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Optimization IPAS Learning Outcomes through the Snowball Throwing Model Based on Animated Media among Elementary School Students

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ABSTRACT

This study investigates the effectiveness of integrating the Snowball Throwing cooperative learning model with animated video media to improve learning outcomes in Integrated Natural and Social Sciences (IPAS) among elementary school students. The approach addresses low engagement and underachievement in IPAS learning under the Merdeka Curriculum. A two-cycle Classroom Action Research (CAR) was conducted with 13 fourth-grade students at UPT SDN 4 Makale Selatan. Instruments included observation sheets, interviews, and a validated IPAS achievement test. Data were analyzed using descriptive statistics, paired-sample t-tests, Cohen's d, and normalized gain (N-Gain). Student performance improved significantly from Cycle I (mean = 66.92; mastery = 46.15%) to Cycle II (mean = 80.76; mastery = 92.30%). Statistical analysis showed a significant effect ($t(12) = 6.24$, $p < .001$) with a large effect size ($d = 1.73$) and moderate-to-high learning gain (N-Gain = 0.62). Improvements were also observed in students' engagement, reasoning, and collaborative skills. The results demonstrate that combining Snowball Throwing and animated videos creates a student-centered, interactive learning environment. Animated media served as cognitive scaffolds, while the cooperative model fostered active inquiry and peer interaction. This integration aligns with social constructivist principles and supports 21st-century competencies, particularly critical thinking and collaboration.

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1. INTRODUCTION

One of the hallmark innovations in Indonesia's *Kurikulum Merdeka* is the integration of Natural and Social Sciences learning, known as IPAS (*Ilmu Pengetahuan Alam dan Sosial*). This subject aims to provide a more holistic and interdisciplinary understanding of natural and social phenomena by blending environmental science, biology, geography, and social studies into one cohesive learning experience (Kemdikbudristek, 2022). Rather than focusing solely on content memorization, the IPAS framework emphasizes the cultivation of higher-order thinking skills such as critical thinking, creativity,

collaboration, and reflection—key elements of the *Profil Pelajar Pancasila*, which serves as the character and competency foundation of Indonesian education (Mulyasa, 2023). Under this curriculum shift, teachers are expected to play transformative roles as facilitators who guide students to explore, interact, and construct knowledge actively through inquiry-based and meaningful learning experiences.

Despite these curriculum aspirations, implementation at the elementary level remains uneven and often limited by conventional teaching practices. Observations conducted at UPT SDN 4 Makale Selatan in Tana Toraja revealed that fourth-grade students' learning outcomes in IPAS fell below the expected Minimum Mastery Criteria (*Kriteria Ketuntasan Minimal* or KKM = 67). Of the 13 students observed, more than half scored below 65, highlighting not only a lack of mastery of core content but also low learning motivation and passive classroom engagement. This condition reflects a broader trend across Indonesian schools, where low achievement in science-related subjects is often linked to teacher-centred approaches, lack of student interaction, and limited opportunities for collaborative exploration (Sari, Andayani, & Putra, 2021). These pedagogical challenges indicate a gap between curriculum ideals and classroom realities, especially in under-resourced regions.

In response to these issues, the Snowball Throwing learning model emerges as a promising pedagogical strategy. Grounded in Vygotsky's (1978) social constructivist theory, which emphasizes that learning is shaped through social interaction and dialogue, this model encourages students to collaboratively generate, and exchange questions related to a topic. These "question balls" are metaphorically thrown among peers to provoke discussion, foster responsibility, and reinforce content understanding through reciprocal teaching (Beno, Lee, & Harsono, 2022). The dynamic nature of this strategy aligns with the principles of active and cooperative learning and is well-suited for the IPAS subject, where interdisciplinary thinking and social context are central. Hasanah and Fitri (2023) affirm that Snowball Throwing not only promotes engagement and participation but also strengthens students' confidence, collaboration, and critical thinking skills critical to 21st-century learning.

Nevertheless, the traditional application of Snowball Throwing has its limitations, particularly in conveying abstract or complex scientific and social concepts. Elementary students often struggle to conceptualize topics that require visual or spatial reasoning, such as environmental processes, ecosystems, or community structures. To address this, integrating animated video media into the model is proposed as a powerful enhancement. Educational animations can visualize abstract ideas in ways that are cognitively accessible and emotionally engaging for young learners (Islam, Rahman, & Rahaman, 2022). Animation allows for real-time simulations, vibrant storytelling, and multimodal presentation of information, which can increase comprehension, memory retention, and learner motivation (Clark & Mayer, 2016; Lin & Chen, 2021).

Numerous studies have confirmed the pedagogical effectiveness of animation in elementary science education. Kaur and Singh (2021), for example, demonstrated that educational animations improved student achievement in science subjects by up to 28% compared to conventional instruction. Likewise, Zhang, Chen, and Zhao (2023) found that integrating animation into cooperative learning models enhanced students' intrinsic motivation and reflective reasoning. In the IPAS context, where understanding both environmental and social systems is essential, animated media can serve as both a cognitive scaffold and a catalyst for collaborative inquiry. The dual emphasis on cooperative learning through Snowball Throwing and visual representation through animation offers a robust strategy for designing engaging and meaningful instruction.

The integration of Snowball Throwing and animation also aligns with the framework of 21st-century education, which emphasizes the "4Cs": critical thinking, communication, collaboration, and creativity (Trilling & Fadel, 2021). The interactive group discussions fostered by Snowball Throwing encourage communication and collaboration, while the visual narratives presented in animations stimulate creativity and critical thinking. Moreover, as Suparno (2020) argues, IPAS requires a transdisciplinary understanding that connects natural and human systems, making the synergy between social interaction and media visualization not just beneficial but essential.

In addition to fostering cognitive development, this model also supports affective learning. Sumarni, Wijayanti, and Koesnandar (2022) emphasized that instructional media play a significant role in shaping learners' motivation, curiosity, and emotional engagement. When integrated with Snowball Throwing, animation becomes more than just a content delivery tool—it facilitates emotional connection, stimulates imagination, and encourages learners to articulate their ideas confidently during group interactions. Liu, Li, and Chen (2022) further confirm that multimedia-based learning increases student persistence and reduces passive behavior, especially when learning involves complex or unfamiliar content.

The theoretical foundation of this integrated model is also supported by Mayer's (2021) Cognitive Theory of Multimedia Learning, which posits that learning is more effective when information is presented using both verbal and visual channels. This theory underscores the value of synchronously combining spoken explanations with dynamic visuals to reduce cognitive overload and improve knowledge construction. Within the Snowball Throwing model, animated video acts as a pre-learning scaffold that equips students with conceptual understanding before they engage in peer discussions, question formulation, and reflective dialogue.

Although previous studies have shown the effectiveness of Snowball Throwing in subjects such as social studies and language (Firdausi, 2020; Kusumawati & Lestari, 2021), limited empirical research has examined its integration with animated media specifically in IPAS learning at the elementary level. This gap is particularly evident in the eastern regions of Indonesia, including 3T areas (Terdepan, Terluar, dan Tertinggal—frontier, outermost, and underdeveloped), where both pedagogical innovation and digital learning resources are still limited. Consequently, this study offers both theoretical novelty and practical relevance by contextualizing the implementation of the Snowball Throwing model enhanced with animated media within the framework of the Kurikulum Merdeka in a 3T setting.

Based on these considerations, this study aims to explore how the Snowball Throwing learning model integrated with animated video media can improve student engagement and academic achievement in IPAS learning. Specifically, the research is guided by three questions: (1) How is the Snowball Throwing model with animated video implemented in IPAS instruction? (2) Does this model lead to improved student learning outcomes? and (3) What are students' perceptions of this integrated approach? Accordingly, the study seeks to describe the model's implementation, analyze its impact on learning outcomes, and understand students' experiences in the process. By addressing these questions, the research contributes to the growing body of literature on technology-enhanced cooperative learning and offers actionable insights for educators seeking to transform their IPAS classrooms in alignment with national curriculum reforms and 21st-century learning goals.

2. METHODS

2.1 Design and Research Approach

This study employed a Classroom Action Research (CAR) design, focusing on continuous improvement of instructional processes and student learning outcomes. The CAR design was considered most appropriate to address classroom-based educational problems, as it enables teachers to act as reflective practitioners in analyzing and improving their own teaching practices (Burns, 2020). The research followed the cyclical model proposed by Kemmis and McTaggart (2014), which includes four main stages—planning, acting, observing, and reflecting—repeated iteratively until meaningful improvement is achieved.

The study was conducted at UPT SDN 4 Makale Selatan, Tana Toraja Regency, South Sulawesi, Indonesia. This school was selected because it represents a typical semi-urban elementary school with limited technological resources but high motivation to adopt innovative learning practices. The research was carried out over five months during the second semester of the 2024/2025 academic year, involving 13 fourth-grade students with heterogeneous academic abilities.

This research adopted a collaborative approach, in which the classroom teacher worked jointly with the researcher as an equal partner in planning, implementing, and reflecting on the learning interventions. Such a participatory approach enhances the ecological validity of the study, ensuring that the intervention is both theoretically grounded and contextually relevant (Creswell & Poth, 2018).

2.2. Ethical Considerations and Research Validity

Prior to the study, all participants and school authorities were informed of the research objectives, procedures, and students' rights. Written consent was obtained from the school principal and parents. The researcher guaranteed anonymity and confidentiality for all participants, and ensured that all classroom activities complied with ethical research principles in education.
Internal validity was maintained through three strategies:

a. Source triangulation—comparing data obtained from observations, interviews, and learning assessments;
b. Member checking—discussing preliminary findings with teachers and students to confirm the accuracy of interpretations; and
c. Peer debriefing—consulting interim findings with two educational experts from Universitas Kristen Indonesia Toraja.
   These strategies ensured that the data collected were credible, dependable, and scientifically verifiable (Lincoln & Guba, 1985).

2.3. Research Procedures

Each action research cycle consisted of four sequential stages, aimed at progressively improving the effectiveness of *Snowball Throwing*–based instruction supported by animated video media:

a) **Planing**
   During the planing stage, the researcher and teacher collaboratively analyzed the baseline learning outcomes and identified instructional challenges. Lesson plans were designed following *student-centered* and *cooperative learning* principles. Animated videos were developed using *Powtoon* and *Animaker*, featuring local Toraja environmental themes to help students connect scientific and social concepts to their everyday experiences (Rahman et al., 2023).
   Prepared instruments included: (a) teacher and student observation sheets, (b) semi-structured interview guides, (c) IPAS learning achievement tests aligned with curriculum indicators, and (d) a teacher reflection journal.

b) **Action Implementation**
   The teacher implemented the *Snowball Throwing* model through structured classroom activities:
   1) Introduction and video-based contextual orientation (7–8 minutes),
   2) Formation of small groups (4–5 students),
   3) Formulation of guiding questions by each group,
   4) *Throwing* and answering questions among groups,
   5) Class discussion and concept clarification,
   6) Joint conclusion and reflection.
   The teacher acted as a facilitator and provided scaffolding while linking IPAS concepts to the values of *Profil Pelajar Pancasila*, such as *gotong royong* (mutual cooperation) and critical reasoning.

c) **Observation**
   The researcher systematically observed classroom interactions using structured observation

sheets that recorded indicators such as engagement, collaboration, and questioning frequency. Observations also included affective indicators such as curiosity, responsibility, and respect for peers' ideas. Quantitative data were complemented with reflective notes to enrich the interpretation of classroom dynamics.

d) **Reflection**
After each cycle, both the teacher and researcher analyzed the implementation process to identify obstacles and determine necessary revisions. In Cycle I, several students struggled to construct higher-level questions. Accordingly, in Cycle II, the teacher introduced guided examples of *Higher-Order Thinking Skills (HOTS)* questions and slowed down video narration to enhance comprehension.

2.4. Research Instruments

The IPAS learning achievement test was developed according to the learning objectives in the *Merdeka Curriculum*, covering three indicators: (1) conceptual understanding, (2) application of concepts, and (3) reflective reasoning. Each indicator was assessed using a combination of multiple-choice and open-ended items.

Reliability analysis using Cronbach's alpha yielded a coefficient of 0.87, indicating high internal consistency (Azwar, 2012). Additionally, empirical testing in a parallel class confirmed balanced item difficulty and discrimination indices, ensuring that the assessment was both valid and reliable.

3. FINDINGS AND DISCUSSION

3.1. Preliminary Conditions

Baseline data showed that students were accustomed to teacher-centred instruction. Learning was predominantly lecture-based, limiting opportunities for students to explore ideas and engage in inquiry. These findings align with Sari et al. (2021), who noted that low science achievement in Indonesian elementary schools is often linked to conventional teaching methods that fail to facilitate active and social learning.

3.2. Cycle I Results

The initial implementation of *Snowball Throwing* in Cycle I produced modest improvement, as students were still adapting to the new collaborative learning format. While several groups displayed enthusiasm, others remained hesitant and passive.

Table 1. Students' Learning Outcomes in Cycle I

No	Assessed Aspect	Mean Score	Mastery (%)	Category
1	Conceptual Understanding	68.15	53.85	Fair
2	Concept Application	65.00	46.15	Fair
3	Reasoning & Reflection	67.62	38.46	Fair
Average Total		**66.92**	**46.15**	**Not Achieved**

Three main challenges were identified: (1) video narration was too fast, (2) students struggled to formulate analytical questions, and (3) discussion time was insufficient. Based on reflection,

improvements were made in Cycle II by using slower-paced video narration and adding written subtitles for clarity.

3.3. Cycle II Results

After implementing these revisions, Cycle II demonstrated substantial improvement in both cognitive and behavioral domains.

Table 2. Students' Learning Outcomes in Cycle II

No	Assessed Aspect	Mean Score	Mastery (%)	Category
1	Conceptual Understanding	82.31	92.30	Good
2	Concept Application	79.62	84.61	Good
3	Reasoning & Reflection	80.35	92.30	Good
Average Total		**80.76**	**92.30**	**Achieved**

Statistical analysis using the paired-sample t-test indicated a significant difference between Cycle I and Cycle II ($t(12) = 6.24$, $p < .001$). The Cohen's d value of 1.73 reflected a large effect size, while an N-Gain score of 0.62 signified a medium-to-high level of learning improvement.

Discussion

This study aimed to examine the impact of integrating the Snowball Throwing cooperative learning model with animated video media on students' learning outcomes in Integrated Natural and Social Sciences (IPAS) at the elementary level. The findings confirm that this pedagogical integration significantly improved students' conceptual understanding, application of knowledge, and reflective thinking skills. The shift from teacher-centered to student-centered instruction aligns with the principles of the Merdeka Curriculum, which emphasizes student agency, collaboration, and contextual learning (Kemdikbudristek, 2022).

The improvement in student outcomes from Cycle I to Cycle II, as reflected in the mean score increase from 66.92 to 80.76 and mastery level from 46.15% to 92.30%, indicates that the integration of interactive media and cooperative learning strategies creates a more engaging and effective learning environment. These findings are consistent with Vygotsky's (1978) social constructivist theory, which posits that meaningful learning occurs through social interaction within the Zone of Proximal Development (ZPD). Through the Snowball Throwing model, students actively constructed knowledge by generating, exchanging, and responding to questions in a collaborative setting.

The addition of animated video media enhanced this process by providing visual scaffolds that supported students in understanding abstract or complex IPAS content. Mayer's (2021) Cognitive Theory of Multimedia Learning supports this, arguing that learning is optimized when verbal and visual materials are presented simultaneously, engaging both auditory and visual processing channels. This dual-channel processing facilitates better retention and transfer of knowledge, which explains the statistically significant improvement in learning outcomes observed in this study ($t(12) = 6.24$, $p < .001$; $d = 1.73$).

The observed effect size (Cohen's $d = 1.73$) reflects a very strong impact, further validated by the N-Gain score of 0.62, classified as moderate to high (Hake, 1998). These results suggest that integrating animated media with cooperative learning not only enhances cognitive understanding but also positively influences student motivation and engagement. Similar findings were reported by Islam, Rahman, and Rahaman (2022), who found that animated video-based instruction significantly improved students' attention, participation, and achievement in science education.

From a pedagogical standpoint, the Snowball Throwing model promotes higher-order thinking and metacognitive awareness. When students create and respond to peer-generated questions, they are encouraged to analyze, evaluate, and reflect—skills aligned with Bloom's higher-order cognitive processes (Anderson & Krathwohl, 2001). Moreover, the cooperative nature of this model encourages social learning, mutual respect, and communication—key components of 21st-century learning competencies (Trilling & Fadel, 2021).

The study also observed behavioral improvements, such as increased student curiosity, collaboration, and self-confidence during classroom discussions. This aligns with Self-Determination Theory (Deci & Ryan, 2017), which suggests that intrinsic motivation is fostered when learners experience autonomy, competence, and relatedness. The Snowball Throwing model, particularly when supported by stimulating multimedia, satisfies these needs by giving students agency over their learning, providing cognitive support, and creating a socially rich classroom environment.

Additionally, the localized design of animated content—featuring environmental themes familiar to Toraja students—demonstrates the value of culturally responsive pedagogy. Integrating local content into media materials helps students connect new information to their lived experiences, enhancing relevance and comprehension (Gay, 2018). This approach is crucial in Indonesia's 3T (frontier, outermost, and underdeveloped) regions, where contextualization and low-cost digital solutions can bridge educational gaps (Reiser, 2022).

These findings also contribute to the broader discourse on Technology-Enhanced Cooperative Learning (TECL). While many studies have focused on STEM subjects, this research demonstrates the potential of TECL in interdisciplinary, thematic subjects like IPAS, which require both scientific reasoning and social contextual understanding (Zhang, Chen, & Zhao, 2023). It supports prior work by Ulfah, Fadhilah, and Ramadhan (2023), who found that the synergy of animation and cooperative learning significantly boosts retention, engagement, and critical thinking.

Despite these promising results, the study acknowledges several limitations. The small sample size (n = 13) limits the generalizability of findings, though it is appropriate for action research aiming at classroom improvement (Burns, 2020). Furthermore, the same teacher conducted both intervention cycles, which may introduce instructional bias, although triangulation and peer debriefing were employed to enhance validity.

Future research should consider quasi-experimental designs with larger, diverse samples to assess the long-term effects of integrating animated media in cooperative learning models. Exploring the impact of different animation types (e.g., 2D vs. 3D, interactive vs. passive) and comparing effects across various subjects may further expand the applicability of this model in broader educational settings.

In conclusion, the integration of Snowball Throwing and animated video media represents a pedagogical innovation aligned with the principles of the Merdeka Curriculum and the needs of 21st-century learners. It fosters not only academic improvement but also the development of soft skills such as collaboration, confidence, and reflective thinking. This approach has the potential to be scaled and adapted across contexts to support inclusive, technology-enhanced learning environments in elementary education.

4. CONCLUSION

This study concludes that integrating the Snowball Throwing cooperative learning model with animated video media significantly improves elementary students' learning outcomes in Integrated Natural and Social Sciences (IPAS), as evidenced by a substantial increase in mean scores, learning mastery, and student engagement across two action research cycles. The combination of cooperative interaction and visual media enhanced not only cognitive understanding but also reflective thinking and collaboration, aligning well with the goals of the Merdeka Curriculum and 21st-century competencies. However, the study's findings are limited by the small sample size (n = 13) and the

single-classroom setting, which restrict generalizability. Additionally, the same teacher facilitated both cycles, introducing potential instructional bias despite efforts to mitigate it through triangulation and peer validation. Future research should employ larger and more diverse samples using quasi-experimental or mixed-method designs to explore the long-term impact of this model. Comparative studies across different grade levels, subjects, and types of animation (e.g., interactive vs. non-interactive) are also recommended to better understand how various media characteristics influence learning processes and outcomes in diverse educational contexts.

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