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DEVELOPMENT OF INTERACTIVE MULTIMEDIA ASSISTED WEB 2.0 APK USING ARTICULATE STORYLINE 3 TO ENHANCE ECOSYSTEM LEARNING OUTCOMES OF ELEMENTARY SCHOOL STUDENTS

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Abstract

This study was conducted to develop and assess the validity, practicality, and effectiveness of interactive multimedia assisted by Web 2.0 APK and designed using Articulate Storyline 3 for fifth-grade ecosystem instruction. The research applied a Research and Development (R&D) method through the ADDIE framework, which includes the stages of analysis, design, development, implementation, and evaluation. The participants involved one classroom teacher and 31 fifth-grade students from SD Negeri 1 Pendem. Data were obtained through classroom observations, interviews, questionnaires, expert validation forms, and pretest–posttest assessments. The validation findings revealed that the multimedia achieved a score of 92.97% from the material expert and 98.68% from the media expert, both categorized as highly valid. In terms of practicality, the teacher's assessment reached 98.68%, while students' responses obtained 94.44%, resulting in an overall average of 96.56%, which indicates a highly practical category. Moreover, students' mean achievement scores increased from 68.29 on the pretest to 88.25 on the posttest. These results demonstrate that the developed multimedia effectively enhanced students' understanding and learning outcomes in ecosystem topics.

Keywords: Web 2.0 APK, Interactive Multimedia, Ecosystem Learning, Learning Outcomes, Articulate Storyline 3

Abstrak: Penelitian ini dilakukan untuk mengembangkan dan menilai validitas, kepraktisan, serta efektivitas multimedia interaktif berbantuan Web 2.0 APK yang dirancang menggunakan Articulate Storyline 3 pada pembelajaran ekosistem kelas V sekolah dasar. Penelitian ini menerapkan metode Research and Development (R&D) dengan menggunakan model ADDIE yang meliputi tahap analisis, desain, pengembangan, implementasi, dan evaluasi. Partisipan penelitian terdiri atas satu guru kelas dan 31 siswa kelas V SD Negeri 1 Pendem. Data diperoleh melalui observasi kelas, wawancara, angket, lembar validasi ahli, serta tes pretest–posttest. Hasil validasi menunjukkan bahwa multimedia memperoleh skor 92,97% dari ahli materi dan 98,68% dari ahli media, yang keduanya termasuk dalam kategori sangat valid. Dari segi kepraktisan, penilaian guru mencapai 98,68%, sedangkan respons siswa memperoleh 94,44%, sehingga menghasilkan rata-rata keseluruhan sebesar 96,56% yang menunjukkan kategori sangat praktis. Selain itu, rata-rata nilai siswa meningkat dari 68,29 pada pretest menjadi 88,25 pada posttest. Hasil tersebut menunjukkan bahwa multimedia yang dikembangkan efektif dalam meningkatkan pemahaman dan hasil belajar siswa pada materi ekosistem.

Kata Kunci: Web 2.0 APK, Multimedia Interaktif, Pembelajaran Ekosistem, Hasil Belajar, Articulate Storyline 3.

Background

In the contemporary digital education era, the integration of technology into classroom instruction has become increasingly important in improving learning quality and enhancing students' academic achievement (Cui, 2024). However, science literacy among Indonesian students remains a significant educational challenge. According to the 2022 results of the Programme for International Student Assessment (PISA), Indonesia recorded a science literacy score of 383, remaining substantially below the OECD average score of 485 (OECD, 2023). This disparity highlights the urgent necessity for the integration of innovative digital learning media capable of enhancing students' scientific literacy and academic achieve. This disparity reflects persistent challenges faced by students in comprehending scientific concepts, critically analyzing scientific phenomena, and applying scientific knowledge to real-world contexts, particularly at the elementary school level (Carolina, 2023).

The use of appropriate learning media is important in elementary education because students at this stage are still in Piaget's concrete operational phase and require visual, contextual, and interactive learning experiences to understand abstract concepts (Margunayasa *et al.,* 2021). This condition is highly relevant to Ilmu Pengetahuan Alam dan Sosial (IPAS) learning, especially ecosystem material, which requires students to understand the relationships between living organisms and their environment (Ghaniem *et al*., 2023). Therefore, interactive multimedia is considered suitable to support students' conceptual understanding and learning engagement (Mayer, 2024).

However, the learning media currently used in schools are still limited and tend to rely on textbooks, PowerPoint presentations, and teacher explanations, which are less capable of visualizing ecosystem concepts comprehensively (Artawan *et al.,* 2024). Preliminary observations and interviews conducted on 10 October 2025 with Mrs. Ni Luh Ketut Yunita Sari,

S.Pd., the fifth-grade teacher at SD Negeri 1 Pendem, revealed that students show greater interest in interactive digital media such as animations, educational videos, quizzes, and games. Unfortunately, the integration of technology-based learning media in classroom practice has not been optimized (Ermawan *et al.,* 2025). This gap between students' learning needs and the available learning media contributes to low engagement and suboptimal learning outcomes in IPAS learning (Nasution, 2023).

To address this issue, accessible and interactive learning tools are needed to support student-centered learning in accordance with the Merdeka Curriculum, which emphasizes creativity, active participation, and the integration of technology in learning processes (Kemendikbudristek, 2024). One alternative is the use of Web 2.0 APK-assisted interactive multimedia integrated with Articulate Storyline 3. Web 2.0 APK enables students to access learning materials flexibly through digital devices, while Articulate Storyline 3 provides interactive features such as animations, quizzes, simulations, and game-based learning activities that can improve students' motivation and conceptual understanding (Rohmad & Sarah, 2021).

A number of earlier investigations have demonstrated that interactive multimedia designed with Articulate Storyline 3 can enhance both students' motivation to learn and their academic performance (Dewanto et al., 2021). Nevertheless, most existing research has concentrated on varied subject content, teaching approaches, and educational contexts, whereas studies specifically addressing ecosystem topics in elementary education are still relatively scarce. In addition, the integration of Web 2.0 APK technology as a practical and adaptable platform to support learning activities has received limited attention within the field of interactive multimedia development (García, 2025). These circumstances emphasize the importance of creating technology-enhanced instructional media that encourages active participation, learner autonomy, and student-centered instruction. Accordingly, the present study seeks to design interactive multimedia assisted by Web 2.0 APK through the use of Articulate Storyline 3, as well as to evaluate its validity, practicality, and effectiveness in improving the learning outcomes of fifth-grade students on ecosystem-related materials (Dewi, 2024).

Method

The interactive multimedia assisted by Web 2.0 APK for the topic "Harmony in Ecosystem" was designed using the ADDIE instructional development approach. This development procedure followed five interconnected phases, namely analysis, design, development, implementation, and evaluation. The ADDIE model was selected due to its well-organized and systematic characteristics, which support the creation of instructional media that is interactive,

effective, and oriented toward student learning needs. Every phase was implemented in a gradual and continuous manner to ensure the appropriateness and overall quality of the multimedia product developed in this study. The complete stages of the process are illustrated in the diagram below.

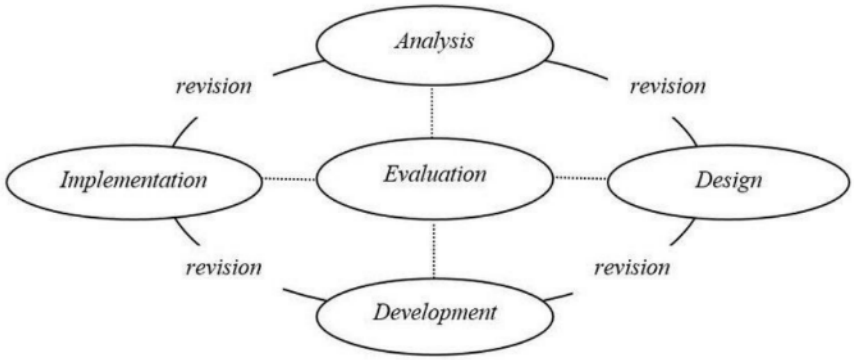

Figure 1. Stages of the ADDIE Development Model

This research adopted a Research and Development (R&D) methodology to produce interactive multimedia integrated with Web 2.0 APK technology through Articulate Storyline 3 for ecosystem instruction at the elementary school level. The study took place at SD Negeri 1 Pendem, located in Jembrana Regency, Bali, during the 2025/2026 school year. The subjects involved in the research included 31 students from the fifth grade along with one homeroom teacher who participated in both the implementation and assessment stages. These participants were engaged to determine the suitability and effectiveness of the multimedia product in facilitating interactive learning supported by digital technology.

At the initial stage of the study, classroom observations were carried out to analyze the learning conditions, students' characteristics, and the instructional media utilized in ecosystem learning activities. Interviews with the fifth-grade teacher were also carried out to obtain information regarding learning difficulties, students' engagement, and the need for interactive learning media. In addition, documentation activities such as collecting lesson plans, learning materials, photos, and school data were conducted to support the research process.

Drawing upon the data gathered during the preliminary stages, the interactive multimedia product was systematically designed and developed through the integration of Articulate Storyline 3 with a Web 2.0 APK platform. Following the development process, the product underwent a validation procedure involving a material expert and a media expert to evaluate its overall quality and instructional feasibility. The assessment covered several essential aspects, including the accuracy and relevance of the content, language appropriateness, presentation structure, navigation functionality, and visual design. In addition, the suggestions and feedback provided by the experts were used as essential references for revising and improving the multimedia product before its implementation in classroom learning activities.

The implementation phase was conducted during fifth-grade ecosystem learning activities at the research site. Prior to the use of the developed multimedia, students were required to complete a pretest to measure their initial understanding of ecosystem concepts. Subsequently, after participating in the learning process utilizing the Web 2.0 APK-assisted interactive multimedia, students completed a posttest to evaluate improvements in their learning outcomes. Additionally, questionnaires were administered to the classroom teacher and students to evaluate the practicality and usability of the developed multimedia in real classroom situations. The instrument used a four-point Likert scale consisting of strongly agree, agree, disagree, and strongly disagree categories. The obtained data were analyzed and converted into percentage scores to determine the validity and practicality levels of the multimedia product.

The effectiveness of the multimedia product was evaluated by comparing students' academic performance prior to and following the use of the developed interactive multimedia in the learning process. The comparison between pretest and posttest results was used to identify the extent to which the multimedia contributed to students' conceptual understanding of ecosystem material. Moreover, the results of this study were used to evaluate the feasibility, instructional effectiveness, and practical advantages of the multimedia as an innovative learning medium for fifth-grade elementary school students.

Result and Discussion

Result

The development of Web 2.0 APK-assisted interactive multimedia utilizing Articulate Storyline 3 was carried out by adopting the ADDIE instructional design framework. This development model comprises five systematic and interconnected stages, namely Analysis, Design, Development, Implementation, and Evaluation, which were implemented to ensure the development of effective, interactive, and pedagogically suitable learning media for elementary school students.

During the analysis stage, classroom observations and interviews were carried out with the fifth-grade teacher at SD Negeri 1 Pendem to examine students' learning characteristics, identify learning obstacles, and analyze the instructional media commonly used in ecosystem learning activities. The findings indicated that the learning process remained largely dependent on textbooks and teacher-centered instruction, limiting students' understanding of ecosystem concepts in a comprehensive manner. As a result, many students experienced difficulties in connecting theoretical concepts with real-life environmental phenomena. Moreover, students demonstrated stronger interest and engagement when exposed to interactive digital learning resources, including animations, educational videos, quizzes, and game-based activities.

These conditions indicate the necessity of developing innovative and interactive learning media capable of facilitating students' conceptual understanding, increasing learning motivation, and promoting more active participation in classroom learning activities.

Referring to the findings obtained during the analysis phase, the interactive multimedia was systematically designed by integrating Articulate Storyline 3 with a Web 2.0 APK platform. At this stage, the researcher developed the overall structure and interface of the multimedia product, which included the homepage, learning objectives, instructional content, animated videos, interactive quizzes, educational games, and evaluation components. The multimedia interface was designed in accordance with the cognitive abilities and learning preferences of elementary school students through the integration of attractive color schemes, simple navigation systems, clear typography, and various interactive visual elements. These features were incorporated to foster a learning atmosphere that is more engaging, meaningful, and focused on students' active involvement, thereby encouraging greater motivation and participation during ecosystem learning activities.

At the development stage, the designed multimedia components were developed and integrated into Articulate Storyline 3. A variety of multimedia components, including pictures, audio recordings, animations, videos, and interactive assessment activities, were integrated to produce an engaging instructional medium. Following the development stage, the multimedia product was transformed into a Web 2.0 APK format, enabling access through smartphones, laptops, and other digital platforms. Once finalized, the product underwent validation by a material expert and a media expert to assess aspects such as content accuracy, language clarity, presentation quality, navigation, and visual design. Feedback, recommendations, and evaluations provided by the experts served as the basis for revising and refining the developed multimedia product.

Figure 2. Interactive Multimedia

The implementation stage was conducted in the fifth grade of SD Negeri 1 Pendem involving 31 students and one classroom teacher. During the learning activities, students used the developed multimedia in ecosystem learning. Before using the multimedia, students

completed a pretest to measure their initial understanding of ecosystem concepts. Following the completion of the learning activities, students completed a posttest to assess the improvement of their learning outcomes. In addition, questionnaires for both teachers and students were distributed to measure the practicality and ease of use of the multimedia product during its implementation in classroom learning activities.

The evaluation stage was conducted to determine the validity, practicality, and effectiveness of the developed interactive multimedia. Product validity was assessed by material and media experts, while practicality was identified through teacher and student questionnaire responses during implementation. The effectiveness of the multimedia was measured by comparing students' pretest and posttest scores on ecosystem material. The results showed that the multimedia met highly valid and practical criteria and effectively improved fifth-grade students' learning outcomes. Therefore, the Web 2.0 APK-assisted multimedia integrated with Articulate Storyline 3 is considered suitable for supporting technology-based learning in elementary schools.

The validity assessment was carried out to examine the feasibility and quality of the Web 2.0 APK-assisted interactive multimedia developed through Articulate Storyline 3. The validation process involved two experts, namely a material expert and a media expert, to evaluate the instructional and technical feasibility of the multimedia product. The material expert evaluated several aspects, including the relevance and accuracy of the learning content, the clarity of language usage, the alignment of learning objectives, and the suitability of the ecosystem material with the elementary school curriculum. In contrast, the media expert focused on assessing the visual design, navigation functionality, level of interactivity, layout organization, and overall technical performance of the multimedia. Through this validation process, the developed multimedia was systematically reviewed to ensure its effectiveness and appropriateness for classroom implementation.

Table 1. Results of Material and Media Expert Validation Analysis

Variable	Precentage (%)	Criteria
Material Expert	92,97%	Very Valid
Media Expert	98,68%	Very Valid

According to the validation findings, the material expert evaluation achieved a percentage score of 92.97%, while the media expert evaluation obtained a score of 98.68%. Both assessments were categorized as "Very Valid," indicating that the developed interactive multimedia fulfills the required instructional and technical standards for classroom application. These results demonstrate that the multimedia is highly appropriate for supporting ecosystem learning activities among fifth-grade elementary school students.

In addition, the experts provided several constructive recommendations to improve the quality of the multimedia product, including revising instructional guidelines, enhancing text

consistency, and refining several visual components to increase readability and student engagement. Following the revision and refinement process based on the experts' feedback, the multimedia product was considered feasible and ready to be implemented in elementary school learning activities.

The practicality assessment was carried out to examine the usability, attractiveness, and functional performance of the developed multimedia during the learning process. The evaluation involved one fifth-grade teacher and 31 students of SD Negeri 1 Pendem. This assessment aimed to determine the extent to which the multimedia could be easily used, support instructional activities effectively, and increase students' engagement in ecosystem learning. Through this assessment, the developed multimedia was examined not only from a technical perspective but also from its ability to create meaningful and interactive learning experiences in the elementary school classroom context.

Table 2. Results of Practicality Analysis Based on Teacher and Student Responses

Respondent	Percentage (%)	Criteria
Teacher	98,68%	Very Practical
Students	94.44%	Very Practical
Average	96,56%	Very Practical

The teacher's evaluation produced a percentage score of 98.68%, indicating that the developed multimedia was highly practical and could be implemented effectively within classroom learning activities. According to the teacher's response, the multimedia facilitated clearer explanations of ecosystem concepts and contributed positively to increasing students' learning motivation and classroom participation.

Similarly, the students' responses reached a percentage score of 94.44%, which was also categorized as "Very Practical." Most students demonstrated strong enthusiasm and active engagement while using the multimedia because it integrated various interactive features, such as animations, educational videos, interactive quizzes, images, and game-based learning activities. These features created a more enjoyable, interactive, and meaningful learning atmosphere compared to conventional instructional methods.

Overall, the average practicality score achieved 96.56%, indicating that the developed multimedia demonstrated a high level of practicality and was highly appropriate for supporting ecosystem learning activities in elementary schools.

The effectiveness analysis was carried out to examine whether the implementation of Web 2.0 APK-assisted interactive multimedia developed with Articulate Storyline 3 was able to enhance students' achievement in learning ecosystem concepts.

The effectiveness analysis was carried out using pretest and posttest scores obtained from 31 fifth-grade students. Before the multimedia was implemented, students completed a

pretest to measure their initial understanding of ecosystem concepts. After participating in the learning activities using the developed multimedia, students completed a posttest.

The findings revealed a substantial increase in students' learning outcomes following the use of the developed multimedia, with the average score improving from 68.29 on the pretest to 88.25 on the posttest. Statistical analysis also confirmed that the data were normally distributed and showed a significant difference between pretest and posttest results. These results indicate that the Web 2.0 APK-assisted interactive multimedia developed with Articulate Storyline 3 was effective in enhancing fifth-grade students' understanding of ecosystem concepts.

Discussion

The findings of this study demonstrate that the Web 2.0 APK-assisted interactive multimedia developed with Articulate Storyline 3 achieved high validity, practicality, and effectiveness for ecosystem learning in elementary schools. Expert validation results confirmed that the multimedia fulfilled instructional and technical quality standards through appropriate content, interactive features, and attractive visual design suited to elementary students' learning characteristics.

Teacher and student responses also indicated that the multimedia was practical and easy to use in classroom activities. The integration of videos, animations, and interactive quizzes created a more engaging learning atmosphere that increased students' motivation and participation during the learning process.

In terms of effectiveness, students' posttest scores showed clear improvement compared to their pretest results, indicating better understanding of ecosystem concepts. Moreover, the use of Web 2.0 APK technology enabled flexible access through various digital devices, supporting independent and technology-based learning aligned with the Merdeka Curriculum. Overall, the developed multimedia can be considered an innovative and effective instructional medium for fifth-grade ecosystem learning.

Conclusion

The results of this study indicate that the Web 2.0 APK-assisted interactive multimedia developed with Articulate Storyline 3 was highly valid, practical, and effective for ecosystem learning among fifth-grade elementary students. Expert evaluations confirmed that the multimedia met instructional and technical requirements, making it appropriate for classroom use.

Teacher and student responses also showed that the multimedia was engaging, easy to use, and capable of supporting more interactive learning activities. In addition, the

improvement in students' posttest scores demonstrated that the multimedia effectively enhanced their understanding of ecosystem concepts. Therefore, the developed multimedia can be regarded as an innovative learning medium that supports technology-based and student-centered learning in elementary schools.

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