data (in the form of expert assessments) were collected to determine the feasibility of the media.

The validation process involved three experts: a subject matter expert, a media expert, and a language expert. As shown in Table 1, the subject matter expert awarded the Smart Box a score of 43 out of a maximum of 48, yielding a validity percentage of 89.6%, which falls under the "very feasible" category. The expert highlighted that the content was well-organized, coherent across subtopics, and aligned with the intended learning objectives. Furthermore, the

media was noted to stimulate students' interest and motivation effectively. Some minor improvements were recommended, particularly regarding color combinations and sentence formulation, but the overall content quality was deemed high.

Table 1.

Validation results by subject matter expert

Indicator	No.	Aspect	Score
Appropriateness	1	Background design	4
	2	Clarity and color combination	3
Presentation	3	Material presentation across sub-chapters reflects coherence and meaning	4
	4	Relevance of the learning video as a medium to deliver messages	3
	5	The Smart Box media increases students' interest and motivation	4
Language	6	Language is clear and easy to understand	4
	7	Language use complies with standard Indonesian grammar rules	4
	8	Language used is communicative	3
	9	Sentence construction is accurate, effective, and efficient	3
	10	Sentences are unambiguous and avoid multiple interpretations	3
Competency	11	Content is aligned with learning objectives	4
	12	Learning material develops cognitive, affective, and psychomotor domains	4
Total Score			43
Maximum Score			48
Percentage			89.6%

In terms of visual and technical design, the media expert's evaluation also resulted in a strong rating. As seen in Table 2, the media received a score of 53 out of 60, translating to an 88.3% validity, which is again classified as "very feasible." The evaluation considered aspects such as background design, clarity of visuals, text layout, and usability. According to the media expert, Smart Box was user-friendly and appealing for students working both individually and in groups. Nevertheless, there was still room for improvement, particularly in optimizing the visual layout of texts and enhancing the appeal of the video content.

Table 2.

Validation results by media expert

Indicator	No.	Aspect	Score
Media Display	1	Background design	4
	2	Clarity and color combination	4
	3	Smart Box video engages students	3
	4	Proper text layout	3
Text, Image, and Video Quality	5	Appropriate font type selection	4
	6	Appropriate font size	3
	7	Text is visible and legible	4
	8	Image size is appropriate	4
	9	Images are clear and properly positioned	4
	10	The video is engaging and not distracting	3
Media Quality	11	Media is easy to maintain and manage	3
	12	Media can be used over an extended period	3
	13	Media is well-received by students and teachers	3
Usability	14	Smart Box is easy to use individually or in groups	4
	15	Instructions for general use and practice questions are clear and understandable	4
Total Score			53
Maximum Score			60
Percentage			88.3%

Table 3.

Validation Results by Language Expert

Indicator	No.	Aspect	Score
Linguistic Accuracy	1	Uses clear and comprehensible spelling	3
	2	Grammar follows standard rules	4
	3	Vocabulary aligns with language standards	4
	4	Sentences are accurate, effective, and efficient	3
Clarity	5	Sentence structure effectively conveys information	4
	6	Terminology and sentence consistency	3
Communicative Value	7	The message and information are clearly understood	4
Developmental Appropriateness	8	Matches students' intellectual development	4
	9	Matches students' emotional development	4
	10	Encourages student motivation and critical thinking	4
Total Score			37
Maximum Score			40
Percentage			92.5%

Regarding language use, the **language expert** awarded a score of 37 out of 40, equivalent to a **92.5% validity** (see **Table 3**). This high score indicated that the language used in Smart Box was clear, appropriate, and matched the

developmental stage of elementary students. The expert emphasized the grammatical accuracy, clarity of vocabulary, and sentence structure, all of which effectively conveyed educational messages without causing ambiguity. The language also contributed positively to fostering students' motivation and critical thinking skills.

Table 1.

Expert validator input and suggestions

No	Expert Validator	Feedback and Suggestions
1	Material Expert Validator	Improve Mind Mapping format
		Add some other local diversity to the student environment
		You can add the Palapa Oath, Youth Pledge, as Indonesia's national diversity
		Please make use of the outer box with additional materials, so it is not empty
2	Media Expert Validator	Use waterproof materials
		Differentiate the designs for each theme/topic
		Create a place to put diversity cards
		Include maps in learning media
		Provide a learning flow on how to use the media
3	Linguist Validator	Reduce the media size if each group gets media, and if the media is enlarged, then 1 class of 1 media is enough
		Spelling can be refined

To enrich the qualitative aspect of validation, inputs and suggestions from all three validators were compiled and presented in Table 4. For example, the subject matter expert suggested refining the mind mapping format by incorporating additional local cultural elements, such as the Palapa Oath and the Youth Pledge, to represent national diversity and utilizing the outer box area for supplementary materials. The media expert recommended using waterproof materials, differentiating the design for each topic, adding a compartment for diversity cards, including a map, and offering clear guidance on how to use the media. Furthermore, it was advised to adjust the media size depending on the usage context—whether for group or whole-class instruction. Meanwhile, the language expert advised improvements in spelling accuracy.

Based on these qualitative inputs, the Smart Box media was revised to enhance both content and presentation aspects. The final version of the product, along with images and supporting materials, can be accessed through the following link: <https://bit.ly/Bahan-Media-SmartBox>. The final version of the Smart Box media, including product images, can be accessed via the following link: <https://bit.ly/Bahan-Media-SmartBox>.

3.4 Implementation of the Smart Box based on discovery learning

The fourth stage of the development process involved implementing the Smart Box media within the Discovery Learning model, which consists of six structured steps: stimulation, problem statement, data collection, data

processing, verification, and generalization. Each stage was facilitated by interactive components of the Smart Box designed to foster active engagement and support conceptual understanding in Natural and Social Sciences. To assess the feasibility and appeal of the media, three sequential trials were conducted: an individual trial with five students, a small group trial with 10 students, and a field trial involving 21 students. These evaluations aimed to gather student feedback on visual design, content clarity, video quality, and overall learning experience, with the results summarized in Table 5.

The individual trial generated a total score of 189 out of 200 (94.5%). This was followed by 385 out of 400 (96%) in the small group trial and 804 out of 840 (96%) in the field trial. These consistently high percentages suggest that the Smart Box was positively received in terms of visual appeal, clarity of text, and the engaging nature of the videos. Students also indicated that the media enhanced their understanding of Natural and Social Sciences content, increased their learning motivation, and helped them apply it to various other learning topics. In addition, the language used in the media was considered age-appropriate and easy to understand. At the same time, the student worksheet activities were reported to be user-friendly and accessible both individually and in group contexts. As shown in Table 5, these findings confirm that Smart Box is an effective and engaging instructional medium that aligns well with the Discovery Learning model.

Table 5.

Smart Box media appeal trial results

No	Evaluation Aspect	Individual Trial	Small Group Trial	Field Trial
1	Smart Box media appearance is attractive in Natural and Social Sciences learning	19	39	84
2	Content and text are straightforward to read	20	40	82
3	Videos are clear, funny, and engaging	18	36	73
4	Smart Box makes it easier to understand Natural and Social Sciences material	19	39	82
5	Learning with Smart Box is very enjoyable	19	38	81
6	Smart Box applies to other learning topics	18	40	81
7	The language used is easy to understand	19	38	81
8	Smart Box increases learning motivation	20	40	81
9	Smart Box is accessible individually and in groups	20	37	79
10	Student worksheet activities are easy to follow	18	39	80
Total Score		189	385	804
Percentage		94,5%	96%	96%

The implementation of the Smart Box-based Discovery Learning media in Integrated Natural and Social Sciences learning was achieved through a series of activities that integrated all stages of Discovery Learning into the media's structure. In the initial stage, students were provided with stimulating questions

related to the daily habits and traditions within their communities, encouraging them to collaboratively identify problems. They then watched animated videos on local wisdom accessed via barcodes embedded in the Smart Box and used a drawing to determine specific topics about community practices in Betoyo Village. Through group discussions, students identified issues related to local wisdom in their surroundings based on the topic obtained from the drawing.

The next phase involved data collection, during which students explored the topic further using guidance provided in the third worksheet inside the Smart Box. They interviewed teachers or local resource persons to verify their preliminary findings. Subsequently, students analyzed the information collected, discussed it with their peers, and formulated logical explanations, thereby constructing new knowledge. Verification was carried out by comparing the analyzed data with the initial identification results to ensure the accuracy of their conclusions. Once all groups completed the process, students took turns presenting their findings, followed by a joint reflection session led by the researcher to draw overarching conclusions. To consolidate the learning outcomes, a final instructional video was played, reinforcing the key concepts discussed throughout the activity.

Overall, the integration of Smart Box media within the Discovery Learning model not only provided an engaging and interactive learning experience but also encouraged students to explore, verify, and conclude their own understanding of local wisdom. This process effectively strengthened both their conceptual grasp of Integrated Natural and Social Sciences content and their appreciation for the cultural values embedded within their community contexts.

3.5 Evaluation of the Smart Box based on discovery learning

The evaluation of the Smart Box media development was conducted formatively at each stage of the ADDIE model. During the analysis stage, observations and questionnaires revealed that students struggled to understand cultural diversity material because the learning was unengaging and the use of concrete media was limited. In the design stage, the initial development of the Smart Box media for social studies was carefully aligned with the learning materials and objectives. The researcher conducted an internal evaluation to ensure that the media design integrated the discovery learning syntax, promoting active student engagement. Consideration was also given to the physical size of the media, ensuring it was representative and practical for classroom use.

The development stage involved validation by content, media, and language experts, resulting in feasibility scores of 91.66%, 87.5%, and 90%, respectively, all categorized as highly feasible. Subsequently, during the implementation stage, evaluations were conducted through individual trials, small group tests, and field trials, achieving feasibility percentages of 92.5%, 91.25%, and 90.31%, respectively. Thus, evaluations at every stage demonstrate that the Smart Box

media is feasible and engaging for teaching Natural and Social Sciences on the topic of Indonesia Kaya Budaya, based on local wisdom, in elementary schools.

4. Discussion

The Smart Box media was developed based on the results of identifying learning barriers and student needs through the analysis stage. The results of the observation indicate that classroom learning is one-way and lacks engaging media, leading students to be passive and struggle to understand the material. Akrim (Akrim, 2018) emphasizing that learning effectiveness increases if the media is adjusted to the real conditions of the classroom. This is in line with (Kanade and Achat, 2024) which emphasizes the importance of early analysis to bridge the gap between learning practice and expected goals. Comprehensive initial analysis also allows for timely interventions to improve student success and retention (Romero and Ventura, 2019).

In addition, the results of the analysis show a diversity of student learning styles—visual, auditory, and kinesthetic—that demand a multisensory approach. These findings are an essential basis in the design stage. Alzboun et al. (2023) stated that media suitable for learning styles can improve concentration and learning outcomes. In line with that, Ginting et al. (2024) emphasizes that adaptive design encourages active participation and cognitive reinforcement. Thus, Smart Boxes are designed as a flexible, multimodal system capable of accommodating the diverse learning styles in elementary schools.

From a physical and technical point of view, Smart Boxes were developed by paying attention to proportional size, shape, and visual appearance. This ergonomic design facilitates interaction and increases student motivation in learning (Syafar, Gani and Agung, 2023; Utami, Triutami and Ningsih, 2023; Castro *et al.*, 2025). Clear visualization and good text layout also support emotional engagement and information retention (Baeva, 2024; Mohamed, 2025), this combination ultimately fosters critical thinking, deep processing, and meaningful learning outcomes (Özgür and Altun, 2021; Tusupbekova and Aituganova, 2024).

The language used in the Smart Box is structured communicatively and tailored to the cognitive stage of elementary school students, making it easy to understand and free of ambiguity. This is important because effective language can improve literacy and critical thinking skills by providing authentic, engaging, and culturally relevant experiences (Yingsoon *et al.*, 2025). A simple sentence structure also serves to prevent misconceptions in understanding concepts (Gambino and Share, 2023).

At the validation stage, experts provide recommendations for improvement from cultural and technical aspects. Suggestions such as adding elements of local wisdom in learning media help students connect academic concepts with

their cultural background, reinforcing their identity and pride in their heritage (Aulia *et al.*, 2024; Setyowati, Hendratno and Sukartiningsih, 2024). This also indicates that the media is suitable for use in learning, as it has fulfilled the aspects of cultural relevance, design clarity, and effective media functionality (Faradila and Purwati, 2025). Meanwhile, technical inputs related to waterproof materials and design variations ultimately support the goals of continuous learning and media user engagement. The validation results indicate that Smart Boxes are very feasible and do not require major revisions.

The Implementation Stage shows that Smart Boxes effectively support Integrated Natural and Social Sciences learning through the Discovery Learning model. The combination of videos, images, and a student worksheet helps students learn in multiple ways, increasing motivation and retention (Jiang *et al.*, 2023; Rohi and Nurhayati, 2024; Nursolikin, Ismiyanti and Yustiana, 2025). In addition, the development of this media refers to the Constructivist learning theory, which states that learning is formed through relevant and real learning activities, thus allowing students to connect new information with the knowledge that they already have before (Husamah *et al.*, 2020; Pramusinta and Faizah, 2021).

At the Evaluation stage, the trial results showed that Smart Boxes were considered attractive, easy to use, and effective in increasing students' motivation and learning independence. This is in line with the research of Irianti *et al.* (2025), Prasetyaningrum *et al.* (2025) and Fatimah *et al.*, (2025) Which shows that easy-to-understand visual media increases student focus and engagement. Based on the overall stage of ADDIE, Smart Boxes have proven to be feasible, valid, and effective as an innovative and relevant Natural and Social Sciences learning medium to the needs of elementary school students.

The implementation of Smart Boxes in Natural and Social Sciences learning is carried out through the six-step Discovery Learning process. At the stimulation stage, the researcher begins learning by asking a triggering question about the benefits of diversity. This stage aims to foster students' curiosity so that they are encouraged to find answers to the problems posed by themselves (Grigorescu, 2022; Edwards and Robichaux-Davis, 2025). Providing stimuli in the form of open-ended questions promotes independent learning (Ma and Cai, 2024). In addition, this strategy fosters curiosity as a prerequisite for critical thinking in discovery-based learning (Hunaepi *et al.*, 2021; Farji-Brener, 2025).

Furthermore, the activity continued on the problem statement step. At this stage, students and their groups sing songs of cultural diversity accessed through barcodes and discuss to identify the benefits and ways to preserve culture. This process helps students recognize and formulate problems that they will solve independently (Davis, 2019; Arellano and Yáñez, 2020). Through collaborative activities like singing and discussing the benefits and methods of preserving

culture, students' cultural awareness is enhanced. They are encouraged to reflect on local cultures, enabling them to relate the concepts learned to the surrounding cultural context (Beynon and Lang, 2018; Lozano Ramírez *et al.*, 2023). This activity also strengthens the sense of belonging to the learning process, increases student motivation, and encourages collaboration effectively (Lee, 2019).

The next stage is data collection, where students work on student worksheet and conduct interviews with the community around the school to gather as much information as possible about the benefits and ways to preserve culture. This activity encourages students to develop scientific thinking skills and social skills through exploratory activities (Sunariyati, Suatma and Miranda, 2019; Munira, Mulyadi and Ramadhan, 2024). This finding also reflects a more participatory learning model oriented toward the development of students' social character (Rizal *et al.*, 2025), as students are actively involved in real-world interactions and collaborative inquiry. In addition, this stage enriches the educational experience and contributes to preserving cultural heritage for future generations (Kasi *et al.*, 2024).

After that, the activity continued to the data processing step, where students in groups analyzed the collected information to identify the factors of diversity in Indonesia. At this stage, learners learn to analyze information critically, leading to a deeper understanding of the subject matter (Hardiati and Muthi, 2025; Zufiyardi, Ayuni and Resti, 2025). These findings are in line with Information Processing Theory, encouraging students to organize data systematically, improve their cognitive abilities, and promote meaningful learning, ultimately leading to a more comprehensive understanding of the material (Wang, 2021). Through this activity, students are trained to think logically and formulate evidence-based arguments (Shargel and Twiss, 2019; Sharma *et al.*, 2022).

The next stage is verification. At this stage, learners re-check their answers and create a work *Mind Map* based on the data obtained, starting from topic A to topic C according to the format on the Smart Box media. The proofreading process helps students ensure their findings are aligned with the facts, promoting deeper engagement and intrinsic motivation in evaluating and using evidence effectively (Kirch, 2015; Affognon, 2024). Making activities, such as *Mind Mapping*, also trains students to structure information visually and improve their memory of the concepts learned (Sbaa *et al.*, 2022; Rai and Kaur, 2024).

Finally, the learning activity reaches the step of concluding (generalization), where each group presents the results of their Mind Mapping and collectively concludes their findings on the benefits and methods of preserving culture. This stage is important for building reflective abilities and communicating learning outcomes to others (Karpin and Mahmudatussa'adah, 2022; Mäeots *et al.*, 2016). Through the presentation process, students strengthen conceptual

understanding while developing communication skills (Praveena *et al.*, 2025). Ultimately, students discover principles for themselves that can be applied in real life, making learning more meaningful and contextual (Hakim, Sariyatun and Sudiyanto, 2018).

5. Conclusion

This study successfully developed the Smart Box learning media based on the Problem-Based Learning approach, following the ADDIE model stages of analysis, design, development, implementation, and evaluation. The media was specifically designed for the science topic Indonesia Kaya Budaya aimed at fourth-grade students. Validation results showed high quality, with material validity at 89.5%, media/design validity at 88.33%, and language validity at 92.5%. Moreover, the Smart Box media received an average attractiveness score of 96%, classified as very attractive. These results indicate that the Smart Box media is highly valid, engaging, and suitable for supporting the learning process of grade IV students at Madrasah Ibtidaiyah Al Hidayah Betoyo, Manyar, Gresik.

The implications of this research suggest that the Smart Box media effectively enhances student engagement, facilitates understanding of complex scientific concepts, and promotes critical thinking and collaborative learning through interactive problem-based activities. These findings contribute to educational knowledge by showing that interactive media based on local culture can support science learning in elementary schools. In teaching practice, Smart Box media can help teachers create more active, meaningful, and student-centered learning experiences while improving students' understanding and collaboration skills. This media also offers an innovative learning resource that supports the implementation of the Merdeka Curriculum through adaptive learning connected to local cultural richness.

However, this study has some limitations. The Smart Box media development was limited to science content centered on the Indonesia Kaya Budaya topic. Its application was confined to fourth-grade students, and the physical size of the media is not yet optimal for use in larger groups or broader classroom contexts. Future research is encouraged to broaden the content scope, adapt the media for other grade levels, and improve its scalability to maximize its effectiveness in diverse learning environments.

References

- Affognon, D. (2024). How to Teach Students What Constitutes Scientific Evidence. *Journal of Studies in Education*, 14(4), 49. <https://doi.org/10.5296/jse.v14i4.22249>
- Akrim, M. (2018). Media Learning in Digital Era. *Proceedings of the 5th International Conference on Community Development (AMCA 2018)*. <https://doi.org/10.2991/amca-18.2018.127>
- Alzboun, M. S., Halalsheh, N. Z., Alslaiti, F. M., Aldreabi, H., & Dahdoul, N. K. S. (2023). The Effect of Digital Content Designed Based on Learning Styles on Academic Achievement and Motivation toward Learning. *International Journal of Education in Mathematics, Science and Technology*, 11(6), 1405–1423. <https://doi.org/10.46328/ijemst.3750>
- Andriievskaya, V., Olefirenko, N., & Ostapenko, L. (2022). Media Texts as a Basis of Formation of Primary School Students' Media Literacy. *Open Educational E-Environment of Modern University*, 13, 104–113. <https://doi.org/10.28925/2414-0325.2022.138>
- Arellano, E. F., & Yáñez, J. C. (2020). Uma Aproximação à Forma Como os Alunos do Ensino Primário Formulam Problemas. *Revista de Educação Matemática*, 17, e020015. <https://doi.org/10.37001/remat25269062v17id257>
- Astuti, D. G., & Andayani, S. W. (2023). Pengembangan Bahan Ajar Berbasis Audio Visual pada Mata Pelajaran Boga Dasar. *Jurnal Keluarga*, 09(01), 1–11. <https://doi.org/https://doi.org/10.30738/keluarga.v9i1.12913>
- Aulia, N. D., Pratiwi, A., Nuri, A. Y., Rahmah, R., Nasution, A. M., & Yusnaldi, E. (2024). Integrasi Kearifan Lokal dalam Pembelajaran IPS di SD Untuk Membentuk Karakter Cinta Budaya. *Education Achievement: Journal of Science and Research*, 6(1), 29–39. <https://doi.org/10.51178/jsr.v6i1.2232>
- Baeva, D. (2024). Analysis of Information Visualization Approaches by Combining Text and Images. *Strategies for Policy in Science and Education*, 32(5s), 133–139. <https://doi.org/10.53656/str2024-5s-13-ana>
- Beynon, C., & Lang, J. (2018). The More We Get Together, The More We Learn: Focus on Intergenerational and Collaborative Learning Through Singing. *Journal of Intergenerational Relationships*, 16(1–2), 45–63. <https://doi.org/10.1080/15350770.2018.1404405>
- Branch, R. M. (2010). *Instructional Design: The ADDIE Approach*. Springer.
- Branson, R. K., Rayner, G. T., Cox, L., Furman, J. P., King, F. ., & Hannum, W. H. (1975). *Interservice Procedures for Instructional Systems Development*. National Technical Information Service.
- Castro, A., Díaz, B., Aguilera, C., Prat, M., & Chávez-Herting, D. (2025). Identifying Rural Elementary Teachers' Perception Challenges and

- Opportunities in Integrating Artificial Intelligence in Teaching Practices. *Sustainability*, 17(6), 2748. <https://doi.org/10.3390/su17062748>
- Davis, W. S. (2019). The Problem Statement. In *The Information System Consultant's Handbook* (pp. 87–90). CRC Press. <https://doi.org/10.1201/9781420049107-12>
- Edwards, C., & Robichaux-Davis, R. (2025). Stimulating Curiosity in Mathematics. *Mathematics Teacher: Learning and Teaching PK-12*, 118(9), 650–652. <https://doi.org/10.5951/MTLT.2025.0266>
- Faizah, S. N., & Khairiyah, U. (2019). *Perencanaan Pembelajaran*. CV. Pustaka Djati.
- Farji-Brener, A. G. (2025). Stimulating Curiosity and Critical Thinking: the Legacy of William Eberhard. *Animal Behaviour*, 221, 122748. <https://doi.org/10.1016/j.anbehav.2023.10.001>
- Fatimah, H. A., Annisa, A. Z., Seftiyani, A., & Jubaedah, S. (2025). Penggunaan Media Pembelajaran Visual dalam Meningkatkan Motivasi Belajar Bahasa Inggris pada Siswa Sekolah Dasar. *Jurnal Padamu Negeri*, 2(4), 106–112. <https://doi.org/10.69714/9zp8gg36>
- Faradila, M. A. and Purwati, P. D. (2025) 'Developing an E-Big Book Assisted Global Method to Improve Information Narrative Text Comprehension among Elementary School Students', *Journal of Integrated Elementary Education*, 5(2), 304–322. <https://doi.org/10.21580/jieed.v5i2.25937>
- Gambino, A., & Share, J. (2023). Critical Media Literacy and Second Language Acquisition. In R. J. Tierney, F. Rizvi, & K. Ercikan (Eds.), *International Encyclopedia of Education (Fourth Edition)* (Fourth Edi, pp. 76–85). Elsevier. <https://doi.org/https://doi.org/10.1016/B978-0-12-818630-5.07072-X>
- Ginting, D., Sabudu, D., Barella, Y., Madkur, A., Woods, R., & Sari, M. K. (2024). Student-centered learning in the digital age: in-class adaptive instruction and best practices. *International Journal of Evaluation and Research in Education (IJERE)*, 13(3), 2006. <https://doi.org/10.11591/ijere.v13i3.27497>
- Grigorescu, D. (2022). The Neurobiology of Curiosity as a Lesson for Teachers. *Jus et Civitas – A Journal of Social and Legal Studies*, 73(1), 1–7. <https://doi.org/10.51865/JETC.2022.01.01>
- Hakim, M. F. Al, Sariyatun, S., & Sudiyanto, S. (2018). Constructing Student's Critical Thinking Skill through Discovery Learning Model and Contextual Teaching and Learning Model as Solution of Problems in Learning History. *International Journal of Multicultural and Multireligious Understanding*, 5(4), 175. <https://doi.org/10.18415/ijmmu.v5i4.240>
- Hardiati, S. P., & Muthi, I. (2025). Penggunaan Media Peta dalam Metode Discovery Learning untuk Meningkatkan Pemahaman Materi Kenampakan Alam Indonesia pada Siswa Kelas V Sekolah Dasar. *Jurnal Arjuna : Publikasi*

- Ilmu Pendidikan, Bahasa Dan Matematika*, 3(5), 28–43.
<https://doi.org/10.61132/arijuna.v3i5.2273>
- Hunaepi, H., Ikhsan, M., Suwono, H., & Sulisetijono, S. (2021). Curiosity in Learning Biology: Literature Review. *Prisma Sains : Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, 9(2), 343.
<https://doi.org/10.33394/j-ps.v9i2.4272>
- Husamah, Pantiwati, Y., Restian, A., & Sumarsono, P. (2020). *Belajar dan Pembelajaran* (3rd ed.). UMM Press.
- Irianti, A. et al. (2025) 'Pengembangan Media Pembelajaran Berbasis Video Animasi Menggunakan Powtoon Pada Mata Pelajaran Matematika Kelas V di MI Roudlotul Khuffadz', *Jurnal Petisi (Pendidikan Teknologi Informasi)*, 6(2), pp. 184–196. <https://doi.org/10.36232/jurnalpetisi.v6i2.360>
- Israel, G. F. G., & Juanillo-Tumampos, M. L. F. (2023). Influence Of Spiral Progression Approach And Use of Instructional Media in Teaching Science on the 21st Century Learning Skills Amid Covid-19. *International Journal of Research Publications*, 130(1).
<https://doi.org/10.47119/IJRP1001301820235313>
- Jamilah, N. H., & Faizah, S. N. (2021). Efektivitas Lembar Kerja Peserta Didik Elektronik Berbasis Problem Based Learning di Era New Normal Terhadap Hasil Belajar Tematik. *BASICA: Journal of Arts and Science in Primary Education*, 2(2), 63. <https://doi.org/10.37680/basic.v2i2.2044>
- Jiang, H., Hu, Y., Yan, Z., Zhou, S., Yan, N., Wang, J., Chen, X., & Wu, M. (2023). Analysis of the Advantages and Disadvantages of Multi-Modal Teaching - a Programming Course as an Example. *2023 5th International Conference on Decision Science & Management (ICDSM)*, 292–297.
<https://doi.org/10.1109/ICDSM59373.2023.00066>
- Kanade, P. G., & Achat, P. (2024). Early Prediction on Students Performance. *International Journal of Advanced Research in Science, Communication and Technology*, 266–270. <https://doi.org/10.48175/IJARSCT-22240>
- Karpin, K., & Mahmudatussa'adah, A. (2022). Learning Reflections to Build Learner Autonomy. *Invotec*, 18(1), 32–40.
<https://doi.org/10.17509/invotec.v18i1.30172>
- Kasi, Y. F., Widodo, A., Samsudin, A., Riandi, R., Novia, N., Sukmawati, W., & Shidiq, A. S. (2024). Integrating Local Science and School Science: The Benefits for Preserving Local Wisdom and Promoting Students' Learning. *Paedagogia*, 27(1), 24. <https://doi.org/10.20961/paedagogia.v27i1.83925>
- Kirch, S. A. (2015). Teaching and Learning the Purpose of Evidence for Knowledge and Knowing. *The Reading Teacher*, 69(2), 163–167.
<https://doi.org/10.1002/trtr.1396>
- Lee, J. (2019). Sense of Belonging in Context: How Different Online Discussion

- Modes and Students' Engagement Are Interconnected. *Proceedings of the 2019 AERA Annual Meeting*. <https://doi.org/10.3102/1443752>
- Lee, J. S. Y., & Yeung, C. Y. (2022). Assisted Discovery-based Learning for Literature Studies. *Innovations in Education and Teaching International*, 59(5), 543–554. <https://doi.org/10.1080/14703297.2021.1916567>
- Limbong, M., Firmansyah, Fahmi, F., & Khairiah, R. (2022). Sumber Belajar Berbasis Media Pembelajaran Interaktif di Sekolah. *Decode: Jurnal Pendidikan Teknologi Informasi*, 2(1), 27–35. <https://doi.org/10.51454/decode.v2i1.27>
- Lozano Ramírez, K., Munevar Rodríguez, D. S., Herrera Mateus, M. R., & Bernal Hernández, A. A. (2023). Problem-based Learning Activities as a Promotion of Local Cultural Awareness in A1 English Students. *Mextesol Journal*, 47(4), 1–10. <https://doi.org/10.61871/mj.v47n4-10>
- Ma, Y., & Cai, J. (2024). Teaching Mathematics through Problem Posing: four Practices for Handling Students' posed Problems. *Revemop*, 6, e2024009. <https://doi.org/10.33532/revemop.e2024009>
- Mäeots, M., Siiman, L., Kori, K., & Pedaste, M. (2016). Relation between Students' Reflection Levels and Their Inquiry Learning Outcomes. *8th International Conference on Education and New Learning Technologies*, 5558–5564. <https://doi.org/10.21125/edulearn.2016.2324>
- Meishinta, M., Farisma, S., Perdana, F. P., Munawwar, M. Z., & Apriani, F. (2023). Permainan Rujak-Rujak Sebagai Media Pembelajaran Konsep Perkalian Bilangan Bulat. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 7(1), 658–667. <https://doi.org/10.31004/cendekia.v7i1.1028>
- Mohamed, A. O. (2025). The Effect of Design on the Viewer's Perception of Media Content and Its Role in Problem Solving. *Journal of Ecohumanism*, 4(1). <https://doi.org/10.62754/joe.v4i1.5956>
- Munawaroh, S. A., Andriana, E., & Setiawan, S. (2023). *Pengembangan Media Gift Box Berbasis Multiliterasi Pada Pembelajaran Penemuan di Kelas VI Sekolah Dasar*. 9(2), 399–411. <https://doi.org/10.31932/jpdp.v9i2.2229>
- Munira, I., Mulyadi, M., & Ramadhan, Mf. (2024). Implementation of Ethnoscience to Improve Elementary School Students' Critical Thinking Ability in Science Learning. *JUPE: Jurnal Pendidikan Mandala*, 9(2), 616. <https://doi.org/10.58258/jupe.v9i2.7119>
- Nasir, M. F. A., & Fatonah, S. (2023). Use of Interactive Multimedia in Increasing Motivation for Learning Science at Primary School. *Forum Pedagogik*, 14(2), 233–241. <https://doi.org/10.24952/paedagogik.v14i2.6599>
- Nofitasari, F. E., Indiaty, I., Suneki, S., & Sijamini, N. (2023). Analisis Profiling Gaya Belajar Peserta Didik dalam Merancang Pembelajaran Berdiferensiasi Kelas III. *Jurnal Pendidikan Tambusai*, 7(2), 8811–8820.

<https://doi.org/10.31004/jptam.v7i2.7631>

- Nursolikin, M., Ismiyanti, Y., & Yustiana, S. (2025). Implementasi Metode Literasi Multimodal Terhadap Motivasi Belajar Peserta Didik Di Sekolah Dasar. *Jurnal Pendidikan Dasar Flobamorata*, 6(2), 214–220. <https://doi.org/10.51494/jpdf.v6i2.2057>
- Özgür, A., & Altun, A. (2021). Emotional Design and Engagement With Multimedia Learning Materials in E-Learning. In *Motivation, Volition, and Engagement in Online Distance Learning* (pp. 168–191). IGI Global Scientific Publishing. <https://doi.org/10.4018/978-1-7998-7681-6.ch008>
- Pradana, F. A. P., & Mawardi. (2021). Pengembangan Instrumen Penilaian Sikap Disiplin Menggunakan Skala Likert dalam Pembelajaran Tematik Kelas IV SD. *Fondatia: Jurnal Pendidikan Dasar*, 5(1), 13–29. <https://doi.org/10.36088/fondatia.v5i1.1090>
- Pramusinta, Y., & Faizah, S. N. (2021). *Belajar dan Pembelajaran Abad 21 Sekolah Dasar*. Nawa Litera Publishing.
- Prasetyaningrum, P. T., Ibrahim, N., Suria, O., Aryani, E., Putri Surga, M. S., & Siregar, R. M. (2025). Innovation in Interactive Learning Media Based on Visual Design and Gamification to Enhance Student Engagement. *Abdimas: Jurnal Pengabdian Masyarakat*, 8(3), 1319–1333. <https://doi.org/10.35568/abdimas.v8i3.6714>
- Prasetyo, A. D., & Abduh, M. (2021). Peningkatan Keaktifan Belajar Siswa Melalui Model Discovery Learning Di Sekolah Dasar. *Jurnal Basicedu*, 5(4), 1717–1724. <https://doi.org/10.31004/basicedu.v5i4.991>
- Praveena, K. S., F, J., Patil, C. M., & K, B. (2025). Using Gibb's Reflective Model Approach for Enhancing Project-Based Learning Among Students Through Reflective Assessment. *Journal of Engineering Education Transformations*, 38(IS2), 148–155. <https://doi.org/10.16920/jeet/2025/v38is2/25018>
- Quoc, N. L., & Van, L. H. (2023). Enhancement of EFL learners' lexical retention: The role of social constructivism. *Cogent Education*, 10(1), 1–16. <https://doi.org/10.1080/2331186X.2023.2223811>
- Rai, M., & Kaur, N. (2024). Mind Mapping as an Innovative Teaching Learning Tool in Education. In *Innovative Educational Frameworks for Future Skills and Competencies* (pp. 63–80). IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3693-7555-6.ch003>
- Rizal, M. S. et al. (2025) 'The Effectiveness of Project-Based Learning in Enhancing Social Competence Among Elementary School Students', *Journal of Integrated Elementary Education*, 5(2), 269–285. <https://doi.org/10.21580/jieed.v5i2.28047>
- Rohi, M. P., & Nurhayati, L. (2024). Multimodal Learning Strategies in Secondary EFL Education: Insights from Teachers. *Voices of English Language*

- Education Society*, 8(2), 458–469. <https://doi.org/10.29408/veles.v8i2.26546>
- Romero, C., & Ventura, S. (2019). Guest Editorial: Special Issue on Early Prediction and Supporting of Learning Performance. *IEEE Transactions on Learning Technologies*, 12(2), 145–147. <https://doi.org/10.1109/TLT.2019.2908106>
- Ruma Bay, R., Purwant, R., Tembang, Y., & Yampap, U. (2022). Use of Civics Learning Visual Media to Improve Primary School Student Learning Outcomes. *SHS Web of Conferences*, 149, 01046. <https://doi.org/10.1051/shsconf/202214901046>
- Saavedra, A. R., & Opfer, V. D. (2012). Learning 21st-Century Skills Requires 21st-Century Teaching. *Phi Delta Kappan*, 94(2), 8–13. <https://doi.org/10.1177/003172171209400203>
- Saputro, M. N. A., & Pakpahan, P. L. (2021). Mengukur Keefektifan Teori Konstruktivisme dalam Pembelajaran. *JOEAI (Journal of Education and Instruction)*, 4(1), 24–39. <https://doi.org/https://doi.org/10.31539/joeai.v4i1.2151%250>
- Sbaa, M., Faouzi, L., Eljahechi, M., & Lghdaich, F. (2022). The Mind Map at the Service of Learning. *International Journal of Multidisciplinary Research and Analysis*, 05(12), 3564–3581. <https://doi.org/10.47191/ijmra/v5-i12-37>
- Setyowati, E., Hendratno, H., & Sukartiningsih, W. (2024). Assessing the Impact of Local Wisdom on Indonesian Language Learning in Primary Schools. *Scaffolding: Jurnal Pendidikan Islam Dan Multikulturalisme*, 6(3), 198–212. <https://doi.org/10.37680/scaffolding.v6i3.6473>
- Shargel, R., & Twiss, L. (2019). Evidenced-Based Thinking for Scientific Thinking. In *Redefining Scientific Thinking for Higher Education* (pp. 79–103). Springer International Publishing. https://doi.org/10.1007/978-3-030-24215-2_4
- Sharma, M., Doshi, B. M., Verma, M., & Verma, A. K. (2022). Strategies for Developing Critical-Thinking Capabilities. *World Journal of English Language*, 12(3), 117. <https://doi.org/10.5430/wjel.v12n3p117>
- Suhelayani, Rahmawati, I., Z, S., & Dkk. (2023). *Pembelajaran Ilmu Pengetahuan Alam Sosial (INTEGRATED NATURAL AND SOCIAL SCIENCES)* (J. Simarmata & R. Watrianthos (eds.); 1st ed.). Yayasan Kita Menulis.
- Sujarwo. (2022). Developing 21st Century Skills. *Edukasi IPS*, 6(2), 14–23. <https://doi.org/10.21009/EIPS.006.02.02>
- Sukaryanti, A., Murjainah, M., & Syaflin, S. L. (2023). Pengembangan Media Pembelajaran Kotak Pintar Keragaman Di Indonesia Untuk Siswa Kelas IV SD. *Jurnal Pendidikan: Riset Dan Konseptual*, 7(1), 140. https://doi.org/10.28926/riset_konseptual.v7i1.675
- Sunariyati, S.-, Suatma, S., & Miranda, Y. (2019). Efforts to Improve Scientific Attitude and Preservation of Local Culture through Ethnobiology-based

- Biological Practicum. *Edusains*, 11(2), 255–263.
<https://doi.org/10.15408/es.v11i2.13622>
- Syafar, A. M., Gani, H. A., & Agung, M. (2023). The Utilization and Practicality of Learning Media Based Augmented Reality. *Asian Journal of Education and Social Studies*, 49(4), 326–332.
<https://doi.org/10.9734/ajess/2023/v49i41211>
- Tirtoni, F., Su'udiyah, F., & Susilo, J. (2019). Pengembangan Media Smart Exploding Box Berbasis Deep Dialogue Critical Thinking untuk Menghadapi Era Revolusi Industri 4.0. *Jurnal Pendidikan Dasar Nusantara*, 5(1), 191–204. <https://doi.org/10.29407/jpdn.v5i1.13589>
- Tusupbekova, S., & Aituganova, V. (2024). Using infographics to improve the visual perception of educational material. *Problems of Engineering and Professional Education*, 75(4), 62–71. <https://doi.org/10.32523/2220-685X-2024-75-4-62-71>
- Utami, A. S., Triutami, M., & Ningsih, P. H. (2023). The Role of Learning Media in Improving Learning Achievement of Elementary School Students. *Jurnal Primagraha*, 4(1), 33. <https://doi.org/https://doi.org/10.59605/jp.v4i01.654>
- Wang, S.-H. (2021). The Application of Information Processing Theory in Higher Education. *2021 2nd International Conference on Education, Knowledge and Information Management (ICEKIM)*, 930–933.
<https://doi.org/10.1109/ICEKIM52309.2021.00209>
- Yingsoon, G. Y., Zhang, S., Chua, N. A., & Xiaoyao, T. (2025). Empowering Multicultural Literacies. In *Supporting Cultural Differences Through Literacy Education* (pp. 77–108). IGI Global. <https://doi.org/10.4018/979-8-3693-9271-3.ch004>
- Zufiyardi, Z., Ayuni, R., & Resti, R. (2025). Analisis Aktivitas Belajar Siswa Melalui Penerapan Model Pembelajaran Discovery Learning di SMAN 06 Kota Bengkulu. *Jurnal Multidisiplin Dehasen (MUDE)*, 4(3).
<https://doi.org/10.37676/mude.v4i3.8811>