

DEVELOPMENT OF ISPRING SUITE 11 ASSISTED RME LEARNING MEDIA TO ENHANCE STUDENTS' MATHEMATICAL CRITICAL THINKING SKILLS

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ABSTRACT

Students' mathematical critical thinking skills remain low due to teacher-centered instruction, limited use of interactive digital media, and insufficient contextual learning experiences. Previous studies indicate that the Realistic Mathematics Education (RME) approach can support students' reasoning, but its integration with interactive digital platforms such as iSpring Suite 11 has not been widely explored. This study addresses that gap by developing an RME-based interactive learning media assisted by iSpring Suite 11 for the topic of linear equations in two variables. The research used a Research and Development design with the ADDIE model. Data were collected through expert validation sheets, student response questionnaires, and a mathematical critical thinking skills test. Participants included media experts, material experts, instructional design experts, and 33 ninth-grade students at State Junior High School (SMP Negeri) 8 Tasikmalaya. Data analysis covered feasibility evaluation, practicality assessment, and effectiveness testing using the N-gain formula. The results show that the media was rated highly feasible by all experts, received very positive responses from students, and effectively improved mathematical critical thinking skills with an average N-gain score of 0.73, categorized as high. These findings demonstrate that iSpring Suite 11–assisted RME media provides meaningful learning experiences by combining contextual problem-solving with interactive digital features. The developed media can serve as an alternative digital tool to support mathematics instruction and strengthen students' mathematical critical thinking skills.

Keywords: iSpring Suite 11, Realistic Mathematics Education, mathematical critical thinking skills, interactive learning media, SPLDV

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INTRODUCTION

The Mathematical critical thinking skills is an essential competence in 21st-century learning, particularly in mathematics, which requires deep conceptual understanding and logical reasoning. Developing this skills demands interactive learning media that not only attract students visually but also support the learning approach used. Wijaya & Irianti (2021) emphasized the importance of learning environments that encourage students to construct ideas actively. Andriani & Sari (2024) highlighted that the Realistic Mathematics Education (RME) approach is relevant for improving students' mathematical critical thinking skills because it

connects mathematical concepts to real-life contexts. Hendi et al. (2020) added that students' low critical thinking skills can be addressed by developing innovative and interactive learning media that make learning more engaging.

Despite these insights, students' mathematical critical thinking skills remains low. Found that all four indicators of mathematical critical thinking skills among students at SMP Mutiara 1 Bandung were below 50%. This finding suggests that students have difficulty interpreting information, analyzing problems, evaluating solutions, and drawing logical conclusions. Salehha et al. (2021) argued that teacher-centered practices are one of the factors contributing to this condition, as such practices position students as passive recipients. Juandi et al. (2022) reported that limited visualization in presenting mathematical concepts also hinders students' understanding. noted that learning that lacks contextual relevance makes it difficult for students to see the connection between mathematics and their daily experiences.

RME is considered an appropriate approach to address these challenges. RME helps students explore mathematical concepts by linking them to everyday experiences. RME-based learning is more effective than conventional methods in improving students' mathematical critical thinking skills. Juandi et al. (2022) further confirmed, through a systematic literature review, that RME supports active engagement and promotes meaningful learning.

Preliminary observations at SMP Negeri 8 Tasikmalaya revealed that mathematics instruction for ninth-grade students typically involves lectures, group discussions, and problem presentations linked to real-life situations. However, interactive digital learning media have not yet been used. Teachers rely mainly on textbooks and PowerPoint slides, which increase student interest but still lack interactivity. Daily assessment data for the topic of linear equations in two variables (SPLDV) also show that students' achievement remains below the minimum mastery criteria, indicating difficulties in understanding contextual problems and translating them into mathematical models.

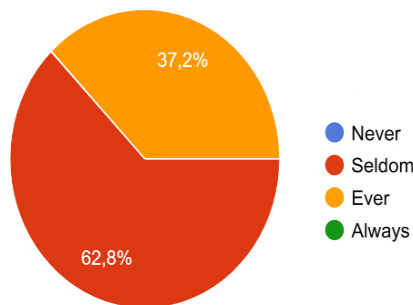


Figure 1. Requirements Analysis Diagram

A preliminary questionnaire administered to 43 ninth-grade students showed that 62.8% had never used interactive learning media. A total of 93% reported difficulty understanding SPLDV, especially in translating word problems. Furthermore, 60.5% expressed dissatisfaction with the learning media currently used, describing them as monotonous. Meanwhile, 58.1% stated that they were interested in interactive digital media featuring images, audio, videos, and quizzes. Most students also believed that contextual learning would help them understand concepts more effectively.

The use of digital learning media has been shown to support learning by increasing students' attention, motivation, and engagement. Stated that learning media stimulate students' focus and emotions, making learning objectives easier to achieve. Media contribute to enjoyable learning environments and can enhance students' concentration during mathematics learning (Weigand et al., 2024). Additionally, digital media can increase student involvement due to their interactive nature.

iSpring Suite is one of the digital tools that can support interactive learning. Sulistyorini & Listiadi (2022) explained that iSpring Suite allows teachers to incorporate text, images, audio, video, and quizzes into their materials. Yuliana et al. (2023) reported that iSpring Suite 11 offers enhanced features, including a quiz editor, simulation tools, interactive conversations, and a larger illustration library, and found that iSpring-based media can increase students' learning motivation. Research by Dewi & Izzati (2020) also demonstrated the potential of iSpring and RME-based media in mathematics learning. Firmansyah (2024) showed that RME based animated videos can improve students' mathematical critical thinking skills.

Based on the above description, the research problems in this study are: (1) how the process of developing a Realistic Mathematics Education (RME) based learning media assisted by iSpring Suite 11 is conducted for the topic of Systems of Linear Equations in Two Variables (SPLDV); (2) how the feasibility of the developed learning media is evaluated by experts; (3) how the practicality of the learning media is perceived by students; and (4) how effective the learning media is in improving students' mathematical critical thinking skills. Accordingly, this study aims to describe the development process of the RME based learning media, determine its feasibility, examine its practicality, and evaluate its effectiveness in enhancing students' mathematical critical thinking skills. This study contributes novelty to the field of mathematics education, as there has not yet been an RME based learning media for SPLDV developed using iSpring Suite 11 whose effectiveness has been empirically tested using N-gain analysis to measure improvements in students' mathematical critical thinking skills.

METHOD

This study employed a Research and Development (R&D) method, which aims to develop or refine an existing product and produce a validated and feasible outcome after undergoing an evaluation process. According to Sugiyono (2024), R&D focuses on producing educational products that meet quality standards, while Waruwu (2024) describes it as a systematic process for developing and validating educational tools, including learning media, instructional methods, and other teaching resources. The development process in this study followed the ADDIE model Analysis, Design, Development, Implementation, and Evaluation which provides a structured and programmed framework for addressing learning needs based on students' characteristics, as explained Prayoga et al. (2022). In this research, the R&D method was applied to develop an interactive learning media assisted by iSpring Suite 11 and grounded in the principles of Realistic Mathematics Education (RME). The objective was to produce a learning media that is feasible, practical, and effective for improving students' mathematical critical thinking skills. Data were obtained from media experts who assessed the technical and operational aspects of the product, material experts who evaluated content accuracy and alignment with learning objectives, and instructional design experts who examined the compatibility of the media structure with the stages of the applied learning approach. This learning media can be accessed through the following link: <https://refidm28.itch.io/media-pembelajaran-realmath-spldv>

The feasibility of the learning media was determined through validation conducted by media experts, material experts, and instructional design experts. Each expert assessed the developed media using a scoring criteria sheet consisting of five categories:

Table 1. Criteria for Assigning Expert Validation Scores

Criteria	Score
Very Good	5
Good	4
Fair	3
Poor	2
Very Poor	1

Source: (Sugiyono, 2024)

After the scores were collected, the percentage of the validation results was calculated using the formula proposed by (Rahmawati et al., 2021)

$$NP = \frac{R}{MS} \times 100\%$$

Explanation:

NP = Percentage Score

R = Total Score

MS = Maksimum Score

The assessment results for the validation instruments covering media, material, and instructional design were categorized into five levels of feasibility. These categories were determined based on the criteria proposed by Riduwan as cited in (Hildayatni et al., 2019). Each percentage score obtained from the validation process was classified into one of the five feasibility levels, which served as the basis for determining whether the developed learning media required revision or could be used without modification.

Table 2. Learning Media Feasibility Criteria

Percentage Value Interval	Qualification	Eligibility Criteria
81% - 100%	Very Valid	No Revision
61% - 80%	Valid	No Revision
41% - 60%	Quite Valid	Needs Revision
21% - 40%	Less Valid	Revision
0 - 20%	Very Less Valid	Total Revision

The analysis of students' responses to the learning media was conducted using a Likert scale, applying the predetermined scoring criteria for each item. The questionnaire results were used to determine how students perceived the practicality and usability of the developed media.

Table 3. Criteria for Scoring Student Responses

Criteria	Score
Very Good	5
Good	4
Fair	3
Poor	2
Very Poor	1

Source: (Sugiyono, 2024)

The students' questionnaire responses were analyzed and categorized into five levels of practicality based on assessment criter.

Table 4. Student Response Criteria

Percentage Value Interval	Criteria
81% - 100%	Very Practical
61% - 80%	Practical
41% - 60%	Quite Practical
21% - 40%	Not Practical
0 - 20%	Very Impractical

The effectiveness of students' mathematical critical thinking after using the iSpring Suite 11-based learning media with the RME approach was measured through pretest and posttest procedures. Students completed an effectiveness evaluation sheet by solving both sets of questions, and the improvement in their performance was analyzed using the N-Gain formula:

$$g = (S_{posttest} - S_{pretest}) / (S_{max} - S_{pretest})$$

The N-Gain scores were then analyzed using the criteria proposed by Hake, adapted from Hamidah (2020), as presented in the following table.

Table 5. N-Gain Effectiveness Criteria

Score	Category
$(g) \geq 0,7$	High/Very Effective
$0,3 \leq (g) < 0,7$	Medium/Effective
$(g) < 0,3$	Low/Fairly Effective

Source: (Hamidah, 2020)

RESULT

This study produced an interactive learning media product based on the principles of Realistic Mathematics Education (RME) and developed using iSpring Suite 11 for the topic of Systems of Linear Equations in Two Variables (SPLDV). The goal was to support the improvement of students' mathematical critical thinking. The development process followed the ADDIE model, which consists of analysis, design, development, implementation, and evaluation.

The development began with the analysis stage, where the researcher conducted a needs assessment to identify problems related to the learning process and the gap between current classroom conditions and the expected learning outcomes. This was supported by a front-end analysis that compiled contextual information required to determine an appropriate solution. The findings from both analyses confirmed the need for interactive media that integrates real-life contexts and supports students in strengthening their critical thinking skills.

The design stage involved preparing the structural framework for the learning media. A flowchart was created to outline the navigation and the operational sequence of the program, ensuring that users could follow the learning path intuitively. A storyboard was then developed to plan the visual presentation, content layout, navigation features, and learning components. The instructional content was structured according to the RME approach so that mathematical concepts could be linked to situations familiar to students.

During the development stage, the researcher first conducted pre-production activities by preparing the necessary devices and collecting supporting assets, including learning materials, images, videos, sound effects, and animations. These assets were edited to match the design needs, and the background layout was created using Canva. The production stage followed, where all components were assembled and integrated into iSpring Suite 11 according to the storyboard. The completed media, named RealMath SPLDV, was exported in HTML5 format for hosting through Itch.io and later converted into an APK file using Website 2 APK Builder to enhance accessibility.

Expert validation was carried out after the initial version of the media was completed. Two media experts assessed the technical quality using a validation questionnaire that covered readability, visual quality, ease of use, program management, feedback display, and documentation quality. The results showed that the RME-based learning media developed with iSpring Suite 11 met the criteria of "very valid," indicating that the product was technically appropriate and ready for further implementation and evaluation in classroom settings.

The validation results also showed that the RME-based learning media developed with iSpring Suite 11 to improve students' mathematical critical thinking was rated as highly valid by the material experts. This evaluation reflected the media's alignment with the quality of content and instructional objectives.

Table 6. Media Expert Assessment Results

No	Aspects	Media Expert 1	Media Expert 2	Percentage	Conclusion
1	Readability	Valid	Very Valid	90%	Very Valid
2	Display Quality	Very Valid	Very Valid	95%	Very Valid
3	Ease of Use	Very Valid	Very Valid	100%	Very Valid
4	Program Management Quality	Very Valid	Very Valid	95%	Very Valid
5	Answer Presentation Quality	Very Valid	Very Valid	95%	Very Valid
6	Documentation Quality	Very Valid	Very Valid	100%	Very Valid

Table 7. Material Expert Assessment Results

No	Aspects	Material Expert 1	Material Expert 2	Percentage	Conclusion
1	Accuracy	Very Valid	Very Valid	95%	Very Valid
2	Importance	Very Valid	Very Valid	95%	Very Valid
3	Completeness	Very Valid	Very Valid	97%	Very Valid
4	Balance	Very Valid	Very Valid	95%	Very Valid
5	Interest/attention	Very Valid	Very Valid	95%	Very Valid
6	Suitability for Students	Very Valid	Very Valid	90%	Very Valid

Furthermore, the validation results indicated that the RME-based learning media developed using iSpring Suite 11 to enhance students' mathematical critical thinking was rated as highly valid by the instructional design experts. This assessment reflected the media's alignment with the standards of instructional design quality.

Table 8. Instructional Design Expert Assessment Results

No	Aspects	Instructional Design Expert 1	Instructional Design Expert 2	Percentage	Conclusion
1	Providing Learning Opportunities	Very Valid	Very Valid	95%	Very Valid
2	Providing Learning Assistance	Very Valid	Very Valid	100%	Very Valid
3	Motivating Quality	Very Valid	Very Valid	85%	Very Valid
4	Instructional Flexibility	Very Valid	Very Valid	100%	Very Valid
5	Quality of Social Interaction in Instruction	Very Valid	Very Valid	90%	Very Valid
6	Quality of Tests and Assessments	Very Valid	Very Valid	85%	Very Valid
7	Making an Impact on Students	Very Valid	Very Valid	100%	Very Valid
8	Making an Impact on Teachers and Learning	Very Valid	Very Valid	100%	Very Valid

The implementation phase began with a small-group trial involving 10 students from class IX J at SMP Negeri 8 Tasikmalaya. The following section presents the students' responses obtained through the practicality questionnaire.

Table 9. Small Group Trial Results

No	Statement	Score	Maximum Score	Percentage	Criteria
1	Usefulness	146	150	97%	Very Practical
2	Convenience	220	250	88%	Very Practical
3	Efficiency	89	100	89%	Very Practical
4	Satisfaction	139	150	93%	Very Practical
	Total	594	650	91%	Very Practical

The next stage was the field trial, which involved 33 students from class IX C at SMP Negeri 8 Tasikmalaya. The results of the students' response assessment are presented as follows.

Table 10. Field Test Results

No	Statement	Score	Maximum Score	Percentage	Criteria
1	Usefulness	470	495	95%	Very Practical
2	Convenience	734	825	89%	Very Practical
3	Efficiency	300	330	91%	Very Practical
4	Satisfaction	460	495	93%	Very Practical
Total		1.964	2.145	91%	Very Practical

The practicality of the learning media, based on the total responses given by the students, reached 91%, which falls into the "very practical" category for use in the learning process.

In the evaluation stage, the researcher administered a mathematical critical thinking test to determine the effectiveness of the Realistic Mathematics Education (RME) learning media assisted by iSpring Suite 11 in improving students' critical thinking skills. The pretest and posttest data of the mathematical critical thinking abilities of class IX C students are presented in the following table.

Table 11. Mathematical Critical Thinking Skills Test Results (Part 1)

Subject	Pre-test	Post-test	N-Gain Score
S-1	50	83	0,66
S-2	63	86	0,62
S-3	54	95	0,89
S-4	64	85	0,58
S-5	61	96	0,90
S-6	60	91	0,78
S-7	63	93	0,81
S-8	62	92	0,79
S-9	68	89	0,66
S-10	73	91	0,67
S-11	51	76	0,51
S-12	67	87	0,61
S-13	56	97	0,93
S-14	74	94	0,77
S-15	65	90	0,71
S-16	70	100	1,00
S-17	73	95	0,81
S-18	67	95	0,85
S-19	57	98	0,95
S-20	79	94	0,71
S-21	61	87	0,67
S-22	69	88	0,61
S-23	64	82	0,50
S-24	67	88	0,64
S-25	67	82	0,45
S-26	78	98	0,91
S-27	80	100	1,00
S-28	73	92	0,70

Table 12. (Continued) Mathematical Critical Thinking Skills Test Results (Part 2)

Subject	Pre-test	Post-test	N-Gain Score
S-29	75	96	0,84
S-30	51	83	0,65
S-31	67	95	0,85
S-32	69	94	0,81
S-33	58	82	0,57
Total	2156	2994	

$$N_gain = (S_posttest - S_pretest) / (S_max - S_pretest)$$

$$N_gain = (2994 - 2156) / (3300 - 2156)$$

$$N_gain = 838 / 1144$$

$$N_gain = 0,73251748$$

Based on the analysis summarized in Table 11, an improvement in students' mathematical critical thinking skills was observed after the implementation of the iSpring Suite 11 assisted learning media. The average pretest score was 65,33, while the average posttest score increased to 90,73, indicating a substantial improvement in students' performance after the intervention. The N-gain results show that most students experienced moderate to high improvement, with 19 students categorized as having high gains and 14 students categorized as having moderate gains. The overall N-gain calculation yielded an average value of 0,73, which, according to the N-gain effectiveness criteria, falls into the high or highly effective category. These findings indicate that the Realistic Mathematics Education (RME) based learning media assisted by iSpring Suite 11 is effective in improving students' mathematical critical thinking skills on the topic of SPLDV.

DISCUSSION

The findings of this study indicate that the Realistic Mathematics Education (RME) based learning media assisted by iSpring Suite 11 effectively enhanced students' mathematical critical thinking skills on the topic of systems of linear equations in two variables (SPLDV). This improvement can be explained by the close alignment between the instructional features of the media, the stages of the RME approach, and the indicators of mathematical critical thinking.

The learning media was designed to consistently follow the RME learning trajectory, beginning with contextual problem situations drawn from students' daily experiences. These contextual tasks required students to interpret given information by identifying known and unknown variables, which directly trained the interpretation indicator of mathematical critical thinking. For example, in one activity, students were presented with a real-life purchasing scenario involving two different items with total prices, requiring them to translate the situation into a system of linear equations. This process encouraged students to meaningfully interpret mathematical information rather than merely applying formulas.

The subsequent stages of explaining and solving the contextual problems supported the development of students' analysis and evaluation abilities. Students were guided to analyze relationships among variables, choose appropriate solution strategies, and justify their selected methods. Interactive features such as step-by-step problem prompts, embedded exercises, and guided questions enabled students to examine alternative strategies and evaluate the correctness of their solutions. These features fostered active reasoning and discouraged trial-and-error approaches.

The stages of comparing solutions and drawing conclusions further strengthened students' inference skills. Through quizzes, reflection questions, and feedback provided by the

iSpring Suite 11 system, students were encouraged to compare their answers with correct solutions and infer general conclusions from specific problem cases (Daryanes et al., 2023). The availability of automatic feedback allowed students to reflect on their reasoning processes and identify conceptual errors independently, which is essential for higher-order thinking development.

The effectiveness of the media is also supported by the integration of various item types, including contextual problem-solving tasks, structured exercises, and evaluative questions explicitly aligned with the indicators of mathematical critical thinking: interpretation, analysis, evaluation, and inference (Yohannes & Chen, 2024). This systematic alignment ensured that critical thinking skills were not only assessed but continuously practiced throughout the learning process. As a result, students experienced consistent cognitive engagement rather than episodic exposure to higher-order tasks.

The overall effectiveness, indicated by an average N-gain score of 0,73 (high category), suggests that the improvement achieved in this study is comparable to or stronger than outcomes reported in similar studies. Previous research by Juandi et al. (2022) reported that RME effectively enhances students' critical thinking through meaningful contextualization, while emphasizing that integrating RME with digital media strengthens students' reasoning and problem-solving abilities. In addition, Dewi & Izzati (2020) found that iSpring Suite 11 improves students' motivation and learning focus, which indirectly contributes to higher cognitive performance. The findings of this study extend prior research by demonstrating that an RME based SPLDV learning medium developed using iSpring Suite 11 can achieve a high level of effectiveness as measured through N-gain analysis of mathematical critical thinking skills.

Overall, the results indicate that the effectiveness of the developed media does not stem solely from its technological aspects, but from the pedagogical coherence between contextual problems, interactive features, and structured cognitive demands. This coherence enables students to actively construct mathematical understanding, engage in reflective reasoning, and systematically develop their mathematical critical thinking skills.

CONCLUSION AND SUGGESTIONS

This study demonstrates that the learning media based on Realistic Mathematics Education (RME) developed using iSpring Suite 11 was rated as highly valid by media experts, material experts, and instructional design experts, indicating that it was suitable for use without revision. The field trials also showed that the media were highly practical, easy to use, supportive of students' understanding, and provided an enjoyable learning experience. The effectiveness of the media was reflected in the improvement of students' mathematical critical thinking skills, with an average N-gain score of 0,73, categorized as high. These findings confirm that integrating RME with interactive digital technology can significantly enhance students' critical thinking skills.

For practical implementation, teachers who intend to adopt this learning media are advised to prepare adequate digital devices such as computers or smartphones and ensure sufficient internet access for downloading or accessing the media. Teachers are also encouraged to familiarize themselves with the operation of the iSpring Suite 11 based application, including guidance on installing and using the APK file to support classroom instruction or independent learning activities. Future research is recommended to develop iSpring Suite 11 based learning media for other mathematics topics or to integrate the media into broader digital learning platforms. In addition, the media may be combined with other instructional methods or learning approaches to produce a more comprehensive impact on students' learning outcomes.

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