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Development of Artificial Intelligence-Based Interactive Learning Media to Improve Elementary School Students' Civic Skills

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Abstract

This study aims to develop AI-based interactive learning media to improve students' civic skills. The study was conducted in elementary schools in the Banyumanik Subdistrict, Semarang Regency. The research focused on fifth-grade elementary school students. The ADDIE model was employed in this study. Data were collected through observation, interviews, tests, questionnaires, and expert validation rating scales. The data were analyzed qualitatively and quantitatively. The qualitative analysis emphasized descriptive methods, while quantitative analysis employed statistical tests, including normality and homogeneity tests as prerequisites, followed by the Welch T-Test for hypothesis testing. The product was found to be feasible, with feasibility percentages of 71% for media, 85% for content, and 83% for language. It also demonstrated high practicality, with teacher and student practicality scores of 90.8% and 93%, respectively. The experimental group achieved higher mean posttest scores than the control group in both cognitive outcomes (89.02 vs. 81.51) and psychomotor outcomes (83.02 vs. 78.27). Welch's t-test showed that these differences were statistically significant, with $p < .001$ for cognitive outcomes and $p = .006$ for psychomotor outcomes. These findings indicate that the AI-based interactive learning media is feasible, practical, and effective in improving elementary school students' citizenship skills.

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Introduction

Civic skills are essential abilities that need to be developed as fundamental competencies for students to actively, responsibly, and effectively participate in society and the state (Guerrero Elecalde et al., 2024). Civic skills encompass critical thinking, decision-making, social problem-solving, communication, and participation in democratic life (Afandi et al., 2026; Alhalalmeh, 2026). Through civic skills, students not only understand citizenship concepts cognitively but also apply them through attitudes and concrete actions (Yustiana & Afandi, 2023). Concrete civic actions include respecting differences, preserving the environment, and engaging in social activities. Civic skills help students become reflective citizens who respond to various social issues responsibly and wisely (Megasari et al., 2025). Therefore, civic skills need to become a core component of the learning process, particularly to prepare future generations who contribute to society and sustain democratic life.

Field observations indicate that students' civic skills remain relatively low, as evidenced by their inability to express opinions critically, low participation in discussions, and limited decision-making abilities, particularly regarding environmental issues (Sholahuddin et al., 2023). During learning, some students tend to be passive, merely receiving information from teachers without opportunities to respond. Students also experience difficulty when asked to analyze contextual citizenship issues (Porto et al., 2025). Field findings align with previous studies showing that some students have not yet possessed adequate civic skills, particularly in terms of participation (Torney-Purta et al., 2007). A study by Schulz et al. (2018) found that students' decision-making skills and active participation require improvement through contextual learning. The low level of civic skills is also associated with insufficient opportunities for students to engage in open discussions during learning (Reichert et al., 2018).

The low level of students' civic skills indicates a need for innovative learning approaches that actively, contextually, and participatively engage students. One such innovation is the use of interactive learning media. Interactive media enable students to engage actively in simulations, exploration, and decision-making. Such media can develop critical thinking, communication, and democratic participation as core components of civic skills (Videla et al., 2025).

Previous studies have shown that interactive media can increase student engagement, conceptual understanding, and decision-making abilities . In addition, interactive media provide opportunities for students to learn actively, independently, and reflectively. These media have been proven effective in strengthening students' civic competencies (Choi et al., 2018; Garcia, 2017). More recent international evidence also suggests that digital citizenship learning becomes more effective when it is embedded in core subjects through collaborative and gamified learning activities, especially for younger learners (Li et al., 2025). This implies that interactive and well-designed technology-based learning environments are particularly relevant for strengthening students' civic-related competencies from an early age.

With technological advancements, AI should be integrated into interactive learning media. AI serves as an innovative and adaptive solution for developing students' civic skills. AI can create complex and realistic learning experiences through social simulations, provide automated feedback, and enable personalized learning in a safe

and guided manner (Holmes et al., 2019; Zawacki-Richter et al., 2019). Recent international studies have shown that AI-assisted learning is increasingly relevant not only for improving engagement and meaningful learning but also for fostering AI literacy, critical thinking, and ethical awareness. Kosmas et al., (2025), for example, found that AI-integrated lesson materials in elementary classrooms were perceived by students as enjoyable, engaging, and meaningful. Yim and Su (2025), further showed in their review that AI literacy in primary schools includes interaction and collaboration with AI, computational thinking, critical data literacy, and AI ethics. Likewise, Walter (2024), emphasized that AI in education should be accompanied by AI literacy and critical thinking, while Chen and Delaney (2025), argued that the educational use of AI for children must be anchored in equity, ethics, and responsible practice. These findings suggest that AI-based learning media can contribute not only to cognitive achievement but also to broader competencies required for responsible citizenship in the digital era.

However, prior research has typically looked at digital citizenship and AI-supported learning in different ways. While some studies have looked at digital citizenship outcomes like online safety, self-efficacy, privacy awareness, and responsible digital behavior, others have concentrated on enhancing critical thinking, engagement, or literacy through AI-assisted learning media (Iskandar et al., 2025; Jones et al., 2024). Only a small amount of research has particularly created AI-based interactive learning materials to enhance primary school pupils' civic engagement abilities. Specifically, citizenship abilities like critical participation, decision-making, communication, and responsible civic engagement have not yet been systematically strengthened by the incorporation of AI-based interactive media into primary citizenship education. This gap offers a significant chance to increase the application of AI in civic education. Thus, the goal of this research is to create interactive learning materials based on AI to help elementary school pupils become better citizens.

Moreover, AI enhances the quality of student interaction through intelligent tutoring systems and adaptive learning. The use of AI has been proven effective in improving students' critical thinking and decision-making skills (Afandi et al., 2025; L. Chen et al., 2020; Luckin et al., 2016). Therefore, the use of AI-based interactive learning media becomes important as a strategic effort to address the low level of students' civic skills and to prepare students as active, critical, and responsible citizens in the digital era.

Previous studies have examined the development of AI-based interactive learning media. Some studies focused on improving critical thinking skills and student engagement in social studies or civics education. For instance, a study by Saputra et al. (2025) investigated web-based interactive learning media and proved a significant improvement in students' critical thinking skills compared to learning using conventional media. Furthermore, interactive animated videos developed by Ningsih et al. (2024) were also effective in training critical thinking skills in Civics learning. Additionally, the integration of technology in learning provides potential to facilitate student engagement and conceptual understanding through adaptive features and real-time feedback (Md Sabri et al., 2024). However, previous studies generally emphasized critical thinking skills, conceptual understanding, and student engagement, without specifically addressing students' civic skills.

The current study is noteworthy in this regard because it addresses the increasing demand for creative civic education strategies that are both interactive and flexible enough to meet the needs of students in the digital age.

This project aims to theoretically and practically contribute to the integration of artificial intelligence in citizenship education, specifically in enhancing students' critical participation, decision-making, and responsible civic behavior, by creating AI-based interactive learning materials for elementary school pupils.

Previous studies reveal a research gap: few studies have integrated the development of elementary school students' civic skills through the development of AI-based interactive learning media. Existing literature focuses on improving critical thinking and other general skills, but civic skills have not been systematically mapped in citizenship education. AI in learning serves as an interactive and adaptive medium that strengthens holistic civic skills. The limitations of previous studies provide opportunities to expand understanding and optimize civic skills instruction at the elementary school level. Therefore, this study aims to develop AI-based interactive learning media to improve elementary school students' civic skills.

Method

This study employed a Research and Development (R&D) design to produce AI-based interactive learning media and to test its feasibility and effectiveness in improving the civic skills of fifth-grade elementary school students. The R&D approach was selected because it enables researchers to systematically develop educational products based on field needs and to validate them empirically before broader implementation (Borg & Gall, 2003). The ADDIE model was selected as a guideline for media design. The ADDIE model was chosen for its systematic steps, which align media development with students' needs and characteristics. The ADDIE model consists of five stages: analysis, design, development, implementation, and evaluation (Afandi et al., 2021).

At the analysis stage, observations and interviews were conducted to identify the causes of students' low civic skills and to determine the fundamental need for learning media that are engaging and appropriate to the characteristics of elementary school students. At the design stage, the researcher developed the initial media design, including material flow and menu structure. At the development stage, the product was created and feasibility testing was conducted by content, media, and language experts. Subsequently, a limited product trial was conducted to evaluate the product's practicality.

Participant (Subject) Characteristics

At the implementation stage, effectiveness testing was conducted on a limited scale at SDN 1 Jekerto and SDN 2 Bringin to measure instrument validity and reliability. Meanwhile, a broader trial was conducted at SDN Batukali, SDN 2 Batagede, SDN Jabungan, and SDN Dokoro involving a total of 94 students. The implementation stage also involved testing using a quasi-experimental design (Sundayana, 2014), specifically a quasi-experimental posttest-only control group design (Rustamana et al., 2024).

The testing aimed to determine improvements in students' civic skills following the use of AI-based interactive learning media. This design involved one experimental group that received the AI-based interactive learning media and one control group that received conventional instruction. Finally, the evaluation stage assessed each of

the previous stages. This stage yielded data confirming that the AI-based interactive learning media are feasible, practical, and effective for learning.

Sampling Procedures

The sampling technique used was quota sampling, which involves selecting samples from a population with certain characteristics until the required quota is fulfilled (Rustamana et al., 2024). The population in this study consisted of fifth-grade elementary school students who were taking Pancasila Education. To determine the sample size, the Slovin formula was used as follows:

$$n = \frac{N}{1 + Ne^2}$$

Data Collection

Data were collected through observation, interviews, expert validation sheets, tests, and questionnaires. Observation was conducted to identify the initial classroom learning conditions and students' citizenship-related behaviors. Structured interviews with teachers and students were used to confirm the observational findings and to identify the need for developing AI-based interactive learning media. Expert validation sheets were employed to evaluate the feasibility of the product in terms of content, media design, and language before implementation. The validation process involved experts in each respective field, and their feedback was used to revise and refine the product prior to the field trial. Tests and questionnaires were then administered to measure the effectiveness and practicality of the developed media.

The validation sheet covered three main aspects (Grant & Davis, 1997):

(1) the content aspect, which assessed the alignment of content with learning outcomes, conceptual accuracy, and integration of the civic skills model for elementary school students;

(2) the media aspect, which included visual design quality, navigation, interactivity, and clarity of instructions; and

(3) the language aspect, which assessed language appropriateness, terminology usage, and suitability for the target audience.

Validation was conducted by experts in their respective fields to ensure the quality, usability, and feasibility of the media before implementation.

The test instrument was designed to measure students' civic skills after the use of AI-based interactive learning media. The items were developed based on civic skills indicators such as intellectual civic skills, participatory skills, and communicative and collaborative skills. The test included both cognitive and psychomotor items. Both the cognitive and psychomotor assessments included 10 multiple-choice questions on Pancasila Education.

Data Analysis

The practicality questionnaire assessed the ease of use, efficiency, and functionality of the AI-based interactive

learning media (Gao et al., 2018). Data were analyzed quantitatively to determine the level of media practicality. The distribution of questionnaires and administration of post-tests were conducted online via Google Forms. The media were developed in the form of a web-based interactive application equipped with AI features. The practicality data from questionnaires administered to teachers and students were calculated using the following formula (Ramadhani & Izzati, 2023):

$$P = \frac{\sum x}{\sum xi} \times 100\%$$

Description:

P = Percentage of questionnaire score

∑x = Total questionnaire score

∑xi = Maximum total score

100% = Constant

Quantitative data were analyzed using SPSS software. The data analysis in this study was conducted in stages to ensure that the product met the criteria of feasibility, practicality, and effectiveness (Wickham, 2016). Feasibility was analyzed through expert assessments using validation sheets, and average scores were calculated. The results were then converted into categories to determine the level of product feasibility. Practicality analysis was conducted using user response questionnaires and observation sheets, expressed in percentages to determine the ease of product use in learning (see Table 1).

Table 1. Practicality Conversion Guidelines with a 5-Point Scale

Percentage (%)	Practicality Criteria
$0 \leq X \leq 20$	Not practical
$21 \leq X \leq 40$	Less practical
$41 \leq X \leq 60$	Fairly practical
$61 \leq X \leq 80$	Practical
$81 \leq X \leq 100$	Very practical

Effectiveness was analyzed by comparing students' civic skills outcomes after product use through relevant statistical tests. Before conducting statistical testing, prerequisite tests were performed, including normality and homogeneity tests (Salim & Tiawa, 2015). To test effectiveness, posttest scores from the experimental and control groups were compared. Normality was tested using the Shapiro–Wilk test, followed by homogeneity testing using Levene's test. Since the homogeneity test indicated unequal variances, Welch's t-test was used to compare the mean scores of the two groups at a significance level of 0.05.

Results

The product developed in this study was AI-based interactive learning media designed to improve students' civic skills. The product development was conducted using the ADDIE model. The ADDIE model consists of five stages: analysis, design, development, implementation, and evaluation. Product development through the ADDIE stages produced findings related to feasibility, practicality, and effectiveness. The results are described as follows.

Preliminary Study Analysis

At the analysis stage, a preliminary study examined problems in the field and the needs of teachers and students regarding media development. The problems observed focused on classroom learning in general, particularly in Pancasila Education. From the results of the analysis, observations indicated that most students were unable to apply Pancasila values in their behavior. For example, students did not work harmoniously during discussions. Some students selectively chose friends when forming groups. This behavior stemmed from established friendships and preferences. Such behavior did not reflect the fifth principle of Pancasila. In addition, disputes still occurred among students in the classroom, such as fighting over pencils or erasers. They even blamed each other during conflicts. This did not reflect the second principle of Pancasila.

These problems stemmed from various factors, including student motivation, parental supervision, environmental influences, social jealousy, and variations in teacher-student interactions. If left unresolved, these problems could cause negative impacts. For example, social disharmony among students, an uncomfortable learning environment, and continuous conflicts may occur. On the other hand, classroom learning also appeared monotonous due to the lack of engaging learning media. Therefore, these problems motivated the researcher to develop AI-based interactive learning media to improve students' civic skills in Pancasila Education. The selection of this medium was also based on teachers' needs conveyed through interviews. The teacher stated,

> "We really need learning media that are specifically designed to be used comprehensively for one subject. If there is interactive media that can facilitate students' abilities in Citizenship Education learning, it will be highly accepted by teachers, and at the same time add digital learning resources for students."

The information conveyed by the teacher was consistent with student interview results. The interview findings indicated their desire to obtain engaging and enjoyable learning media. One student stated, "I really want good media, not just books. It is boring. If possible, there should be games." Interview results showed that students preferred game-based learning. These expectations indicated a desire for technology-based learning media. Therefore, the development of AI-based interactive media was considered appropriate to the needs and expectations of both teachers and students.

Design of Artificial Intelligence-Based Interactive Learning Media Product

The product developed in this study reflects a design concept planned in advance. Product development began by selecting content aligned with learning objectives. The selected subject was Pancasila Education for Grade V Semester 1. The main topic was the history of the birth of Pancasila and its values. The media were developed through the website https://nilai-nilaipancasila.my.canva.site/. In this application, students must first log in by entering their name, attendance number, and class. After successfully logging in, students encountered the learning menu display. The learning menu design was as shown in Figure 1.

The first menu included material, examples, exercises, quiz, reflection, and closing sections. The material section contains content on Pancasila values. In this section, students received content on the principles of Pancasila. The

examples section provided illustrations of the first through fifth principles in daily life. Students were presented with four examples of the first principle's implementation at school. The results are shown in Figure 2.

Figure 1. Learning Menu Display

Figure 2. Examples Menu Display

After the examples section, students were directed to the exercises section. The exercises section contained items in the form of statements and corresponding values based on selected Pancasila principles. There were three exercise options: the first, second, and third principles. Corresponding values included being diligent in worship, helping others, and loving the homeland. Students dragged the blue items to the appropriate value columns until the Pancasila Principal column was empty. If students completed it correctly, they received the maximum score (30). The score was immediately displayed in the interactive exercise. An example of the result is shown in Figure 3.

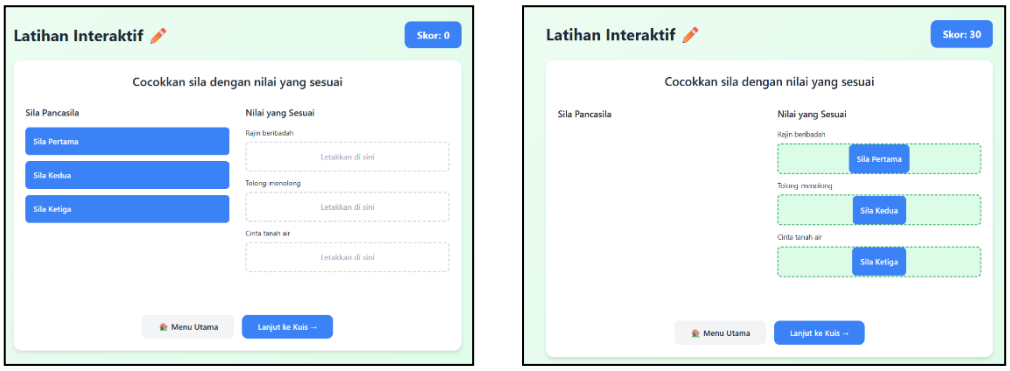

Figure 3. Exercises Menu Display

Next, students were directed to complete the evaluation quiz. The quiz consisted of five questions. The questions were designed to align with the material and examples previously provided. Students could directly see the score obtained from the evaluation quiz. If each question was answered correctly, the maximum score was 50. The score appeared after the quiz was completed. The evaluation quiz design is presented in Figure 4.

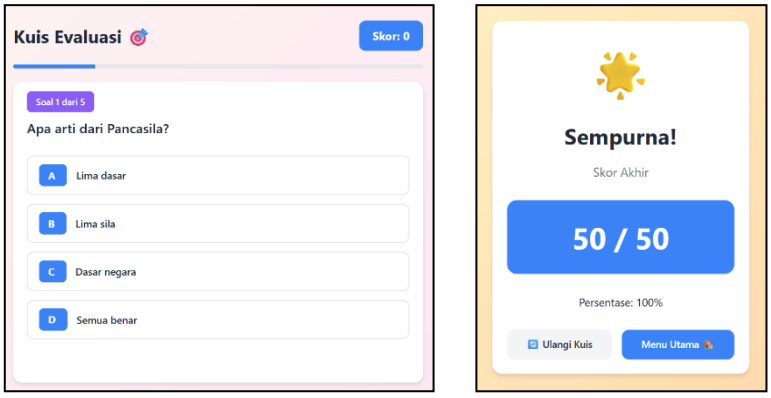

Figure 4. Quiz Menu Display

After that, students were directed to the reflection menu. This section allowed students to record their learning experiences. Students were instructed to write about experiences from their day. There were columns to be filled in, such as 'today I learned,' 'the most interesting thing,' and 'the thing I still find confusing.' The reflection menu design is presented in Figure 5.

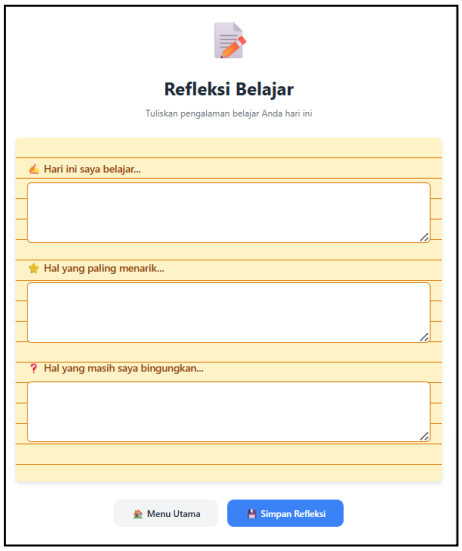

Figure 5. Reflection Menu Display

Finally, there was a closing section presenting student achievements in learning Pancasila values. This section also provided motivational messages for students. Overall, the AI-based interactive learning media were presented with a complete and engaging design for elementary school students.

The developed product also included an adventure activity. This component was separate from the previous design

(link: https://paulakinskiportofolio.my.canva.site/aplikasi-interaktif-pancasila). The initial display contained the title 'Adventure in the Castle.' Students were asked to enter their name, class, and attendance number before beginning the adventure. Students then encountered a welcome display before entering the castle. The design results are presented in Figure 6.

Figure 6. Initial Display of the Castle Adventure

After successfully entering the castle, students encountered the screen shown in Figure 7. In the castle room, students were asked to answer questions. There were several navigation options, including arrows pointing up, left, down, and right. The up arrow directed the character upward. Similarly, the left, right, and down arrows functioned according to their respective directions. In addition to navigation options, there were symbols such as question numbers, score indicators, fire, candles, swords, a character face, doors, and jars. The design results are presented in Figure 7.

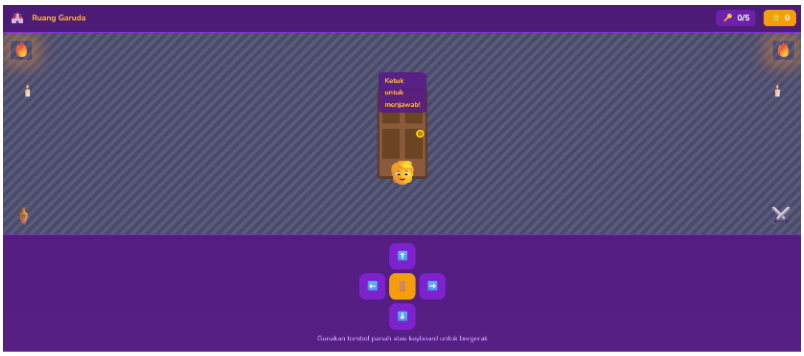

Figure 7. Castle Adventure Menu

After students tapped the door, they were directed to answer a question and select the most appropriate answer. If the answer was correct, the score was highlighted in the upper right corner, and students received 10 points per question. Students had to follow the same steps to complete the next four questions. After successfully answering all questions, students obtained a final maximum score of 50 points. This indicated that students had found the Pancasila treasure. Students had completed the adventure. The design results are presented in Figure 8.

Figure 8. Castle Adventure Score

Development of Artificial Intelligence-Based Interactive Learning Media

The third stage was development. The developed product was tested for feasibility and refined. The refinement was adjusted based on input from media experts, content experts, and language experts. Media experts assessed integration, balance, color, language, and presentation. Content experts assessed aspects of quality, objectives, and language. Language experts assessed the level of language used, appropriate terminology usage, and language suitability. Two experts evaluated each aspect, resulting in a total of six expert assessments. The results of the media feasibility test are presented in Table 2.

Table 2. Results of Media Feasibility Test

No item	Indicator	Val 1	Val 2
1	Integration aspect		
a	Integration	4	3
b	Suitability	4	3
c	Clarity of writing	4	4
2	Balance aspect		
a	Image form	4	4
b	Image size proportion	4	4
c	Image variation	3	3
3	Color aspect		
a	Background color suitability	4	4
b	Text color suitability	4	4
c	Image color suitability	3	3
4	Language aspect		
a	Language used	3	3
b	Technological terms (AI/smart)	3	3
c	Language suitability	4	3
d	Communicative language	3	4

No item	Indicator	Val 1	Val 2
5	Presentation aspect		
a	Logical flow of media presentation	4	3
b	Systematics of presentation	4	3
c	Access speed	4	3
d	Exercise feature (drag-and-drop)	4	3
e	Quiz feature provides quick response for students.	4	4
f	Reflection feature provides space for student expression	4	3
g	Media provides usefulness	4	3
Total score		75	67
Average		3.75	3.35
Overall average		3.55	

Based on Table 2, the AI-based interactive media product achieved an average score above 3. When converted to a percentage, the average score is equivalent to 71%, categorized as feasible in terms of media. The majority of media assessments obtained scores above three from both Validator 1 and Validator 2. Therefore, the AI-based interactive media are considered feasible in terms of media aspects. Next, the material feasibility test is presented.

Table 3. Result of Material Feasibility Test

No item	Indicator	Val 1	Val 2
1	Content quality and objective aspect		
a	Alignment with learning objective flow (ATP)	5	4
b	Alignment with learning outcomes (CP)	4	4
c	Alignment with indicator achievement	5	4
2	Material aspect		
a	Material suitability	5	5
b	Material accuracy	5	5
c	Material accuracy	4	4
d	Material delivery	4	3
e	Material delivery	4	3
3	Language aspect		
a	Accuracy of language usage	4	4
b	Clarity and readability	5	4
Total value		45	40
Total score		54	48
Average		4.5	4
Overall average		4.25	

Table 3 shows that the material feasibility test of the AI-based interactive learning media product achieved an average score of 4.25 with a percentage of 85%. This means that the developed media are highly feasible for

implementation in learning. Based on material aspects, the media can be used without revision because the results indicate very high feasibility. The results of language feasibility are presented in Table 4.

Table 4. Result of Language Feasibility Test

No item	Indicator	Val 1	Val 2
1	Level of language used	14	12
2	Appropriate terminology usage	13	11
3	Language suitability	18	15
Total value		18	15
Total score		45	38
Average		4.5	3.8
Overall average		4.15	

Table 4 shows that in terms of language, the AI-based interactive learning media obtained a feasibility score of 4.15 from two validators. This score is equivalent to a percentage of 83%, categorized as highly feasible. Therefore, the developed product has been declared highly feasible for use in learning, specifically to improve students' civic skills.

In addition to feasibility testing by experts, this study also tested practicality with practitioners (teachers and students). The teacher practicality test included their responses to the developed media after being tested on a small scale. From the results of the practicality test through the distribution of rating scales, good results were obtained with an average score above 4.54. When converted into a percentage, this score reached 90.8% practicality from teachers. Four teachers as practitioners provided positive responses categorized as very practical. The complete results are presented in Table 5.

Table 5. Result of Teacher Practicality Test

No item	Indicator	Teacher 1	Teacher 2	Teacher 3	Teacher 4
1	Ease of use aspect				
a	Alignment with learning objective flow (ATP)	5	5	5	5
b	Alignment with learning outcomes (CP)	5	4	5	5
c	Alignment with indicator achievement	4	4	5	4
Total value		14	13	15	14
2	Material aspect				
a	Material suitability with students' ability level	5	4	5	5
b	Material accuracy	4	4	5	4
c	Systematic material delivery	4	4	4	4
Total value		13	12	14	13

No item	Indicator	Teacher 1	Teacher 2	Teacher 3	Teacher 4
3	Language aspect				
a	Accuracy of language usage	5	5	5	5
b	Clarity and readability	5	4	5	5
Total value		10	9	10	10
4	Presentation aspect				
a	Engages students actively	5	4	5	5
b	Engages students actively	4	4	5	4
Total value		9	8	10	9
Total score		32	29	34	32
Average		4.57	4.14	4.86	4.57
Overall average			4.54		

In addition to teacher practicality testing, the media were also tested with students. The trial was conducted on a limited sample of students in accordance with the designated schools. There were 60 students who became respondents in the practicality test. There were ten practicality test statements, all focusing on content quality and media presentation aspects. The results are presented in Table 6.

Table 6. Student Practicality Test

No	Aspect	Total Score	Average Score	Overall Average
1	Content quality aspect			
a	Clarity	277	4.62	4.63
b	Ease	279	4.65	
2	Presentation aspect			
a	Visual display aspect	280	4.66	4.67
b	Civic skill aspect	281	4.68	

Based on Table 6, data show that the student practicality test score for the AI-based interactive learning media reached 4.65. When converted into a percentage, the score obtained was 93%. This means that the developed media achieved the highest level of practicality. The media have clear material and are easy to use. From the presentation aspect, the media have attractive visuals and fully incorporate civic skills aspects.

Effectiveness of AI-Based Interactive Learning Media to Improve Civic Skills

The validity test of cognitive test items and the civic skills questionnaire was conducted to determine the accuracy and suitability of each item in measuring each assessed aspect. The items used in the large-scale trial consisted of 10 multiple-choice cognitive questions and 10 civic skills questionnaire items covering affective and psychomotor aspects with r-count > r-table, with n = 55 and r-table = 0.266. The cognitive items and civic skills questionnaire values were greater than 0.266, thus they were declared valid. Reliability testing was also conducted to determine

the consistency level of the instrument in providing stable measurement results. An instrument is considered reliable if the Cronbach's alpha value is greater than 0.70. Conversely, if the value is less than or equal to 0.70, the instrument is declared unreliable. The reliability results were 0.768 for cognitive ability and 0.834 for psychomotor skills.

Students in both the experimental and control classes only underwent a posttest because the research design used was post-test only. The effectiveness of the AI-based interactive learning media product in improving civic skills was analyzed through comparison of post-test scores of the questionnaire and cognitive test between the control and experimental groups. The scores of both classes are presented in Table 7.

Table 7. Post-test Results of Cognitive Test and Civic Skills Questionnaire

	Cognitive Test				Psychomotor Questionnaire			
Class	N	Mean	Min	Max	N	Mean	Min	Max
Experimental	43	89.02	80	98	43	83.02	60	100
Control	55	81.51	60	96	55	78.27	60	90

The table above presents a recapitulation of cognitive and psychomotor citizenship aspect results at the post-test in the experimental and control classes. The difference in the post-test mean of civic ability was 6, and the difference in civic skills was 3.24. These findings indicate an improvement in cognitive and psychomotor civic skills between the control and experimental classes.

The normality test was analyzed using the Shapiro-Wilk method, with data considered normal if the significance value was greater than 0.05. The significance values of the post-test cognitive and psychomotor civic skills in the experimental class were 0.127 and 0.127 (>0.05), while the control group obtained significance values of 0.060 and 0.066 (>0.05). The normality test results show that the post-test values in both groups have significance values above 0.05, indicating that the samples used in this study are normally distributed. The results of the normality test are shown in Table 8.

Table 8. Normality Test Results

Tests of Normality	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Cognitive (Exp)	.188	41	<.001	.957	41	.127
Psychomotor (Exp)	.094	41	.200*	.957	41	.127
Cognitive (Control)	.128	41	.091	.948	41	.060
Psychomotor (Control)	.170	41	.004	.949	41	.066

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

After the data were declared normally distributed, a homogeneity test was conducted to determine the equality of variance between groups. Based on the post-test cognitive and psychomotor results analyzed using Levene's test,

the significance values for both were <0.001, indicating that the data were not homogeneous. Although the data in this study were normally distributed, the homogeneity test results (<0.05) indicated non-homogeneous data. Therefore, further analysis was conducted using the Welch T-Test in SPSS 29.

The effectiveness test in this study was conducted by comparing post-test cognitive and psychomotor civic skills (see Table 9). Effectiveness was measured using the Welch t-Test on two samples with equal variance assumption, with a significance level of 5% ($\alpha = 0.05$).

Table 9. Welch t-Test

Robust Tests of Equality of Means					
		Statistic	df1	df2	Sig.
Cognitive Results	Welch	28.965	1	83.871	<.001
Psychomotor Results	Welch	8.247	1	62.786	.006

a. Asymptotically F distributed.

Discussion

The research findings show that the developed AI-based interactive learning media meet the criteria for high feasibility for implementation in learning, viewed from the aspects of content, media, and language, with a feasibility percentage of more than 80%. This high feasibility percentage indicates that the media are aligned with students' needs, characteristics, curriculum, and the principles of effective learning media development. These principles refer to content clarity, material accuracy, and the use of communicative language. This feasibility serves as an indicator that the integration of AI in learning media can present material in an adaptive, contextual, and systematic manner. Therefore, the developed media facilitates students in mastering civic skills.

These findings are consistent with a study by Holmes et al. (2019), which found that AI-based learning media have high potential in improving the quality of student learning because they can adjust the presentation of material according to students' needs and competencies. Additionally, research by Zawacki-Richter et al. (2019) emphasizes that well-designed AI learning systems demonstrate high levels of feasibility in terms of content, structure, and language, making them appropriate as innovative and effective learning tools.

The findings also indicate that the AI-based interactive learning media product has a very high level of practicality according to users. This shows that the media are easy to use, support the learning process, and optimally strengthen student engagement in civic learning. The high practicality also indicates that AI-based features encourage ease of use for both teachers and students. This ease is significant because practical media tend to be more flexible, promote learning effectiveness, and support sustainable use. These findings are supported by research by Luckin et al. (2016), which found that AI technology can enhance user convenience and learning efficiency through engaging menus. Other research has found that AI-based learning media provide practical and interactive learning experiences. Thus, these findings reinforce previous studies that AI-based interactive learning media are feasible in terms of content, language, and media aspects. "Additionally, these findings indicate that

the media are practical for users, with the potential for broader implementation in elementary school learning.

Meanwhile, validity and reliability tests of cognitive and psychomotor civic skills in the large-scale trial confirmed instrument validity. All items were valid, with significance values below 0.05 as required. The reliability test results were 0.768 (> 0.70) for cognitive civic ability and 0.834 (> 0.70) for psychomotor civic skills. The validity and reliability results are consistent with research by Hong and Kim (2025), which reported that exploratory factor analysis and reliability analysis were conducted to verify validity and reliability, showing relatively good reliability levels above 0.6.

The results of the significance test using the Welch t-Test show significance values of $p < 0.001$ for cognitive outcomes and $p = 0.006$ for psychomotor outcomes. These significance values are smaller than 0.05, so it can be concluded that there are significant differences in civic knowledge and skills before and after using AI-based interactive learning media. Overall, the results of this study provide strong evidence that AI can function as a transformative tool to enhance civic knowledge and skills. This improvement is accompanied by increased critical thinking, participation, and the internalization of Pancasila values in students' daily lives. The significant improvement in cognitive and psychomotor abilities after using AI-based interactive learning media further highlights the effectiveness of combining timely data-based feedback with structured collaborative activities. This aligns with research by Yunita et al. (2025), which emphasizes that positive behavior is more likely to be internalized when students observe, practice, and receive reinforcement for such behavior. These findings are also consistent with learning analytics principles that prioritize the use of digital data to understand and optimize the learning process (Siemens, 2012).

The integration of AI technology can create immersive learning environments (Merchán Sánchez-Jara et al., 2024). Research by Fu'adah and Ratnaningrum (2024) also shows that the use of AI-based interactive learning media is superior to conventional learning media. AI has remarkable capabilities that can significantly transform the way learning is conducted, particularly in creating more personalized, interactive, and adaptive learning experiences according to students' needs (Faizal et al., 2025). AI can assist in learning processes tailored to meet the needs of each student and maximize the effectiveness of learning tools available in schools (Rathore et al., 2023; Syahnaz & Fithriani, 2023). Previous findings also state that the use of artificial intelligence in education has broad positive impacts, ranging from personalized learning and adaptive teaching to data analysis for informed decision-making (Rahmawati, 2017).

Teaching AI literacy is not merely about providing theoretical knowledge, but also about offering direct learning experiences from real-world examples. Such experiences help students understand the practical applications of AI, recognize its impact on society, and comprehend its ethical implications (Yıldırım & Çalışkan, 2024). This is also consistent with research by Nuryadi et al. (2025), which found that learning utilizing AI-based media can enhance creativity and civic skills, enabling students to face contemporary challenges.

These findings indicate that AI use in education produces positive results because it can improve aspects of critical thinking, participation, and understanding of Pancasila values in daily life. Artificial intelligence technology in

the development of learning tools offers strong potential to achieve learning objectives and is expected to foster civic knowledge and skills. Governments and institutions should allocate sufficient resources to create and maintain the technological framework necessary for AI integration. Another important aspect is professional development and continuous training for educators. As AI technology advances, teachers must possess the expertise and skills to integrate these tools seamlessly into their teaching methods.

There are a number of limitations to this study that should be noted. First, the results may not be immediately applicable to other educational contexts or geographical areas because the study was limited to a few primary schools in the Banyumanik District of Semarang Regency. Second, the results are not as applicable to other grade levels or topic areas because the participants were restricted to fifth-grade elementary school pupils in Pancasila schooling. Third, the study did not look at how students' civic skills changed from the pre-test to the post-test since the effectiveness test used a small sample size and a post-test-only control group design. To improve the generalizability of the results, it is advised that future research use bigger and more varied sample sizes, encompass a wider range of educational environments, and employ more thorough experimental designs.

Conclusion

The AI-based interactive learning media have been proven valid and effective in improving elementary school students' civic skills. The product was declared feasible for use after validation by content, media, and language experts with a feasibility percentage of more than 80%. This makes it a quality learning medium ready for implementation. The results of the Welch t-Test show significant values of $p < 0.001$ for cognitive outcomes and $p = 0.006$ for psychomotor outcomes. Both significant values are smaller than 0.05, indicating that the use of the product has a significant effect on improving cognitive ability and civic skills.

This study confirms that AI can be effectively utilized to support cognitive learning, enhance student engagement, and encourage more collaborative and reflective learning practices. The results provide practical implications for educators and policymakers by highlighting the role of AI in improving learning quality and preparing students to face more complex real-world challenges. Policymakers and educators can harness the transformative potential of AI in managing compulsory education while ensuring that the integration of this technology is sustainable, equitable, and beneficial for all students.

Statements and Declarations

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