Development of Pixton-Based Digital Comic Media on Plant Structure and Photosynthesis to Improve Grade 4 Elementary Students' Learning Outcomes

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ABSTRACT

The limited availability of innovative learning media in elementary schools often results in low student engagement and suboptimal learning outcomes, particularly in abstract science-related subjects. This study aims to develop and evaluate the effectiveness of Pixton-based digital comic media on plant structure and photosynthesis in Grade 4 Integrated Science and Social Studies (IPAS) learning. The research employed a Research and Development (R&D) approach using the ADDIE model, which includes analysis, design, development, implementation, and evaluation stages. The study was conducted at SDI Al-Amanah, South Tangerang, involving 30 fourth-grade students as research participants. Data were collected through expert validation sheets, student response questionnaires, and pretest–posttest instruments. The data analysis utilized descriptive statistics and inferential analysis using a paired sample t-test with SPSS. The results showed that the developed digital comic media achieved high feasibility levels, with validation scores of 96% from media experts, 88% from language experts, and 86% from material experts. Effectiveness testing revealed a significant improvement in students' learning outcomes, indicated by a Sig. (2-tailed) value of 0.000 < 0.05 and an N-Gain score of 0.61 in the moderate category. These findings indicate that Pixton-based digital comic media are effective in improving learning outcomes and can be utilized as an alternative instructional medium in elementary science learning.

Keywords: digital comics, learning media, Pixton, learning outcomes, elementary education

INTRODUCTION

The rapid development of information and communication technology has significantly influenced various aspects of human life, including the field of education. In elementary education, learning media play a crucial role in facilitating students' understanding of concepts, especially for subjects that involve abstract or complex material. However, many elementary schools still rely heavily on conventional teaching methods, such as textbook-based instruction and teacher-centered explanations, which often fail to accommodate diverse student learning styles [1].

Integrated Science and Social Studies (IPAS) in elementary schools contains scientific concepts that require visualization, such as plant structure and the process of photosynthesis. These topics are frequently perceived as difficult by students because they involve microscopic structures and processes that cannot be directly observed. As a result, students often experience low motivation and limited comprehension, which ultimately affects their learning outcomes [2].

Learning media innovation is therefore necessary to address these challenges. One form of instructional media that has gained increasing attention is digital comic media. Digital comics combine visual storytelling, images, text, and dialogue in an engaging format that can enhance students' interest and motivation to learn [3]. Previous studies have shown that digital comics can improve students' understanding, motivation, and learning outcomes by presenting material in a more concrete and contextual manner [4].

Pixton is a web-based platform that allows educators to create customized digital comics easily without requiring advanced graphic design skills. Through Pixton, learning content can be transformed into illustrated stories that align with students' cognitive and emotional development. The integration of Pixton-based digital comics in elementary learning is particularly relevant in supporting visual learners and fostering digital literacy among students [5].

Despite the growing number of studies on digital learning media, research focusing specifically on the development of Pixton-based digital comics for IPAS learning in Grade 4 elementary schools remains limited. Most existing studies emphasize motivation or general media effectiveness without thoroughly examining feasibility, validity, and learning outcome improvements within a structured development model [6]. This gap highlights the need for systematic research that develops and evaluates digital comic media using an established instructional design framework.

This study aims to address this gap by developing Pixton-based digital comic media on plant structure and photosynthesis using the ADDIE model and evaluating its feasibility and effectiveness in improving students' learning outcomes. The research seeks to contribute to the advancement of innovative instructional media in elementary education and provide practical recommendations for teachers and schools in integrating digital comics into classroom learning.

LITERATURE REVIEW

Learning is a process through which individuals acquire knowledge, skills, attitudes, and values as a result of experience and interaction with their environment. In the context of elementary education, learning should be designed to accommodate students' developmental characteristics, including their cognitive, emotional, and social needs [7]. Effective learning requires appropriate strategies and media that can facilitate meaningful learning experiences.

Learning media are tools or resources used to convey information and support the teaching and learning process. Media function as intermediaries that help transform abstract concepts into concrete representations, making learning more accessible to students [8]. The use of appropriate learning media can enhance students' attention, motivation, and comprehension, leading to improved learning outcomes.

Digital comic media are a form of visual learning media that combine narrative elements with illustrations and text. Digital comics differ from traditional printed comics in that they can be accessed through electronic devices, allowing for interactive and flexible learning experiences. Research indicates that digital comics can foster students' interest, improve reading comprehension, and support conceptual understanding, particularly in science-related subjects [9].

Pixton-based digital comics offer several advantages in educational contexts. Pixton allows educators to design characters, settings, and storylines that align with learning objectives. The platform supports the creation of contextualized learning scenarios that reflect students' real-life experiences, thereby enhancing relevance and engagement [10]. Additionally, Pixton-based comics can be accessed repeatedly, enabling students to review material independently.

Learning outcomes refer to the knowledge, skills, and attitudes acquired by students after participating in learning activities. Learning outcomes are influenced by various factors, including internal factors such as motivation and interest, as well as external factors such as learning environment and instructional media [11]. The use of innovative learning media has been shown to positively affect students' learning outcomes by increasing engagement and facilitating deeper understanding.

Several previous studies support the effectiveness of digital comic media in elementary education. Mulia and Kristin [12] found that digital comic media significantly improved students' motivation and learning outcomes in social studies. Similarly, Pinatih and Putra [13] reported that digital comics developed using a scientific approach were valid and effective for elementary science learning. These findings indicate that digital comic media have strong potential as instructional tools.

Based on the theoretical framework and previous research, this study hypothesizes that Pixton-based digital comic media are feasible and effective in improving Grade 4 students' learning outcomes in IPAS learning.

METHODOLOGY

This study employed a Research and Development (R&D) approach aimed at developing and testing the effectiveness of an instructional product. The development model used in this research was the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation [14]. The development process of the digital comic media followed the ADDIE model, which consists of five systematic stages as illustrated in Figure 1

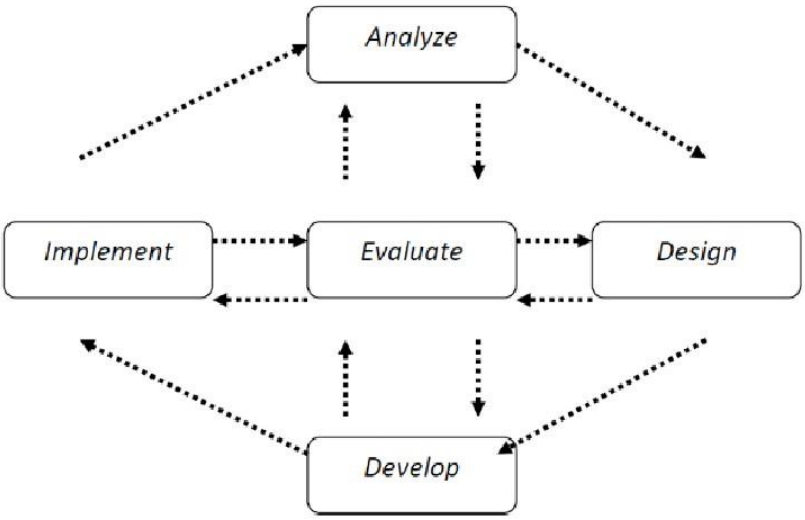

Figure 1. Stages of ADDIE Model in Developing Pixton-Based Digital Comics

The research was conducted at SDI Al-Amanah, South Tangerang, during the 2024/2025 academic year. The population of the study consisted of all Grade 4 students, with a sample of 30 students selected as research participants. The sample was determined based on class availability and research feasibility.

In the analysis stage, researchers identified students' learning needs, curriculum requirements, and existing learning media limitations. The design stage involved creating storyboards, learning objectives, and content structures for the digital comic. During the development stage, Pixton was used to produce the digital comic media, followed by expert validation by media, language, and material experts.

Data collection instruments included expert validation questionnaires, student response questionnaires, and pretest–posttest instruments to measure learning outcomes. The instruments were tested for validity and reliability prior to use. Data were collected through classroom implementation of the developed media.

Data analysis was conducted using descriptive and inferential statistics with SPSS version 26. Descriptive analysis was used to determine feasibility levels based on expert validation scores. Inferential analysis employed a paired sample t-test to examine differences between pretest and posttest scores. Effectiveness was further measured using N-Gain analysis.

RESULTS AND DISCUSSION

The results of expert validation indicated that the Pixton-based digital comic media achieved high feasibility levels. Media experts rated the product at 96%, language experts at 88%, and material experts at 86%, all of which fall within the "very feasible" category. These results demonstrate that the developed media meet instructional design standards and content accuracy requirements.

Table 1. Expert Validation Results of the Pixton-Based Digital Comic Media

Validator	Score (%)	Category
Media Expert	96	Very Feasible
Language Expert	88	Very Feasible
Material Expert	86	Very Feasible

The effectiveness of the Pixton-based digital comic media was evaluated using a pretest–posttest design. The paired sample t-test results indicated a significant difference between students' pretest and posttest scores, with a mean difference of 10.47 and a significance value of $p < 0.05$. Furthermore, the N-Gain analysis showed an average score of 0.61, which falls into the medium improvement category, indicating that the developed media effectively improved students' learning outcomes. This finding suggests that the digital comic media effectively enhanced students' understanding of plant structure and photosynthesis. The improvement can be attributed to the visual and narrative elements of the digital comic, which helped students conceptualize abstract scientific processes.

Table 2. Summary of Pretest–Posttest Results and N-Gain Score

Measurement	Mean Score
Mean Difference Posttest - Pretest	10.47
N-Gain	0.61
N-Gain Category	Medium

These findings are consistent with previous studies that highlight the effectiveness of digital comic media in improving learning outcomes [12], [13]. The integration of visual storytelling and contextualized content supports meaningful learning and aligns with constructivist learning principles. Furthermore, the use of Pixton facilitated student engagement and digital literacy development.

CONCLUSION

This study concludes that Pixton-based digital comic media on plant structure and photosynthesis are highly feasible and effective for use in Grade 4 IPAS learning. The developed media demonstrated strong validity based on expert evaluations and significantly improved students' learning outcomes, as evidenced by statistical analysis.

The findings imply that digital comic media can serve as an innovative instructional alternative for elementary teachers, particularly in teaching abstract science concepts. The media support student engagement, motivation, and independent learning.

However, this study has limitations, including a limited sample size and focus on a single school. Future research is recommended to expand the use of digital comic media across different subjects and grade levels, as well as to incorporate experimental designs with control groups.

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