



Exploring the cyber world: the innovation of the cristal booklet to improve speaking literacy skills and critical thinking for elementary school students

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Article info	Abstract
Keywords: Speaking Literacy, Critical Thinking, CRISTAL Booklet, Digital Learning Media, Elementary School.	This study aims to examine the contribution of the CRISTAL Booklet (Critical Reading, Interactive Speaking, and Technology-Assisted Learning) to improving the speaking literacy and critical thinking skills of fifth-grade students who participated in the study. Speaking, literacy, and critical thinking are important skills that students need to develop. However, there are still challenges in applying these skills in the classroom. The CRISTAL Booklet was designed as a multimodal learning medium that combines critical reading, interactive speaking, and technology to enrich students' learning experiences. This study used a quantitative approach with a one-group pretest-posttest research design. The participants were fifth-grade students from an elementary school. The research instruments included a pretest and a posttest to measure students' speaking literacy and critical thinking skills. The results showed that the CRISTAL Booklet improved students' speaking literacy and critical thinking skills, with a significant difference between pretest and posttest scores. Overall, the findings indicate that the CRISTAL Booklet can be used as an innovative and effective learning medium to improve speaking literacy and critical thinking skills among elementary school students.

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1. Introduction

Basic literacy skills at the elementary school level, such as reading, writing, and numeracy, remain the primary focus of learning (Alghazo et al., 2022; Wu & Yang, 2022). However, changes in today's world require a broader view of literacy. Literacy should focus not only on traditional skills but also on critical thinking and effective communication (Atikah & Istiq'faroh, 2023; Visedsun, N., Npueng, S., Imjai, N., Chávez-Díaz, J. M., & Aujiरणongpan, 2026). In this context,

literacy is not only about understanding texts but also about interpreting and processing information deeply (Izza et al., 2023; Kim, J., Lund, B., & Santana, 2026; Oeksuez, S. S., Buholzer, A., Hascher, T., Zulliger, S., Maskos, K., & Schulz, 2026). Therefore, learning in elementary schools needs to be designed to develop different aspects of literacy in an integrated way.

Speaking, literacy, and critical thinking skills among elementary school students remain major challenges in the learning process in today's digital era (Alghuwainem, 2025; Vokatis, B., Zhang, J., Sun, Y., & Bogouslavsky, 2026). Many studies have shown that traditional learning media are often less effective at encouraging students to speak actively and think critically (Coppe & Lucchini, 2023; Colognesi et al., 2023; Özenç, 2021). In this study, technology-based multimodal media are considered effective for improving students' oral communication skills and developing their analytical and evaluative skills (Belda-Medina, 2021). In her study, Istiq'faroh et al. (2023) stated that the use of digital-based booklets can significantly improve the motivation and speaking literacy of elementary school students. In addition, Haleem et al. (2022) also found that integrating technology into learning materials can create a learning environment that supports the optimal development of elementary school students' critical thinking skills.

Optimizing students' literacy aligns with the rapid growth of technology in the 21st century and requires changes in learning approaches in elementary schools, especially through the integration of multimodal media to develop students' critical thinking and speaking literacy (Colognesi et al., 2023; Ekayani & Suwedawati, 2023). However, although the importance of digital learning has been widely recognized, there is still a gap between expectations and classroom practice. Many digital learning media merely convert printed text into digital screens without providing meaningful interaction (Bus, A. G., Neuman, S. B., & Roskos, 2020; Furenes, M. I., Kucirkova, N., & Bus, 2021). Based on the preliminary study, most teaching materials used in elementary schools are still text-based and linear, with very little interaction. As a result, students' reasoning skills remain low. This weak communication performance is also supported by Pebriana (2017), who reported that without well-designed interactive digital media, elementary school students' use of digital devices may reduce their social interaction and verbal communication skills.

Students' inability to express their ideas critically is also caused by the limited availability of learning materials that integrate both receptive and productive skills (Sulis & Mercer, 2026). Therefore, simply emphasizing the importance of digital literacy is no longer sufficient without practical solutions that have been tested in real classroom settings (Meyers et al., 2013; Vaszkun & Mihalkov Szakács, 2025). A hybrid learning medium is needed to stimulate students' multiple senses while guiding them to think logically through a clear instructional structure. One approach considered effective for comprehensively developing students' literacy skills is the multimodal literacy approach. This approach integrates different modes of representation, such as text, visuals, audio, and video, to create learning experiences that are more diverse, engaging, and relevant to today's world (Kulju & Wiseman, n.d., 2018; Lim et al., 2022). By using different forms of communication, students can access and process information in ways that suit their learning styles. As a result, they become more actively involved in the learning process (Deep et al., 2024). In addition, multimodal literacy plays an important role in developing students' critical thinking and analytical skills through more interactive, contextual learning activities (Kargin, 2023; Istiq'faroh et al., 2025). This approach is becoming increasingly relevant in the development of innovative learning media such as the CRISTAL Booklet, which was designed to support students' speaking literacy and critical thinking skills.

The theoretical construct that connects digital literacy, multimodal media, critical thinking skills, and speaking literacy among elementary school students has been widely discussed in

global education research. However, these topics are often studied separately rather than as an integrated concept (Jusak Patty, 2025; Mecklenburg & Scheithauer, 2026). Most previous studies have focused on the use of video-based digital media to improve productive skills (Matsiola, 2024), while research on how print-digital text structures can promote higher-order thinking remains limited. Digital text-based learning is often considered ineffective in encouraging meaningful social interaction when it is not designed to be interactive (Kurniawan et al., 2025; Mercer et al., 2019). In the context of elementary schools in Indonesia, Pebriana (2017) reported a real risk of declining social and verbal communication skills among children due to passive use of digital media. This finding is supported by Vaszkun & Mihalkov Szakács (2025), who stated that technology integration in elementary classrooms often overlooks the development of adaptive oral communication skills.

On the other hand, some researchers argue that students' critical thinking can be developed through instructional strategies that are based on guiding questions (Andreucci-Annunziata et al., 2023). This view is supported by the findings of Kara & Tekindur (2025), who showed that differentiated instruction effectively improves the depth of thinking among elementary school students. However, this approach often faces challenges due to a lack of practical learning materials. As a result, teachers find it difficult to monitor the development of students' critical thinking and speaking skills simultaneously (Sajidin, 2026). This empirical contradiction creates a clear research gap. There is still no agreement on a compact digital learning material that can naturally combine critical reading activities with interactive speaking practice for children. This study addresses both the methodological and practical gaps by developing the CRISTAL Booklet. Unlike general digital literacy media, this booklet was systematically developed using the ADDIE model. It was designed to help students transform information from digital reading into critical oral arguments through a structured learning process (Adawiyah et al., 2024; Elvianasti et al., 2023).

This schematic framework is synthesized from the convergence of the Cognitive Theory of Multimedia Learning (CTML) and the social semiotic perspective. In the pre-intervention (baseline) condition, the persistent classroom gap is reflected in the dominance of conventional learning materials that are rigid, linear, and lack visual stimulation, leading to stagnant critical thinking and reduced confidence in students' verbal expression during classroom learning. As a measurable mitigation strategy, the CRISTAL Booklet was systematically implemented through three integrated dimensions: Critical Reading, Interactive Speaking, and Technology-Assisted Learning. The responsive digital features serve as initial cognitive scaffolding to guide students in analyzing and evaluating the depth of information in the reading materials (receptive activity). In the next phase, the learning tasks in the booklet guide this cognitive process toward reconstructing it into adaptive, logical, and well-organized oral arguments through interactive speaking tasks (productive activity). Through this functional integration, the CRISTAL Booklet intervention is expected to accelerate students' critical-thinking indicators while simultaneously improving their speaking literacy within a single coherent learning process.

To address these problems, learning media that can integrate technology with a multimodal literacy approach are needed. One alternative is the CRISTAL Booklet (Critical Reading, Interactive Speaking, and Technology-Assisted Learning), designed to improve students' critical-thinking and speaking-literacy skills. This learning medium combines critical reading activities, interactive speaking, and digital technology into a single integrated learning process. This booklet is the primary feature that sets it apart from most existing learning media. Most interactive learning media used in elementary schools focus only on one-way visual presentation of learning materials or simply convert printed text into static digital content without integrated instructional

design (Meyers et al., 2013; Prastiti & Adi, 2024). This systemic weakness of conventional learning media was identified by Alshaye (2021), who stated that many current digital platforms have not been able to guide students in transforming from passive readers into critical speakers. Therefore, the use of this learning medium is expected to be an effective solution for improving elementary school students' speaking literacy and critical thinking skills.

2. Method

2.1 Research design

This study aims to examine the contribution of the CRISTAL Booklet (Critical Reading, Interactive Speaking, and Technology-Assisted Learning) to improving the speaking literacy and critical thinking skills of fifth-grade elementary school students who served as participants. This study used a quantitative research design with a one-group pretest-posttest design. This design was chosen because it was effective for measuring changes before and after the intervention. Quantitative data were analyzed to assess the significance of improvements in students' speaking literacy and critical thinking scores. Putri et al. (2024) used a similar approach with a pretest-posttest design to measure elementary school students' oral skills. Dermawan et al. (2025) applied the 4D model with a pretest-posttest design and N-gain analysis for a critical thinking e-module. Kurtaliqi et al. (2024) used a mixed-methods approach, with quantitative analysis as the main method, conducted in SPSS. Basir (2024) used a single-group pretest-posttest design for speaking instruction. The experimental study with correlation analysis of listening and speaking skills (Coppe & Lucchini, 2023).

The development of the CRISTAL Booklet in this study was carried out systematically based on the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). During the implementation stage, the booklet was integrated into classroom learning for four sessions, with each session lasting two class periods. In this process, students were active participants who explored digital texts critically (critical reading) through technology-assisted features (technology-assisted learning). They then expressed their ideas through interactive speaking activities (interactive speaking tasks). This structured development design is in line with the findings of Wardhani et al. (2024), who reported that digital learning media developed through the ADDIE stages have significantly created a more interactive learning environment. Furthermore, students' achievement was measured during the evaluation stage using N-gain analysis and inferential statistical tests. This comprehensive assessment at the final stage was very important because the use of digital learning media in elementary schools should not only focus on learning outcomes but also on how the characteristics of the learning media can support students' different 21st-century learning needs, including critical thinking and speaking literacy (Casmana et al., 2023).

2.2 Participants

The study was conducted at SD Negeri 1 Bringin, an elementary school in Malang Regency that is representative of the elementary education context in Indonesia. The participants consisted of 18 fifth-grade students from the school, which has implemented the Merdeka Curriculum. They were expected to provide an overview of the learning media's effectiveness in improving students' speaking literacy and critical thinking skills, as shown in the samples in this study. The fifth grade was selected because students at this level are generally able to participate actively in simple discussions and presentations. A similar study was conducted by Dermawan

(2025) on fourth-grade students of an elementary school. Li & Walsh (2023) included 98 Elementary School students in a study on online learning media. El Shazly (2021) used 12 Elementary School classes in a study on oral communication. Fadhil (2025) focused on students at an Islamic Elementary School (MIN) in a study on booklet learning materials.

2.3 Implementation

The implementation stage of this study was conducted through a structured intervention across four learning sessions, excluding the pretest and posttest. Each session lasted 2 × 35 minutes. In every session, the teacher served as a facilitator who guided the learning process, while the students completed a series of connected activities: (1) exploring the digital learning media independently using mobile devices, and (2) taking part in critical reading activities and actively participating in group discussions to complete interactive speaking tasks. This intervention design, which used interactive digital media as the primary support for classroom activities, aligns with the findings of Anggoro et al. (2024), who reported that implementing learning media based on the ADDIE model effectively improved children's critical thinking skills. Through these structured digital learning activities, students not only receive information passively but are also encouraged to build logical reasoning and speaking literacy at the elementary school level (Sappaile, 2025).

2.4 Instruments

The data collection methods used in this study include a structured oral test to assess speaking literacy and a critical-thinking test. This study employs research instruments consisting of observations of students' media use and in-depth interviews with teachers and students. The collected data will provide insights into how the use of these media contributes to the development of speaking and critical thinking skills. The instruments consist of expert-validated assessment rubrics, with validity and reliability tested beforehand. Meirbekov et al. (2022) used digital tools alongside rational-thinking tests. Moody utilized literacy support instruments. Sinaga et al. (2022) measured the impact of EITMs using cognitive tests. Broeckelman-post et al. (2020) presented measures for public speaking competencies. Pretests and posttests for speaking literacy were conducted using the instruments listed below. The relevant data are presented in Table 1.

Table 1. Assessment instruments for speaking literacy skills

Variable	Aspec	Indicator
Speaking literacy skills	Fluency	Clear and coherent ideas
	Pronunciation/Intonation	Accurate pronunciation and proper intonation.
	Coherence	Systematic and logical presentation of ideas
	Vocabulary	Appropriate and varied word choice
	Confidence and Eye Contact	Confidence and positive interaction.

Data was also collected by observing each learning session that used the CRISTAL Booklet. In addition, interviews were conducted with teachers and students to learn about their experiences using this resource. The data analysis technique used in this study is quantitative, employing a paired-samples t-test in SPSS to determine the significance of differences between the pretest and posttest and to assess the booklet's effectiveness. Additionally, N-gain is used to

measure the effectiveness of improvements in students' speaking and critical thinking literacy. The results of observations and interviews will be analyzed to provide a deeper understanding of improvements in students' speaking and critical-thinking literacy. Thus, this study is expected to contribute to the use of multimodal learning media to support the development of students' speaking and critical-thinking skills in elementary school. Critical thinking was assessed using the following instrument. The relevant data are presented in Table 2.

Table 2. Assessment instrument for critical thinking skills

Variable	Aspect	Indicator
Critical Thinking	Interpretation	Analysis of the essence of content
	Analysis	Synthesis of relationships between ideas
	Evaluation	Relevance of arguments and prediction
	Inference	Logical inference and prediction
	Explanation	Articulation of reasoning and conclusions

3. Results

This study used a one-group pretest-posttest design and found that the CRISTAL Booklet (Critical Reading, Interactive Speaking, and Technology-Assisted Learning) was effective in improving the speaking literacy and critical thinking skills of fifth-grade elementary school students. The CRISTAL Booklet was developed by integrating a web-based exploration approach that encouraged students to search for, process, reflect on, and actively present information orally, and was designed with elementary school students in mind. The corresponding visualization is presented in Figure 1.



Figure 1. CRISTAL Booklet

For the speaking literacy variable, the pretest and posttest results of the 18 fifth-grade students are presented below. The relevant data are presented in Table 3.

Table 3. Analysis of the pretest and posttest results for speaking literacy

Variable	Mean Pretest Score	Mean Posttest Score	Mean N-gain Score
Speaking Literacy	57.56	87.78	0.71

The N-gain score for speaking literacy was 0,71, which fell into the high category ($g > 0,7$). This result indicated a significant improvement in students' scores before and after the intervention. Similarly, the results of the Shapiro–Wilk normality test showed that the significance

value for the speaking literacy scores of the study's subject samples was greater than 0,05, indicating that the data were normally distributed. The relevant data are presented in Table 4.

Table 4. Normality test results for speaking literacy

	Kolmogorov-Smirnov			Shapiro Wilk		
	Statistic	df	Sig	Statistik	Df	Sig
Pretest of Speaking Literacy	0.222	18	0.019	0.853	18	0.090
Posttest of Speaking Literacy	0.241	18	0.007	0.897	18	0.052

The normality test for speaking literacy showed a significance value greater than 0.05. Therefore, it was concluded that the data were normally distributed, and further statistical analysis could be performed. The paired-sample t-test results for the speaking literacy variable are presented in Table 5. The analysis showed a standard deviation of 8,07834, with 17 degrees of freedom (df) and a significance value of < 0,01. Since the significance value was less than 0,01, it was concluded that there was a statistically significant difference between the pretest and posttest speaking literacy scores.

Table 5. Paired-samples t-test analysis for speaking literacy

Variable	Mean	Std Deviation	df	Significance	
				One Sided p	Two Sided P
Speaking Literacy	-26.38778	8.07834	17	<0.001	< 0.001

The statistical test results showed a significant improvement in the students' scores. This finding indicated that using the CRISTAL Booklet was positively associated with the development of speaking literacy skills among students in this study. The same procedure was applied to the critical thinking variable. The assessment was conducted using a test based on the instrument's assessment criteria, which experts had validated.

Critical thinking variable to evaluate the effectiveness of the CRISTAL Booklet on the critical thinking skills of elementary school students, a one-group pretest-posttest experiment was conducted with 18 fifth-grade students at SD Negeri 1 Bringin. Since 18 students participated in the test, the degrees of freedom (df) were 17. The normality of the data was tested using the Kolmogorov-Smirnov test. The results of the data analysis are presented below: The relevant data are presented in Table 6.

Table 6. Normality test results for critical thinking

	Kolmogorov-Smirnov			Shapiro Wilk		
	Statistic	df	Sig	Statistik	Df	Sig
Pretest of Critical Thinking	0.194	18	0.071	0.899	18	0.055
Critical Thinking	0.210	18	0.035	0.929	18	0.183

The results of the normality test showed that the pretest scores had a significance value of 0,055, while the posttest scores had a significance value of 0,183. Both p-values were greater

than the 0,05 significance level. Therefore, it was concluded that the data were normally distributed and met the assumptions for parametric analysis. Next, the hypothesis was tested using a paired-sample t-test. The results of the analysis are presented below: The relevant data are presented in Table 7.

Table 7. Paired-Samples t-test analysis for critical thinking

Variable	Mean	Std Deviation	df	Significance	
				One Sided p	Two Sided P
Critical Thinking	-21.38889	4.97510	17	<0.001	< 0.001

The results of the analysis showed a significance value ($p < 0,001$), indicating a highly significant difference between the mean critical thinking scores before and after the intervention. These findings indicated a statistically significant improvement in the students' critical thinking skills. The effectiveness of the intervention was further evaluated using the normalized gain (N-gain) index, as proposed by Hake (1988). The results of the N-gain analysis are presented below: The relevant data are presented in Table 8.

Table 8. N-gain score

Variable	Mean Pretest Score	Mean Posttest Score	Mean N-Gain Score
Critical Thinking	68.61	90.56	0.71

The N-gain score was 0,71. Based on Hake's classification, an N-gain value of 0,70 or higher is categorized as a high level of improvement. Therefore, it was concluded that the use of the CRISTAL Booklet: Web Exploration effectively improved the critical thinking skills of elementary school students, with a high level of improvement. The observation results also showed that the students became more active in classroom discussions after using the CRISTAL Booklet. They were able to express their ideas and opinions more systematically and confidently. The interactive speaking activities in the booklet encouraged students to communicate more openly and present their arguments in a logical, well-organized way. These findings indicate that the learning media successfully improved the students' speaking skills.

In addition, the questionnaire data showed that both teachers and students found the CRISTAL Booklet practical and easy to use in the learning process. Teachers reported that the booklet helped them manage the classroom and promote better interaction among students. This finding was supported by the practicality test, which showed a percentage score of 96,67%. Meanwhile, students reported that the booklet was interesting and enjoyable to use, with a questionnaire response score of 93,44%. These findings indicated that the CRISTAL Booklet could be used effectively without requiring complicated preparation.

Interviews with the teachers further supported the practicality analysis. The interviews revealed that using the CRISTAL Booklet helped students develop their critical thinking skills. The teachers reported that students were able to identify and analyze problems more easily and develop more creative solutions. This reflected the learning media's success in integrating critical reading and interactive speaking into the learning process. Overall, the findings of this study showed that the CRISTAL Booklet could be used as an effective and innovative learning medium to improve the speaking literacy and critical thinking skills of elementary school students. The booklet not only improved students' speaking literacy and critical thinking skills but also provided a more complete and enjoyable learning experience.

4. Discussion

The empirical findings of this study show a positive deviation between the pretest and posttest scores. In addition, the N-gain index results provide strong evidence of the CRISTAL Booklet's contribution to stimulating classroom activities, which lead to improvements in speaking literacy and critical thinking skills among fifth-grade students at SD Negeri 1 Bringin. However, these findings should be interpreted with caution and cannot be taken as definitive evidence of a single causal relationship, given that this study used a one-group pretest-posttest design without a control group.

However, the findings of this study align with previous research: a multimodal approach that integrates various media, such as text, images, audio, and video, can improve students' engagement and understanding in the learning process (Staneviciene & Žekienė, 2025). The CRISTAL Booklet, which combines critical reading, interactive speaking, and technology assistance, has successfully enriched students' learning experiences. As a result, students have become more confident in expressing their opinions and have been able to analyze and evaluate information more (Liu, C. C., Liu, S. J., Hwang, G. J., Tu, Y. F., Wang, Y., & Wang, 2023). This finding is also supported by research showing that multimodal media significantly improves elementary school students' speaking and critical thinking skills (Aridasarie, Z., & Rohmah, 2024). This result is also reflected in the current study, where the use of the CRISTAL Booklet, which integrates critical reading, interactive speaking, and technology, has enriched students' learning experiences and helped them develop deeper speaking literacy and critical thinking skills.

The findings of this study are also consistent with previous research by Siregar et al. (2024), which found that the use of technology-based media could improve students' communication skills in elementary schools. The CRISTAL Booklet, designed on multimodal principles, has enabled students to develop their speaking literacy interactively. Students are encouraged to express their opinions systematically and participate in classroom discussions. This finding proves that the media could significantly improve students' speaking literacy. Although the CRISTAL Booklet shows positive results, some challenges in its implementation still exist. Some students experienced initial difficulties using technology effectively, which aligns with Park's (2023) findings that digital literacy remains a challenge in many elementary schools. This finding shows that although technology can support the learning process, its implementation requires careful preparation by both teachers and students to ensure effective use.

On the other hand, while using the CRISTAL Booklet is effective in improving speaking literacy and critical thinking skills, achieving optimal results requires sufficient time and repeated use. This finding is consistent with the research of Kaban et al. (2024), which revealed that the use of technology in learning requires an adaptation process and adequate time. Therefore, to ensure that the positive impacts are sustained, the CRISTAL Booklet should be used consistently and continuously in the learning process. One important aspect to consider is how the CRISTAL Booklet supports the development of students' critical thinking skills. This study confirmed previous findings regarding the importance of critical thinking in education (Vieriu & Petrea, 2025). Through critical reading activities and interactive discussions in the CRISTAL Booklet, students are encouraged to analyze information and express their ideas in a more structured and logical way. This finding is consistent with educational theories emphasizing that critical thinking skills can be developed through active engagement with relevant learning materials.

In addition, the findings of this study indicate that the CRISTAL Booklet has positively affected students' motivation to learn. Teachers and students reported that the media is interesting and easy to use, which helps students become more active in the learning process.

This finding supports the research by Zitha et al. (2023), which found that students' motivation can be improved through innovative and engaging learning media. Using the CRISTAL Booklet in learning can be one way to create a more enjoyable learning experience.

Overall, the success of this study is due to the architecture of the CRISTAL Booklet, which does not treat technology as a mere visual substitute but as a cognitive catalyst. When students are exposed to responsive digital texts, a structured process of information internalization occurs, which then helps them formulate inferences, evaluations, and logical explanations. This cognitive transformation directly encourages students' confidence in expressing their ideas orally during the interactive speaking tasks in the classroom. Therefore, these findings strengthen the idea that combining visual, audio, and textual modes of representation with appropriate instructional methods is effective in transforming one-way learning patterns into active, meaningful discussion spaces. However, the absence of a control group in this research design requires a moderate interpretation of the results. The improvement in scores is more appropriately described as strong evidence of the positive role of hybrid media in accelerating speaking literacy and critical thinking skills, within the limitations of the studied participants.

5. Conclusion and implications

Use of the CRISTAL Booklet was associated with improvements in speaking, literacy, and critical thinking skills among the 18 students who participated in this study. It makes a meaningful contribution to improving the speaking literacy and critical thinking skills of fifth-grade elementary school students in the research sample. This multimodal learning medium, which combines critical reading, interactive speaking, and digital technology, positively impacts students' speaking literacy and critical thinking skills. Therefore, the use of the CRISTAL Booklet can be an innovative and effective solution for elementary school learning, especially in developing speaking literacy and critical thinking skills, which are essential in 21st-century education. A recommendation for further use is to integrate the CRISTAL Booklet continuously into the learning process across various elementary schools. Teachers need training to use this media effectively, and media accessibility should be expanded to ensure that all students can experience its benefits. The consistent use of the CRISTAL Booklet can help improve the quality of education and support the development of students' skills that are relevant to the demands of the Merdeka Curriculum. Given the limitations of this study, which used a non-experimental design without a control group, future research is recommended to employ a quasi-experimental or true experimental design with a larger sample size to better generalize the findings regarding the effectiveness of the CRISTAL Booklet media.

6. Limitation

This study has methodological limitations due to the use of a one-group pretest-posttest design, a small sample size (18 students), and the absence of a control group. Therefore, the CRISTAL Booklet contributes to improvements in speaking literacy and critical thinking outcomes observed in this study.

Declaration and Statement

CRediT Authorship Contribution Statement

Esty Yuliana Rabiah Aswadah conducted the data collection and formal data analysis. Nurul Istiq'faroh developed the research concept and manuscript, and reviewed the scientific content. Wahyu Sukartiningsih reviewed and improved the language of the manuscript. All authors read and approved the final version of the manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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Data Availability Statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request. The data are not publicly available because they contain information from human participants and are protected to ensure participant confidentiality.

Ethical Declaration

This study was conducted in accordance with ethical principles for research involving human participants. Permission to conduct the study was obtained from the school authorities prior to data collection. Informed consent was obtained from the participants and their parents or legal guardians. Participation was voluntary, and all personal information was kept confidential and used solely for research purposes.

Informed Consent Statement

Informed consent was obtained from all individual participants and their parents or legal guardians prior to data collection, with official permission granted by the school authorities. Participation was entirely voluntary, and confidentiality of all personal data was strictly maintained solely for research purposes

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Declaration of Generative AI and AI-Assisted Technologies

ChatGPT (OpenAI) was used solely to improve the grammar, language quality, and clarity of this manuscript. All AI-assisted revisions were carefully reviewed, edited, and validated by the authors. The authors take full responsibility for the content of this manuscript.

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