

## FOSTERING CRITICAL THINKING AND ENVIRONMENTAL AWARENESS THROUGH INTEGRATED 3R-BASED MEDIA PANCASILA STUDENT PROFILE

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### Abstract

This study aims to develop and test the feasibility of an Eco-Edutainment learning media that integrates educational games, 3R (Reduce, Reuse, Recycle) materials, and the Pancasila Student Profile framework to enhance students' critical thinking, creativity, and cooperation in the Natural and Social Sciences (IPAS) subject. The research employed a Research and Development (R&D) method using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The study was conducted at Purworejo Private Elementary School (SDN Purworejo), Central Java, Indonesia. The population comprised all fourth-grade students, and the sample consisted of 13 students selected through purposive sampling. Data were collected through interviews, observations, expert validation sheets, questionnaires, and pretest-posttest assessments, while data analysis included quantitative descriptive analysis for validity and practicality, and the Normalized Gain (N-Gain) formula to measure effectiveness. The resulting product, titled "Exploring Energy Sources," consists of three interactive board games designed from recycled materials to facilitate active and enjoyable learning about energy transformation. The research findings show that the media met the feasibility criteria of being very valid, very practical, and effective. These results demonstrate that the Eco-Edutainment model successfully created a meaningful, engaging, and sustainable learning experience while promoting environmental awareness and character competencies aligned with the Pancasila Student Profile.

### Keywords

Edutainment media; 3R materials; Pancasila student profile; critical reasoning; media development.



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## INTRODUCTION

The paradigm of basic education in Indonesia has undergone a significant transformation with the introduction of the Merdeka Curriculum. This policy, which includes combining Natural Sciences (IPA) and Social Sciences (IPS) into Natural and Social Sciences (IPAS), presents both challenges and opportunities for educators to design more holistic and contextual learning processes (Wijayanti & Ekantini, 2023). The Merdeka Curriculum emphasizes student-centered, flexible, and in-depth learning, which requires pedagogical innovation to shift from conventional teaching methods, which are often tedious (Agustina et al., 2022; Darlis et al., 2022). The monotonous learning models that were often used in the past must now be replaced with new models that are more interactive, enjoyable, and motivating for students so that they can practice these 21st-century skills (Indarta et al., 2022). Initial observations in the field show that learning processes that rely solely on textbooks and verbal explanations often make students feel bored and find it difficult to explore the material independently (Triyono et al., 2024), especially when it comes to providing practical examples beyond those found in books (Evans et al., 2021). This condition underscores the urgent need for innovative learning media that is not only capable of delivering academic content, but also actively engages students and fosters 21st-century competencies (Hati & Karo, 2025).

Initial observations at SDN Purworejo, Kabupaten Purworejo, Jawa Tengah, indicate that students' critical thinking skills and environmental awareness remain relatively low. Based on interviews with teachers and classroom observations conducted in March 2025, it was found that many fourth-grade students tend to memorize rather than analyze concepts, especially in Integrated Natural and Social Sciences (IPAS) lessons related to energy sources and environmental conservation. Learning is still dominated by lectures and textbook explanations, with limited opportunities for students to engage in experimentation or problem-solving activities. Meanwhile, students' awareness of environmental cleanliness is also not optimal; waste sorting has not been implemented consistently, and many students have not understood the importance of recycling or reusing materials. This condition reflects a gap between the goals of the Merdeka Curriculum—which emphasizes active, contextual, and critical learning—and the actual practice in the classroom.

From an institutional perspective, SDN Purworejo has implemented several programs aimed at fostering environmental care, such as weekly "Clean Friday" activities and the

collection of plastic bottles for school cleanliness campaigns. However, these activities tend to be routine and lack an explicit educational framework that links them to learning objectives or character building. Teachers also face limitations in developing innovative teaching media due to the absence of low-cost yet effective materials. Therefore, the development of Integrated 3R-Based Learning Media aligned with the Pancasila Student Profile is deemed necessary. This approach allows students to learn while playing through the concept of edutainment, encouraging them to transform waste materials into meaningful educational tools. The integration of 3R principles (Reduce, Reuse, Recycle) not only addresses environmental issues around the school but also strengthens the dimensions of critical thinking, creativity, and cooperation as mandated in the Pancasila Student Profile. Consequently, this research emerges as a response to the contextual needs of SDN Purworejo in cultivating both cognitive and character development through sustainable and locally relevant learning innovation.

To address these challenges, this research is built on three mutually reinforcing conceptual pillars: the pedagogical power of edutainment, the imperative of sustainable education through the use of 3R materials, and the framework for national character building through the Pancasila Student Profile. The first pillar is the edutainment or game-based learning (GBL) approach. Edutainment is a concept that combines elements of education and entertainment to create a fun, engaging, and boredom-free learning environment (Riska et al., 2024; Sartika et al., 2021). Theoretically, GBL has been proven effective in increasing student learning outcomes, engagement, and motivation at the elementary school level (Chang et al., 2018; Partovi & Razavi, 2019). Game-based learning environments encourage active participation, facilitate the understanding of complex concepts, and develop problem-solving skills (Bhat et al., 2023; Wibawa et al., 2021; Zakaria & Zakaria, 2025). The basic principle of edutainment is to create a balanced blend of fun and seriousness, transforming the learning process into a dynamic and interactive experience (Aksakal, 2015; Yanuardianto, 2020). Thus, the choice of the edutainment approach is not merely to entertain students, but rather a pedagogical strategy based on empirical evidence to achieve superior cognitive and affective learning outcomes.

The second pillar is the integration of the principles of Education for Sustainable Development (ESD) through the use of 3R (Reduce, Reuse, Recycle) materials. Amidst

growing environmental issues, education plays a crucial role in shaping a generation that is ecologically aware and responsible (Adnyana et al., 2023; Davis & Elliott, 2023; Nugroho et al., 2025). The use of recycled materials such as cardboard, plastic bottles, and paper in the creation of learning media serves a dual purpose. On one hand, it is a practical and economical solution for schools with limited resources. On the other hand, more importantly, it is a powerful pedagogical tool. The process of transforming materials considered "trash" into useful learning tools provides real lessons in creativity, innovation, and the value of sustainability (Anggry et al., 2022; Santulli & Lucibello, 2018). Interacting with recycled materials can enhance students' physical (fine motor skills), cognitive (classification, problem-solving), and emotional (creative self-confidence) development (Burky, 2022). This approach directly instills a circular mindset and environmental awareness from an early age, in line with the global goals of ESD (Melani, 2022; Ramasari & Purwasi, 2021).

The third pillar is character building in line with the Pancasila Student Profile (PPP). The PPP is a framework of character and graduate competencies formulated to realize the ideals of national education, namely Indonesian students who are globally competent but still adhere to the noble values of Pancasila (Ngazizah & Laititia, 2022). This study specifically targets three of the six dimensions of PPP: critical thinking, creativity, and cooperation. These dimensions are essential competencies needed to face future challenges (Juliani & Bastian, 2021; Thohiroh, 2024). Well-designed learning media should be able to serve as an arena for students to practice and demonstrate these competencies, not merely as a one-way channel of information ((Ngazizah et al., 2022; Sutrisno et al., 2023).

Several previous studies have explored the potential of integrating educational innovation, environmental education, and character development in elementary school learning. Rahmawati et al. (2020) found that game-based learning using local materials significantly improved students' critical thinking and problem-solving abilities in science learning. Similarly, Wijayanti and Arifin (2021) demonstrated that project-based edutainment integrating environmental issues encouraged students to develop creativity and ecological responsibility. From an environmental education perspective, Anggraeni et al. (2022) revealed that utilizing recycled and reusable materials in classroom media not only reduced waste but also cultivated students' awareness of sustainability and resource efficiency (Listyowati et al., 2024). In addition, Rachman and Fauziah (2023) reported that the use of 3R-based learning

media increased students' motivation and collaborative skills, especially when applied through thematic learning. Meanwhile, in the context of character education, Nuryanti and Prasetyo (2024) showed that the implementation of Pancasila Student Profile-oriented media effectively fostered moral reasoning, creativity, and mutual cooperation among elementary students (Sobry & Hadisaputra, 2025). These findings highlight that while each approach game-based learning, environmental sustainability, and Pancasila-based character education has been studied individually, limited empirical research has examined their integration into a unified pedagogical framework.

Although there have been many studies discussing GBL, the use of recycled materials in education, or the implementation of PPP separately, there is a significant research gap in studies that synergistically integrate these three elements into a single empirically validated learning media product. The novelty of this research lies in the development and validation of the "Eco-Edutainment" model. This model uniquely combines the motivational appeal of game-based learning, the pedagogical and ecological benefits of using 3R materials, and the character-building framework of the Pancasila Student Profile. The relationship between these three components is mutually reinforcing: the use of 3R materials is a direct trigger for the creative and critical thinking dimensions of PPP; the edutainment format provides an active vehicle in which PPP competencies are practiced; and the PPP framework provides a higher purpose for play activities, transforming them into meaningful character-building exercises. Thus, this study offers a holistic, low-cost, and culturally relevant solution to improve IPAS learning in Indonesian elementary schools. Based on this background, the aim of this research is to create an edutainment media product using 3R materials integrated with the Pancasila Student Profile and to determine its feasibility in terms of validity, practicality, and effectiveness in improving fourth-grade students' understanding of energy transformation.

## **METHOD**

This study employed a Research and Development (R&D) design aimed at developing an innovative learning product in the form of Eco-Edutainment media based on the 3R (Reduce, Reuse, Recycle) principles and integrated with the Pancasila Student Profile (Anggry et al., 2022). The R&D design was selected because the main focus of this research was to produce and validate a learning media prototype that is feasible, practical, and effective for

real classroom use. The research process adopted the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), which offers a structured and iterative framework for instructional product development (Ratnaningsih et al., 2020; Sartika et al., 2021; Setiawan & Phillipson, 2019). The model was chosen for its systematic nature and adaptability to educational contexts, ensuring that each stage contributes to the creation of a high-quality product.

In the analysis stage, researchers conducted a needs analysis at SDN Purworejo, Kabupaten Purworejo, Central Java, through classroom observations, teacher interviews, and curriculum review. These activities aimed to identify the existing learning challenges, particularly in the Integrated Natural and Social Sciences (IPAS) subject focusing on the topic “Changing Energy Forms.” The analysis revealed that learning activities were still dominated by lectures and textbook-based discussions, while students showed low levels of engagement and critical inquiry. Based on these findings, the design stage involved planning the conceptual framework of the Eco-Edutainment media titled “Exploring Energy Sources.” This included designing the content, creating game mechanisms, determining assessment rubrics, and ensuring that all components adhered to the 3R principles by using recyclable materials such as cardboard, plastic bottles, and paper waste.

The development stage focused on producing a physical prototype of the learning media using 3R materials and preparing research instruments such as expert validation sheets, teacher and student questionnaires, and pretest–posttest assessments. The product was then evaluated by media and material experts to assess its validity, clarity, and relevance to the learning objectives. The implementation stage was carried out in March–April 2025 at SDN Purworejo with a sample of 13 fourth-grade students. The population of this study consisted of all fourth-grade students at the school, while participants were selected using purposive sampling. This sampling technique ensured that students had completed the “Energy Transformation” learning unit and were willing to participate with parental consent. During implementation, students used the developed media in a classroom setting under the guidance of their teacher, while researchers observed student engagement and recorded responses.

The data collected in this study consisted of both primary and secondary sources. Primary data included expert validation results, teacher and student responses, observation

notes, and pretest–posttest scores that measured students’ understanding before and after the use of the media. Secondary data were obtained from curriculum documents, school profiles, and records of environmental programs implemented by SDN Purworejo. Data collection techniques comprised interviews, classroom observations, questionnaires, tests, and documentation. Interviews with teachers and the principal provided insights into existing environmental awareness programs and school policies. Observations helped identify student behaviors and classroom dynamics during the learning process. Questionnaires were distributed to teachers and students to evaluate the practicality and attractiveness of the media, while pretest–posttest instruments measured cognitive improvement related to energy concepts. Documentation, such as photographs and videos, served as supporting qualitative data to illustrate the learning process.

Data analysis was conducted comprehensively to evaluate the feasibility of the developed product in three main aspects: validity, practicality, and effectiveness. Validity was analyzed descriptively using quantitative expert validation scores, which were then converted into qualitative categories such as “very valid,” “valid,” or “less valid” (Darmawan et al., 2021). Practicality was assessed through descriptive analysis of teacher and student questionnaire responses, with supporting qualitative interpretations from observation notes. Effectiveness was analyzed by comparing students’ pretest and posttest scores using the Normalized Gain (N-Gain) formula to measure the improvement in learning outcomes. In addition, where applicable, a paired t-test or nonparametric equivalent was used to confirm the statistical significance of learning gains. Qualitative data from interviews and open-ended questionnaire responses were analyzed thematically to capture teachers’ and students’ perceptions of the media’s strengths, weaknesses, and potential for broader classroom application. To ensure the reliability and credibility of findings, all research procedures were carried out under the supervision and permission of the school, and the anonymity of participants was maintained throughout the study.

## **FINDINGS AND DISCUSSION**

### **Findings**

The results of this research and development are presented comprehensively, covering quantitative data on the feasibility of the media in terms of validity, practicality, and

effectiveness, as well as an in-depth discussion of the efficacy of the developed Eco-Edutainment model. Overall, the results show that the "Exploring Energy Sources" media is proven to be valid, practical, and effective for use in IPAS learning in elementary schools. This discussion outlines how the synergy between the edutainment approach, the use of 3R materials, and the integration of the Pancasila Student Profile contributes to the success of the media.

### **Product Description**

The product successfully developed through this research is an edutainment media called "Jelajah Sumber Energi". This media is designed for IPAS learning in grade IV on the subject of energy conversion. In line with its concept, this media is made from 3R materials such as used cardboard, unused HVS paper, used calendars, and bottle caps. "Exploring Energy Sources" consists of three types of games integrated into one package, namely the Adventure Board, Tower Building Board, and Word Building Board. Each game is designed to actively engage students in the learning process while playing, while also stimulating the dimensions of the Pancasila Student Profile targeted by. The visual appearance of the developed product is presented in Figure 1.



**Figure 1.** Visual Presentation of the "Exploring Energy Sources" Edutainment Media Product

### **Analysis Stage**

The analysis phase focused on identifying the needs, curriculum relevance, and learning problems encountered in IPAS instruction at Purworejo Private Elementary School. Through interviews and classroom observations, it was found that IPAS learning—especially in the “Changing Energy Forms” unit still relied heavily on textbooks and teacher explanations. Students tended to lose focus and enthusiasm due to the abstract nature of the



material. Curriculum analysis confirmed that the Merdeka Curriculum emphasizes active, contextual, and student-centered learning. Therefore, there was a need for innovative media capable of integrating scientific content, character values, and environmental awareness in an engaging way. This analysis provided the foundation for the design of the “Exploring Energy Sources” edutainment media.

### **Design Stage**

In the design phase, the concept of “Eco-Edutainment” was developed by combining the principles of edutainment, 3R-based materials (Reduce, Reuse, Recycle), and the Pancasila Student Profile (PPP). The media was designed to support the topic “Changing Energy Forms” and to foster three PPP dimensions: critical thinking, creativity, and cooperation. The product, titled “Jelajah Sumber Energi” or “Exploring Energy Sources”, consists of three integrated games:

1. Adventure Board, which trains critical thinking through energy-related problem-solving;
2. Tower Building Board, which fosters cooperation and creativity using recycled materials;
3. Word Building Board, which enhances conceptual understanding through interactive word challenges.

This design ensured that every element of play directly aligned with the intended learning outcomes and PPP competencies.

### **Development Stage**

During the development phase, the design was realized into a physical prototype made from 3R materials such as used cardboard, old calendar sheets, unused HVS paper, and bottle caps. Supporting research instruments—such as validation sheets, teacher/student questionnaires, and pretest–posttest assessments—were also prepared. Validity testing was conducted by two experts: one subject matter expert and one media expert. Their assessments ensured that both the academic content and the design met quality standards.

**Table 1.** Expert Validation Results for Media Suitability

Expert	Final Score	Criteria
Subject Matter Expert	4.00	Very Valid
Media Expert	3.90	Very Valid

The subject matter expert confirmed that the learning content was accurate, comprehensive, and aligned with the curriculum. The media expert judged the design to be attractive, readable, and user-friendly. Thus, the “Exploring Energy Sources” media met the “Very Valid” criterion and was ready for implementation.

### Implementation Stage

This stage tested the practicality and effectiveness of the product. Trials were conducted with 13 fourth-grade students at Purworejo Private Elementary School, Central Java, using a purposive sampling technique. Practicality testing involved gathering feedback from students and teachers through questionnaires.

**Table 2.** Results of the Practicality Aspect Assessment

Assessment Aspect	Average Score	Criteria
Student Responses (Group Trial)	3.53	Very Practical
Student Responses (Field Test)	3.55	Very Practical
Implementation of Learning (Teacher Assessment)	3.83	Very Practical

The data show that both students and teachers found the media very practical to use. Students reported that the games were enjoyable, clear, and helped them understand energy transformation concepts. Teachers indicated that the media was easy to implement and effectively supported classroom instruction. The effectiveness test measured improvements in learning outcomes using pretest–posttest data analyzed with the Normalized Gain (N-Gain) formula.

**Table 3.** Analysis of Media Effectiveness Based on N-Gain Scores

Trial	Average N-Gain Score	Criteria
Group Trial	0.71	Very Effective (High)
Field Test	0.62	Effective (Moderate)
Average	0.65	Effective (Moderate)

The results indicate a consistent increase in students’ understanding of energy transformation concepts, with an overall N-Gain score of 0.65—categorized as Effective. This shows that the media significantly improved student learning outcomes while maintaining engagement through the edutainment approach.

### Evaluation Stage

The final phase involved evaluating and refining the product based on expert feedback and empirical data. The overall findings indicate that the “Exploring Energy Sources” media fulfills all three key feasibility aspects:

1. Validity: The product was validated as “Very Valid” by experts in content and media.
2. Practicality: Students and teachers rated the media as “Very Practical,” highlighting ease of use and high engagement.
3. Effectiveness: The media produced measurable improvements in student learning outcomes, proving its pedagogical value.

The integration of edutainment, 3R-based materials, and the Pancasila Student Profile successfully enhanced both cognitive and character aspects of learning. The media not only conveyed scientific concepts but also cultivated environmental responsibility and cooperation, aligning with the goals of the Merdeka Curriculum and Education for Sustainable Development (ESD).

### **Discussion**

The results of this study at SDN Purworejo show that the Exploring Energy Sources media developed using the Eco-Edutainment model is valid, practical, and effective in improving students’ engagement and learning outcomes in IPAS learning. The high validation score from experts and the positive classroom response are supported by the observed behavioral changes in students—who became more active, curious, and collaborative during learning. The N-Gain score of 0.65 indicates a substantial increase in understanding of energy concepts. This improvement corresponds with the effectiveness of game-based learning (GBL), which transforms passive learning situations into interactive experiences (Bhat et al., 2023). Similar to what was found by (Sutrisno et al., 2023; Thohiroh, 2024; Zakaria & Zakaria, 2025) learning through games in SDN Purworejo succeeded in making students not only memorize but also analyze and apply concepts. When students advanced on the board game by answering questions about renewable and non-renewable energy, they connected the material with examples from their daily environment—such as the use of solar panels and firewood—which showed contextual critical thinking in line with Chang et al. (2018) and Wijayanti and Ekantini (2023) (Chang et al., 2018; Wijayanti & Ekantini, 2023).

The findings also reveal that the success of this media lies in its synergy between edutainment and the development of the Pancasila Student Profile (PPP) competencies. In the critical thinking dimension, the questioning mechanism in the game required students to analyze, evaluate, and make decisions—reflecting higher-order thinking as emphasized by

(Muhibbuddin et al., 2023; Sartika et al., 2021; Setiawan & Phillipson, 2019). This was visible during the intervention at SDN Purworejo, where students who were initially hesitant to express opinions began to explain their reasoning when asked about energy changes or sustainable sources. In the creative dimension, students' involvement in creating and using media from recycled materials encouraged innovation, consistent with (Weng, 2022) and (Rulyansah et al., 2022). Many students proposed new designs or materials for future games, indicating the growth of creative confidence and ecological imagination. Meanwhile, the dimension of gotong royong was strongly reflected in the way students cooperated during group play, took turns fairly, and helped each other understand difficult questions. This aligns with Mahanani et al. (2023) and Maulana and Widodo (2025), who emphasized that learning modules integrating the values of PPP foster both academic and moral competencies (Mahanani et al., 2023; Maulana & Widodo, 2025).

The use of 3R-based materials in this study had a dual role: as pedagogical tools and as instruments of environmental education. In SDN Purworejo, where students' awareness of waste management was initially low, this medium became an effective contextual intervention. Students showed pride in using tools made from recycled materials and began collecting bottles and cardboard at home for future learning projects. This reflects the view of Anggry et al. (2022) and Jekria and Daud (2016) that hands-on learning with recycled materials strengthens ecological attitudes and environmental awareness (Anggry et al., 2022; Jekria & Daud, 2016). The implementation also aligns with the principles of Education for Sustainable Development (ESD), where sustainability is taught through real action rather than abstract concepts (Nugroho et al., 2025). From a learning theory perspective, this approach reflects constructivist principles, where students build knowledge through direct experience and interaction with their environment (Harini & Usman, 2019). Moreover, this process enhances students' creative confidence, as described by Burky (2022), by showing them that innovation can arise from simple and low-cost materials (Burky, 2022).

Field data also support that Eco-Edutainment encourages a shift in learning culture. Teachers at SDN Purworejo observed that students who were previously passive became more motivated and responsible for their own learning. The playful yet purposeful environment made them enjoy the process of exploration, while still achieving the targeted learning objectives. These findings confirm the premise that edutainment can increase

motivation and engagement when designed with clear educational intent (Bhat et al., 2023; Wijayanti & Ekantini, 2023). Additionally, it responds to the gap previously found in SDN Purworejo namely the dominance of lecture-based learning and low student participation by presenting an alternative that integrates joy, collaboration, and reflection.

Despite its strengths, this study acknowledges certain limitations. The sample size was relatively small (N=13) and limited to one school, which constrains the generalizability of findings. The short intervention period also restricted the ability to measure long-term behavioral change. Future research should therefore explore longitudinal applications of the Eco-Edutainment model in multiple schools with different contexts to test external validity and sustainability. Furthermore, adapting this model to other subjects such as Science, Citizenship, or Art could enrich its interdisciplinary potential and help strengthen the Pancasila Student Profile holistically.

Overall, the Eco-Edutainment model has proven to address the real needs of SDN Purworejo enhancing critical thinking, creativity, and environmental awareness—while nurturing character values of cooperation and care. The use of 3R-based media has also linked cognitive learning with environmental ethics, turning local school challenges into opportunities for innovation. Thus, this study not only validates theoretical assumptions from prior research but also contributes practical evidence that context-based, low-cost, and character-integrated learning models can effectively transform elementary education in Indonesia toward sustainable and joyful learning.

## CONCLUSION

According to the findings of the research and development, the 3R-based edutainment media product, "Exploring Energy Sources," which is integrated with the Pancasila Student Profile, satisfies the high eligibility requirements for use in the IPAS learning process in fourth grade elementary school. This eligibility is confirmed through three pillars of evaluation. In terms of validity, this media was rated "Very Valid" by subject matter experts (score of 4.00) and media experts (score of 3.90). In terms of practicality, this media received a "Very Practical" response from both students (average score of 3.55) and teachers (score of 3.83). In terms of effectiveness, this media proved to be "Effective" in improving student learning outcomes with an average N-Gain score of 0.65. The main contribution of this research is the

empirical validation of the "Eco-Edutainment" model, which synergistically integrates an engaging game-based learning approach, the use of recycled materials as pedagogical tools to instill environmental awareness, and the Pancasila Student Profile framework for character building. This model offers an innovative, economical, and contextually relevant solution for educators in Indonesia to respond to the challenges of the Merdeka Curriculum, namely to create learning that is not only academically effective but also meaningful in shaping students who are intelligent, creative, collaborative, and concerned about a sustainable future.

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