
EFFECTIVENESS OF A MULTIMODAL E-BOOK IN ENHANCING 21st CENTURY SKILLS IN *PANCASILA* EDUCATION

SURYA DHARMA¹, HODRIANI², HALKING³, AND IRA SAFITRI⁴

^{1,2,3}Universitas Negeri Medan, Indonesia

⁴Universitas Pendidikan Indonesia, Indonesia

Corresponding author: suryappkn@unimed.ac.id

Abstract

The weakening of students' civic character is caused by the influence of globalization and the ineffectiveness of conventional learning methods in Pancasila Education. These challenges demand innovative learning media that can foster 21st-century skills while internalizing Pancasila values. This study aims to develop and test the effectiveness of Multimodal E-Books as a learning medium capable of improving students' critical thinking and collaboration skills. A mixed method with a Research and Development (R&D) approach followed by a quasi-experiment was used in this study. The e-book was tested on two groups of students, namely the experimental group and the control group, with 30 participants in each group. This study included expert validation, pre-test, post-test, normality test, homogeneity test, independent sample test, and N-Gain analysis. The results show that the Multimodal E-Book is highly valid and suitable for use. In the effectiveness test stage, the experimental group obtained an N-Gain score of 0.68, which falls into the medium-high category. Meanwhile, the control group obtained an N-Gain score of 0.32, which falls into the low-medium category. The t-test results confirm that the difference between the two groups is highly significant (sig. 0.000). This study concludes that Multimodal E-Books are effective as a transformative learning medium capable of improving critical and collaborative skills and understanding of Pancasila values among students.

Keywords: 21st century skills, effectiveness, multimodal e-book , Pancasila Education

Introduction

Social and cultural changes caused by globalization have significantly affected the character and identity of citizenship, especially among the younger generation (Rosalina et al., 2022). The mindset, behavior, and attitudes of citizens have been influenced by globalization. National values such as justice, mutual cooperation, and mutual respect have been replaced by more individualistic and egocentric values (Hofstede, 2011). These changes pose a major challenge in shaping the character of the nation, especially among students, who are caught between conventional citizenship values and international cultural influences (Alscher et al., 2022). Amidst rapid change, students are confronted with contemporary issues ranging from social problems to global citizenship (Dharma et al., 2023). This situation poses a serious challenge for higher education, particularly in the teaching of Pancasila, which should be the main vehicle for shaping tolerance and social responsibility.

The goal of national education is to develop students' potential to become obedient, knowledgeable, democratic, and responsible individuals. College graduates must not only have the cognitive abilities to meet the demands of the global era; they must also have 21st-century skills, such as critical thinking, communication, creativity, and collaboration. Students must also have a character based on Pancasila values (Kerr, 1999). Strengthening tolerance and appreciation for diversity among students is important to do at this time, given the many conflicts that occur due to intolerance (Abdallah, 2021). Higher education plays a strategic role in

fostering active citizenship, critical thinking, and social responsibility through participatory and inclusive learning strategies (Hoskins et al., 2008).

However, in practice learning that is still dominated by lecture and memorization methods causes the learning process to focus more on cognitive aspects alone and is less able to develop 21st-century skills, such as critical thinking, communication, creativity, and collaboration (Osler & Skarra, 2024). In addition, low student engagement in learning, weak contextualization of material, and minimal use of digital technology increase the risk of intolerance and open the door to radical ideologies, making Pancasila Education not yet fully relevant to the character of the digital generation and global demands (Suryanto et al., 2023). Recognizing these problems, higher education is required to transform its learning practices. The Pancasila Education curriculum can no longer rely solely on lectures and memorization, as this approach fails to foster important 21st-century competencies such as critical thinking, communication, and collaboration (Hoskins et al., 2008).

Media innovation is a prerequisite for creating meaningful and relevant learning experiences. To facilitate the internalization of Pancasila values, it is necessary to develop Multimodal E-Books that combine various modes (text, images, audio, and interactive videos). The use of this Multimodal E-Book is believed to be able to increase students' cognitive engagement and provide space for them to actively practice 21st Century Skills, in line with the principles of active learning (Warsono & Hariyanto, 2017) and constructivism (Vygotsky, 1978). It is hoped that this media innovation can connect the theory of Pancasila with real life. Therefore, a paradigm shift is needed from learning that only emphasizes knowledge to learning that encourages cross-cultural competence and global diversity (Wang et al., 2012).

Various previous studies have confirmed the importance of participatory, constructivist, and technology-based learning in fostering active citizenship and 21st-century skills. One such previous study was conducted by Redhana in 2019. This study explains that students' mastery of 21st-century skills can be optimized through educators' efforts to reform the learning process. This reform is realized through the implementation of learner-oriented learning and the use of a scientific approach as emphasized in the 2013 Curriculum, which conceptually and practically becomes the main strategy in developing 21st-century skills in students (Redhana, 2019).

The social constructivism theory proposed by Lev Vygotsky emphasizes that effective learning occurs through social interaction and meaningful experiences (Vygotsky, 1978). In addition, a number of studies have also shown the effectiveness of project-based learning and collaborative learning models in increasing student participation. For example, research conducted by Suseno and colleagues in 2022. This study explains that the project-based learning model has been proven effective in increasing student activity and academic ability in Industrial Sanitation courses (Suseno et al., 2022). Furthermore, research conducted by Ardiansyah and colleagues in 2025. This study explains that the team-based learning model has been proven to significantly improve the quality of student collaboration and is recommended as the main pedagogical strategy in higher education curricula oriented towards strengthening teamwork and developing soft skills (Ardiansyah et al., 2025). Furthermore, when linked to previous research discussing the use of multimodal e-books in Pancasila Education, the research by Firdaus and colleagues in 2024 can be referenced. This research explains that multimodal learning is an effective medium for improving understanding among high school students (Firdaus & Gloriani, 2024). However, most of the previous studies still focus on general pedagogical strategies, without examining in depth the role of specific digital learning media. Research that specifically discusses the use of multimodal e-books in Pancasila Education is still limited, especially those that systematically examine its effectiveness in integrating Pancasila values with the development of critical and collaborative thinking skills. On the other hand, studies on strengthening Pancasila

values tend to be normative and conceptual, so they are not fully connected to the use of technology as a contextual and interactive learning tool. This condition shows a gap between the demands of 21st-century learning, the potential of digital technology, and the actual practice of Pancasila Education in higher education.

Based on these issues and gaps, there is a need for learning innovations that can bridge the need for character building, mastery of 21st-century skills, and optimal use of digital technology. Multimodal e-books that integrate text, images, audio, video, and interactive features are considered to have great potential to increase students' cognitive and emotional engagement, facilitate active and reflective learning, and connect Pancasila concepts with the realities of social life. Therefore, this study aims to analyze the effectiveness of using multimodal e-books in Pancasila Education learning, examine their influence on improving students' critical thinking, communication, creativity, and collaboration skills, and explore their role in strengthening the internalization of Pancasila values. Specifically, this study is directed at answering questions regarding the extent to which multimodal e-books are effectively used in Pancasila Education learning. Thus, this study is expected to provide theoretical and practical contributions to the development of a Pancasila Education learning model that is relevant, contextual, and adaptive to the challenges of globalization and the digital era.

Literature Review

The literature review used in this study is related to 21st-century skills, cognitive load theory, multimodal e-books, and Pancasila education. This literature review is important to discuss the effectiveness of multimodal e-books because these four aspects are conceptually and pedagogically interrelated. The following is an explanation.

21st Century Skills

21st century skills as a new orientation of citizenship education

Education is dynamic and constantly undergoing adjustments in line with the times. Various efforts to reform and optimize the learning process in the classroom are a necessity. The 21st century is marked by rapid advances in technology and science, which require students to have a set of skills to prepare them for life. These skills are what distinguish humans as adaptive and creative resources from machines or robots, which are merely the products of technology (Kusuma et al., 2025).

Learning in the 21st century reflects four main objectives known as the 4Cs, namely communication, collaboration, critical thinking and problem solving, and creativity. Communication skills include the ability of individuals to interact directly and indirectly, enabling the exchange of information and understanding of others' responses. Experts state that most of an individual's time in daily life is spent communicating, which shows that communication is a basic need that is acquired through social interaction in the surrounding environment.

Collaboration is a form of social process that involves cooperative activities to achieve common goals through mutual assistance, understanding, and respect for different views. In the context of learning, collaboration is manifested through joint planning and implementation of tasks, consideration of various perspectives, and active participation in discussions by sharing ideas, listening, and providing support to others. Critical thinking skills are defined as a higher-order thinking process that involves the ability to analyze, evaluate, and develop ideas systematically. In education, critical thinking skills are believed to play an important role in

preparing students to meet intellectual demands and deal with various problems rationally. Meanwhile, creative thinking skills are the ability to connect various concepts, objects, and fields of knowledge to produce innovative and relevant solutions. Creativity can be developed through systematic information search and processing activities, making it easier for students to understand learning materials and develop ideas productively (Faricha et al., 2021).

College graduates must possess critical thinking, teamwork, communication, and creativity skills to meet the demands of the 21st century. Hoskins states that modern civics education must provide students not only with institutional knowledge about the state but also encourage them to participate, think critically, and assume social responsibility (Hoskins et al., 2008). In other words, twenty-first century skills are needed to build democratic and empowered citizens. 21st-century skills have significant ideological relevance for Pancasila education. Students must be able to think critically about injustice, collaborate in diverse environments, and communicate ethically and argumentatively. If they do not do so, they will not be able to develop values of fairness, social justice, and deliberation. However, the conventional approach to learning, which is still used by most, centered on lectures and rote memorization, does not provide sufficient opportunity to develop these skills.

In Pancasila education in higher education, there is a structural discrepancy between the demands of 21st-century competencies and the practice of this learning. Students often understand Pancasila conceptually but fail to apply it to addressing political, social, and national issues. Therefore, incorporating 21st-century skills into Pancasila education is a greater epistemological and practical necessity than mere pedagogical innovation. Learning must challenge students to see real situations, discuss differences, and collaborate to solve problems based on Pancasila values.

Cognitive load theory

The application of cognitive load theory in multimodal pancasila education

Cognitive Load Theory is a conceptual framework developed by John Sweller in the 1980s. This theory focuses on how the human brain processes information, particularly in relation to the limitations of working memory capacity. Based on this perspective, effective learning needs to be designed with consideration of the cognitive limitations of learners so that the information processing can take place optimally. Cognitive load refers to the level of mental effort required by an individual to process information within a certain period of time. The level of this load affects a person's ability to understand and master learning material.

Therefore, managing cognitive load is an important aspect in designing efficient and meaningful learning. In this theory, cognitive load is classified into three main types, namely intrinsic cognitive load, extrinsic cognitive load, and germane cognitive load. Intrinsic cognitive load is related to the level of complexity of the material and the learning experiences that learners have had previously. Extrinsic cognitive load arises from the presentation of information that is ineffective, irrelevant, or confusing, thereby hindering the learning process. Meanwhile, germane cognitive load is related to the mental effort directed at building, organizing, and strengthening knowledge structures in the form of schemas.

The significance of cognitive load theory lies in its ability to help educators and learning designers minimize unnecessary cognitive load, especially extrinsic load. Thus, learners' mental resources can be maximally allocated to understanding, integrating, and internalizing learning material. The application of this theory covers various aspects of education, from curriculum design and teaching material preparation to classroom learning strategies. One practical

implication of this theory is the application of the worked example effect, which is the provision of sample questions accompanied by complete solution steps as an initial guide for learners before they work on the questions independently. This strategy has been proven to reduce cognitive load because it helps students understand the structure of systematic problem solving. In addition, the split-attention effect principle asserts that integrated presentation of information is more effective than separate presentations, such as text and images that are far apart, which can overload students' attention. Various empirical findings show that the principles in cognitive load theory have a strong scientific basis and are relevant for practical application in education (Siregar, 2025).

Cognitive Load Theory, proposed by John Sweller, provides a strong conceptual foundation for designing effective and meaningful Pancasila education. Civic Education not only requires mastery of normative and philosophical concepts, but also contextual understanding of national values in social life (Anisya et al., 2026). The complexity of the material, which covers ideological, historical, and moral aspects, has the potential to cause high intrinsic cognitive load for students. If the material is presented in a monotonous and unstructured manner, extrinsic cognitive load will also increase, thereby hindering the understanding process. Therefore, the application of cognitive load theory principles in Pancasila Education learning is important to ensure that students' working memory capacity can be optimally used in processing, integrating, and reflecting on Pancasila values.

In the context of technology-based learning, the use of multimodal e-books in Pancasila Education has the potential to be an effective strategy for managing students' cognitive load. The presentation of material that integrates text, visuals, audio, and interactive elements can help reduce extrinsic load through a more systematic and integrated delivery of information. In addition, the application of worked examples and the presentation of contextual cases in e-books can strengthen germane cognitive load, namely students' mental efforts in constructing a scheme of understanding about Pancasila values and their application in real life. Thus, students not only memorize concepts but are also able to analyze, evaluate, and implement them critically. The integration of cognitive load theory in the development of multimodal Pancasila Education learning media is expected to increase learning effectiveness, strengthen the internalization of national values, and support the balanced and sustainable development of 21st-century skills.

Multimodal E-Books as transformative learning media based on constructivism

The constructivist paradigm views learning as an active process that generates knowledge through experience, social interaction, and critical reflection. Therefore, creating multimodal e-books as learning media is crucial (Vygotsky, 1978). Multimodal e-books differ from conventional textbooks in that they combine multiple modes of representation, including text, visuals, audio, video, and interactivity. This allows students to use multiple cognitive channels simultaneously to process information. Kokotsaki said that project-based and multimodal learning can increase student engagement and encourage the development of superior thinking skills (Kokotsaki et al., 2016). Multimodality is crucial in Pancasila education because its values are non-specific and normative. Students can understand Pancasila contextually and applicatively rather than merely conceptually by presenting the material through visual cases, moral dilemmas, and interactive discussions. Furthermore, multimodal e-books serve as pedagogical spaces that enable the immediate application of 21st-century skills. These e-books include discussions, collaborative assignments, and case studies that encourage students to collaborate, argue, and communicate. These e-books feature discussions, collaborative assignments, and case studies that encourage students to collaborate, argue, and communicate. Therefore, multimodal books

not only serve to inform others, but can also change the way students learn by incorporating Pancasila values into real-life situations. Conventional learning fails to develop students' critical skills and civic character, and this media innovation is a solution to this problem.

Pancasila education

Pancasila education in the context of globalization and the crisis of civic character

Students' citizenship identity and character have been significantly influenced by the process of globalization. The weakening internalization of national values, including Pancasila, in students' lives often clashes with the current of liberal, individualistic, and pragmatic global values. Hofstede explained that collective moral orientation can shift toward an instrumental and egocentric mindset if global cultures converge without strengthening local values (Hofstede, 2011). Decreased social awareness, low tolerance, and awareness of civic responsibility are all examples of this condition.

In higher education institutions, Pancasila education aims to build civic character based on the values of Belief in God, Humanity, Unity, Democracy, and Social Justice. However, research shows that the implementation of Pancasila education is often normative, textual, and cognitively focused. This approach views Pancasila as a rote doctrine rather than a value system relevant to students' social lives. As a result, the lessons do not foster students' critical awareness so they can reflectively address national and global issues.

Furthermore, Pancasila education that lacks dialogue and context allows radical and intolerant ideologies to enter campuses. According to Abdallah and Suryanto, there is a correlation between less participatory civics learning practices and low religious tolerance among students (Abdallah, 2021). Consequently, Pancasila education must be transformed from merely disseminating values to a critical, reflective, and transformative pedagogical process. To achieve this transformation, new learning media and methods must be created that connect Pancasila values to the actual problems faced by students worldwide.

A literature review of 21st-century skills, cognitive load theory, multimodal e-books, and Pancasila Education provides an important foundation for discussing the effectiveness of multimodal e-books, as these four aspects are conceptually and pedagogically interrelated. 21st-century skills, such as critical thinking, communication, collaboration, and creativity, represent key competencies that must be developed in Pancasila Education learning so that students are able to face global challenges adaptively and responsibly. Meanwhile, the cognitive load theory developed by John Sweller provides a scientific framework for designing learning that takes into account the limitations of working memory capacity, so that complex Pancasila material can be understood more effectively.

Multimodal e-books, with their integration of text, visuals, audio, and interactivity, are considered relevant for reducing unnecessary cognitive load while increasing student engagement in learning. In the context of Pancasila Education, this medium has the potential to connect normative values with the realities of life in a contextual and reflective manner. Therefore, a literature review that integrates these four aspects provides a strong theoretical basis for explaining how multimodal e-books can function as innovative learning media in improving 21st-century skills while strengthening the internalization of Pancasila values in students.

Methodology

Research design and approach of the study

To determine the effectiveness of the developed product, this study used a Research and Development (R&D) approach followed by a quasi-experimental design. The R&D stage aims to produce a valid, practical, and usable Multimodal Pancasila Education E-Book by referring to the 4-D model, which includes the stages of define, design, develop, and disseminate. The definition stage began with an analysis of Pancasila Education learning needs based on 21st-century skills through literature studies, classroom observations, and interviews with lecturers and students (Dharma et al., 2023). In the development stage, the e-book product was validated by subject matter experts, media experts, and learning experts to ensure the suitability of the content, language, appearance, and functionality of the media before conducting a limited trial.

Research Site and Participants

The quasi-experimental stage used a non-equivalent control group design, involving 60 undergraduate students who were taking Pancasila Education courses at a university, selected through purposive sampling based on curriculum uniformity and class characteristics. Participants consisted of students majoring in Pancasila and Civic Education, Faculty of Social Sciences, Medan State University, in their second to fourth semesters, aged 18–22 years, with relatively heterogeneous social, economic, and educational backgrounds. The sample was divided into two groups, namely the experimental group ($n = 30$) who used multimodal e-books in learning, and the control group ($n = 30$) who followed learning using conventional methods based on lectures and printed teaching materials. The learning intervention was conducted over eight weeks with a frequency of two meetings per week.

In the experimental group, learning was conducted using multimodal e-books containing Pancasila material, contextual videos, animations, case studies, interactive exercises, and project-based collaborative assignments. Students were directed to conduct group discussions, individual reflections, and problem solving based on actual citizenship issues through the features available in the e-book. Meanwhile, the control group received learning through lecturer explanations, limited discussions, and the use of conventional textbooks without interactive media support.

The research instruments consisted of a 21st-century skills test covering critical thinking and collaboration aspects, a student perception questionnaire, and a learning activity observation sheet. The test instruments were compiled based on 21st-century skill indicators and underwent content validity testing by experts and empirical validity testing using item correlation analysis. The reliability of the instruments was tested using Cronbach's Alpha coefficient, with results falling into the high category. Data collection was conducted through a pretest before the intervention and a posttest after the intervention ended to measure the improvement in students' skills in both groups. With this design and procedure, this study is expected to provide a comprehensive empirical description of the effectiveness of multimodal e-books in improving 21st-century skills in Pancasila Education learning.

Data collection

For data analysis, the results of R&D product validation were processed descriptively through expert feasibility percentages. Validation data were obtained using an assessment sheet

instrument developed by researchers based on learning media feasibility standards, consisting of 25 statements with a five-point Likert scale. This instrument covers aspects of content feasibility, language, presentation, graphics, interactivity, and suitability with the characteristics of Pancasila Education learning. The content validity of the instrument was assessed through expert judgment by two subject matter experts and one media expert, while its reliability was tested using Cronbach's Alpha coefficient with a value of 0.87, indicating a high category. Qualitative data in the form of suggestions and comments from validators were analyzed thematically and used as the basis for product revision prior to implementation. Meanwhile, pre-test and post-test data were analyzed inferentially, preceded by prerequisite tests (normality and homogeneity).

In the quasi-experimental phase, data analysis was conducted inferentially on the pretest and posttest results of 21st-century skills. The 21st-century skills test instrument used was developed by the researcher by adapting indicators of critical thinking, collaboration, communication, and creativity from international literature, consisting of 30 items in the form of a combination of multiple-choice questions and short essays. This instrument specifically measures the ability to analyze citizenship issues, evaluate arguments, collaborate in completing group tasks, convey ideas logically, and produce creative solutions to social issues. Construct validity was tested through exploratory factor analysis, while empirical validity was tested using item-total correlations, with all items falling into the valid category ($r > 0.30$). The reliability test produced a Cronbach's Alpha coefficient of 0.91, indicating a very high level of internal consistency. The test duration was set at 60 minutes for each pretest and posttest session.

To test the hypothesis, the main methods were independent samples t-tests or ANCOVA, which compared the differences in post-test scores between the experimental and control groups. In addition, the effectiveness of improving 21st-century skills was measured using the N-Gain test or normal gain, as a strong indicator of media effectiveness, similar to the methodology applied in learning model development studies that focus on character building and civic skills (Nababan et al., 2025). If the NGain scores of the experimental and control groups are significantly different, the multimodal e-book is considered effective.

Data analysis

The data analysis techniques in this study are divided into two main phases: qualitative/descriptive data analysis for the development phase (R&D) and inferential data analysis for the effectiveness testing phase (Quasi-Experimental).

1. Qualitative and Descriptive Data Analysis (Development Phase)

Data obtained from expert material and media validation instruments were analyzed descriptively and quantitatively. The assessments from the validators (Subject Matter Experts and Multimodal Experts) were converted into a percentage of feasibility (validity) using a Likert scale. This percentage was then compared with the feasibility criteria to determine whether the Multimodal E-Book was in the "Very Good" or "Feasible" category for testing. This process is very important to ensure the validity of the content and product construct prior to implementation, as was done in previous project-based model development research (Nababan et al., 2025). Qualitative data in the form of suggestions and comments from validators were used as a basis for revising the E-Book product.

2. Inferential Data Analysis (Effectiveness Phase)

In this process, inferential statistics were used to analyze the twenty-first century skills scores (pre-test and post-test) for both the experimental and control groups:

a. Prerequisite Analysis Test, before conducting a comparative hypothesis test, a prerequisite test was conducted to ensure that the data met the parametric assumptions. To

ensure that the data is normally distributed, a normality test (e.g., using the Kolmogorov-Smirnov or Shapiro-Wilk test) is performed on the post-test scores. Next, a test for heterogeneity of variance (e.g., using Levene's test) is performed to ensure that the variation in scores between the experimental and control groups is homogeneous.

b. Initial Comparison Test (Pre-test T-test), an independent sample t-test on pre-test scores was used to ensure that there were no significant differences in baseline ability between the two groups prior to treatment. If the results show $\text{sig.} > 0.05$, the two groups are considered equivalent.

c. Hypothesis Test (Effectiveness) to measure the effectiveness of the Multimodal E-Book treatment, two main types of tests were conducted:

- 1) Independent Samples T-Test in Final Exams: Used to compare the average final scores for 21st Century Skills between the experimental and control groups. The hypothesis that multimodal books are more effectively accepted if the value of sig. is less than 0.05, indicating that there is a significant difference.
- 2) N-Gain Analysis (Normalized Gain): To provide a more accurate measurement of effectiveness and show how much improvement each group achieved, the N-Gain score was calculated (Hake, 1998). The significant and high improvement in the experimental group is a strong indicator that the Multimodal E-Book produces better learning efficiency compared to conventional methods.

d. Correlation and Contribution Analysis if possible, additional analyses such as Regression Analysis can be performed to measure the extent to which Multimodal E-Books (as an independent variable) contribute to the improvement of 21st Century Skills (as a dependent variable). To provide a practical interpretation of the impact of Multimodal E-books on the learning process, it is recommended to report the Effect Size (for example, using Cohen's d) (Creswell, 2014).

Findings

This section presents empirical findings obtained through a series of product validation and effectiveness testing stages. The results are presented systematically to directly address the research objectives and questions as formulated in the introduction. The research findings focus on two main dimensions, namely the quality of the developed product and its impact on improving students' 21st-century skills. The findings are presented based on two main aspects, namely product quality and the impact of implementation on improving student skills.

A. *Validity and feasibility of multimodal E-Books product*

Validation was carried out by subject matter experts and media experts to ensure that Multimodal E-Books meet feasibility standards in terms of both substance and digital learning design.

Table 1. Results of expert validation subject matter experts and media experts

Validator	Aspects Assessed	Average Percentage (%)	Eligibility Category
Subject Matter Expert	Alignment of Pancasila Material with 21st Century Skills	94,72%	Very good
Media Expert	Multimodal Design, Interactivity, and Display	94,20%	Very good

Based on Table 1, the validation results show that the Multimodal E-Book obtained a score of 94.72% from subject matter experts and 94.20% from media experts. Both scores are in the excellent category. The subject matter expert validation score indicates that the developed content is in line with the learning outcomes of Pancasila Education, has adequate depth of material, and systematically integrates 21st-century skills. Meanwhile, the media expert validation results show that the visual design, layout, navigation, and integration of multimodal elements meet the principles of digital learning media development. The overall average of 94.46% confirms that the developed product is highly suitable for implementation in the learning process.

B. Effectiveness of multimodal E-Books

Product effectiveness was analyzed through statistical prerequisite tests, initial ability equivalence tests, gain analysis (N-Gain), and learning outcome difference tests.

1. Prerequisite Analysis Test

Table 2. *Normality and homogeneity test results*

Test Type	Significance Value	Description
Normality	> 0,05	Normally distributed data
Homogeneity	> 0,05	Homogeneous variance

The significance value in the normality and homogeneity tests is greater than 0.05, so the data meets the assumptions of parametric statistics.

2. Equality of Initial Ability

Table 3. *Pre-test equivalence test results*

Significance Value (2-tailed)	Description
0,611	No Difference

A significance value of 0.611 (> 0.05) indicates that there was no significant difference between the experimental group and the control group at the initial stage. Both groups were in equivalent initial conditions before the treatment was administered.

3. Improvement in Learning Outcomes

Table 4. *N-gain analysis results*

Group	Post-Test Average	N-Gain	Category
Experiment	85,90	0,68	Medium-High
Control	69,30	0,32	Low-Medium

The experimental group obtained an N-Gain score of 0.68, which falls into the moderate to high category, while the control group obtained a score of 0.32, which falls into the low to moderate category. These data show that the improvement in 21st-century skills among students in the group that used multimodal e-books was higher than that among students in the group that used conventional learning methods.

4. Testing Differences in Learning Outcomes

Table 5. *Independent t-test results*

T calculated	Significance value (2-tailed)	Description
5,821	0,000	significant

A significance value of 0.000 (< 0.05) indicates that there is a significant difference between the learning outcomes of the experimental group and the control group. Thus, the Multimodal E-Book is statistically proven to be more effective in improving students' 21st-century skills.

Discussion

The findings of this study indicate that the Multimodal Pancasila Education E-Book has a very high level of validity in terms of both content and media design. Validation scores of 94.72% from subject matter experts and 94.20% from media experts confirm that the product developed meets academic standards, curriculum suitability, and systematic digital learning design principles. This high score indicates that the material structure, content depth, and integration of 21st-century skill indicators have been designed conceptually and pedagogically. From a media perspective, the consistency of layout, integration of visual elements, and interactive navigation reflect the application of instructional design principles that support message clarity and material delivery effectiveness.

The effectiveness of using Multimodal E-Books is reflected in the N-Gain value of the experimental group of 0.68, which is in the moderate category and close to the high limit, as well as the significant difference based on the independent t-test ($p = 0.000$). These data indicate that multimodal-based learning has a stronger impact than conventional learning. These findings reinforce the argument that a dominant textual, one-way approach tends to be less than optimal in developing 21st-century skills (Hodriani et al., 2025).

Theoretically, this effectiveness can be explained through multimodal learning theory and cognitive theory. The principle of multimodality states that information presented through various models of text, visuals, audio, and interaction will enrich the mental representation process of learners. In the context of Pancasila Education, which contains abstract concepts such as social justice, deliberation, and civic responsibility, a single text-based presentation has the potential to cause a high cognitive load. The integration of videos, infographics, and interactive case studies in E-Books helps distribute this cognitive load so that students can build a more structured and in-depth understanding. This is in line with the constructivist approach, which emphasizes that knowledge is actively constructed through interaction with the learning environment (Vygotsky, 1978).

Furthermore, interactive features such as value dilemma simulations and contextual case analyses shift the role of students from recipients of information to active subjects in the process of constructing meaning. These activities encourage higher-order thinking processes because students not only memorize concepts, but also analyze, evaluate, and make decisions based on

Pancasila values. Thus, the improvement in 21st-century skills as measured by N-Gain scores represents not only a quantitative improvement, but also a qualitative transformation in the learning process.

From the perspective of 21st-century skills development, the design of E-Books that include integrated discussion forums and mini project-based assignments directly facilitates the practice of communication, collaboration, and creativity. This approach is consistent with literature that emphasizes that participatory and project-based learning are effective strategies for building active citizenship and critical thinking (Akirav, 2023). In its implementation, students not only understand the values of Pancasila normatively, but also apply them in solving real problems through discussion and group work. This process strengthens the applicative dimension of Pancasila Education as both values education and character education.

In addition to impacting cognitive aspects and skills, the effectiveness of the Multimodal E-Book is also related to strengthening civic character. Presenting current issues in a multimodal format allows students to connect Pancasila values with the social realities they face. This contextualization increases the relevance of learning and strengthens the internalization of values. These findings are in line with research showing that project-based citizenship education models are effective in strengthening students' global diversity and social responsibility (Nababan et al., 2025). Thus, the improvement of 21st-century skills through this E-Book also reflects an increase in students' capacity as reflective, critical, and responsible citizens.

Overall, the results of this study indicate that the effectiveness of Multimodal E-Books does not lie solely in the use of digital technology, but rather in the systematic integration of multimodal design, constructivist approaches, and a focus on 21st-century skills. With a strong theoretical foundation and significant empirical evidence, the Multimodal E-Book on Pancasila Education can be positioned as a relevant and adaptive pedagogical innovation that meets the demands of 21st-century learning in higher education.

Conclusion and Recommendations/Implications

The results of the study show that the development and use of Multimodal E-Books in Pancasila Education learning has proven to be effective in improving students' 21st-century skills, particularly critical thinking and collaboration skills. These findings are supported by expert validation results showing a product feasibility level of more than 94% in terms of material substance, visual design, interactivity, and pedagogical suitability, which are classified as "highly feasible." In addition, quasi-experimental test results show a significant difference between the experimental group and the control group in posttest scores ($p < 0.05$), with the experimental group having a higher average score than the control group. The N-Gain analysis also showed an increase in the moderate to high category in the experimental group (0,68), while the control group was in the low to moderate category (0,32). These data provide strong empirical evidence that the use of multimodal e-books contributes significantly to improving the quality of Pancasila Education learning.

Theoretically, the findings of this study reinforce the relevance of the cognitive load theory proposed by John Sweller, which emphasizes the importance of managing working memory capacity in the learning process. The integration of various modes of representation, such as text, visuals, audio, and interactive elements, has been proven to reduce extrinsic cognitive load while strengthening germane cognitive load, enabling students to construct knowledge schemas more effectively. This study also expands the study of technology-based civic education by showing that multimodal media not only functions as a means of conveying

information, but also as a pedagogical instrument for integrating Pancasila values with the development of 21st-century skills in a contextual manner.

From a practical standpoint, the results of this study have important implications for lecturers, curriculum developers, and higher education institutions. Multimodal e-books can be used as an alternative innovative learning medium that can increase student engagement, encourage active learning, and facilitate the application of Pancasila values through collaborative activities and problem solving. The implementation of this media also supports the transformation of learning from memorization-oriented to reflective, critical, and experience-based learning. Therefore, the results of this study can be used as a basis for universities to integrate multimodal digital media more systematically into Pancasila Education learning. However, this study has several limitations, including the limited number of samples and the scope of the research location, which is still limited to one institution, so the generalization of the results needs to be done carefully. In addition, the relatively short duration of the intervention has not been able to fully describe the long-term impact of the use of multimodal e-books on the character building and civic attitudes of students. This study also focused more on critical thinking and collaboration, so that other skills such as creativity and communication have not been analyzed in depth.

Given these limitations, future research should involve a broader sample across universities and use a longitudinal design to examine the long-term impact of multimodal e-book use. In addition, future research can develop more adaptive variations of content and interactive features, integrate project-based learning or problem-based learning models, and explore the influence of multimodal media on character, tolerance, and civic participation dimensions. Thus, further studies are expected to enrich our understanding of the role of digital media in strengthening Pancasila Education in the global and digital era.

Disclosure statement

No potential conflict of interest was reported by the authors.

References

- Abdallah. (2021). *Rilis Temuan Survei, PPIM Paparkan Potret Toleransi Beragama di Universitas (Survey Findings Released: PPIM Presents a Portrait of Religious Tolerance in Universities)*. PPIM UIN Jakarta. <https://ppim.uinjkt.ac.id/2021/03/01/rilis-temuan-survei-ppim-paparkan-potret-toleransi-beragama-di-universitas/>
- Akirav. (2023). Active Civic Education Using Project-Based Learning: Israeli College Students' Attitudes towards Civic Engagement. *Interdisciplinary Journal of Problem-Based Learning*, 17(1), 1–14. <https://doi.org/https://doi.org/10.14434/ijpbl.v17i1.32354>
- Alscher, Ludewig, & McElvany. (2022). Civic Education, Teaching Quality and Students Willingness to Participate in Political and Civic Life: Political Interest and Knowledge as Mediators. *Journal of Youth and Adolescence*, 51(10), 1886–1900. <https://doi.org/https://doi.org/10.1007/s10964-022-01639-9>
- Anisya, F., Ansori, Wahyuliana, I., & Boemiya, H. (2026). Sosialisasi Pendidikan Pancasila Melalui Sosialisasi dan Workshop Kebangsaan dalam Pembentukan Kesadaran Generasi Z: Studi Kasus Universitas Trunojoyo Madura (Socialization of Pancasila Education through National Awareness Seminars and Workshops in Shaping Generation Z Consciousness: A Case Study at Trunojoyo University Madura). *Jurnal Mrdia Akademik*, 4(1), 1–19.
- Ardiansyah, D. R., Sari, I. A., Benu, P. J., Afrona, E. L., & Nayoan, C. R. (2025). Efektivitas

- Model Pembelajaran Berbasis Tim dalam Meningkatkan Kolaborasi Mahasiswa di Lingkungan Kampus (The Effectiveness of Team-Based Learning Models in Enhancing University Students' Collaboration on Campus). (*Jurnal Penelitian Multidisiplin Bangsa*, 2(2), 245–253).
- Creswell. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (Keempat). SAGE Publications.
- Dharma, Halking, Hodriani, & Wahyudi. (2023). *Analysis of The Needs for Electronic Book Development of 21st Century Skill-Based Pancasila Education in Higher Education*.
- Faricha, I., Pramudita, E., Praherdhiono, H., & Adi, E. P. (2021). Studi Keterampilan Abad 21 Mahasiswa dalam Memilih Peminatan (A Study of Students' 21st-Century Skills in Choosing Specialization Tracks). *Jurnal Kajian Teknologi Pendidikan*, 4(3), 251–259. <https://doi.org/10.17977/um038v4i32021p251>
- Firdaus, S., & Gloriani, Y. (2024). The Effectiveness of Use of Multimodal Text Teaching Materials on Learning the Indonesian Language in High School. *International Journal of Educational Research Excellence*, 03(02), 657–667. <https://doi.org/10.55299/ijere.v3i2.970>
- Hake. (1998). Interactive-engagement versus traditional methods: A six-thousand- student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, 66(1), 64–74.
- Hodriani, Halking, Dharma, Nainggolan, & Junaidi. (2025). Pengembangan Media Pembelajaran PKn dengan Pendekatan Dilema Moral Berbasis Android Berbantuan Augmented Reality (Development of Civics Learning Media Using an Android-Based Moral Dilemma Approach Assisted by Augmented Reality). *Jurnal Moral Kemasyarakatan*, 10(1), 233–250. <https://doi.org/https://doi.org/10.21067/jmk.v10i1.11832>
- Hofstede. (2011). Dimensionalizing Cultures: The Hofstede Model in Context. *Online Readings in Psychology and Culture*, 2(1), 1–26. <https://doi.org/https://doi.org/10.9707/2307-0919.1014>
- Hoskins, Hombres, & Campbell. (2008). Does Formal Education Have an Impact on Active Citizenship Behaviour? *European Educational Research Journal*, 7(3), 386–402. <https://doi.org/https://doi.org/10.2304/eej.2008.7.3.386>
- Kerr. (1999). *Citizenship Education: An International Comparison*. Qualification and Curriculum Authority London.
- Kokotsaki, Menzies, & Wiggins. (2016). Project-based Learning: A Review of the Literature. *Improving Schools*, 19(3), 267–277. <https://doi.org/https://doi.org/10.1177/1365480216659733>
- Kusuma, N. F., Haerunisa, N., Harahap, A. T., & Zainiza, M. (2025). *Best Practice Pembelajaran Abad 21 (Pertama)*. Naba Edukasi Indonesia.
- Nababan, Dharma, Siahaan, Junaidi, Fatimah, & Faudzi. (2025). Mengubah Pendidikan Civic Melalui proyek-proyek nasionalisme untuk memperkuat keragaman global Karakter dalam pendidikan tinggi (Transforming Civic Education through Nationalism Projects to Strengthen Global Diversity Character in Higher Education). *Jurnal Kewarganegaraan*, 22(2), 160–179. <https://doi.org/https://doi.org/10.24114/jkv22i2.65623>
- Osler, & Skarra. (2024). The Rhetoric and Reality of Human Rights Education: Policy Frameworks and Teacher Perspectives. In *Nordic Perspectives on Human Rights Education: Research and Practice for Social Justice*. Taylor & Francis., 13(3), 75–95. <https://doi.org/https://doi.org/10.4324/9781003340676-8>
- Redhana, I. W. (2019). Mengembangkan Keterampilan Abad ke-21 dalam Pembelajaran Kimia (Developing 21st-Century Skills in Chemistry Learning). *Jurnal Inovasi Pendidikan Kimia*, 13(1), 2239–2253.
- Rosalina, Junaidi, Fatmarini, Giry, Nasution, & Febryani. (2022). Against Cultural Amnesia

-
- Through Optimizing The Role of The Youth Generation in Paloh Naga Agrotourism. *Jupiiis: Jurnal Pendidikan Ilmu-Ilmu Sosial*, 14(2), 123. <https://doi.org/https://doi.org/10.24114/jupiiis.v14i2.38212>
- Siregar, T. (2025). *Cognitive Load Theory* (Pertama). PT Tujuh Pustaka Penerbit.
- Suryanto, A., Saliman, & Sudrajat. (2023). The Weakness of Character Education in Indonesian Teenager. *Jurnal Penelitian Pendidikan IPA*, 9(1), 1–6. <https://doi.org/https://doi.org/10.29303/jppipa.v9i1.3721>
- Suseno, R., Indriyani, Afdal, M., & Nizori, A. (2022). Efektivitas Model Pembelajaran Berbasis Proyek terhadap Keaktifan dan Kemampuan Mahasiswa (The Effectiveness of Project-Based Learning Models on Students' Participation and Competence). *Jurnal Inovasi Teknologi Pembelajaran*, 9(1), 90–98.
- Vygotsky. (1978). *Mind in Society: Development of Higher Psychological Processes*. Harvard University Press.
- Wang, Heppner, Fu, Zhao, Li, & Chuang. (2012). Profiles of Acculturative Adjustment Patterns Among Chinese International Students. *Journal of Counseling Psychology*, 59(3), 424–436. <https://doi.org/https://doi.org/10.1037/a0028532>
- Warsono, & Hariyanto. (2017). *Pembelajaran Aktif: Teori dan Asesmen* (Cetakan Ke). Bandung: PT Remaja Rosdakarya.