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Transforming Student Literacy in the Digital Era: The Effect of Discovery-Based Reading with Leveled Books on Critical Reading Comprehension

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Abstract. This research was motivated by the low level of critical reading comprehension skills among elementary school students, which reflects one of the indicators of low reading literacy in Indonesia as reported by the 2022 PISA study. Reading instruction in schools generally focuses more on reading fluency rather than on text comprehension. Therefore, it is necessary to apply learning methods that can enhance students' critical thinking and reading comprehension skills, one of which is the discovery based reading (DbR) method supported by digital leveled books. The purpose of this study was to analyze the effect of the discovery based reading method on elementary school students' critical reading comprehension skills and to compare it with the SQ3R method. The study employed a quasi-experimental design using the Matching-Only Pre-test-Post-test Control Group Design. The research subjects consisted of 43 fifth-grade students from two elementary schools in Bandung Regency, divided into experimental and control groups. Data were collected through a critical reading comprehension test covering six critical thinking indicators and analyzed using normality, homogeneity, and t-test statistical tests to examine the hypotheses. The results showed a significant improvement in critical reading comprehension skills for both the experimental class using the discovery based reading method and the control class using the SQ3R method. The average post-test score of the experimental class increased from 52.08 to 88.75, while that of the control class increased from 37.40 to 76.90. However, the gain test results indicated no significant difference between the two methods. In conclusion, both discovery based reading and SQ3R methods are effective in improving students' critical reading comprehension skills. These methods can complement each other and be applied flexibly in Indonesian language learning to enhance students' literacy and critical thinking skills in the digital era.

Keywords: Discovery Based Reading, Digital Leveled Books, Critical Reading Comprehension Skills

INTRODUCTION

Education in the 21st century plays a crucial role in developing intelligent and high-quality human resources capable of fulfilling their rights and responsibilities (Abidin, 2015). This century is characterized by rapid advances in science and technology that have significantly transformed various aspects of human life. Therefore, education should be oriented toward preparing individuals to adapt to contemporary developments and to contribute to building a dignified civilization. Education is not merely understood as a process of teaching and learning between teachers and students, but also as a process of developing the ability to think, behave, and act effectively in real-life contexts.

Twenty-first-century education requires students to possess critical thinking, creativity, collaboration, and communication skills (the 4Cs), along with strong character values (Fauzi, 2020). In line with this, the *Strengthening of Character Education* program (*Penguatan Pendidikan Karakter* or PPK) is designed to cultivate character through school culture,

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classroom practices, and community engagement (Umayah & Riwanto, 2020). One of the key implementations of PPK is the school literacy program, which not only strengthens character development but also plays an essential role in enhancing 21st-century cognitive and thinking skills.

Reading serves as the foundation of the educational process, as it enables students to acquire knowledge, gain experience, and develop critical thinking skills (Kesuma, Yulianti, & Supriatna, 2022). Reading comprehension, in particular, is a fundamental determinant of academic achievement (Alpian & Yatri, 2022), as it involves not only word recognition but also the construction of meaning from texts (Chasanah et al., 2021). However, the 2022 PISA study revealed that Indonesian students' reading literacy remains below the international average, with a mean score of 359—declining from 371 in 2018 (Kemendikbudristek, 2023). This low level of reading comprehension can be attributed to several factors, including inappropriate instructional strategies and insufficient emphasis on text understanding. Many teachers still prioritize reading fluency rather than comprehension (Amanata & Taufik, 2020).

To address this issue, it is essential to apply instructional methods that can effectively enhance elementary students' reading comprehension and critical interpretation skills. One such method is *Discovery-Based Reading* (DbR) (Yulianta, 2021), derived from Jerome Bruner's *Discovery Learning* model. This approach encourages students to actively construct meaning from texts through exploration and inquiry based on their own experiences. Previous studies have demonstrated that DbR effectively improves students' reading comprehension and critical thinking skills (Mulyati & Syam, 2020; Berliana, Sugiyanto, & Fardhani, 2023).

In addition to DbR, the SQ3R (*Survey, Question, Read, Recite, Review*) method has also proven effective in enhancing comprehension by helping students organize information systematically and strengthen their analytical abilities (Sakinah & Ibrahim, 2023). Alongside technological advancement, reading instruction should also integrate digital media such as e-books. The use of e-books has been shown to increase students' motivation and engagement by providing interactive reading experiences that combine text, audio, video, and animation (Pertiwi & Mindaryani, 2024; Efendi, Siswono, & Mariana, 2022). Moreover, e-books are regarded as innovative learning media suited to the characteristics of 21st-century education, fostering creativity and learner autonomy (Rusdianti, 2024).

Thus, the implementation of *Discovery-Based Reading* and SQ3R methods integrated with digital e-books is expected to serve as an effective strategy to improve elementary students' reading comprehension and critical literacy skills in the 21st century.

METHODOLOGY

The research design employed in this study was the Matching-Only Pretest-Posttest Control Group Design (Fraenkel, Wallen, & Hyun, 2023), which involved two classes as research samples: an experimental class and a control class. This design is a modification of the Pretest-Posttest Control Group Design by adding a matching element to control extraneous variables and minimize potential bias. In this design, the experimental and control groups were not selected randomly but through a matching process based on shared characteristics, and their results were subsequently compared. The experimental class received treatment using the Discovery-Based Reading method, whereas the control class was taught using the SQ3R method.

The study involved both a population and a sample. The population is defined as a group of research subjects that possess similar characteristics, thereby allowing for generalization (Fraenkel & Wallen, 2009). The population of this research consisted of fifth-grade elementary school students in Bandung Regency, while the sample included fifth-grade students from two schools within the same area.

Table 1. **Research Sample**

Students	**Number of Students**
Experimental Class	18
Control Class	25
Total	43

The sample selection was conducted in accordance with the requirements of the experimental design, which stipulates that both data groups must originate from matched groups. The research instrument used in this study was a Critical Reading Comprehension Test. This instrument was employed to collect data directly from students. The data were obtained through a written test based on six indicators: the ability to explain, apply, interpret, build perspective, empathize, and demonstrate self-awareness. The research procedures followed the stages of the Matching-Only Pretest-Posttest Control Group Design.

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1. Normality Test

A normality test was conducted to determine whether the obtained data were normally distributed. The formula used is as follows (Coladarci & Cobb, 2014): $\chi^2 = \Sigma((f_0 - f_e)^2 / f_e)$

Description: χ^2 = Chi-square value; f_0 = Observed frequency; f_e = Expected frequency.

2. **Homogeneity** Test

The homogeneity test was used to determine whether the samples were drawn from populations with equal variances. Decision criterion: Reject H_0 if the calculated test statistic exceeds the critical value at the predetermined significance level ($\alpha = 0.05$); otherwise, accept H_0.

3. Hypothesis Testing

A two-mean difference test was used to test the research hypothesis. This test aims to determine whether there is a significant difference between the pre-test and post-test results.

1. If the data are normally distributed but not homogeneous, a specific test formula was used (not presented here for brevity). The decision criterion is to reject H_0 if the calculated value exceeds the critical value; otherwise, accept H_0, at a 0.05 significance level.

2. If the data are not normally distributed and not homogeneous, a non-parametric statistical test, namely the Mann–Whitney test, was used. The decision criterion is to reject H_0 if the calculated value exceeds the critical value; otherwise, accept H_0, at a 0.05 significance level.

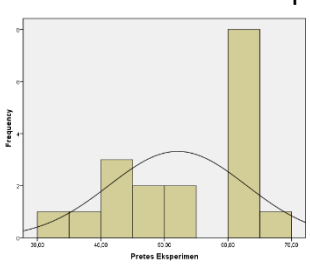
3. If the data are normally distributed and homogeneous, a parametric t-test was applied using the following formula: $t = (\bar{X}_1 - \bar{X}_2) / (S_p \sqrt{(1/n_1 + 1/n_2)})$

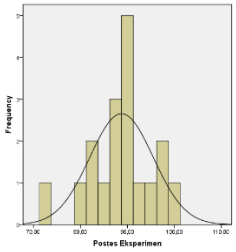
Where: $\bar{X}_1$ = Mean of pre-test; $\bar{X}_2$ = Mean of post-test; n_1, n_2 = Number of students in each group; S_p = Pooled standard deviation. Decision criterion: Reject H_0 if the Sig. (2-tailed) value < 0.05; otherwise, accept H_0.

RESULTS AND DISCUSSION

RESULTS

Based on the pre-test and post-test data from the experimental class, the results present a comparison of scores aimed at identifying changes in students' critical reading comprehension skills before and after the implementation of the Discovery-Based Reading method using

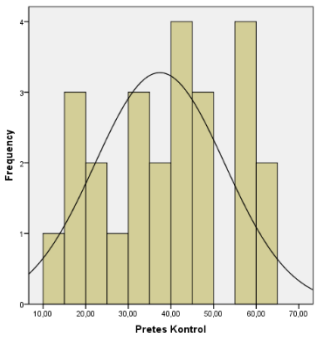


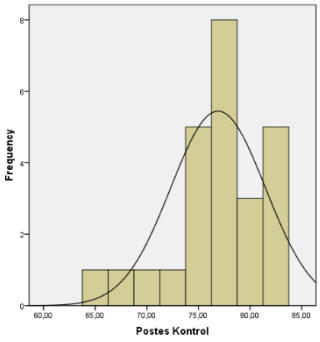


digital leveled e-books as the learning medium.

In this study, six indicators were established for measurement. These indicators were derived from the components of students' critical reading comprehension skills, namely the ability to explain, apply, interpret, build perspective, empathize, and demonstrate self-awareness. The highest post-test score in the experimental class was 100. Students achieved the maximum score of four points for each predetermined indicator. A student was considered to have attained the highest score because they were able to meet almost all the criteria across every indicator. Specifically, the student scored four points in explaining, four points in applying, four points in interpreting, four points in building perspective, four points in empathizing, and four points in self-awareness.

Based on the pre-test and post-test data of the control class, the results represent a comparison of scores aimed at identifying changes in students' critical reading comprehension skills before and after the implementation of the *Discovery-Based Reading* method using digital leveled e-books.





Data analysis revealed a significant change between the pre-test and post-test results following the implementation of the SQ3R method in developing students' reading comprehension skills. The lowest pre-test score was 12.5, while after the intervention, the highest post-test score increased to 82.5. This improvement illustrates the effectiveness of the

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applied method. The change in students' performance between the pre-test and post-test indicates that the SQ3R method successfully enhanced students' critical reading comprehension skills during the learning process. The consistency of score improvement across all samples further reinforces the conclusion that this method effectively and comprehensively influences students' critical reading comprehension abilities in a positive manner.

Subsequently, a normality test for the experimental class data was conducted using the *One-Sample Kolmogorov–Smirnov Test*. The results are presented in Table 3, which displays the distribution characteristics of the experimental class data.

Table 2. Normality Test Results of the Experimental Class

		Pretest Eksperimen	*Postest* Eksperimen
N		18	18
Normal Parameters[a,b]	*Mean*	52,0833	88,7500
	Std. Deviation	10,82107	6,76551
Most Extreme Differences	*Absolute*	,268	,149
	Positive	,146	,149
	Negative	-,268	-,149
Kolmogorov-Smirnov Z		1,136	,632
Asymp. Sig. (2-tailed)		,151	,820

Based on the normality test results for the experimental class using the Kolmogorov–Smirnov test, the obtained value was 1.136 with a significance level of 0.151. Since the significance value was greater than the predetermined significance threshold of 0.05 (0.151 > 0.05), the pre-test data of the experimental class were normally distributed. For the post-test data of the experimental class, the Kolmogorov–Smirnov statistic was 0.632 with a significance value of 0.820. As this value was also greater than 0.05 (0.820 > 0.05), the post-test data of the experimental class were likewise normally distributed.

The results of the normality test for the control class, conducted using the one-sample Kolmogorov–Smirnov test, are presented in the following table.

***Table 3**. Normality Test for the Control Class*

		Pretest Kontrol	*Postest* Kontrol
N		25	25
Normal Parameters[a,b]	*Mean*	37,4000	76,9000
	Std. Deviation	15,21512	4,58030
Most Extreme Differences	*Absolute*	,116	,192
	Positive	,114	,128
	Negative	-,116	-,192
Kolmogorov-Smirnov Z		,582	,961
Asymp. Sig. (2-tailed)		,888	,315

Based on the normality test results of the control class, the Kolmogorov–Smirnov statistic for the pre-test was 0.582 with a significance value of 0.888. Since the significance value was greater than the alpha level of 0.05 (0.888 > 0.05), it can be concluded that the pre-test scores of the control class were normally distributed. For the post-test, the Kolmogorov–Smirnov statistic was 0.961 with a significance value of 0.315, which is also greater than 0.05 (0.315 > 0.05). This indicates that the post-test data of the control class were normally distributed. Overall, the normality test results show that the data were generally normally distributed.

Subsequently, hypothesis testing was conducted for the experimental class using a *paired samples t-test*. The results of the analysis, which compare the mean scores of the pre-test and post-test, are presented in the following table.

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Table 4. Paired Samples Statistics of Students' Critical Reading Comprehension Skills in the Experimental Class

		Pair 1
		Post-test Eksperimen – *Pre-test* Eksperimen
Paired Differences	*Mean*	36,66667
	Std. Deviation	10,28992
	Std. Error Mean	2,42536
	95% Confidence Interval of the Difference *Lower*	31,54961
	Upper	41,78372
t		15,118
df		17
Sig. (2-tailed)		,000

Based on the results of the paired-samples statistical test for students' critical reading comprehension skills in the experimental class, a *t*-value of 15.118 was obtained, with a significance value (*Sig.* 2-tailed) of 0.000 < 0.05. Therefore, the null hypothesis (H_0) was rejected, and the alternative hypothesis (H_1) was accepted. This indicates a significant difference between the mean pre-test and post-test scores in the experimental class, with a mean difference of 36.66667 and a standard deviation of 10.28992.

The results of the paired-sample *t*-test for the mean pre-test and post-test scores of students' critical reading comprehension skills in the control class are presented in the following table.

Table 6. Paired-Sample *t*-Test of Students' Critical Reading Comprehension Skills in the Control Class

		Pair 2
		Post-test Kontrol - *Pretest* Kontrol
Paired Differences	*Mean*	39,50000
	Std. Deviation	16,52019
	Std. Error Mean	3,30404
	95% Confidence Interval of the Difference *Lower*	32,68080
	Upper	46,31920
t		11,955
df		24
Sig. (2-tailed)		,000

Based on the results of the paired sample t-test for the control class, a t value of 11.955 was obtained with a significance level (Sig. 2-tailed) of 0.000 < 0.05. Therefore, the null hypothesis (H_0) was rejected, and the alternative hypothesis (H_1) was accepted. This indicates that there was a significant difference between the mean scores of the pre-test and post-test for students' critical reading comprehension skills in the control class.

Furthermore, the results of the independent sample t-test comparing the mean pre-test scores of the experimental and control classes in students' critical reading comprehension skills are presented in the following table.

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Table 6. Independent Samples Test

		Pretest	
		Equal variances assumed	*Equal variances not assumed*
Levene's Test for Equality of Variances	*F*	2,201	
	Sig.	,146	
t-test for Equality of Means	*t*	3,501	3,698
	df	41	40,999
	Sig. (2-tailed)	,001	,001
	Mean Difference	14,68333	14,68333
	Std. Error Difference	4,19385	3,97056
	95% Confidence Interval of the Difference *Lower*	6,21369	6,66463
	Upper	23,15298	22,70204

Based on the output of the independent sample *t*-test, the result of Levene's Test for Equality of Variances was 0.146 > 0.05, indicating that the variance of the data between the experimental and control classes was homogeneous. In line with the results of the comparative analysis of the pre-test scores of the experimental and control groups, it was found that there was a difference in critical reading comprehension ability prior to the implementation of the learning treatment.

Therefore, the difference test could not be conducted directly by comparing the post-test results. Instead, the analysis was performed using the *gain* scores (improvement data) to evaluate the increase in students' critical reading comprehension skills.

Table 7. Gain Test Results

		Gain	
		Equal variances assumed	*Equal variances not assumed*
Levene's Test for Equality of Variances	*F*	5,773	
	Sig.	,021	
t-test for Equality of Means	*t*	,642	,691
	df	41	40,310
	Sig. (2-tailed)	,524	,493
	Mean Difference	2,83333	2,83333
	Std. Error Difference	4,41143	4,09866
	95% Confidence Interval of the Difference *Lower*	-6,07573	-5,44839
	Upper	11,74239	11,11505

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Based on the results of the gain t-test, Levene's Test for Equality of Variances yielded a significance value of 0.021 < 0.05, indicating that the data between the experimental and control classes had equal variances. The analysis produced a calculated *t* value of 0.642. The interpretation of the results refers to the row labeled *Equal variances assumed*. The *Sig. (2-tailed)* value was 0.524 > 0.05, which indicates that H_0 is accepted and H_1 is rejected. This means that there was no significant difference in students' critical reading comprehension abilities between the experimental class and the control class after the learning intervention.

DISCUSSION

Based on the research findings, a strong relationship was observed between the *Discovery-Based Reading* pre-test and post-test results of students' critical reading comprehension in the experimental class. The significant changes and positive effects of using the *Discovery-Based Reading* method indicate that after the implementation of digital leveled e-books, students became more enthusiastic and actively engaged in the learning process. The notable difference between the pre-test and post-test results in the Indonesian language subject, particularly in literary text comprehension, can be explained by the effective learning implementation. The experimental class, which used *Discovery-Based Reading* supported by digital leveled e-books, actively integrated critical reading comprehension into the learning process, making the literary text materials more meaningful and relevant to the students. This integration improved the overall learning quality, as reflected in higher post-test results, increased motivation, and enhanced learning outcomes compared to the initial pre-test performance.

Similarly, the significant improvement in the control class's pre-test and post-test results in the same subject can be attributed to the implementation of the SQ3R method supported by e-books. The control class effectively integrated critical reading comprehension strategies into the learning process, enabling students to engage more deeply with the texts. This approach fostered student independence and engagement, which were less visible during the pre-test phase. The use of the SQ3R method with digital leveled e-books was found to have a positive impact on students' critical reading comprehension skills. Beyond improving comprehension, the SQ3R method also enhances critical thinking and learner autonomy. The students demonstrated greater enthusiasm and significant improvement in understanding reading materials, as they were able to connect textual content with personal experiences and prior knowledge (Tego, 2019).

The overall learning implementation in both experimental and control classes proceeded effectively and optimally. The use of digital media provided an engaging context that allowed students to explore and develop their critical thinking skills. Both instructional methods proved valuable in strengthening basic comprehension and memory skills. The combination of these two methods enabled students to benefit from the strengths of each approach and medium. However, the effectiveness of each method depends greatly on its proper implementation by the teacher. Educators must adapt teaching methods to students' needs and characteristics while ensuring balanced use of both approaches (Wicaksono & Agustyaningrum, 2018). With flexible and adaptive teaching strategies, teachers can foster students' critical thinking and awareness of their own reading comprehension abilities skills essential for academic success and the development of reflective, analytical readers.

The following are the main differences between the *Discovery-Based Reading* and SQ3R methods in influencing critical reading comprehension:

1. Learning Approach: *Discovery-Based Reading* adopts an exploratory and independent learning approach in which students actively seek information through inquiry and discussion, emphasizing discovery and self-directed understanding. In contrast, SQ3R is a more structured and systematic method consisting of five clear steps (Survey, Question, Read, Recite, Review), emphasizing organized reading and comprehension through repetition.
2. Student Engagement: In *Discovery-Based Reading*, students are more actively engaged in information-seeking and group discussions, enhancing their social and collaborative skills. Meanwhile, SQ3R encourages individual engagement through reading and summarizing activities, which improve concentration and retention.
3. Critical Thinking Development: *Discovery-Based Reading* trains students to think critically through exploration and reflection, helping them develop analytical and evaluative skills independently. The SQ3R method, on the other hand, fosters critical thinking by encouraging students to ask questions and review information repeatedly, improving comprehension and memory retention.
4. Learning Focus: *Discovery-Based Reading* focuses on the process of exploration and understanding through active interaction and inquiry. SQ3R focuses on systematic and structured reading processes that strengthen comprehension and long-term retention.

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Both methods have distinct advantages and can be applied according to students' learning needs and classroom contexts. Combining *Discovery-Based Reading* and SQ3R may yield optimal benefits for students. For instance, teachers can begin with *Discovery-Based Reading* steps to stimulate exploration and discussion, then proceed with SQ3R to help students organize and retain information more effectively. The following illustrates how both methods can be integrated within a single learning session:

1. Problem or Task Presentation (Discovery-Based Reading): Provide students with a text or problem to solve. Encourage them to explore and understand the content individually or collaboratively.
2. Survey and Question (SQ3R): Ask students to conduct a quick survey of the text to grasp its general meaning, then formulate questions based on their initial reading.
3. Exploration and Discussion (Discovery-Based Reading): Facilitate group discussions in which students seek answers to their questions, promoting critical inquiry and deeper analysis.
4. Read and Recite (SQ3R): Have students read the text carefully to find answers and summarize key information in their own words.
5. Review (SQ3R): Guide students to review the text and reflect on their understanding collectively, reinforcing comprehension through class reflection.

Integrating both methods can comprehensively support students in developing their critical reading comprehension skills.

CONCLUSION

The findings of this study demonstrate that both the Discovery-Based Reading (DbR) method supported by digital leveled books and the SQ3R approach significantly enhanced students' critical reading comprehension skills. The DbR method encouraged active exploration, inquiry, and interpretation, enabling students to construct meaning through discovery processes that fostered engagement and deeper comprehension. Meanwhile, the SQ3R method provided a structured framework that strengthened comprehension through systematic reading and review. Although statistical analysis revealed no significant difference between the two methods, both produced substantial learning gains and contributed effectively to the development of students' critical literacy in the digital learning context.

Comparatively, Discovery-Based Reading was more effective in stimulating collaborative inquiry and independent reasoning, while SQ3R excelled in promoting structured understanding and long-term retention of information. The complementary nature of both methods suggests that their integration can create a balanced instructional model combining exploratory learning with systematic comprehension. Hence, teachers are encouraged to apply these methods adaptively and synergistically to optimize students' critical reading comprehension, foster analytical thinking, and cultivate lifelong literacy skills aligned with 21st-century learning demands.

Suggestions for Future Research

Future studies are recommended to expand the scope of participants to include students from various grade levels and different educational settings to obtain broader generalizations. Subsequent research may also explore the long-term impact of the *Discovery-Based Reading* and SQ3R methods on students' critical reading development, motivation, and independent learning behavior. Moreover, integrating these methods with other digital literacy strategies or adaptive learning technologies could further enhance students' engagement and comprehension in diverse digital learning environments.

In addition, future researchers are encouraged to employ mixed-method approaches that combine quantitative and qualitative data to gain deeper insights into students' learning processes, cognitive engagement, and critical thinking patterns. Comparative studies across regions or subject areas would also provide valuable perspectives on how contextual factors influence the effectiveness of these reading strategies. Such efforts can contribute to refining instructional models that foster critical literacy and 21st-century learning competencies.

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