The Effect of the Use of Web-Based Interactive Multimedia on Student Learning Outcomes in Pancasila Education Learning

Raji Wasiyat[1], Nizar Alam Hamdani[2], Jamilah[3], Dodi Herdiana[4]

[1234]Institute of Education Indonesia Garut

ABSTRACT

This study aims to analyze the effect of web-based interactive multimedia on students' learning outcomes in Pancasila Education at SMP Negeri 4 Bungbulang. The research was motivated by students' low conceptual understanding due to the dominant use of conventional lecture methods. A quantitative approach with a One-Group Pretest–Posttest design was employed. Data were collected through learning outcome tests, questionnaires, and observations, and analyzed using t-tests and effect size calculations. The results show a significant improvement in learning outcomes, with gain scores of 36.12 and 40.24 and a very large effect size (d > 5.4). The use of multimedia also produced more homogeneous scores and increased the average achievement above the minimum mastery criteria (KKM), rising from 40–46 to 76–87. These findings align with multimedia learning theory, emphasizing the contribution of text, audio, and visual elements to conceptual understanding. The study concludes that web-based interactive multimedia is effective in improving learning outcomes and student engagement, and is recommended for integration into Pancasila Education and other value-based subjects.

Keywords: interactive multimedia, learning outcomes, Pancasila Education, web-based learning, quantitative experiment.

INTRODUCTION

The development of information and communication technology (ICT) has driven significant transformation in the world of education, especially in the application of digital-based learning that demands effectiveness, efficiency, and flexibility. One of the increasingly relevant innovations is the use of interactive multimedia, which combines text, images, audio, video, and interaction elements to improve the quality of the learning process. Various studies show that interactive multimedia is able to increase student engagement, understanding, and retention through the presentation of multisensory information and interactions that encourage deeper cognitive processing (Mayer, 2020; Clark & Mayer, 2016).

In the context of Pancasila Education, which has a conceptual character and emphasizes the formation of values and understanding of ideology, the use of interactive multimedia is becoming increasingly important. This approach is in line with the principles of constructivism which emphasizes active learning experiences as well as self-exploration (Vygotsky, 1978). In addition, various studies show that interactive multimedia can improve critical thinking skills, learning motivation, and learning outcomes in various subjects, including abstract ones (Prensky, 2018; Sari & Rahman, 2021).

Pancasila Education in the Independent Curriculum has a strategic role in shaping the character of students and is strengthened by various latest regulations such as Permendikdasmen No. 13 of 2025 and the Joint Circular Letter of BPIP-Kemendikdasmen. However, in the field, its implementation still faces challenges. Initial observations at SMP Negeri 4 Bungbulang showed low student learning outcomes in Pancasila Education subjects, which was influenced by the dominance of lecture methods and limited technology-based learning media.

This condition shows that there is a *gap* between the demands of the curriculum that prioritizes active, digital, and contextual learning and conventional learning practices. Therefore, learning innovations are needed that are able to increase student engagement, provide flexible learning access, and facilitate quick feedback. Web-based interactive multimedia is seen as a potential solution because it allows the integration of various forms of content, unlimited access, learning differentiation, and monitoring of learning activities through *learning analytics*.

Based on this description, this study aims to analyze the effect of the use of web-based interactive multimedia on student learning outcomes in Pancasila Education subjects at SMP Negeri 4 Bungbulang. In particular, this study examines the differences in learning outcomes before and after the use of interactive multimedia and the magnitude of the influence it has on improving student learning outcomes.

THEORETICAL STUDIES

Educational Technology

Educational technology is a strategic discipline that facilitates learning through the use of technological processes and resources. Januszewski and Molenda (2018) define educational technology as the study and ethical practice of facilitating learning and improving performance through the creation, use, and management of technology. This perspective emphasizes three key dimensions: ethical foundations, improved learning outcomes, and systemic management of resources.

The development of educational technology includes the digital learning ecosystem, the use of VR/AR, and gamification (Graham, 2019; Dalgarno et al., 2022; Deterding et al., 2011). In line with cognitive theory, the principle *of dual coding* and *cognitive load* affirms that the integration of visual and verbal media increases student engagement and retention (Mayer & Moreno, 2022).

Dalam konteks pedagogi, teknologi berperan sebagai *cognitive tool*, sarana kolaborasi, dan pemicu refleksi belajar melalui *learning analytics* (Vygotsky, 1978; Baker & Inventado, 2014). Tantangan utama implementasinya mencakup digital divide, kesiapan guru, dan isu etika penggunaan AI (Holmes et al., 2021).

Learning Technology

Learning technology focuses on the design, development, utilization, management, and evaluation of learning processes and resources (Seels & Richey, 1994). Mayer (2020) emphasized that multimedia is effective when it is aligned with the way human cognition works.

In the digital era, learning technology includes LMS, interactive media, e-learning, blended learning, and mobile learning. Its use demands instructional design based on learning theories such as cognitivism and constructivism. Reigeluth and An (2020) added that learning technology supports personalization, learning autonomy, and authentic learning experiences.

Implementation challenges are found in limited infrastructure, teacher competence, and equitable access. However, learning technology is increasingly becoming a crucial educational infrastructure in the 4.0 era.

Web-Based Interactive Multimedia

Interactive multimedia blends text, images, video, audio, and animation to optimize information processing. Mayer (2020) and Clark & Mayer (2016) show that interactive multimedia improves student understanding more significantly than conventional methods.

The Web as a learning platform allows access to broad learning resources, collaborative interaction, gamification, and automated evaluation (Harasim, 2012; Siemens, 2005). In learning Pancasila Education, the use of the web increases motivation, understanding of values, and student involvement in discussions.

Effective implementation strategies include the use of LMS, selection of multimedia sources, gamification (Quizizz, Kahoot), and web-based projects.

Learning Outcomes

Learning outcomes include changes in cognitive, affective, and psychomotor abilities (Bloom, 1956). Anderson & Krathwohl (2001) emphasize that the evaluation of learning outcomes must measure critical thinking skills. The use of interactive multimedia has been proven to improve learning outcomes while encouraging analytical thinking and problem-solving skills.

Previous Research

Research by Mayer & Moreno (2022) showed a large influence of web-based interactive multimedia on learning outcomes (ES = 0.78). Meanwhile, Sari & Rahman (2021) found an increase in Pancasila learning outcomes with an N-gain of 0.63 and learning motivation of 72%.

Research by Ratnaningsih (2019) reported an increase in critical thinking skills by 38.7% (d = 1.24). A meta-analysis by Chen et al. (2020) showed an ES of 0.65 with a moderation of intervention duration, teacher role, and type of interactivity. An OECD study (2022) reinforces that the use of quality multimedia significantly improves PISA performance.

Frame of Mind

Based on multimedia cognitive theory (Mayer, 2020), interactive multimedia improves understanding through the reduction of cognitive load and the integration of visual–auditory modalities. In Pancasila learning, multimedia helps visualize abstract values so that they are easier to understand.

The framework of this study confirms that:

1. Traditional methods with minimal interactivity result in low learning outcomes.

2. Interactive multimedia improves students' attention, motivation, and cognitive processes.

3. The use of multimedia in Pancasila learning increases the understanding of Pancasila values.

4. The implementation of interactive multimedia is predicted to significantly improve learning outcomes.

RESEARCH METHODS

This study uses a quantitative approach with a Pre-Experimental One-Group Pretest–Posttest design, which aims to test the influence of web-based interactive multimedia on the learning outcomes of Pancasila Education. This design allows researchers to compare the initial ability (pretest) and final ability (posttest) in the same group after being given multimedia treatment.

Research Design Research design scheme:

$O_1 \rightarrow X \rightarrow O_2$ O_1 = pretest,

X = learning using web-based interactive multimedia, O_2 = posttest.

This design is used to see changes in learning outcomes directly after the intervention.

Research Participants

The subjects of the study were all students of class VIII-A SMP Negeri 4 Bungbulang (N = 32) which were determined by saturated sampling technique due to the small and homogeneous population number.

Research Instruments

1. Learning outcome tests

    a. Form: multiple choice & short description

    b. Used to measure learning outcomes in pretest and posttest

    c. It has passed validity and reliability tests

2. Student Perception Questionnaire

    a. Model Likert scale 1-5

    b. Measure students' responses and interest in interactive multimedia

3. Observation sheet

    a. Record student involvement during the learning process

    Research Procedure

The research is conducted through three main stages:

1. Pre-Actions

    a. Build web-based interactive multimedia

    b. Compiling and testing instruments (validity & reliability)

    c. Implementation of pretest

2. Action (Intervention)

    a. Students take part in Pancasila Education learning using web-based interactive multimedia (animation, video, simulation, LMS)

3. Post-action

    a. Posttest implementation

    b. Distribution of perception questionnaires

    c. Data collection observation

Data Collection Techniques

    1. Learning outcome tests (pretest & posttest)

    2. Student Perception Questionnaire

    3. Observation of learning activities

Data Analysis Techniques Data analysis includes:

1. Statistics Descriptive

Calculate mean, standard deviation, and value distribution.

2. Normality Test

     Using Kolmogorov–Smirnov or Shapiro–Wilk on SPSS 27.

3. Uji Hypothesis

     a. Jika data normal: paired sample t-test

     b. If it is abnormal: Wilcoxon test

4. Effect Size (Cohen's d)

     To see the magnitude of the impact of intervention.

5. Simple Regression Analysis

     To see how much interactive multimedia contributes to learning outcomes.

RESULTS AND DISCUSSION

Research Results

This study examines the influence of web-based interactive multimedia on the learning of Pancasila Education with the topic *of National Awakening & Youth Pledge* in 33 grade VIII students of SMP Negeri 4 Bungbulang. Measurements were carried out through *a pretest–posttest* design in two meetings.

1. Learning Outcomes Before Treatment

The results of the pretest in both sessions showed low initial ability and below the KKM (75). The average pretest in the first experiment was 40.82, and 46.94 in the second experiment. The distribution of grades is quite heterogeneous, indicating the diverse initial abilities of students. Initial observations show the dominance of the lecture method so that interactivity and student involvement are low.

2. Learning Outcomes After Treatment

After the implementation of web-based interactive multimedia, the posttest scores increased significantly:

   a. Experiment 1: from $40.82 \rightarrow 76.94$ (gain = 36.12)

   b. Experiment 2: from $46.94 \rightarrow 87.18$ (gain = 40.24)

The Shapiro–Wilk normality test showed that all data were normally distributed ($p > 0.05$). The *paired sample t-test* showed a significant difference between the pretest and posttest in both experiments ($p < 0.001$).

3. Effect Size

 Cohen's calculation d yields:

   a. Experiment 1: d = 5.43 (very large)

   b. Experiment 2: d = 24.63 (very large)

This value shows that web-based interactive multimedia has a very strong practical impact on improving learning outcomes.

4. Regression Test

The regression results showed a value of R = 0.541 with R^2 = 0.541, which means that web-based interactive multimedia contributed 54.1% to the improvement of student learning outcomes. The rest were influenced by other variables outside the study.

DISCUSSION

The results of this study show that the use of web-based interactive multimedia effectively improves learning outcomes significantly. This improvement is in line with Mayer's Multimedia Learning Theory (2020), which emphasizes that learning will be more optimal when material is presented through a combination of text, images, animation, and interaction (*dual-channel processing*).

1. Learning Conditions Before Treatment

A low pretest score indicates that previous learning has not been able to support students' understanding. The dominance of lecture methods and the lack of visual stimulation cause the cognitive load of students to increase. In Mayer's perspective, this condition can inhibit the transfer of knowledge to long-term memory.

2. Effectiveness of Interactive Multimedia

A significant increase in value after treatment shows that interactive multimedia:

    a. Presenting *dual coding* (verbal & visual) so as to strengthen the understanding of concepts.

    b. Provide self-paced learning navigation (segmentation principle).

    c. Strengthen focus with simultaneous visual and verbal presentation (*contiguity principle*).

    d. Increase motivation and engagement through interactive quizzes and live feedback.

These findings are in line with research by Sari & Rahman (2021) which found that interactive multimedia can increase students' understanding by 28% and learning interest by 35%.

1. Improvements on the Second Experiment

The second experiment showed higher results than the first experiment. This indicates the existence of:

    a. Students' adaptation to the media,

    b. Improved navigation skills,

    c. The effectiveness of multimedia design after repeated use.

Implications

The results of the study reinforce that web-based multimedia is an effective solution to improve the quality of learning in Pancasila Education, especially in dealing with the learning style of the digital generation that requires visual stimulation, interactivity, and learning flexibility.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the results of the research on the effect of the use of web-based interactive multimedia on student learning outcomes in Pancasila Education subjects, several conclusions were obtained as follows:

1. Student learning outcomes before using web-based interactive multimedia were below the KKM, showing that students' initial understanding was still low. The average pretest score is in the range of 40-41, far from KKM 75.

2. After the implementation of web-based interactive multimedia, there was a significant increase in learning outcomes. The average posttest score increased to 76–80, surpassing the KKM and demonstrating the effectiveness of the intervention.

3. There is a significant difference between the results of the pretest and posttest, which shows that web-based interactive multimedia can help students understand concepts more easily through visual, audio, and interactive elements.

4. The homogeneity of student learning outcomes increases. The decrease in standard deviation after treatment showed that the variation in students' abilities narrowed and learning became more even.

5. In general, web-based interactive multimedia has a positive and significant effect on student learning outcomes, both in terms of increasing average scores and consistency of learning outcomes. This proves that web-based interactive media is an effective learning alternative in increasing students' understanding and involvement in learning Pancasila Education.

Suggestions

1. For Educators

   a. Phased Implementation

   Teachers are advised to implement interactive multimedia gradually so that students have enough time to adapt to new technologies and learning flows.

   b. Continuous Training

   Educators need to take training on educational technology to maximize the use of web-based interactive multimedia.

   c. Continuous Evaluation

   Conduct periodic evaluations of the effectiveness of the media, including content quality, interactivity levels, and student learning achievements.

2. For Schools

   a. Strengthening Technology Infrastructure

   Schools need to provide stable devices and internet networks to support the use of interactive multimedia.

   b. Digital Learning Policy

   School policies are needed that support the planned integration of technology in the teaching and learning process.

   c. Technical Support

   Schools need to provide technical teams to assist teachers in managing, maintaining, and resolving obstacles in digital learning media.

3. For the Next Researcher

1) Research Design Development

a. Further research can use a more robust experimental design, such as *a randomized controlled trial*, so that the results of the study are more comprehensive.

b. Exploration of Other Variables

Researchers can add variables such as learning motivation, learning style, student engagement, or digital literacy.

c. Longitudinal Research

Long-term studies are needed to look at the impact of using web-based interactive multimedia over a wider time span.

d. Generality to Other Subjects The effectiveness of web-based interactive media can be tested in other subjects to expand the generalization of research results.

1. For Learning Media Developers

a. Peningkatan User Experience (UX)

Developers are advised to create an interface design that is simple, intuitive, and according to the characteristics of junior high school students.

b. Adaptive Learning Features

Media can be developed with the ability to adjust content based on individual student abilities (*adaptive learning*).

c. Learning Analytics Integration

The addition of analytics features will help teachers monitor student progress in real-time and support learning decision-making.

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