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Effectiveness of a Mixed Methods-Based Literacy Program in Improving Reading Comprehension, Vocabulary Mastery, and Reading Fluency Skills of Early Grade Students

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Abstract. Many young children still experience reading difficulties when they enter school age. This study aimed to examine the effectiveness of a mixed methods-based reading literacy program (computer-assisted reading, independent tiered reading, and group-based reading teaching) to improve reading comprehension skills, vocabulary mastery, and reading fluency among early grade students. The study used a quantitative approach with experimental research methods. A quasi-experimental design was used to achieve the research objectives by involving 350 elementary school students who were in the fourth to sixth grade range of elementary school. The sample selection in this study involved the purposive sampling technique using several criteria. The teachers involved in this study totaled 150 teachers from 8 schools who acted as program implementers at school. The reading literacy program was implemented for two semesters for five days each week. The research findings show that the mixed methods-based reading literacy program had a significant effect on all competencies (word reading efficiency, reading comprehension ability, and reading fluency) in Grade 3 students, but this increase in ability was not seen in grades 5 and 6 students. More specifically, the effect size of the intervention on oral reading fluency in Grade 3 students was greater than the effect size in Grade 5 students. Furthermore, the effect size in Grade 4 was greater than the effect size in grades 5 and 6. This is because the treatment of reading difficulties in younger students is easier and more effective than in older students. In addition, based on the results of the correlation analysis, the number of words read during reading activities using a computer had a positive relationship with word reading scores and visual word reading efficiency in the post-test phase. Therefore, mixed methods-based literacy programs have a significant impact on reading fluency, and on vocabulary mastery and reading comprehension competence and reading fluency. This research has implications in that improving

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reading ability in the early grades is better done by using a combination of methods, such as computer-assisted reading, independent tiered reading, and group-based reading teaching. In this way, the improvement of students' reading skills is more optimal.

Keywords: early grade students; literacy program; mixed methods; reading comprehension; reading fluency; vocabulary mastery

1. Introduction

Currently, researchers are focusing on various methods or programs to prevent early grade students from experiencing reading difficulties when they enter school age. This prevention is not only done by researchers but also supported by the government, who facilitates various literacy programs for early grades. Early grade literacy programs are not only held in Indonesia but also in many other countries (e.g., the United States, England, Japan, South Korea, and Finland). These programs take the form of partnership literacy programs, interactive reading literacy programs, head start literacy programs, early reading literacy programs, and many others (Higgins et al., 2015; Sampa et al., 2018). Prevention of reading difficulties is better than overcoming reading difficulties when students enter a higher school level (Al Jefri & Areepattamannil, 2019; Anderson et al., 2019). Even though prevention of reading difficulties is better, in reality, the literacy programs implemented are mostly used to overcome reading difficulties experienced by students in lower grades, especially in schools that have not paid optimal attention to their students' reading abilities. One of the factors that greatly affects reading ability is the pattern of reading habits that is carried out at home. Children who regularly, that is at least five days a week, read story books with their parents at home in their early grades (grades 1–3 of elementary school) tend to have better reading skills when they enter Grade 4 of elementary school. However, on the other hand, children who do not regularly read with their parents at home will have difficulty in reading while at school. Naturally, the low levels of reading literacy in the early grades will have a significant impact on students' academic abilities when they grow up or enter the middle class.

The Indonesian Government has held a literacy program for early childhood students to overcome reading difficulties at school. Intervention programs designed by teachers must accommodate the heterogeneity of students' reading difficulties, for students in early grades 1 to 3 and also early grades 5 to 6 (Ruotsalainen et al., 2022; Yang et al., 2018). Components that need to be considered in improving reading skills in the early grades are phonemic awareness, phonic awareness, vocabulary mastery, reading fluency, and reading comprehension (Steiner et al., 2022). All the required competencies must be accommodated in reading instructions, which will require the integration of various methods or mixed methods. Reading difficulties are not caused by one aspect only but several, hence the need for a literacy program that accommodates these aspects. One example is the youth reading model, which accommodates several aspects of reading, such as phonological awareness, word reading, decoding, reading fluency, and language skills (vocabulary, structure, and syntax) (Juanjuan & Mohd Yusoff, 2022; Thomas et al., 2020). Based on the method that

accommodates these various abilities, the researcher adapted a literacy program with mixed methods intervention. This program is part of a literacy program designed by the government, but the technique has been modified by the researcher to obtain more optimal results because the literacy program of the government is general in nature. The modification of the technique of this program lies in the intervention of reading skills used in implementation during the program, such as computer-assisted reading, independent tiered reading, and group-based reading teaching.

Students who have difficulty in reading at the elementary school level will usually show delays in participating in the learning process and low academic achievement will start to be seen among students in grades 4 to 6 of elementary school. In addition, students will often avoid reading learning activities and have no motivation to learn to read (Hadianto et al., 2022; Steiner et al., 2022). Differences in the intensity of reading activities that students receive at home have an impact on their reading ability. Given this, teachers often find it difficult to minimize the difference in the intensity of reading activities between students who have good reading skills and those who have poor reading skills (Counihan et al., 2022; Te Maro et al., 2019). Teachers must at least provide students with low abilities exposure to intensive reading activities. This will be difficult if intensive reading is done in the classroom, because the teacher must be fair and pay equal attention to all students, so a program is needed that embraces both abilities (individual and community attention). Based on these problems, the researcher modified the reading literacy program by combining various reading-method interventions (computer-assisted reading, independent tiered reading, and group-based reading teaching) for early grades. The aim was to improve reading comprehension skills, vocabulary mastery, and reading fluency in class, for both students who are still having difficulties and those who have excelled. Differences in reading ability on the intensity of reading literacy activities can show the residual variance of reading ability scores in the post-test phase. This research can serve to fill the gap in the deficiencies that were not investigated in previous studies. Therefore, this study attempted to, first, investigate the effectiveness of a mixed methods-based reading literacy program in improving reading comprehension skills, vocabulary mastery, and reading fluency in early grade students, especially students who experience difficulty in reading in early grades. Second, the study attempted to investigate correlations between literacy program interventions and variables of ethnicity, level of reading ability, and grade level.

2. Literature Review: Mixed Methods-Based Literacy Program

A mixed methods-based reading literacy program is a program that is designed to overcome reading difficulties in early grade students, especially in reading comprehension competence, vocabulary mastery, and reading fluency. This program is designed by integrating various methods to improve early grade reading skills (Gutierrez et al., 2021; Thomas et al., 2020). This program is implemented by combining several methods, namely the use of computers, tiered books, and small-group-based teaching. The integrated treatment used in the literacy program is computer-assisted reading, independent tiered reading, and group-based reading teaching. This program is implemented five times a week

for one year. Some of the books used are non-fiction books, including science, social science, language, and mathematics, with the aim of improving students' reading skills as well as knowledge at the elementary school level (Ioannidou et al., 2019; Jung, 2019). In addition, teachers also provide direct instruction to facilitate students in mastering vocabulary in these various fields of study. For example, in the field of social sciences, teachers generate schemata of students by asking questions about the contents of the text, carrying out reading activities together, and introducing new words on the topic (Heyne et al., 2023; Morris et al., 2019). In teaching vocabulary, the teacher begins by reading the word being studied, providing an explanation of its meaning, using the word in a sentence, asking questions whose answers must include the word, and providing additional explanations about the word (Byrne et al., 2023; Higgins et al., 2015). Furthermore, group teaching is done by grouping students into several small groups, where each group consists of four or five students. In these groups, students take turns carrying out several activities, namely doing computer-assisted reading instructions, reading tiered books independently, and using reading models (Kim & Riley, 2021).

This mixed methods-based literacy program is widely used in several countries, such as the United States, England, Japan, South Korea, and Finland, where the method is modified and adapted to the level of difficulty and reading problems of students. The modifications made are interventions that are used according to the level of students' initial reading ability. There are several previous studies that encourage researchers to use this reading literacy program in Indonesia with method modifications (Borman et al., 2021; Hadianto et al., 2022; Karatza, 2020). Ten studies conducted in several countries on the effect of the mixed methods-based reading literacy program had one central finding, namely an average ability increase of 50% in the ability to read comprehension from the initial ability (Mawyer & Johnson, 2019). Furthermore, several previous studies have revealed a lack of ability to read efficiently and of reading fluency among early grade students (grades 1–6 in elementary school), which are very necessary and are a top priority in literacy programs for early grade students. In addition, the evaluation of a mixed methods-based reading literacy program has not optimally separated the pure impacts of program instruction from interventions to increase students' learning abilities, so the pure impacts of the literacy program have not been optimally evaluated (Morris et al., 2018, 2023). In this evaluation, the experimental group received more intensive intervention than the control group, so that the abilities of the students in the experimental group were superior. Furthermore, the mixed methods employed for the literacy activity program were mixed instruction designed to increase students' intensity in receiving reading literacy activities.

3. Methodology

3.1 Participants and Design

This study used the experimental method with a quasi-experimental research design to examine the effectiveness of a mixed methods-based reading literacy program in improving reading comprehension skills, vocabulary mastery, and reading fluency. This study also aimed to overcome reading difficulties in early

grade students who are in the grade 4 to 5 range at the elementary school level. The study participants totaled 350 elementary school students selected from 8 elementary schools in the Bandung area, Indonesia. The sample selection in this study involved the purposive sampling technique using several criteria, namely the school cluster, grade, gender, and ethnicity of the students. The participants involved were identified first to determine what aspects of reading they found difficult. Students were divided into two groups. The experimental group received intervention through a mixed methods-based reading literacy program; and the control group received a reading literacy program for 60 minutes after school hours. The elementary school students involved in this study were those whose language proficiency scores were below the minimum standard criteria. The value of this language ability is closely related to the ability to read, so that a comprehensive improvement is needed in reading competence. In addition, to determine reading ability, a power analysis was carried out to investigate the necessity of reading competence. The results of the effect size analysis yielded a standard deviation of 0.30 on the reading ability standard. Based on the standard correlation of 0.65–0.80 in the evaluation of the pre-test and post-test phases, it was found that the strength of 300 to 350 participants showed an effect size of 0.30 standard deviation tested using value a = 0.05. This value is in line with the average effect size, with a value of 0.28 in other evaluations. Based on the initial assessment, the number of students who met the selection criteria and had expressed their willingness to participate in the study totaled 350. Table 1 shows the demographic characteristics of the student participants.

Table 1: Demographic aspects of student participants

Variable	Percentage (%)
Grade	
4	35.40
5	38.10
6	30.60
Gender	
Female	50.30
Male	49.70
Ethnicity	
Sundanese	85.08
Non-Sundanese	15.12

3.2 Procedure

The mixed methods-based reading literacy program adapted for this study was carried out over two semesters or one year in the 2021–2022 academic year. The teachers involved in this study totaled 150 teachers from 8 schools, who acted as program implementers at school. Participating schools were scattered in several areas in Bandung, especially schools in the disadvantaged category (low school accreditation, state school status, and free school fees) to include many students who still have difficulty reading. Data on students with reading difficulties were collected from the schools' academic records of the previous year. The mixed methods-based reading literacy program is designed to address readers' reading difficulties in the early grades, which is why it has several different interventions in comparison to the 60-minute reading literacy program. The difference lies in

the treatment, media, intensity of reading, and implementation of the process. The differences between the two literacy programs for reading can be seen in Table 2. The researcher adapted this mixed methods-based reading literacy program based on the principles of the literacy program for early grades so that the implementation of the literacy program was appropriate and optimal to meet the needs of early grade students.

Table 2: Components and learning activities in the mixed methods-based reading literacy program and 60-minute reading literacy program

Program activity	Mixed methods-based reading literacy program	60-minute after-school literacy program
Reading using the computer individually	Reading activities using a computer and assisted by videos, tiered texts, and word studies with topics from various fields	No
Reading tiered books independently	Books according to student level: a) 25 titles (250–350 Lexiles) b) 25 titles (400–600 Lexiles) c) 25 titles (650–850 Lexiles) d) 12 titles with audio	No
Group-based reading teaching	The teacher gives reading instructions in groups. Students carrying out instructions in their groups carry out activities on reading, vocabulary, reading fluency, and reading comprehension.	Teaching reading in groups is carried out with 15 activities: a) reading activities on social science topics; b) math practice through cooperative games; and c) activities to develop vocabulary and social awareness through book exchange and discussion.

The mixed methods-based reading literacy program differs from the 60-minute reading literacy program in its implementation. During the implementation of the intervention program, students received individual computer-based reading training for 30 minutes a day. Then, students received training in reading using scaffolded videos and tiered text. This activity was conducted to measure students' reading comprehension ability. Finally, reading activities were carried out to practice vocabulary mastery and reading fluency. Computer reading activities use a variety of interesting topics according to student subjects, such as society and culture, science, mathematics, and other social sciences. In the process of reading with a computer, students follow several stages. That is, students are given the opportunity to watch the video first to form a mental model and support the ability to understand the text that will appear after watching the video. Furthermore, after they have finished watching the video, the students perform the listening activity of the text being spoken and end with an evaluation by

answering 15 questions to assess their level of understanding. This evaluation is useful to determine the extent of the impact of the activities that were carried out before.

After reading using a computer, the next activity students need to complete is to read tiered books. These are books according to the students' lexical level and students are given the freedom to record reading activities as self-evaluation material. During independent reading activities, students gain access to various types of books facilitated by the teacher according to the students' Lexile level. In the third reading activity, students are placed in small groups. Students then need to read the designated word. This intervention was carried out on students, especially those who found it difficult to read phonetically. Students also receive training in fluent reading by giving demonstrations; providing reading comprehension strategies, for example by using words; knowing the context; and analyzing key words in the reading. For more details, the difference between a mixed methods-based reading literacy program and a 60-minute reading literacy program can be seen in Table 2 above. Literacy program activities in the post-test phase are assessed on all competencies to determine the results of the literacy program intervention.

3.3 Evaluation

Several assessment activities in the pre-test and post-test phases were conducted to determine the overall impact of the mixed methods-based reading literacy program. These activities include assessments on word reading skills and their efficiency, reading comprehension skills and vocabulary mastery, and reading fluency. The researcher also recorded student attendance, conducted a survey in the post-test phase regarding after-school activities, and measured the number of words read during the intervention using a computer.

3.4 Research Ethics

All participants involved completed consent forms to take part in the research and were thus involved voluntarily without any coercion. Additionally, all participants in this study participated anonymously. Research data on students' reading abilities in this study were used for academic purposes in their schools to improve students' reading literacy skills.

3.5 Assessment of Word Reading Efficiency

In evaluating word reading efficiency, the researcher adapted Torgesen's (1999) assessment of word reading efficiency. Assessment was carried out on a measure of accuracy and fluency in reading words with national standards. This assessment was carried out individually to determine the development of skills that are very necessary in reading activities, namely the ability to recognize vocabulary as a unit or in context (maximum score of 120) and ability to pronounce pseudo and complex vocabulary (maximum score of 70). From the analysis results, the reliability coefficient of the questionnaire was obtained, with a value of more than 0.91, and the reliability coefficient of repeated assessment was in the range of 0.85. In addition, group reading assessment was also carried out using group assessment, with several subtests, namely vocabulary mastery, understanding sentences, and understanding parts of sentences. Each student was

given a set of assessments according to their level, namely grades 4 to 6. From the results of the reliability test, the alternative form obtained a reliability score of 0.90 for grades 4, 5, and 6. Furthermore, the reliability test obtained reliable values for grades 4, 5, and 6, at 0.97, 0.80, 0.95, respectively, at each level.

3.6 Assessment of Reading Fluency with DIBELS Oral Reading Fluency (DORF)

Assessment of students' reading fluency was carried out using DIBELS (Dynamic Indicators of Basic Early Literacy Skills). This test measures students' ability to read by measuring their accuracy and speed. Students are instructed to read a part of a text made up of several words (10 words). This reading activity is carried out by speaking for one minute at a time by completing the missing parts (jumbled sentence), with about three seconds to complete the missing parts. Words that are corrected accurately in three seconds indicate good reading ability. The measurement was carried out by counting the number of words that were successfully read correctly by students every minute. The count shows the level of fluency in students' oral reading. The reliability value of the DIBELS assessment obtained was 0.93 to 0.98. Students were divided into three class sections according to pre-test and post-test. In the post-test phase of the 60-minute reading literacy program, students filled out a survey with 35 items to gather information about their motivation to read and the experience they had gained after participating in the 60-minute literacy program after school. Items 1–20 gather data on students' intrinsic motivation in reading. Furthermore, items 21−35 gather data on students' experiences in participating in the literacy program. In addition, these items also reveal students' attitudes and involvement during the 60-minute after-school literacy program.

In addition, four items collect feedback on activities that were carried out by students in the 60-minute after-school literacy program. These are: 1) *I got a dancing learning experience in the literacy program*; 2) *I got a lot of knowledge and competence in the literacy program*; 3) *I am enthusiastic to take part in the literacy program*; and 4) *The literacy program has many rules that must be implemented*. The options provided for these items were 1 = *strongly agree*, 2 = *somewhat agree*, 3 = *do not really agree*, and 4 = *strongly disagree*. In addition, three items attempt to identify students' activities at school and their opinions on the 60-minute literacy program. These are: 1) *What do you think about the activities in the 60-minute literacy program* (answer options: 1 = *I don't like it*, 2 = *good enough*, 3 = *I like the program activities*); 2) *How many times do you read books in a week?* (answer options: 1 = *none*, 2 = *once a week*, 3 = *2–3 times a week*, 4 = *every day*); 3) *How long does it take for your family to help you with your chores at home?* (answer options: 1 = *never helped*, 2 = *less than 20 minutes*, 3 = *20−35 minutes*, 4 = *more than 35 minutes*).

Assessment of the results of the implementation of the mixed methods-based reading literacy program was carried out in several ways. First, the assessment was carried out through self-reporting regarding the frequency of students' reading activities (M = 2.80, SD = 1.20, min = 1 day, max = 5 days) to identify the number of days in a week students read books while participating in the literacy program. The second stage assessed the number of words read by students using computer media. This stage assisted the researcher in predicting students' literacy

levels while participating in the mixed methods-based reading literacy program. At the end of the session, students were given 10 questions to measure understanding and vocabulary in reading activities using a computer. From the results of this computer reading activity, data were obtained on the number of words read by students during the program intervention (M = 16.258, SD = 8.782).

4. Results

Before carrying out the intervention, the researcher tested the initial abilities of the students in the experimental group (intervention mixed methods-based reading literacy program) and the abilities of students in the control group (60-minute literacy program). The results of the initial-ability analysis indicate no significant differences in the three abilities of the two groups (i.e., efficiency in reading vocabulary, reading comprehension and vocabulary mastery, and reading fluency). There was no drastic reduction in the number of students as the phases progressed (pre-test, intervention, and post-test) because there was control through the assessment of student attendance. The reduction in participation was less than 5%, which has no impact on the condition X^2 (390, 1) = .025. From the results of this analysis, the students' reading ability and slight reduction had no impact on the internal validity of the program intervention. Furthermore, it was found that the total scores on word reading ability and comprehension were not significantly different in each phase. Students who took part in all phases, from the pre-test to the post-test, had a similar score (M = 92.47, SD = 12.40) to the five students who took the pre-test only (M = 89.76, SD = 13.02), with $t(350) = -.75$ and $p > .05$. Some of these findings reinforce the notion that external validity does not interfere with the difference between students with low and high abilities.

To answer the formulation of the problem regarding the effectiveness of a mixed methods-based reading literacy program, all the average values and standard deviations of the abilities of word reading ability, reading comprehension and vocabulary mastery, and reading fluency are presented in Table 3. Data analysis shows that all abilities experienced a significant increase in the post-test phase, especially in the efficiency of reading words and reading comprehension. In addition, the increase in ability is also strengthened by the results of the paired *t*-test, in which an increase was seen in the total score of efficiency in word reading and phonetic decoding, as well as in the total score of vocabulary reading and reading comprehension.

To further analyze the impact of the mixed methods-based reading literacy program, an analysis of covariance (ANCOVA) test was performed on the post-test scores using the scores in the appropriate pre-test phase and used as covariates. There are several findings from the results of the ANCOVA regarding the impact of the mixed methods-based reading literacy program and the 60-minute after-school literacy program. First, the abilities of students who participated in the mixed methods-based literacy program intervention in the aspect of evaluating word reading efficiency did not differ significantly from the abilities of students who participated in the 60-minute after-school literacy program intervention, with a value of F(1, 272) = 0.10 as well as in phonetic decoding (F(1, 272) = 0.50) and read words (F(1, 265) = 1.89), with $p = .18$. In

addition, the value was similar to the results of the intervention of the two programs, with the total score for reading comprehension and comprehension having a value of F(1, 275) = .35, comprehension subtest, F(1, 275) = .42, and the vocabulary subtest, F(1, 276) = 0.09. However, in the best proportion on the aspect of reading fluency, it shows that the reading fluency of the experimental group (reading literacy program based on mixed methods) was significantly superior to the reading fluency of students in the control group (60-minute after-school literacy program) (F(1, 275) = 4.53, p = 0.040).

Table 3: Comparison of students' abilities in the two literacy programs

Variable	Mixed methods-based reading literacy program				60-minute after-school literacy program				Effect size
	M	SD	Min	Max	M	SD	Min	Max	
Pre-test									
Word reading efficiency									
Total	90.25	13.50	57	125	91.89	14.45	53	121	
Reading sight words	92.10	11.13	55	118	91.70	11.44	53	115	
Phonetic parsing	92.21	13.31	62	127	93.30	14.71	60	124	
Reading vocabulary and comprehension									
Total	91.88	12.40	60	120	91.40	12.52	55	118	
Understanding	91.45	12.42	61	126	90.20	12.89	53	122	
Vocabulary	93.62	13.61	57	124	94.12	12.90	55	120	
Oral reading fluency									
DORF	88.54	35.30	6	180	89.20	35.30	55	170	
Post-test									
Word reading efficiency									
Total	96.89	14.67	62	142	93.32	12.23	70	135	0.05
Reading sight words	98.21	11.56	70	125	94.61	12.30	60	125	0.15
Phonetic parsing	97.10	15.10	72	142	98.64	13.57	64	132	0.05
Reading vocabulary and comprehension									
Total	94.61	14.32	68	132	93.60	13.10	62	128	0.15
Understanding	95.80	14.72	65	124	91.50	11.30	70	120	0.10
Vocabulary	96.12	14.25	60	130	94.12	14.42	60	129	0.05
Oral reading fluency									
DORF	112.13	41.64	10	242	110.42	37.52	8	189	0.25

In addition, there is no difference in the students' initial language skills obtained from the results of the national standard assessment of the two programs. Students who are involved in these two programs have language skills that do not

meet the minimum criteria. Furthermore, based on the results of the ANCOVA, it was found that the total scores in vocabulary reading and reading comprehension were higher for students who were in the experimental group than the control group, with a value of $F(1, 350) = 1.20$, with $p = .35$. Finally, the attendance rate of students in the experimental group (reading literacy program based on mixed methods) was superior ($M = 71.12$, $SD = 20.35$) compared to the attendance of students in the control group (60-minute after-school literacy program) ($M = 62.35$, $SD = 24.20$), with $t(275) = 2.642$ and $p = .0132$. To see the effect of each program, Table 3 presents the effect size in the post-test phase by adjusting the covariates divided by the number of standard deviations. From the results of the analysis, a positive and significant effect was found on oral reading fluency (ES = 0.25) and the attendance aspect (ES = 0.35). Furthermore, the effect size on reading comprehension competence (0.10) and vocabulary mastery competence (0.05) were smaller than for oral reading competence and word reading efficiency.

To answer the problem formulation, the researcher presented the impact of a mixed methods-based reading literacy program based on several variables, namely ethnicity, gender, reading level, and clarity level. The current study also investigated the interaction between the intervention and student characteristics based on these variables because the mixed methods-based reading literacy program is designed to facilitate students in groups. From the test results, no significant differences in impact were found based on ethnicity and gender variables. This means that ethnicity and gender do not have a strong relationship with students' abilities. This difference can be seen in the attendance scores of Grade 4 students who took part in the mixed methods-based reading literacy program, who had a better score ($M = 70.45$, $SD = 20.50$) than the students who took part in the 60-minute after-school literacy program ($M = 58.60$, $SD = 23.80$), with $t(93) = 3.562$ and $p = .009$. However, this contrasted to students in grades 5 and 6, who did not show a significant difference in attendance rates between the experimental and control groups. Furthermore, based on the results of the ANCOVA, the oral reading fluency scores of Grade 4 students in the experimental group were superior to those of students in the control group ($F(1, 93) = 9.89$, $p = 0.004$). Another finding is that the difference in reading fluency in grades 5 and 6 was not significant, so the effect size on reading fluency in Grade 4 was greater than the effect size on reading fluency in Grade 5 (ES = .01) and Grade 6 (ES = .06) students in the mixed methods-based reading literacy program. From these findings, it can be concluded that the effect that appears to be the most significant is on the competency of oral reading fluency and the enthusiastic attendance aspect of students participating in mixed methods-based reading literacy programs.

Furthermore, to see students' attitudes towards all the instructions in the two programs, the researcher analyzed the survey data to reveal their experiences while participating in these two literacy programs. The results of the analysis of student responses to the questionnaire items show that students who were in the experimental group (reading literacy program based on mixed methods) gave more affirmative responses to the positive items given compared to students who were in the control group (60-minute after-school literacy program). The response

scores on several items were: a) *I learned new and interesting things in the program* ($t(283) = 2.20$, $p > .05$) and b) *I learned a lot* ($t(283) = 2.80$, $p > .01$). In addition, students in the experimental group were also found to be more intensive in reading books compared to students in the control group (M = 2.20, SD = 1.09), with $t(280) = 7.78$ and $p > .001$. The students in the experimental group received classes for five days a week, while those in the control group only one to two days a week. In addition, there were no significant differences in the survey results regarding the experiences of the two programs. The results of the descriptive analysis of student literacy resulting from the intervention of the mixed methods-based reading literacy program and the results of the intercorrelation analysis of reading skills in both phases and the impact of the mixed methods-based reading literacy program are presented in tables 4 and 5, respectively.

Table 4: Descriptive analysis of student literacy in the mixed methods-based reading literacy program

Measures	Range				Percentile				
	M	SD	Min	Max.	10	25	50	75	90
Total words (raw score)	15.423	10.758	525	70.658	5.582	8.742	13.125	19.224	28.230
Total words (Log 2)	14.52	1.08	10.10	17.10	13.32	13.89	14.60	15.18	15.70
Attendance	73.46	16.92	15	90	56	70	78	84	88

Table 5: Intercorrelation analysis of reading skills in both phases and the impact of the mixed methods-based reading literacy program

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Post-test Comprehension	–												
2. Post-test Vocabulary	.72	–											
3. DIBELS post-test Oral reading fluency	.54	.55	–										
4. Post-test Phonemic decoding	.50	.55	.60	–									
5. Post-test Sight word reading	.50	.55	.68	.72	–								
6. Pre-test Comprehension	.70	.68	.45	.45	.55	–							
7. Pre-test Vocabulary	.63	.71	.53	.57	.60	.67	–						
8. DIBELS pre-test Oral reading fluency	.53	.50	.90	.57	.60	.50	.56	–					
9. Pre-test Phonemic decoding	.47	.56	.60	.88	.73	.49	.60	.60	–				
10. Pre-test	.48	.52	.63	.63	.82	.55	.53	.62	.74	–			

Sight word reading													
11. Mean days per week of book reading	.07	-.06	-.11	.14	.02	-.08	-.03	-.16	-.12	.12	–		
12. Words read (raw score)	.35	.42	.54	.38	.45	.32	.30	.50	.40	-.37	.04		
13. Words read (log base 2)	.40	.50	.52	.30	.48	.40	.30	.50	.36	.45	-.06	.87	–

Next, multiple regression analysis was performed on reading comprehension and vocabulary scores, with the results presented in Table 6. The results of the multiple regression analysis on reading fluency scores, word reading, and phonemic decoding are presented in Table 7. These two tables depict the impact of the two literacy programs on these competencies. Model 1 includes the reading pre-test scores and variables that represent impact measures of the literacy program in Model 2. The effects of scores from the pre-test phase of reading comprehension and vocabulary competence, reading fluency and phonemic decoding, and word reading are omitted from the regression analysis in Model 2. Next, it is determined whether competence in reading books and words in reading literacy activities based on mixed methods with the help of a computer can explain the variance in the post-test phase. The results of the analysis are presented in full, including the non-standard regression coefficient (B), the standard error B (SE B), the standard regression coefficient (b), and the correlation (R2).

Table 6: Results of the multiple regression analysis of reading comprehension skills and vocabulary in the mixed methods-based reading literacy program

Dependent variable	B	SE B	Final b	R2
Reading comprehension				
Model 1				
1. Understanding	.55	.11	.48**	
2. Vocabulary mastery	.28	.11	.25*	
3. Reading fluency	.09	.04	.20*	
4. Phonemic breakdown	-.04	.12	-.04	
5. Reading sight words	.05	.14	.05	.60
Model 2				
1. Understanding	.53	.11	.45**	
2. Vocabulary mastery	.30	.11	25*	
3. Reading fluency	.08	.05	.20*	
4. Phonemic breakdown	.04	.12	.03	
5. Reading sight words	.03	.14	.03	
6. Average number of days per week for reading	.90	.89	.07	
7. Number of words read on the computer	.90	.94	.08	.60
Vocabulary				
Model 1				
1. Understanding	.40	.11	.33***	
2. Vocabulary mastery	.43	.10	.40***	
3. Reading fluency	.03	.05	.06	

4. Phonemic breakdown	.12	.12	.12	
5. Reading sight words	.07	.14	.05	.60
Model 2				
1. Understanding	.32	.11	.27**	
2. Vocabulary mastery	.45	.11	.43***	
3. Reading fluency	.02	.05	.03	
4. Phonemic breakdown	.15	.12	.13	
5. Reading sight words	.02	.14	.02	
6. Average number of days per week for reading	.84	.85	.08	
7. Number of words read on the computer	3.81	.90	.25**	.65

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Table 7: Results of multiple regression analysis of reading fluency competence, word reading, and phonemic decoding of students in the mixed methods-based reading literacy program

Dependent variable	B	SE B	Final b	R2
DIBELS oral reading fluency (DORF)				
Model 1				
1. Understanding	.04	.20	.02	
2. Vocabulary mastery	.11	.20	.05	
3. Reading fluency	.83	.07	.78***	
4. Phonemic breakdown	.10	.21	.04	
5. Reading sight words	.40	.25	.12	.80
Model 2				
1. Understanding	.13	.20	.05	
2. Vocabulary mastery	.14	.20	.06	
3. Reading fluency	.80	.08	.78***	
4. Phonemic breakdown	.13	.24	.06	
5. Reading sight words	.35	.26	.10	
6. Average days per week for reading books	1.40	1.72	.05	
7. Number of words read on the computer	3.90	1.81	.10	.80
Sight word reading				
Model 1				
1. Understanding	.11	.07	.12	
2. Vocabulary mastery	.05	.08	.06	
3. Reading fluency	.02	.03	.04	
4. Phonemic breakdown	.23	.08	.25**	
5. Reading sight words	.60	.09	.58***	.75
Model 2				
1. Understanding	.06	.07	.07	
2. Vocabulary mastery	.06	.07	.07	
3. Reading fluency	.00	.03	.0	
4. Phonemic breakdown	.25	.08	.27**	
5. Reading sight words	.60	.10	.58***	
6. Average days per week for reading books	1.90	.58	.12*	
7. Number of words read on the computer	1.41	.60	.15*	.82
Phonemic decoding				
Model 1				
1. Understanding	.00	.09	.00	
2. Vocabulary mastery	.09	.09	.08	

3. Reading fluency	.04	.04	.08	
4. Phonemic breakdown	.96	.10	.83***	
5. Reading sight words	-.07	.12	-.05	.78
Model 2				
1. Understanding	.03	.10	.03	
2. Vocabulary mastery	.08	.09	.07	
3. Reading fluency	.04	.04	.08	
4. Phonemic breakdown	.95	.10	.82***	
5. Reading sight words	.06	.12	.05	
6. Average days per week for reading books	.62	.76	.05	
7. Number of words read on the computer	.53	.79	.06	.78

Note. * $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

From the results of the two regression analyses, a significant correlation was found between the competence of the number of words read in the mixed methods-based reading literacy program in the pre-test and post-test phases. Based on the results in Table 6, the number of words read has a positive relationship with vocabulary scores and reading comprehension in the post-test phase. From the results of the analysis, an additional 5% variance was found in the post-test phase vocabulary score. Furthermore, based on the results in Table 7, the number of words read has a positive relationship with the score of the ability to read sight words in the post-test phase. The number of words read in this computer-assisted reading activity provides an additional 4% variance in the post-test phase for word reading competence. From these findings, it can be concluded that computer-assisted word reading has a positive relationship with post-test vocabulary scores and sight word reading. The multilevel model was applied to the experimental group students. In addition, the researcher also replicated the regression results presented in Tables 6 and 7.

5. Discussion

Three instructions were used in this mixed methods-based reading literacy program designed to improve competence in word reading efficiency, reading comprehension and vocabulary mastery, and reading fluency. Activities in the modified mixed methods-based reading literacy program are computer-assisted reading, independent tiered reading, and group-based reading teaching. Based on the results of the research, this mixed methods-based reading literacy program provides instruction that encourages students to master vocabulary with a high frequency of occurrence in all fields (Farkas & Jang, 2019; Koutsouris et al., 2021). This direct instruction on learning vocabulary can help students who have difficulty understanding words to gain useful knowledge directly towards improving reading comprehension skills when reading texts. The main cause of difficulties in students' reading ability is vocabulary, which is limited when students are in early grades 1 to 3. This difficulty thus continues and is very visible when students are required to have good reading comprehension competence in grades 4 to 6 of elementary school and middle and high school. This finding is in accordance with the theory that the main strength of reading comprehension skills is students' ability to understand each word that forms the text (Bayless et al., 2018; Lo & Leung, 2022).

From the results of the study, although there were several competencies that showed insignificant improvement, this mixed methods-based reading literacy program as a whole was able to improve reading comprehension skills because it presented various activities that accommodated student characteristics, such as learning through computers, reading tiered books, using models, and teaching group-based reading (Metsala & Kalindi, 2022; Steiner et al., 2022). With these various methods, a significant increase was found in aspects of students' vocabulary mastery and reading fluency, compared to other competencies. The curriculum used by schools is also one of the factors that can increase students' ability to read words efficiently and their ability in reading comprehension. Based on the results of an analysis of the curriculum material, the teachers involved in the 60-minute literacy program were given the opportunity to freely choose various reading activities to improve students' reading skills, so that the teachers carried out a variety of reading activities (Dellisse et al., 2021; Yan & Cai, 2022). This is why the 60-minute literacy program has a different and less than optimal effect on students' abilities. In contrast to the mixed methods-based reading literacy programs, this literacy program was initially designed to improve early grade students' reading skills using three uniform methods so that teachers have guidance in its implementation. The two programs share a similar method, namely group-based reading teaching.

The combination of reading methods using computer media, reading of tiered books, and group-based teaching can improve students' reading skills more optimally. This is in accordance with the theory that a combination of digital and traditional-based methods will be more optimal in increasing students' academic achievement abilities (Hadianto et al., 2021a; Snow et al., 2020). This also applies to reading competence. Furthermore, correlation studies and experiments conducted have shown that it is more difficult to improve the reading skills of students who are late in developing their reading skills when they enter grades 4 to 6 compared to improving students' skills during grades 1 to 3 of elementary school (Counihan et al., 2022; Metsala & Kalindi, 2022). Several other longitudinal studies have also made the same finding, namely that there is an ability gap between students who have good and poor reading skills when they enter a higher grade (Jung, 2019; Karatza, 2020). Students who master the alphabet when they are in the early grades will have more opportunities to become proficient readers than students who are late in developing reading skills, including the competencies of word reading efficiency, reading comprehension and vocabulary, and reading fluency.

The results of this study reinforce this theory in several ways. Notably, the trials of the mixed methods-based reading literacy program had a significant effect on all competencies (word reading efficiency, reading comprehension ability, and reading fluency) in Grade 3 students, but this ability increase was not seen in students in grades 5 and 6. More specifically, the effect size of the intervention on oral reading fluency in Grade 3 students was greater than the effect size in Grade 5 students. Furthermore, the effect size in Grade 4 was greater than the effect size in grades 5 and 6. These findings are in accordance with the theory that treatment of reading difficulties in younger students will be easier and more effective than

treatment of reading difficulties in older students (Hadianto et al., 2021b; Thomas et al., 2020). These findings are consistent with findings of remedial reading interventions with a multi-grade sample, which show that improving reading difficulties in older students is more difficult than in younger students. Furthermore, based on the results of the regression analysis on students' ability in mixed methods-based reading literacy programs, this reading literacy program can improve overall reading ability in several competencies. Improvements were seen in the competencies of word reading efficiency, reading comprehension and vocabulary, and reading fluency. In addition, based on the results of the correlation analysis, the number of words read during reading activities using a computer has a positive relationship with word reading scores and visual word reading efficiency in the post-test phase (Thomas et al., 2020; Waldron, 2018).

6. Conclusion, Limitations and Recommendations

The reading literacy program based on mixed methods was more effective in treating reading difficulties in grades 4 to 6 students than the 60-minute after-school literacy program. Improvements in student competence were seen in the aspects of word reading efficiency, reading comprehension, sight word reading, and reading fluency, with the most significant increase seen in students' reading fluency. Students in Grade 4 experienced the most significant improvement in competencies compared to those in grades 5 and 6. This is because it is easier to correct reading difficulties for younger students than for older students. In addition, of the several reading methods used in literacy programs, computer-assisted reading activities have proven to be the most effective in increasing competence in word reading efficiency and reading fluency. The implication of this research is the need for integration of various literacy activities in reading literacy programs to improve students' reading skills. The various reading methods in the literacy program means various student characteristics can be accommodated.

The study had several limitations, including the small sample and number of schools, and the schools not representing developed and developing areas. Furthermore, the timespan of the study was still relatively short and the study compare only two different programs. Future research may compare several programs at the same time. In addition, the study did not consider the aspect of gender and the need for feedback regarding program deficiencies from stakeholders.

Based on some of these deficiencies, several recommendations are made for future research. First, the sample in the study must be enlarged by involving both students who experience difficulty and those who are proficient in reading. Second, schools must be included that represent developed and developing areas. Third, various times for each treatment in the literacy program must be allowed. Fourth, teaching reading to early grade students should be done using various methods. It is better to focus early reading skills on basic abilities such as vocabulary mastery and reading fluency, only after which more complex abilities, namely reading comprehension and effective reading, can be targeted. In addition, teaching reading in the early grades should not only be carried out in

the classroom but must be accompanied by literacy programs outside the classroom. Research is needed to obtain feedback from users and stakeholders involved in the literacy programs.

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