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How *Science-Mathematics* based Fairytale Book Enhance Critical Thinking Skills and Curiosity in Elementary School Students?

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Abstract

This study aims to develop a fairytale book based on *Science-Mathematics* suitable to enhance critical thinking skills and curiosity and reveal the effectiveness of the fairytale book based on *Science-Mathematics* to improve critical thinking skills and curiosity. Moreover, this study was conducted at two State Elementary Schools in Yogyakarta, Indonesia. This study employed the R & D method adapted by Borg and Gall consisting of 10 steps, including (1) collecting information, (2) planning, (3) developing a preliminary xform of product, (4) conducting preliminary field testing, (5) revising main product, (6) conducting main field testing, (7) revising operational product, (8) conducting operational field testing, (9) revising final product, and (10) conducting dissemination and implementation. Moreover, the data were collected through interviews (need analysis), tests, observations, and questionnaires. Before data collection, the products' validation was conducted by involving learning media experts, material experts, linguist experts, and teachers and students. After that, data were analysed using a MANOVA test with a significance level of 5%. The result

showed that the *Science-Mathematics-based* fairytale book was feasible based on learning media, material, and linguist experts with a predicate of "very good". Additionally, the *Science-Mathematics-based* fairytale book effectively improved critical thinking skills and curiosity with medium effectiveness.

Keywords: *fairytale, critical thinking, curiosity*

Abstrak

Penelitian ini bertujuan untuk mengembangkan buku dongeng berbasis Sains-Matematika yang sesuai untuk meningkatkan kemampuan berpikir kritis dan rasa ingin tahu serta mengetahui keefektifan buku dongeng berbasis Sains-Matematika untuk meningkatkan kemampuan berpikir kritis dan rasa ingin tahu. Selain itu, penelitian ini dilakukan di dua Sekolah Dasar Negeri di Yogyakarta, Indonesia. Penelitian ini menggunakan metode R & D yang diadaptasi dari Borg dan Gall, yang terdiri dari 10 langkah, yaitu (1) mengumpulkan informasi, (2) melakukan perencanaan, (3) mengembangkan produk awal, (4) melakukan uji coba lapangan awal, (5) merevisi produk utama, (6) melakukan uji coba lapangan utama, (7) merevisi produk operasional, (8) melakukan uji coba lapangan operasional, (9) merevisi produk akhir, dan (10) melakukan diseminasi dan implementasi. Selain itu, data dikumpulkan melalui wawancara (analisis kebutuhan), tes, observasi, dan kuesioner. Sebelum pengumpulan data, dilakukan validasi produk dengan melibatkan ahli media pembelajaran, ahli materi, ahli bahasa, serta guru dan siswa. Setelah itu, data dianalisis menggunakan uji MANOVA dengan taraf signifikansi 5%. Hasil penelitian menunjukkan bahwa buku dongeng berbasis Sains-Matematika layak berdasarkan ahli media pembelajaran, ahli materi, dan ahli bahasa dengan predikat "sangat baik". Selain itu, buku dongeng berbasis Sains-Matematika efektif meningkatkan kemampuan berpikir kritis dan rasa ingin tahu dengan tingkat keefektifan sedang.

Kata kunci: *dongeng, berpikir kritis, rasa ingin tahu*

INTRODUCTION

Critical thinking and curiosity are two important characteristics of 21st-century learners (Herianingtyas, 2017). It involves a systematic approach to reasoning, allowing individuals to evaluate information critically and make informed decisions (Mulnix, 2012; Rohovyi et al., 2023; Vincent-Lancrin, 2024). This process not only fosters independent thought but also encourages the exploration of diverse perspectives, which is essential in educational settings and beyond (Heard et al., 2020; Lai, 2011). A critical-thinking learner can ask appropriate questions, gather relevant information, efficiently and creatively sort through this information, reason logically, and come to reliable and trustworthy conclusions (Özkan, 2010). Critical thinking is the habit of making sure our assumptions are accurate and that our actions have the results we want them to have (Brookfield, 2013). A habit ensures that assumptions are made and accurate so that actions will produce the desired results. Thus, producing decisions objectively is the goal of critical thinking. In principle, students who can think critically will do much consideration before stepping and making decisions, the steps they do are full of thoroughness and caution.

Critical thinking is the capacity to work with complex ideas whereby a person can effectively provide evidence to justify a reasonable judgement (Moon, 2007). The evidence, and therefore the judgement, will pay appropriate attention to the context of the judgment

(Phan, 2010). Critical thinking can be seen as a form of learning, in that new knowledge, in the form of judgement, is formed in the process (Wright, 2002). The statement indicates that critical thinking is a complex idea in which one can make decisions based on rational evidence. Critical thinking is important for individuals to make better decisions (Turan et al., 2019). A person who can think critically can filter out the relevant and irrelevant evidence and decide what can be used (Jenicek et al., 2011). It will even do repetitive testing to get results and decisions that are logical, precise, and accurate. Accordingly to this research, the ability to think critically is the ability to think through the process of analysis and evaluation to consider everything that it faces thoroughly and has strong and appropriate evidence as the basis for sparking rational ideas and actions. This means that the ability to think critically can be known from the flow of thinking and students' point of view in solving problems, especially students' decision-making process. Students who can think critically will always analyse and evaluate an idea before deciding. They do not easily believe in an idea or opinion from their friends but instead make it a matter of consideration to obtain decisions and conclusions that are logical, rational, and relevant.

Children with adults certainly have different levels of critical thinking. The characteristics of primary school students who can think critically, (1) Focus, students can focus on the questions/problems, (2) Finding Out, students find answers to questions/problems; (3) Analysis, students analyse the results of observations rationally; (4) Overview, students can assess something as a whole whether there is coherence and relevance between the problems and decisions taken; (5) Inference, the student can conclude the reasons which are already stated (Paul & Elder, 2004).

In addition to critical thinking, the character also becomes one of the orientations in the learning process is curiosity, which serves as one of the keys to the emergence of participation and the student's activeness in the teaching and learning process. Maslow reveals his postulate that curiosity could be equated with a basic desire to know (Pitafi & Farooq, 2012). Curiosity can be associated with the basic desire to know. A desire to know ultimately manifests the student to perform certain actions to answer his curiosity. Curiosity is a desire to know, see, or experience that motivates exploratory behaviour directed towards acquiring new information (Litman, 2005a). It contains the sense that curiosity is a desire to know, see, or experience that motivates exploratory behaviour directed at acquiring new information. The goal of curiosity is to understand and master the material, and as such, it can fit into Goal Theory, which conceptualises motivation as goal-directed behaviours (Dinwoodie, 2011). That the purpose of the curiosity character is to understand and master the material because it can help students to achieve the learning objectives, with the emergence of motivations that move student behaviour to keep finding out. Curiosity can be demonstrated by students with various forms of attitudes and actions that eventually come as a character. Some indicators of the emergence of curiosity in the fourth grade of elementary school students adjusted to the characteristics of student development at that age. The indicators of the curiosity character used in this study are: (1) students want to ask questions; (2) students want to seek more in-depth information; (3) students show sensitivity; (4) students observe an object (Litman, 2005b)

Higher Order Thinking Skills (HOTS) are crucial in preparing students to face the challenges of the modern world, as these abilities not only help them solve complex problems

but also develop critical, creative, and metacognitive thinking skills necessary for lifelong learning. However, in reality, the portrait of the world of education cannot achieve those expectations, In terms of complex, theoretical, analytical, problem-solving, tool-making, problem-solving procedures, and investigation or investigation processes in Indonesian students are still low; the quality of education in Indonesia, especially in primary schools, has not optimised activities that lead to high-level thinking skills such as problem-solving, creative thinking, metacognition, and critical thinking (Anggraheni & Kismiantini, 2022; N. Herianingtyas & Warsiti & Suryandari, 2015; Mukhlis & Herianingtyas, 2021).

Despite the importance of high-level thinking skills such as problem-solving, creative thinking, and critical thinking, as highlighted by various studies, an analysis of student bookss by Agusta and Pratiwi (2020) reveals that these essential skills are not adequately incorporated into the books. In addition, the analysis on student bookss showed that bookss did not yet contain critical and creative thinking skills, which indicates that books and other stimuli are needed in learning that can build students' critical thinking and creative thinking. Due to these limitations, books (student books) should not be used as the only teaching material; more varied support is needed so that students gain more varied knowledge and learning experiences. The next researcher conducted interviews and observations at four elementary schools in Yogyakarta Province. The results of interviews and observations describe several conditions: (1) learning uses only one teaching material, namely student bookss, (2) student learning activities are based on activities presented in bookss, (3) the students did not seem to focus on following learning after more than 30 minutes; (4) question and answer activities in learning are very rare, (5) when students are given test questions that lead to analytical and evaluative more than 80% of students can not answer correctly, (6) students do not try to explore the information from various sources. The conclusion from the results of the interviews and observations indicates that the learning process in the classroom still has many weaknesses. Therefore, efforts are needed to improve teaching methods and to use more varied books to support a better learning process.

According to can improve students' critical thinking skills, but not all books can foster critical thinking skills. One teaching material that has the potential to improve critical thinking skills is based on multiple representations, namely the presentation of concepts through various forms such as objects, pictures, words, or symbols (Paul & Elder, 2019). Furthermore, (Nunaki et al., 2023) explained that books that allow students to carry out problem-solving activities and collect various information allow students to build their critical thinking skills and curiosity.

Although previous studies have provided valuable insights into the use of Science-Mathematics-based storybooks in improving critical thinking skills and curiosity in elementary school students, there are still some aspects that need to be further explored to deepen our understanding. Some of the gaps that can be identified include, previous studies have not fully explored the long-term effects of using Science-Mathematics storybooks on students' critical thinking skills and curiosity. Additional research could expand the scope of observation time to assess whether the improvement is sustainable or temporary. Previous research has not included variations in the use of Science-Mathematics storybooks, such as frequency of reading, student interaction with the book, or other types of supporting activities.

In-depth research on these variations can provide a better understanding of the factors that can increase the effectiveness of using the storybooks.

So it is necessary to develop more specific measurement instruments for critical thinking skills and student curiosity. Further research can try to identify certain aspects of critical thinking skills that are influenced by Science-Mathematics books, as well as measuring curiosity in more detail. Further research could consider the role of cultural context and school curriculum in moderating the effects of using Science-Mathematics storybooks. How these factors may influence students' responses to the storybooks needs to be explored further. Previous studies may not have fully explored how Science-Mathematics storybooks can be inclusive of different ability levels of students. Research can go more in-depth to assess the effectiveness of these storybooks in stimulating the engagement of students with different skill levels. By exploring these aspects, future research can further contribute to developing our understanding of the potential use of Science-Mathematics storybooks in the context of basic education.

The *Science-Mathematics-based* fairytale book is a fairytale that brings an educative mission to bring science and math materials into a fairytale, supported by various interesting activities following the achievements of learning competencies. In this research, *Science-Mathematics-based* fairytales are designed to facilitate the development of critical thinking skills and students' curiosity. Based on the above description, the research aims to produce a *Science-Mathematics-based* fairytale book that is feasible and effective in improving the ability to think critically and the character of the student's curiosity.

METHODS

This study employed the Research and Development (R&D) method from (Borg & Gall, 1984) framework refers to an approach used to design, develop, and evaluate a program, product, or procedure. This method is widely used in educational contexts to design and implement innovations in classrooms or educational institutions (Creswell et al., 2004). The following are ten steps taken by the researcher in the implementation, (1) Research and information gathering, identifying and reviewing related literature on science-math education, fairy tales, critical thinking skills, and curiosity in elementary school students and gathering information on relevant research methods and evaluation tools that can be used. (2) Planning, designing the research framework, including objectives, research questions, and hypotheses, determining the research population and samples, and data collection methods to be used. (3) Product initial form development, designing a prototype of a science-math storybook aimed at improving critical thinking skills and curiosity, adjusting the content to the elementary school curriculum and science-math principles. (4) Preliminary field trial, conducting a small trial of the initial form of the product with a number of elementary school students. (5) Collecting responses and feedback from teachers and students for further improvement. (6) Main Product Revision, evaluate the results of the preliminary trial and make revisions to the science-math storybook based on the feedback obtained. (7) Main Field Test, conduct a large-scale trial of the main product involving a large number of students from various elementary schools, observe the impact on critical thinking skills and curiosity, revise the Operational Product, analyze the data from the main field test and make thorough product revisions if necessary, ensuring the product is in accordance with the needs and responses of users. (8) Operational

Field Test, conduct an operational field test to ensure that the product can be implemented effectively in the daily school environment. (9) Final Product Revision, conduct a final evaluation of the product based on the results of the operational field test, make final revisions to ensure the suitability and quality of the final product. (10) Socialization and Implementation, socialize the research results and products to teachers, principals, and other related parties, implement the products in the elementary school curriculum and facilitate training for teachers for effective use.

The subjects of this research were the students and the fourth-grade teacher of SDN Lempuyangwangi (School A) and SDN Lempuyangan I (School B). The subjects of the initial field trial (limited) were nine students and one teacher from IVA Class of School B, while the main field trial subjects (expanded) were fifteen students and one teacher from IVB Class of School B. Lastly, the subjects of operational product trial were the students of IVA and IVB Classes of School A and students of IVC Class of School B, pooling a total of ninety students and three class teachers.

The data obtained in this study were quantitative and qualitative by employing interviews (need analysis), tests, observations, questionnaires, and validation of media experts, material experts, and linguists. The data analysis technique used interactive analysis for qualitative data and statistical analysis for quantitative data using the MANOVA test with a 5% significance level. The effectiveness of *Science-Mathematics* based Fairytale Book was evaluated using a paired t-test, determining the n-gain based on the average results of the scientific literacy test (Gibbons & Chakraborti, 2014).

$$\text{n} - \text{gain} = \frac{(\text{posttest score} - \text{pretest score})}{\text{ideal score} - \text{pretest score}}$$

Table 1. N-Gain Criteria

N-Gain Score	Criteria
$0.7 < g \leq 1.0$	High
$0.3 \leq g \leq 0.7$	Medium
$g < 0.3$	Low

RESULTS AND DISCUSSION

Development of a Science-Mathematics-based Fairytale Book

The Science-Mathematics-based fairytale book contains adventure tales with royal nuances, recounting the adventures of a prince who helps his father. In his journey, many obstacles must be passed by the characters. This adventure story was chosen by the author so that the fairytale book does not only present pure fairytales but can be inserted with riddles that allow the author to invite readers to participate in solving them. In this case, the scientific fairytale book was developed as a supporting book for learning science and mathematics; therefore, its development is oriented towards achieving learning objectives in these two content. The science material being developed is “Life Cycle of Living Things”, and the math material being developed is “Highest Common Factor (HCF) and Lowest Common Multiple (LCM).”

The author not only develops fairytales but also describes material and science and mathematics activities that students can do while reading and following the storyline; the activity components presented in scientific fairytale books include:

Figure 1. Part of *Science-Mathematics-based fairytale* book

"Sekarang Aku Tahu!"

This part described the material following the achievements of basic competencies and indicators of learning science about the life cycle of living things and mathematics about the Highest Common Factor (HCF) and Lowest Common Multiple (LCM).

"Aku akan Mencoba"

This part contained open-ended problem-solving skills in science and mathematics, like analytical and evaluative.

"Aku Ingin Tahu"

This part contained a puzzle in the middle of a fairytale storyline to invite readers or students to solve it.

"Aku akan Mengamati"

This part invites the readers to observe science objects being studied in the surrounding environment so that students get substantial experience.

"Aku akan Mempraktikkan"

This part engages the readers to conduct scientific investigations and gain concrete experience in discovering a concept or theory of science and mathematics.

"Aku dapat Menyimpulkan"

This part facilitates the reader to conclude what he has learned.

Figure 2. Part of *Science-Mathematics-based* fairytale book

These activities aimed to stimulate the formation of students' critical thinking skills and curiosity. These activities were developed based on indicators of critical thinking, including focus, finding out analysis, overview, and inference, and indicators of curiosity, including asking questions, seeking more in-depth information, sensitivity, and observing an object.

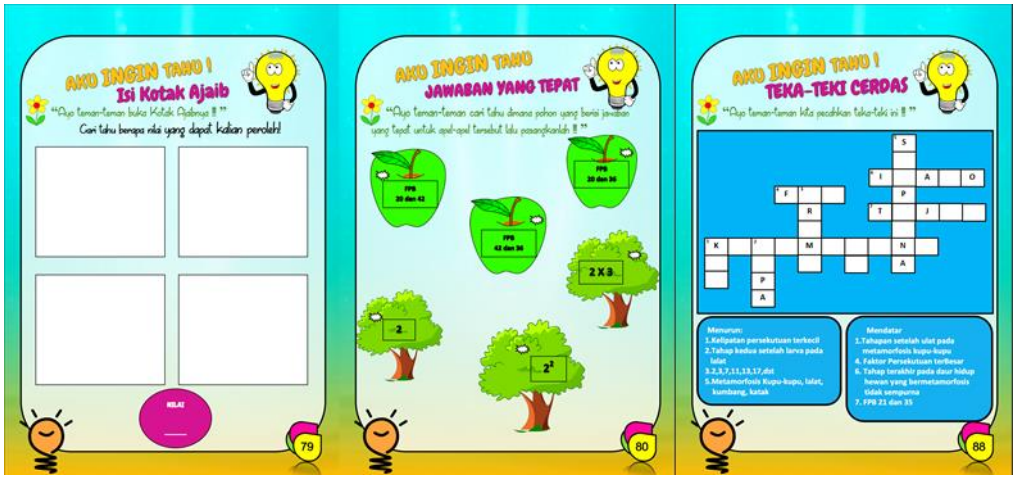


Figure 3. Part of *Science-Mathematics-based* fairytale book

The design uses a bright and eye-catching background, depicting children with enthusiastic expressions while reading the book. uses child-friendly and contrasting colors to make the title and images stand out. uses illustrations of fairy tales adventuring in the world of Science-Mathematics, perhaps exploring magical places or meeting fantastic creatures with elements of science. incorporates elements of math and science into the illustrations by inserting mathematical formulas, and science objects that are magical in nature. Using large fonts and striking colors to highlight the word "Science-Mathematics" in the title.

The fairy book is designed using fonts that are child-friendly but still easy to read. Using a clean and easy-to-read layout with adequate margins. Inserting illustrations on every page to maintain readers' interest. Insert illustrations or supporting images that match the theme of each chapter to help visualize science and mathematics concepts. Using bright colors to maintain visual appeal. Inserting interactive activities or questions in each chapter that

invite readers to think critically and apply the science and math concepts they have learned. Adding blank spaces or special pages at the back of the book to record additional experiments or thoughts that arise during reading. Including an interesting and brief summary of how the Science-Mathematics adventure in the book can improve critical thinking skills and curiosity of elementary school students.

The Feasibility of a Science-Mathematics-based Fairytale Book

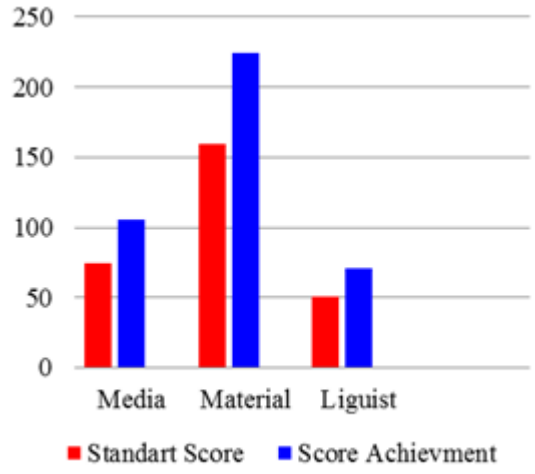
The result of this development and research is a *Science-Mathematics-based* fairytale book as a worthy and effective learning material used in improving the ability to think critically and the curiosity character of fourth-grade students of Elementary School in the Danurejan sub-district. The results of the feasibility assessment of the *Science-Mathematics-based* fairytale book product from media experts, material experts, and linguists are as follows:

Table 2. Feasibility of *Science-Mathematics-based* Fairytale Book

Aspect	Score	Standard Score	Criteria	Decision
Media Expert	106	74.81	Very Good	Worthy
Material Expert	224	159.8	Very Good	Worthy
Linguist Expert	71	51.01	Very Good	Worthy

It can be seen from Table 2 that based on feasibility test results from media experts, the *Science-Mathematics-based* fairytale book gets a score of 106 from the 74.81 feasibility score standard, which then falls under the criteria of "Very Good" and has been declared feasible. Furthermore, it is also written in the table that the results of the assessment of the material experts show a score of 224 from the standard score of 159.8. This means that the *Science-Mathematics-based* fairytale book earned the "Very Good" criteria and has been declared material worthy. Based on the assessment of linguist experts, the *Science-Mathematics-based* fairytale book scores 71 from the standard feasibility score of 51.01, indicating that the book earned a criterion of "Very Good" and that they can be declared feasible in terms of language.

The results of the feasibility test on the *Science-Mathematics-based* fairytale book that appears in Table 3 can be displayed clearly in the following chart:



Graph 1. Feasibility of *Science-Mathematics-based* Fairytale Book

The three feasibility test results presented that a fairytale book based on *Science-Mathematics* "worthy" is used to improve the ability of critical thinking and curiosity in fourth-grade students of SDN in the Danurejan sub-district.

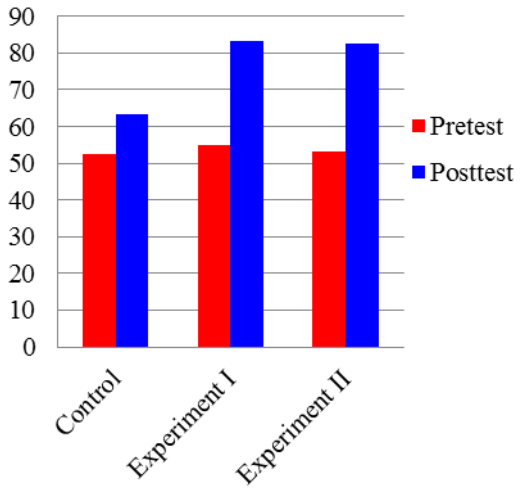
The Effectivity of the Science-Mathematics-based Fairytale Book

After the feasibility test, the *Science-Mathematics-based* fairytale book was used in the research to determine the level of product effectiveness in improving the ability of critical thinking and curiosity character in fourth-grade students of SDN in the Danurejan sub-district. The results show the following data:

Table 3. The Effectiveness of *Science-Mathematics-based* Fairytale Books in Improving the Critical Thinking Skills of Students

Class	Average Value		*Gain*
	Pretest	***Posttest***	
Control	52.50	63.50	0.23
Experimental I	54.83	83.33	0.63
Experimental II	53.33	82.50	0.62

Table 3 presents the pretest and posttest results of students' critical thinking skills, whose improvements can be seen based on the gains generated in each class. It appears in Table 3 that the gain in the experimental class is higher than the gain in the control class. The gain control class obtained is only 0.23 and belongs to the low category. In contrast, experimental class I obtained a gain of 0.63 to be included in the medium category and higher than the control class, and experimental class II obtained a gain of 0.62, which is also included in the medium category and is known to be higher than the control class. Thus, the results obtained that the *Science-Mathematics-based* fairytale book declared effective in improving students' critical thinking skills with the level of effectiveness is. A comparison of improvement between the three classes can also be seen in the following chart:



Graph 2. Comparison of Increasing the Ability of Student Critical Thinking

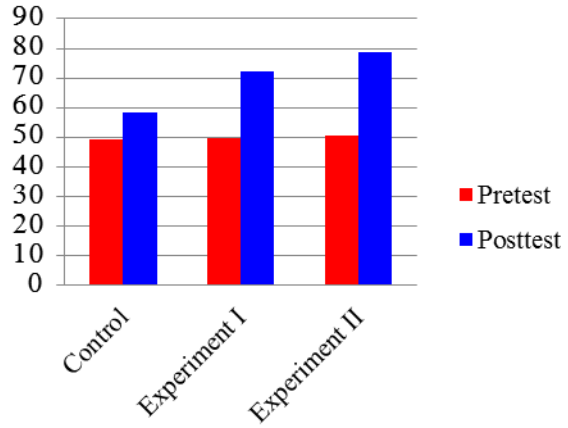
The chart illustrates the values representing the relative increase in the pretest and posttest results of students' critical thinking skills in the control class, experiment I and experiment II. It can be seen that the improvement of students' critical thinking skills in experimental class I and in experiment II is higher than the improvement of students' critical thinking ability in the control class.

In addition to data obtained effectiveness of *Science-Mathematics-based* fairytales book in improving students' critical thinking skills, the research also obtained data about the effectiveness of science-based tale books in improving the character of students' curiosity; the results of the study are shown in the following table:

Table 4. The Effectiveness of *Science-Mathematics-based* Fairytale Books in Improving Students' Curiosity

Class	**Average Value Observation Result**		***Gain***
	Before	**After**	
Control	49.06	58.36	0.18
Experiment I	49.75	72.12	0.45
Experiment II	50.45	78.89	0.57

Table 4. shows observation results of students' curiosity in the control classes, experimental classes I and II. It is known that the gain control class generated only reaches 0.18 and is in a low category. In contrast, the experimental class I obtained a gain of 0.45 and is in the moderate category. It is known that the result is higher than the control class. The experimental class II also scored 0.57, which means being in the category of being and acknowledged as higher than the control class. Thus, the results obtained that the *Science-Mathematics-based* fairytale book declared effective in improving the character of curiosity students with a level of effectiveness is. A comparison of improvement between the three classes can also be seen in the following chart:



Graph 3. Comparison of Increasing Student Curiosity

The chart describes a value that compares the increase of observation results before and after the learning in the control class, experimental class I and experimental class II. The increase in students' curiosity in experimental class I and experimental class II is higher than the increase in students' curiosity character in the control class.

In rows with the results of the effectiveness of *Science-Mathematics-based* fairytale book product in improving the ability of critical thinking and curiosity character of students, also obtained the result of the statistical test using MANOVA test with 5% significance level. The statistical results can be seen in Table 5 below:

Table 5. Statistical Test Result of MANOVA

Effect	Value	F	Hypothesis df	Error df	Sig.
Hotelling's Trace	9,664	415,565[b]	2,000	86,000	,000

Table 5 gives an overview of the MANOVA statistical test result that the significance of the Hotelling's Trace test is 0.000 <0.05, so when compared with the hypothesis can be derived Ho decision is rejected, and Ha accepted, it means there is a significant difference of critical thinking ability and student's curiosity The fourth grade of SDN in Danurejan sub-district between the experimental class that follows the learning using *Science-Mathematics-based* fairytale book with the class of control that does not follow the learning using the *Science-Mathematics-based* fairytale book.

The results of the development and research have illustrated that the *Science-Mathematics-based* fairytale book has been declared feasible and effective in improving the ability to think critically and the curiosity character of the fourth-grade students of SDN in the Danurejan sub-district. The occurrence of feasibility and effectiveness is because of the accuracy of development design with the underlying needs. This means *Science-Mathematics-based* fairytale books have been designed following the needs, rules, and development orientation.

Making the fairytale book for learning science and math has been supported by some experts' opinions, such as (Marpaung, 2012) which reveals many ways to learn science by reading books. However, not only through bookss can children learn about science but also through a fairytale book. Thus, the book of fairytales can convey knowledge, such as material about science, so that children not only learn science through formal media such as books but also learn from fun media such as fairytales. In addition to science, fairytales as one of the media delivery of learning materials can also apply to the content of mathematics lessons. Fairytales include some notions which help children get mathematical notions about the surrounding world, its variety and glory (Andersone, 2009). The field of mathematics is a scientific discipline focused on the exploration of symbols and numbers. It is incorporated into the educational curriculum from elementary to university levels, aiming to equip students with the skills of logical, analytical, systematic, critical, and creative thinking (Arifuddin, 2020).

Fairytales not only develop children's imagination but also develop their skills to use mathematical connections and basic notions in a simple, understandable language in primary and preschools mathematics education, at the same time putting stress on these connections and so paving the way to the further serious acquisition of the systemic course of mathematics. The fairytale includes several ideas that help children gain math knowledge about the surrounding world. The fairytale not only develops children's imagination but also develops their skills to use these math connections. However, the difference is that in this study, the book of fairytales not only teaches math but is combined with the content of science

lessons, so the *Science-Mathematics-based* fairytale book is expected to facilitate the connection of children in understanding the content of science and math lessons.

Fairytale in essence, also by the characteristics of Grade 4 students of elementary school; this is as revealed by Tucker (1990) by now, children with experience of books may have learned to recognise the typical conventions of early fiction so that, for example, they will normally expect certain stereotyped characters to act in certain stock ways, and will feel cheated if popular heroes or heroines are not finally rewarded with happy conclusions to their various adventures. The age of 7-11 years, students who gain much experience can learn to construct and recognise special conventions (Tucker, 1990). For example, they have different perspectives and have great expectations if the good characters are the winners, and the story ends with fun in various adventure stories. At this age, the child is fond of reading that contains adventure stories in fiction packaging to allow children to adventure with their imagination (Andersone, 2009). At the age of 8-10 years children are usually fond of folk tales longer and more complicated, adventure stories to distant and weird fairytale land, humour stories so that it can be understood that the book of a fairytale is one of the good readings and is very popular by children at that age so that it can be a reading material for them (Bunanta, 2008).

Concerning the characteristics of the content of science and mathematics lessons, science is a way of thinking, a way of investigating, and a body of knowledge (Koballa & Chiappetta, 2010). Furthermore, mathematics is an objective fact; a study of reason and logic, a system of rigour, purity, and beauty; free from societal influence; self-contained; and interconnected structure (Chambers, 2008). From the understanding of the two contents of the lesson, it can be seen that both science and mathematics are the content of learning that is learned by practising or "doing", so, in this case, the *Science-Mathematics-based* fairytale book not only contains adventure tales but also presents learning activities such as "I Will Try" *("Aku Akan Mencoba"),* "I Will Know" *("Aku Ingin Tahu"),* "I Will Observe" *("Aku Akan Mengamati"),* "I Will Practice" *("Aku Akan Mempraktikan"),* and "I Can Conclude" *("Aku Dapat Menyimpulkan").*

The science and mathematics problems presented are open-ended scientific observation and investigation activities that can enable students to solve problems with several considerations or answers. Students can integrate open problems in fairytales which emphasise various points of view, logic, and explanations that all problems can be solved using various ways in a fun atmosphere (Putri & Mustadi, 2021). The child's situation in solving problems by considering the information or evidence he gets can be a stimulus to build his critical thinking skills. Critical thinking is the ability and inclination to make and asses conclusions based on evidence (Eggen & Kauchak, 2006). The statement contains the intention that critical thinking skills are part of the ability and inclination to create and evaluate conclusions based on appropriate evidence. Critical thinking is the art of analysing and evaluating thinking to improve it (Paul & Elder, 2019). Analyse and evaluation are the art of critical thinking because both are part of the tool of the emergence of critical thinking so that someone will always make improvements if he has not found the rational truth. Critical thinking involves thinking reflectively and productively and evaluating the evidence (Santrock, 2011). The existence of critical thinking in the self makes it not easily influenced

by others; he will always develop his insights and always think repeatedly in taking a decision.

From the analysis results, the *Science-Mathematics-based* fairytale book is also declared effective in increasing the character of curiosity. Adventure stories of characters with various obstacles can stimulate children's curiosity when following the storyline of a fairytale. Children will have a sense of curiosity about whether the character can pass the obstacles they face or not. Elementary school-age children are active, dynamic, enthusiastic and curious about what they see, hear, and feel; they seem never to stop exploring and learning; therefore, children's fairytales can be a medium for stimulate children's curiosity, develop their imagination as well as to instil character values (Athiroh & Ahmad, 2021). In addition, in the scientific storyline, students are invited to solve interesting puzzles, raising their curiosity to solve the puzzle before continuing the story.

Curiosity is a complex ability that leads to the involvement of reason functions (Perlovsky et al., 2010). For that, curiosity should be formed by fostering interest and interest of students in learning that formed based on willingness in students themselves so that the drive to explore more powerful information. Moreover, Litman (2005b) explains that curiosity is a desire to know, see, or experience that motivates exploratory behaviour towards acquiring new information. This means that curiosity is a desire to know, see, or experience that motivates exploratory behaviour directed at acquiring new information. Thus, the *Science-Mathematics-based* fairytale book has been declared "effective" in improving the ability of critical thinking and curiosity of students.

The fairytale is a story containing moral and social values useful to form the character of children (Zipes, 2013). The media of learning mathematics in the form of fairytale books of children based on folklore, students can practice good characters and able to understand the concept of mathematics learning shown through the results of learning mathematics intact in terms of cognitive, affective, and psychomotor so that it can apply it in everyday life . Learning presented through fairytales can facilitate the character and the development of conceptual understanding (Wangid et al., 2018). The position of this study is to improve cognitive and character abilities through fairytale books equally; only this research increases the ability of critical thinking and the character of curiosity so that not all cognitive abilities and character values are developed.

In this case, the ability to think critically and the character of curiosity are enhanced through the facilitation presented in *Science-Mathematics-based* fairytale books used in learning. The *Science-Mathematics-based* fairytale book can direct students to the science and math activities that lead to the improvement of critical thinking skills and the character of curiosity, through the character of characters in fairytales can also provide exemplary that can stimulate the emergence of critical thinking and curiosity in students.

CONCLUSION

Based on the results of the development and research of the *Science-Mathematics-based* fairytale book, it can be concluded that the *Science-Mathematics-based* fairytale book in improving the ability to think critically and the character of curiosity in fourth-grade students of SDN in Danurejan sub-district has been declared feasible by media experts, material experts, and linguists and *Science-Mathematics-based* fairytale books have been declared

effective in improving the ability of critical thinking and curiosity character in fourth-grade students of SDN in Danurejan sub-district within the middle level of effectiveness. The author recommends that fairytale books can facilitate students in increasing critical thinking skills and curiosity.

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