**JPI**, Vol. 9 No. 1, March 2020
p-ISSN: 2303-288X, e-ISSN: 2541-7207 DOI: 10.23887/jpi-undiksha.v9i1.23101

# The Influence of Survey, Question, Read, Recite, Review Method Toward Reading Comprehension Ability Mediated by Working Memory

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**Abstract**

*Reading comprehension plays a vital role in students' academic achievement. This empirical study aims to determine the influence of survey, question, read, recite, and review (SQ3R) method on reading comprehension ability. The impact of mediation on semantic and phonological working memory toward reading comprehension ability after being given the SQ3R method. The empirical study was Quasi-experimental with untreated control group design with dependent pretest and posttest samples. The total participants are 57 students in elementary school. Thirty of the subjects were selected based on colored progressive matrices and reading comprehension measurement in equal. In this case, 15 students as treatment groups and 15 students as a control group. Backward digit span task was used to measure phonological working memory, sentence completion, responsibility for semantic working memory, and reading comprehension test for reading comprehension ability. Causal analysis technique by SPSS MACRO PROCESS was used to examine the hypothesis of the research. The results revealed that there was an influence SQ3R method toward reading comprehension ability. Semantic working memory and phonological working memory are mediate between SQ3R and reading comprehension, but the mediating effect of semantic working memory is more reliable than phonological working memory. This research indicated that the effectivity of the SQ3R method to improve reading comprehension was mediated by working memory capacity in Bajo's children.*

***Keywords:*** *Metacognition; Reading Comprehension; Working Memory; SQ3R*

## 1. Introduction

The ability to have reading comprehension in elementary school students is an important thing that needs attention (Ilter, 2017; Lonigan & Burgess, 2017; Wassenburg et al., 2016). This ability influences student performance and even predict mathematical problem solving (Fuchs, Gilbert, Fuchs, Seethaler, & Martin, 2018) and science learning (Concannon-Gibney & McCarthy, 2012) and contributes to the academic performance of students (Nyarko, Kugbey, Kofi, Cole, & Edentwi, 2018). Reading comprehension not only plays an important role in academic performance but also becomes an important factor in the development of social skills at the child's age (Sparapani, 2018).

Students who have difficulty understanding reading have an impact on low self-concept (McArthur, Castles, Kohnen, & Banales, 2016). On the other hand, children who have difficulty understanding in reading are influenced by several factors including mastery of vocabulary (Sidak & Rahim, 2015), language skills (van den Bosch, Segers, & Verhoeven, 2019), motivation and personality (Yang, 2016), working memory (Nouwens, Groen, & Verhoeven, 2017; Yang, Peng, Zhang, & Mo, 2017), and metacognition processes (McElvany & Artlet, 2009; Zhusspova & Kazbekova, 2016). Students who have the potential risk of difficulty understanding reading are unable to control and monitor the thought process. That is why strategies are needed to practice reading comprehension based on metacognitive processes (Mirandola, Ciriello, Gigli, & Cornoldi, 2018; Tajalli & Satari, 2013). The cognitive capacity factor of students is an important consideration when an intervention is given to improve academic performance. An exercise or learning method does not directly

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Received 20 January 2020; Accepted 27 March 2020; Available online 31 March 2020

p-ISSN: 2303-288X, e-ISSN: 2541-7207 DOI: 10.23887/jpi-undiksha.v9i1.23101

cause the expected change. There are mental processes in the brain that facilitate or cause an increase in reading comprehension after an intervention is given (McKinnon, 2011). Working memory (WM) is a cognitive capacity that plays an important role in increasing students' reading comprehension (Jung, 2018; Yeari, 2017). On the other hand, WM as a cognitive capacity that supports learning can be improved by providing certain strategic exercises (Fellman, 2020).

This research focuses on a metacognition strategy training program using survey, question, read, recite, and review (SQ3R) methods, and working memory in improving reading comprehension skills of Bajo Tribe children in Southeast Sulawesi. The preliminary study is conducted through interviews with class teachers and observation during the learning process. The conclusion of the interview results that the class teacher did not understand the use of metacognition strategies both in terms of terms and applications in teaching, especially in training students who are still low in reading comprehension. The results of the interview continued on direct observation when the teacher taught in class. The results are proof that the teacher has not implemented teaching based on metacognition strategies. Bajo children have the potential to fail academically because they grow and develop in areas that are socially and economically disadvantaged. Experts report that children who live in environments that lack positive support for mental development are predictors of poor academic performance (Banerjee & Lamb, 2016).

The difference between this research and the previous one is that it involves working memory capacity as a component of executive function that mediates between the practices of the SQ3R method and reading comprehension skills. Previous studies have reported on the important role of working memory on academic achievement (Gropper & Tannock, 2009; Meyer, Salimpoor, Wu, Geary, & Menon, 2010; Swanson & O'Connor, 2009). Low academic performance in students is thought to be due to the low working memory capacity (Nutley & Stina, 2017; Rode, Robson, Purviance, Geary, & Mayr, 2014). On the other hand, previous research did not consider the role of working memory as a mental process that contributes to increasing reading comprehension after obtaining strategic training (Muijiselar et al., 2018; Soto et al., 2019). This mental process needs to be taken into account in how an exercise can improve students' academic skills. Jones, Milton, Mostazir, and Adlam (2019) report that academic results can be maintained by increasing the capacity of working memory by training those using metacognitive strategies.

Good reading comprehension skills are obtained through monitoring what is read. The ability to monitor is the implication of metacognitive strategies (Chevaller, Parrila, Ritchie, & Deacon, 2015; Furnes & Norman, 2015). The metacognitive strategy used in this study is the SQ3R method. Robinson (in Gajria & Jitendra, 2016) describes the SQ3R method involving a metacognitive process consisting of (a) search, aiming to make students familiar with the reading content by reading the title and underlining the first sentence in each paragraph and noting other important things; (b) question, aimed at directing students to make questions related to what has been found in each paragraph; (c) read, this stage is students read well and find answers to the questions that have been made; (d) recite, is retelling through writing all the questions that have been answered; and (e) review, directing students to take notes on everything they have read including making questions and answering in their own words and language. This SQ3R method also contributes to increasing working memory through metacognitive processes or strategies.

Working memory is a capacity for storing temporary information and, at the same time, can manipulate that information (Baddeley, 2012). Information received by reading a short text, then how the information is temporarily stored and processed to provide an immediate response to the stimulus (reading), is not present. Research on the academic performance of Bajo children is still rare. It is crucial to be carried out considering that children living in economically and socially disadvantaged areas are prone to academic failure and thus need the training to improve cognitive capacity, which plays an important role in the academic success (Katz & Shah, 2017). Previous experts only reported the importance of phonological working memory on reading comprehension ability (Nicolileo-Carriho, Crenitte, Lopes-Herrera, & Hage, 2018; Swanson & Kong, 2018; van Wingerden, Segers,

van Balkom, & Verhoeven, 2017). However, other findings suggest that impaired phonological working memory does not always result in reading comprehension difficulties (Kush, Johnson, & Dyke, 2015). The ability to understand reading is also determined by the skill to represent the semantic reading, which is done by the semantic working memory task. Both assignments for phonological working memory and semantic working memory both have variations in the response time of students to each of the two working memory assignments (Tak, Sung, Jeong, & Kim, 2016). Based on the description of the difference this research with previous research that involved each of the dynamics of phonological working memory and semantic working memory after being given a metacognition strategy exercise using the SQ3R method to improve reading comprehension skills.

The purpose of this study was to determine and analyze: (a) the direct effect of the treatment of survey, question, read, recite and review (SQ3R) methods on reading comprehension, (b) the effect of the SQ3R method on reading comprehension ability mediated by semantic working memory and phonological working memory.

## 2. Method

The subjects of the study were the Bajo tribe children who went to State Public Elementary School of 9 Tinanggea, Torokeku Village. The participants were IV grade students, consisting of 57 Bajo children. Participants aged 9 to 11 years with the condition that they have been able to read and have average intelligence based on the colored progressive matric (CPM) test. Standard intelligence test scores and average reading comprehension scores were the initial selection of subjects in this study. The results of the two tests were selected 30 students with equal reading comprehension and intelligence abilities. Subjects were divided into experimental groups who were given the SQ3R method treatment and the control group without treatment.

Measurement of reading comprehension ability uses reading, which consists of several themes. Each theme contains reading texts and questions in the form of multiple-choice, with increasing difficulty. Score 0 (zero) for wrong answers and 1 for correct answers. Semantic working memory, participants listen to short and simple sentences that start from two sentences in a set, then three sentences up to five sentences. Participants assess whether the pairs of sentences that are heard are true or false semantically. Next, participants mentioned one last word of the sentence determined by the experimenter. Phonological working memory is measured with a backward digit span. The number of digits is increasing and the score of 1 for the right answer.

This research is a quasi-experiment with the design of untreated control group design with dependent pretest and posttest samples. All participants had an equivalent reading comprehension ability based on the results of the pretest. There were no differences between the groups (mean pretest of the experimental group = 56.30, and the control group = 56.67). The experimental research was carried out for five meetings, and each session lasted for 70 minutes. The reading topic of the first meeting starts with two paragraphs, and each paragraph consists of 6 lines. The number of sections and lines increases with each meeting session. The analysis technique used is causal analysis for experimental research that includes mediator variables using the SPSS MACRO PROCESS program.

## 3. Results and Discussion

### *3.1 Descriptive Analysis*

Based on the results of the study, it was obtained an average score of reading comprehension, semantic working memory, and phonological working memory of the treatment group, as in table 1. Before the treatment or initial test of reading comprehension, semantic working memory, the phonological working memory, the experimental group reached a significant increase in the final analysis after being treated with the SQ3R method. In contrast, the average score of the initial test of the control group did not come to a significant increase in the final examination.

p-ISSN: 2303-288X, e-ISSN: 2541-7207 DOI: 10.23887/jpi-undiksha.v9i1.23101

**Table 1.** Reading Comprehension Scores, Semantic Working Memory, Phonological Working Memory Before and After Treatment (N = 15)

| Group | Test | Average score | Standard Deviation | Average Default Error |
|---|---|---|---|---|
| Experiment | Initial test of reading comprehension | 56,2986 | 14,0663 | 3,6319 |
| | The final test of reading comprehension | 91,8506 | 6,2530 | 1,6145 |
| | Initial test of semantic working memory | 58,9753 | 9,4952 | 2,4517 |
| | The final test of semantic working memory | 89,7453 | 8,0501 | 2,0785 |
| | Initial test of phonological working memory | 58,4300 | 4,6998 | 1,2135 |
| | The final test of phonological working memory | 87,0600 | 7,4421 | 1,9215 |
| Control | Initial examination of reading comprehension | 56,6673 | 6,7071 | 1,7318 |
| | The final test of reading comprehension | 63,7040 | 8,8754 | 2,2916 |
| | Initial test of semantic working memory | 59,4873 | 18,0318 | 4,6558 |
| | The final test of semantic working memory | 63,0773 | 7,2389 | 1,8691 |
| | Initial test of phonological working memory | 61,5693 | 6,2376 | 1,6105 |
| | The final test of phonological working memory | 63,9227 | 6,6217 | 1,7097 |

The table above shows that the treatment is given, the effective SQ3R method, not only improves reading comprehension skills but also increases semantic capacity and phonological working memory.

*3.2 Prerequisite Test*

The results of the analysis requirements test were carried out to meet the classical assumptions in the regression model. Shapiro-Wilk, normality test results, found that all dependent variables are normally distributed with p-value> .05, namely Posttest reading comprehension (p-value .092), Posttest semantic working memory (p-value .084), and phonological working memory (p-value .084) p-value. 220). The results of the Levene statistic homogeneity test, all dependent variables meet the requirements of homogeneity of variance with p-value> 0.05, Posttest reading comprehension (p-value .198), Posttest semantic working memory (p-value .458), and Posttest phonological working memory (p-value. -value .442). Based on the linearity test shows that between the dependent variable with the mediator variable, there is a linear relationship with the significance of linearity p-value <.05, and the significance of deviation from linearity p-value> .05, namely Posttest reading comprehension-semantic working memory (p-value). 000, and 0.164), Posttest reading comprehension-phonological working memory (p-values .000, and .111).

Heteroscedastic test results on the four regression models obtained Spearman rho correlation (ρ) between the independent variables with unstandardized residuals with p-value> .05, namely Model 1 p-value treatment SQ3R = .240, Model 2 p-value treatment SQ3R = .886 , Model 3 p-value treatment SQ3R = .400), Model 4 p-value treatment SQ3R = .700, p-value Posttest semantic working memory = .669, p-value Posttest phonological working memory = .959), so the four models regression is free from heteroscedastic problems. Multicollinearity test shows that in all regression models there is no multicollinearity between independent variables indicated by tolerance value> 0.1, and VIP value <10, namely SQ3R treatment (tolerance .219, VIP 4,564), Posttest semantic working memory (tolerance .109, VIP 9,136), Posttest phonological working memory (tolerance. 120, VIP 8.361).

*3.3 Hypothesis testing*

The following mediator regression analysis results obtained results, as in Table 2, provide information about the direct effect of the treatment method (SQ3R) on reading

comprehension. The impact of the SQ3R method on reading comprehension is mediated by semantic working memory and phonological working memory.

**Table 2.** Regression Models of The Effect of The SQ3R Method on Reading Comprehension Are Mediated by And Working Memory

| Model | Coefficient | Default error | t-count | P |
|---|---|---|---|---|
| Model 1*: | | | | |
| Constant | 63.70 | 1.98 | 32.14 | .0000 |
| SQ3R | 28.15 | 2.80 | 10.04 | .0000 |
| Model 2** | | | | |
| Constant | 63.08 | 1.98 | 31.91 | .0000 |
| SQ3R | 26.67 | 2.80 | 9.54 | .0000 |
| Model 3*** | | | | |
| Constant | 63.92 | 1.82 | 35.15 | .0000 |
| SQ3R | 23.14 | 2.57 | 8.99 | .0000 |
| Model 4*** | | | | |
| Constant | .074 | 6.137 | .012 | .9905 |
| SQ3R | 2.870 | 2.674 | 1.073 | .2929 |
| Final test of semantic working memory | .585 | .124 | 4.716 | .0001 |
| The final test of phonological working memory | .418 | .135 | 3.101 | .0046 |

** Dependent Variable: Final test of reading comprehension*
***Dependent Variable: Final test of semantic working memory*
****Dependent Variable: Final test of phonological working memory*
*****Dependent Variable: Final test of reading comprehension*

The results of the analysis in Table 2 explain that the SQ3R method has a direct significant effect on reading comprehension ability (model 1) (t = 10.04, p-value = .000) where the SQ3R method affects the semantic working memory (t = 9.54, p-value. 000) (model 2) and phonological working memory (t = 8.99, p-value .000) (model 3). In model 4, by including the mediating variables of semantic working memory and phonological working memory, the direct effect of SQ3R on reading comprehension is insignificant (t = 1.073, p-value .2929).

The description above informs that semantic working memory and phonological working memory are mediators between the SQ3R method and the ability to read comprehension. It shows that to improve the ability to comprehend reading (reading comprehension) can be done by using the SQ3R method, which first increases semantic and phonological working memory.

The effect of treatment, both directly and indirectly, can be seen in Table 3. The indirect effect through semantic working memory is 15.602, and through phonological working memory is 9,674. The total effect of the mediator variable was 25,276, while the direct effect of the SQ3R method on reading comprehension was 2.87. Thus, the total treatment effect was 28,147. The results of the analysis information that the effect of the SQ3R method on reading comprehension through semantic working memory is more significant than through phonological working memory.

**Table 3.** The Total Effect, Direct Effect, An Indirect Effect of The SQ3R Method on Reading Comprehension Skills

| | Effect | Default error | t-count | P |
|---|---|---|---|---|
| The impact of total SQ3R on reading comprehension | 28.147 | 2.803 | 10.041 | 0.0000 |
| The direct effect of SQ3R to reading comprehension | 2.870 | 2.674 | 1.073 | 0.2929 |
| The indirect effect of SQ3R to reading comprehension | | | | |
| Total | 25.276 | 3.851 | | |
| Final test of semantic working memory | 15.602 | 5.281 | | |
| Final test of phonological working memory | 9.674 | 3.481 | | |

p-ISSN: 2303-288X, e-ISSN: 2541-7207 DOI: 10.23887/jpi-undiksha.v9i1.23101

This experimental study proves the direct effect of the SQ3R method on reading comprehension skills in Bajo children in Southeast Sulawesi. The results of this study support previous findings related to the effect of metacognition-based exercise on reading comprehension or reading comprehension (Ferrara & Panlililo, 2020; Follmer & Sperling, 2018) that the effect of a survey, question, read, recite and review (SQ3R) methods on improving comprehension ability reading (reading comprehension). The SQ3R method that applies the metacognition process aims to monitor the thought process through the survey stage, which is exploring themes in the reading intending to grow motivation. Wigfield, Gladstone, and Turci (2016) report the results of their research that strategies developed to motivate students to read play an important role in reading comprehension skills. Students who are motivated to read stimulate curiosity so that it raises questions on a predetermined theme. The activity raised the question directed the Bajo children to read and understand the contents of the story. The activity guides and controls the thought process during reading so the child can retell and review the results of his reading. It is reinforced by previous studies which state that reading comprehension is achieved through controlling thought processes during reading activities in children (Kim & Phillips, 2016). Kim and Phillips (2016) also explained that the strategic approach that controls the thought process during reading is the right strategy for children who come from disadvantaged socioeconomic status. The SQ3R method that uses a metacognitive process is recommended for students who are less skilled at doing academic work independently and have low academic performance. This is in line with research findings reported by Grainger, Williams, and Lind (2016) that the disruption of the metacognitive process has important implications for children's educational success. Children who are less skilled in independence doing school academic work tend to depend on other children or adults to help complete the academic task. As a result, children have the potential to experience academic failure at school. This was reported by Yang and Bai (2019) in their study of the use of metacognitive strategies in completing students' final assignments that the use of metacognitive strategies in academic assignments could accelerate study completion. Even though metacognitive strategies can be general in the diversity of individual academic abilities, it is preferred for children who have the potential to fail academically (Mehrdat, Ahghar, & Ahghar, 2012).

The second research objective proves the effect of SQ3R on reading comprehension ability is mediated by semantic and phonological working memory. Semantic and phonological working memory are cognitive processes that experience changes after being given the SQ3R method to improve reading comprehension. This is supported by previous research findings that the use of reading instructions that focus on understanding texts influences cognitive processes that have an impact on learning outcomes (Jian, 2018). The effect of semantic mediating working memory is more significant in improving reading comprehension skills compared to phonological working memory. The results of this study are in line with previous studies that reported the effect of semantic working memory is stronger than phonological working memory on reading comprehension ability (Shivde & Anderson, 2011). The influence of phonological working memory, which is not strong enough to predict an increase in reading comprehension ability in this study is due to the factor of verbal skills that are less skilled trained in these Bajo children. This is reinforced by the findings made by Gillon et al. (2019) that children who have low oral skills will increase phonology awareness after being given literacy interventions in the early years of children entering elementary school. This explanation indicates that there is low phonological awareness in the study subject before literacy training is given. The important thing in this research is not to practice reading, but to practice reading comprehension by using metacognition strategies to stimulate awareness to understand the meaning of reading (Botsas, 2017). Nishiyama (2018) explained that there are different mechanisms of action between semantic and phonological representations, both of which are part of verbal working memory. This is the basis for designing future interventions that there are variations in the developmental progress between phonological working memory and semantic working memory. Initial identification is needed to design interventions in children based on whether the phonological working memory is experiencing obstacles or semantic working memory.

This is because not only semantic working memory plays an important role in reading comprehension but also phonological working memory (Carvalho, Kida, Capellini, & de Vida, 2014).

This study has limitations, including the insufficient number of samples needed for the effect of generalization. Even so, this study took a sample in a special area, namely the Bajo tribe, who live in a special area with a relatively small population. A further limitation is that this study did not trace and identify differences in development between phonological working memory and semantic working memory, which could have occurred due to cultural factors. This is explained according to neuroscience theory that there are differences in brain growth and development that have an impact on cognitive functions based on culture (Xie, Richards, Lei, Lee, & Gong, 2015). Even in this study, both types of working memory have both increased due to the effects of the SQ3R method and can mediate these methods to improve reading comprehension skills. Subsequent studies need to design appropriate interventions or strategies (Siregar, 2018) in increasing the capacity of cultural perspective working memory aimed at better student academic performance.

The contribution of this experimental research is to consider the thought processes or mental processes involved in improving the performance of academic abilities after reading comprehension strategy exercises. In this case, the thought process in question is semantic and phonological working memory. Experimental research in education is fundamental to consider the cognitive processes that occur as a result of the stimulation of the nervous system in the brain after the exercise of learning strategies is given to cause an increase in learning outcomes. Previous studies have reported that mental processes play an important role in providing methods or training strategies and improving academic performance (Derakhshanrad & Piven, 2018). Tan, Martin, and Dyke (2017) describe that academic tasks, for example, processing words and sentences in reading, involve the role of mental processes, namely working memory. Based on this description, the involvement of mental processes that mediate between providing training and changes in student academic performance is expected to be the main focus in experimental research in education.

This research can also be a direction so that in the future, it can bridge the gap between neuropsychology and education, where learning difficulties can be intervened through an education-based neuropsychological approach.

## 4. Conclusions

Effective teaching methods for elementary school students who have the potential to experience academic failure due to low reading comprehension ability are using the metacognitive strategy training approach, namely SQ3R. This approach plays a vital role in improving the performance of phonological capacity and semantic working memory, which is a predictor of academic success, especially reading comprehension ability.

## Acknowledgment

Thank you to the Republic of Indonesia Ministry of Research, Technology, and Higher Education for funding this research and also to the Principal of 9 Tinanggea State Primary Schools including teachers, and students who have participated in this research.

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