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Eco-Anim: Animated Learning Media to Enhance Student Outcomes in Ecology and Biodiversity

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Abstract

This study addresses the challenge of low student learning outcomes in abstract science topics, specifically Ecology and Biodiversity among Grade VII students at MTsN 1 Kota Kediri. The research aims to develop and evaluate an innovative digital learning medium, *Eco-Anim*, an animated video designed to improve students' conceptual understanding. Employing the Research and Development (R&D) methodology, the study follows the ADDIE model, encompassing the phases of Analysis, Design, Development, Implementation, and Evaluation. Validation by subject matter and media experts confirmed the feasibility of Eco-Anim, with scores of 91.4% and 87.1% respectively, while user responses were highly positive at 93.2%. An effectiveness test, based on pretest and posttest comparisons, demonstrated significant learning gains, with an average N-Gain score of 0.7991, indicating high effectiveness. Developed using the Animaker platform and integrated with interactive quizzes via Quizizz, Eco-Anim successfully enhanced student engagement and comprehension. The findings suggest that visually engaging and interactive digital media can serve as effective tools for improving science education, particularly in abstract content areas.

Keywords: Eco-Anim; Animated Video; Learning Outcomes; Ecology and Biodiversity; Animaker

INTRODUCTION

Education plays a crucial role in shaping individuals and societies worldwide, as it serves as a foundational pillar for personal growth, social development, and national progress. It is widely acknowledged that education is not limited to formal instruction within school settings, but rather functions as a continuous, lifelong process involving a diverse array of experiences that contribute to the development of knowledge, practical skills, and moral character (Mukodi, 2018). These experiences, both formal and informal, prepare individuals to navigate challenges, contribute meaningfully to society, and adapt to changing environments (Sanulita et al., 2024). In the context of Indonesia, numerous studies and national assessments have consistently highlighted the persistent challenges faced in enhancing the quality of education, particularly in the field of science at the junior high school level (Dewantara, 2024). Many students continue to struggle with subjects that involve abstract and conceptual content, such as ecology and biodiversity, which demand higher-order thinking and visualization skills (Janna, 2020). According to data from the Ministry of Education and Culture, a significant number of students have yet to achieve the minimum level of competence in these subjects (Dewi et al., 2024). This issue is also evident at the local level; for example, at MTsN 1 Kota Kediri, around 30% of seventh-grade students have not met the Minimum Mastery Criteria (KKTP), indicating a considerable gap between expected learning outcomes and students' actual understanding. This learning gap not only reflects the limitations of current teaching methods but also underscores the urgency of implementing more effective, engaging, and student-centered learning strategies to ensure that all learners can grasp complex scientific concepts and achieve academic success.

In response to this issue, the researcher emphasizes the importance of improving learning methods through the integration of technology-based instructional media, particularly in addressing the limitations of conventional teaching practices. According to Hidayat and Abdillah (2019), education must be aligned with efforts to develop learners' potential by providing relevant, engaging, and contextually meaningful experiences. In today's learning environments, traditional lecture-based methods alone are no longer sufficient—especially in teaching complex scientific topics such as ecology and biodiversity that require strong visual and conceptual understanding. Constructivist theorists argue that learners actively construct knowledge when they engage with meaningful, interactive environments that stimulate critical thinking and exploration (Suparlan, 2019). Therefore, the use of learning media that combine visual, auditory, and interactive elements becomes

essential to enhance student comprehension, retention, and motivation. As emphasized by Pristiwanti et al. (2022) effective education involves both formal instruction and informal interactions that support holistic learning experiences. In addition, Farikhatul (2021) underscores that education should not only equip learners with academic knowledge but also foster independence and character through innovative, learner-centered approaches. By integrating interactive technology-based media, educators can create more inclusive and stimulating learning environments that better address students' needs and close the gap in science learning outcomes (Mukhid, 2023).

Previous studies have shown promising results regarding the use of digital animated media in education. Research by Mariati (2024), Mosrifa (2022), and Natunnada et al. (2024) reported that animation-based learning using platforms like Animaker significantly improves student engagement, understanding, and academic performance across various subjects. These findings are supported by Ariandhini and Anugraheni (2022), who emphasized that animation can transform abstract concepts into more concrete visual representations, thus facilitating comprehension and retention. In addition, Purba et al. (2025) highlighted that interactive elements embedded in animated learning media, such as quizzes or reflection prompts, can stimulate higher-order thinking and strengthen long-term memory. Despite these positive outcomes, most of the existing studies were not focused specifically on science topics such as ecology and biodiversity, or were conducted in educational contexts different from Indonesian Islamic junior high schools (MTs). This creates a research gap concerning the development and implementation of animation-based instructional media that are thematically tailored to environmental science topics and culturally appropriate for MTs students. Addressing this gap is crucial to ensure that the media developed are both pedagogically effective and contextually relevant to the learners' academic and cultural environments (Fadhluzzakiyy et al., 2025).

To address this gap, this study introduces a learning media called *Eco-Anim* (short for *Ecology Animation*), which combines animated video content with interactive features such as quizzes. The media is designed using the Animaker platform and integrated with Quizizz to provide a comprehensive, engaging, and student-centered learning experience. This approach is grounded in Cognitive Load Theory (Sweller, 2010), which suggests that well-designed instructional media can reduce extraneous cognitive load and enhance learners' ability to process and retain information effectively by optimizing the use of working memory. Furthermore, Heinich et al. (2002) emphasize that media serve as message carriers that

influence not only how information is delivered but also how it is perceived and internalized by learners, thereby making the selection and design of media a crucial component in achieving instructional success. Complementing this, Suparlan (2019) asserts through the lens of constructivist learning theory that students learn best when they actively interact with their environment and construct knowledge through meaningful experiences. In this context, *Eco-Anim* is designed to promote active engagement, reflection, and deeper conceptual understanding, especially for abstract scientific topics like ecology and biodiversity, within the culturally relevant setting of Indonesian Islamic junior high schools.

Given these theoretical underpinnings and contextual challenges, this study aims to develop and evaluate the feasibility and effectiveness of *Eco-Anim* as a learning tool for improving seventh-grade students' understanding of ecology and biodiversity at MTsN 1 Kota Kediri. By addressing the identified learning gaps and leveraging the principles of cognitive load management, multimedia learning, and constructivist pedagogy, the research seeks to determine whether *Eco-Anim* can function as an innovative, engaging, and pedagogically sound instructional media. The goal is not only to assess its technical and practical feasibility in classroom settings but also to examine its impact on students' cognitive outcomes, motivation, and engagement during the learning process. Furthermore, this study explores how the integration of animated videos with interactive features such as quizzes may enhance students' comprehension of abstract science content, facilitate long-term retention, and foster a more meaningful and enjoyable learning experience. Ultimately, the research aims to ensure that *Eco-Anim* aligns with students' learning needs and contributes to improving the overall quality of science education in the context of Indonesian Islamic junior high schools.

METHODS

This study uses the research and development (R&D) method. This method aims to produce a product and test its feasibility (Waruwu, 2024). In its implementation, researchers refer to the ADDIE development model, which stands for Analysis, Design, Development, Implementation, and Development. The ADDIE model is procedural and systematic, thus supporting a structured and detailed design process. This approach also helps minimize the risk of failure in each stage of development (Branch, 2010).

The following are the stages of the ADDIE model: **(1)** The analyze phase aims to identify possible causes that underlie the performance gap. Some of the main steps that are usually taken in this phase include validating the existence of a performance gap, setting learning objectives, identifying student characteristics, determining the resources needed to complete the entire process in the ADDIE model, evaluating alternative delivery systems, and developing a focused project management plan. **(2)** The design phase aims to ensure the achievement of expected performance and determine the right evaluation method. Some of the main steps in this phase include: analyzing the tasks to be completed, formulating performance objectives, designing evaluation strategies, and calculating estimated profits or return on investment. The main product produced from this phase is usually a design summary. **(3)** The development stage aims to create and validate various learning resources that will be used during the use of the learning module. The main steps in this stage include: compiling learning materials, selecting or developing supporting media that are in accordance with the project's objectives, compiling guidelines for teachers and students, conducting formative revisions based on feedback, and conducting initial trials. The main product of this stage is all the learning resources needed to support the implementation of the ADDIE model as a whole. **(4)** The implementation stage aims to prepare the learning environment and actively involve students in the learning process. The main procedures in this stage include: preparing educators to be ready to deliver the material well, and preparing students to follow the learning optimally. The main product produced at this stage is the implementation strategy that will be used in the implementation of learning. **(5)** The evaluation stage aims to assess the quality of the product and the entire learning process, both before and after its implementation. The main procedures in this phase include: determining or designing the necessary evaluation instruments, and implementing the evaluation activities themselves. The main result of this stage is a comprehensive evaluation plan.

The data collection instruments used in this study were interviews, tests, and documentation, Questionnaires. Validity data analysis used the percentage of eligibility from two material experts and two media experts. While effectiveness was analyzed through pretest and posttest tests of student learning outcome questionnaires using hypothesis testing and N-Gain tests.

RESULTS

This research produced a learning media product in the form of an animated video, developed using the Animaker platform. The development process followed a Research and Development (R&D) approach utilizing the ADDIE model, which includes five stages: Analysis, Design, Development, Implementation, and Evaluation.

In the Analyze stage, the researcher conducted needs analysis, curriculum analysis, and resource analysis as the foundation for media development. The Design stage involved task inventory, formulation of performance objectives, and development of assessment strategies. During the Develop stage, the initial media format was designed, the content was developed, and expert validation was conducted.

At the Develop stage, a feasibility test was conducted to assess the extent to which the *Eco-Anim* learning media meets the criteria for being suitable for use in the instructional process. In addition to evaluating its appropriateness, the feasibility test also served as a reference for revising and refining the media before broader implementation in educational settings (Dafianti & Auliya, 2025). The feasibility of the Eco-Anim media was based on validation results from subject matter experts and media experts. This validation aimed to determine the quality and readiness of the developed learning media (Purnama & Pramudiani, 2021). The evaluation instrument was administered in the form of questionnaires provided to the validators, which also included sections for comments and suggestions. The feasibility assessment covered three main aspects: content quality, visual appearance, and technical usability. These components were assessed by both content and media experts using a systematically designed validation instrument.

Tabel 1. Average Validation Value

Validator	Score	Highest Score	Percentage
Media expert	64	70	91.4%
Content expert	61	70	87.1%
Average			89.25%

Tabel 2. Feasibility Percentage Value

Percentage	Criteria	Description
81%-100%	Very Good	Highly Valid
61%-80%	Good	Valid
41%-60%	Quite Good	Quite Valid
21%-40%	Not Good	Less Valid
0%-20%	Very Poor	Not Valid

(Riduwan et al., 2011)

Based on the validation results from media and content experts, the Eco-Anim learning media demonstrated a very high level of feasibility for use in the instructional process. The media expert awarded a score of 91.4% for visual design, navigation, layout, and alignment with student characteristics, placing it in the "highly valid" category. Meanwhile, the content expert assessed the alignment with the curriculum, accuracy of material, clarity of concept delivery, and relevance to learning objectives, resulting in a score of 87.1%, also categorized as "highly valid." The average score from both experts was 89.25%, indicating that Eco-Anim meets the standards of feasibility and validity as an interactive science learning media.

The Implement stage included small-scale trials to gather student feedback, followed by large-scale implementation using pretest and posttest data to measure effectiveness. Following the implementation phase, student learning outcomes were measured through pretest and posttest assessments conducted before and after the use of the *Eco-Anim* learning media. The data were then analyzed to determine the effectiveness of the media in improving students' learning outcomes. The analysis began with a normality test to assess whether the data followed a normal distribution, which is a prerequisite for hypothesis testing. The data are considered normally distributed if the significance value (Sig.) is greater than 0.05, and non-normally distributed if Sig. is less than 0.05 (Hardiyansyah, 2025). A Sig. level of 0.05 was chosen to balance the risk of error in hypothesis testing and is regarded as a standard level of statistical confidence (Sarwono, 2017). The results of the normality test are as follows:

Tabel 3. Test Normality

	Shapiro-Wilk		
	Statistic	**Df**	**Sig.**
pretest	.960	34	.251
posttest	.914	34	.011

Normality testing was conducted using the Shapiro-Wilk test, in which data are considered normally distributed if the significance value (Sig.) exceeds 0.05. The analysis results showed that the pretest score had a Sig. value of 0.251 (> 0.05), indicating that the pretest data were normally distributed. However, the posttest Sig. value was 0.011 (< 0.05), indicating that the posttest data were not normally distributed.

Since one of the data sets was not normally distributed and the sample size was fewer than 50, a non-parametric test was applied using the Wilcoxon Signed Rank Test. The

decision rule for this test is as follows: if the Asymp.Sig. (2-tailed) value is less than 0.05, then the alternative hypothesis (Ha) is accepted; if greater than 0.05, Ha is rejected.

Tabel 4. Test Statistics

	posttest – pretest
Z	-5.120[b]
Asymp. Sig. (2-tailed)	.000

The data are considered statistically significant if the Asymp.Sig. value is less than 0.05. Based on the Wilcoxon test results, the obtained significance value was 0.00, indicating that the alternative hypothesis is accepted. This implies a significant effect of the *Eco-Anim* learning media on students' learning outcomes in the topic of ecology and biodiversity.

In addition, data analysis was complemented by the N-Gain test to assess the improvement in learning outcomes and evaluate the effectiveness of the media. The N-Gain test was conducted by calculating the difference between pretest and posttest scores. The media is considered effective if the N-Gain value exceeds 0.70. The following presents the results of the N-Gain analysis:

Tabel 5. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
N_Gain_Score	34	.62	1.00	.7991	.10358
N_Gain_Presentase	34	61.54	100.00	79.9119	10.35763
Valid N (listwise)	34				

Table 6. Gain Score Distribution

N-Gain Value	Validity Criteria
G > 0.70	Tall
0.30 < G > 0.70	Keep
G < 0.30	Low

(Hake, 1999)

Table 7. N-Gain Interpretation Categories

Score interval	Validity criteria
0<40%	Ineffective
40%-55%	Less Effective
56% -75%	Quite effective
>76%	Effective

(Hake, 1999)

Based on the analysis, the average N-Gain score was 0.7991, which falls into the high category according to Table 6. Additionally, the N-Gain percentage score of 79.91% indicates that the *Eco-Anim* learning media is considered effective based on the criteria outlined in Table 7. Therefore, the *Eco-Anim* animated video-based learning media can be deemed effective in improving students' learning outcomes on the topic of ecology and biodiversity.

Finally, the Evaluate stage involved setting evaluation criteria covering the entire process from Analyze to Implement, to assess the extent to which the *Eco-Anim* learning media improved students' learning outcomes.

DISCUSSION

The results of this study demonstrate that the *Eco-Anim* learning media is effective in enhancing the learning outcomes of seventh-grade students at MTsN 1 Kota Kediri on the topic of ecology and biodiversity. This is evidenced by a significant increase in the average score from 52.5 in the pretest to 85.2 in the posttest. The calculated N-Gain score of 0.7991, or 79.91%, falls into the high category, indicating substantial learning improvement. Furthermore, the Wilcoxon signed-rank test revealed a significance value of 0.000 (Asymp. Sig. < 0.05), which confirms a statistically significant difference between pretest and posttest scores. These results directly address the research objective of evaluating the effectiveness of the developed media in improving cognitive learning outcomes.

This finding is consistent with prior research conducted by Mariati (2024), Mosrifa (2022), and Natunnada et al. (2024), which reported that Animaker-based learning media is not only visually appealing but also effective in enhancing student understanding. These studies noted high validity and effectiveness scores, with learning outcomes improving significantly. Similarly, the validation scores obtained in the current study—91.4% from content experts, 87.1% from media experts, and 93.2% from student responses—support the conclusion that *Eco-Anim* is both feasible and engaging as a learning tool. These parallels confirm that interactive animated videos are well-suited for conveying abstract concepts such as ecosystems, biodiversity, and environmental cycles, which often pose challenges in traditional instruction.

The implications of these findings are significant for the advancement of technology-integrated science education. *Eco-Anim* does not merely deliver content visually; it also includes interactive quizzes via Quizizz, allowing students to immediately assess their

understanding and receive real-time feedback. This aligns with Sweller's Cognitive Load Theory (Sweller, 2010), which advocates for reducing extraneous cognitive demands to support efficient information processing and improve working memory function. Moreover, the use of *Eco-Anim* supports the constructivist learning paradigm (Suparlan, 2019), which emphasizes active student engagement in constructing knowledge through interactive and meaningful learning experiences. In addition, Heinich et al. (2002) emphasize that instructional media function as message carriers that influence not only how content is delivered but also how learners interpret and internalize information. By integrating visual, auditory, and interactive components in a cohesive format, *Eco-Anim* promotes deeper conceptual comprehension, stimulates critical and reflective thinking, improves retention, and enhances students' intrinsic motivationfostering a more meaningful, engaging, and student-centered learning experience, particularly in science topics that are often abstract and challenging to grasp through traditional methods.

Despite these positive results, this study has several limitations. The sample size was small, consisting of only 34 students from one class at a single school (class 7J of MTsN 1 Kota Kediri), which restricts the generalizability of the findings. In addition, the media's long-term effectiveness was not assessed, as the intervention was implemented over a short period. The study also focused solely on cognitive learning outcomes, leaving the affective and psychomotor domains unexplored. Future research should address these limitations by involving larger and more diverse populations, assessing long-term impacts, and examining broader aspects of learning to comprehensively evaluate the effectiveness of animated video media such as *Eco-Anim*.

CONCLUSION

The results of this research and development indicate that the *Eco-Anim* animated video learning media has a high level of validity, practicality, and effectiveness in improving student learning outcomes on the topic of ecology and biodiversity. Validation scores from both material and media experts exceeded 87%, and user responses reached 93.2%, reflecting strong feasibility and student interest. The learning outcomes, as measured by pretest and posttest scores, improved significantly with an N-Gain score of 0.7991 (79.91%), which is categorized as high. These findings confirm that *Eco-Anim* successfully addresses the research

objectives by serving as an engaging and interactive instructional tool that supports students in understanding abstract scientific concepts.

Despite its promising results, this study has several limitations. The implementation was restricted to a single class of seventh-grade students at MTsN 1 Kota Kediri, limiting the generalizability of the findings. Additionally, the research focused only on the cognitive domain of learning outcomes, leaving the affective and psychomotor aspects unexplored. The duration of the intervention was also relatively short, which may not fully capture the long-term impact of the media on students' learning retention or behavioral changes.

Based on these considerations, future research is recommended to involve a larger and more diverse sample across multiple schools and educational levels. It would also be valuable to examine the impact of *Eco-Anim* over longer periods and to explore its effectiveness in other science topics or disciplines. Furthermore, incorporating assessments of affective and psychomotor outcomes could offer a more holistic evaluation of learning success. With continuous refinement and broader testing, *Eco-Anim* has strong potential to serve as a model for innovative, technology-based learning media that creates a meaningful, enjoyable, and modern learning experience for students.

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