BIOEDUPAT:
Pattimura Journal of Biology and Learning
https://ojs3.unpatti.ac.id/index.php/bioedupat
e-ISSN 2775-4472

Research Article

Effect of reading strategies, questioning, answering combined with think pair share against metacognitive skills, cognitive learning outcomes and retention

Monica Hetharia[1*], Aloysius Duran Corebima[2], Abdul Gofur[3]

[1] *Pattimura* University, *Ir. M. Putuhena Street, Poka-Ambon 97232, Indonesia*
[2,3] *Malang State University, Semarang 5 Malang Street, Jawa Timur 65145, Indonesia*
** corresponding author: hmonicahet@gmail.com*

Received: August 18, 2024 Accepted: September 15, 2024 Published: November 12, 2024

ABSTRACT

The tendency of Natural Science Learning, especially biology today is students only studying biology as a product, memorize concepts, theories and laws. Facts in the field also found that teachers have not empowered the students' potential. Consequently metacognitive skills, cognitive learning outcomes, and low student retention. It takes a learning model that can improve and empower the students' potential. The application of *Reading Questioning Answering* learning strategies combined with *Think Pair Share* may increase metacognitive skills, cognitive learning outcomes, and student retention.This study used a quasi-experiment approach (quasi experimental) with a design of non-equivalent pretest-posttest control group design. The research was conducted in the second semester of the academic year 2014/2015 at the high school level in the city of Ambon. The application on the three schools was as follows: State High School 4 Ambon: *RQA*, State High School N 5 Ambon: *RQA* combined with *TPS*, State High School 14 Ambon: conventional.The results showed that there is influence of *RQA* combined with *TPS* learning model against metacognitive skills, there is the influence of *RQA* combined with learning model of TPS against cognitive learning outcomes, but there is no influence of *RQA* combined with learning model of *TPS* on the retention of students.

Keywords: cognitive learning, metacognitive skills, *Reading Questioning Answering,* retention*, Think Pair Share*.

To cite this article:
Hetharia, M., Corebima, A. D., & Gofur, A. 2024. Effect of reading strategies, questioning, answering combined with think pair share against metacognitive skills, cognitive learning outcomes and retention. *Bioedupat: Pattimura Journal of Biology and Learning,* 4(2): 207-213.*DOI:*https://doi.org/10.30598/bioedupat.v4.i2.pp207-213

INTRODUCTION

The current trend in science education, particularly in biology, is that students only study biology as a product, memorizing concepts, theories, and laws. However, in biology education, students are expected to empower their thinking skills in order to achieve high learning outcomes. Biology, as part of education, is one of the fundamental sciences that plays an important role in the development of science and technology, as well as in shaping human character. Biology also provides various learning experiences to understand scientific concepts and processes. The subject of Biology is developed through analytical, inductive, and deductive thinking skills to solve problems related to natural phenomena (BSNP, 2006).

Mulyasa (2008) stated that learning outcomes are the overall achievements of students, which serve as indicators of competence and the degree of behavioral change in the students. The competencies that students

must master need to be expressed in such a way that they can be assessed as manifestations of student learning outcomes, which refer to direct experiences. Coutinho (2007) found a positive relationship between academic achievement and metacognition.

Based on the observations conducted, the facts found at State High School 4 Ambon, State High School 5 Ambon, and State High School 14 Ambon revealed that there are many issues related to the students' learning process. The students' cognitive learning outcomes have not developed well. This can be seen from the fact that students only study when there is homework or an exam. The teaching methods implemented in the schools are still dominated by conventional learning strategies, although teachers have made efforts to apply constructivist approaches, such as inquiry-based learning for students. The goal of teachers using conventional strategies, such as the lecture method, is for students to understand the material and concepts correctly. The lecture method is considered effective and does not require much time. The teaching process is mainly focused on students' final outcomes, without directly improving student activity and failing to empower students' thinking skills to ask questions and explore the learning material more deeply, as well as their metacognitive skills.

Furthermore, students have not developed an awareness of how they should properly learn biology material, both in terms of planning, choosing strategies, and monitoring their own learning progress. As a result, students find it difficult to solve problems related to biology because they are not accustomed to developing their thinking potential. According to Arends (1998) in Corebima (2006) metacognition is the process of knowing and monitoring one's own thinking or cognitive processes. Metacognitive skills affect the way students think, and thus indirectly influence cognitive learning outcomes and students' ability to retain information about what they have learned, known as retention.

In addition to metacognitive skills and cognitive learning outcomes, retention is an important factor in the learning process. The learning process leaves traces within an individual and is temporarily stored in their memory. Memory plays a crucial role in the learning process, not only in the dimension of memorization, but also in terms of critical thinking, learning, connecting, recalling, and using all the knowledge and skills that have been acquired (Banikowski, 1999). The results of learning gained during the learning process are stored in memory and can later be retrieved when needed. The ability to store acquired information in memory is called retention (Tapilow, 2008).

In order to improve student learning outcomes and retention, especially in biology, various efforts have been made. These efforts primarily aim to improve the quality of biology education by developing various learning strategies, particularly those that can empower students' metacognitive skills. The hope is that when metacognitive skills improve, not only will learning outcomes increase, but retention will also improve. One of the changes that can be made in the learning process is the application of learning strategies using a constructivist approach. This strategy centers on the students, enabling them to construct their own knowledge.

One of the learning strategies that is part of the constructivist approach is RQA. This strategy is based on the reality that almost all students who are assigned to read the material often do not do so. As a result, the designed learning process does not take place, and the understanding of the material becomes poor. The implementation of the RQA strategy has proven to encourage students to read the assigned material, thereby improving their understanding. This strategy has also been shown to enhance students' metacognitive awareness and skills (Corebima, 2009). The research conducted by Bahri (2010) shows that the application of the RQA learning strategy has a positive effect on metacognitive awareness, metacognitive skills, and cognitive learning outcomes.

The Think Pair Share (TPS) learning strategy in cooperative learning was first introduced by Frank Lyman (1988). TPS involves three steps: Think (students think individually), Pair (students discuss their ideas with a partner), and Share (students share their answers with other partners or the entire class). Cooperative learning is one form of learning based on the constructivist philosophy. “Constructivism is the foundation of contextual thinking (philosophy), where knowledge is built gradually and is expanded through a limited context, not abruptly.” According to Fogarty and Robin (in Anita Lie, 2004), TPS has several advantages, including improving students' individual or group thinking skills and training students to communicate through group discussions and presenting answers to questions or problems.

Constructivist learning (its meaningful learning) is seen as an important educational goal. Corebima (2006) stated that the results of meaningful learning are highly likely to be meaningful, both in terms of cognitive, affective, and psychomotor aspects. The achievement of learning objectives can be seen through students' learning outcomes. However, the learning outcomes that are most emphasized as indicators of the achievement of learning objectives are those related to the cognitive domain. Cognitive learning outcomes will certainly be more meaningful if they are not easily forgotten. In this regard, retention plays an important role. The achievement of cognitive learning outcomes and retention is closely related to students' independence in learning. Given the characteristics of the two learning strategies above, the combination of the RQA strategy and TPS offers an alternative in biology education to enhance metacognitive skills, cognitive learning outcomes, and retention.

METHODS

This type of research is a quasi-experimental study, specifically the nonequivalent control group design (Tuckman, 1999).It is called so because in school-based research, students in the classroom cannot be divided into groups to meet the criteria for random assignment or matched groups. The purpose of this design is to determine the level of similarity between pretest score groups as a covariate for statistical control. The population in this study is all the students in grade X of State High School in Ambon during the 2014/2015 academic year, second semester. The samples in this study are the students from State High School 4 Ambon, State High School 5 Ambon, and State High School 14 Ambon. The sample classes in each school were determined based on equivalence or similar educational quality across the three schools. The experimental class selection was based on the students' UAN scores. These UAN scores were then statistically analyzed. The statistical analysis showed that three classes were equivalent based on the UAN scores. The statistically equivalent classes were in State High School 4 Ambon (Class X4), State High School 5 Ambon (Class X2), and State High School 14 Ambon (Class X1). Data collection was carried out through pretests, posttests, and retention tests (2 weeks after the posttest). The test items used during the pretest, posttest, and retention were the same, consisting of 12 essay questions.The instructional instruments used in this study were the syllabus, Lesson Plan, and Student Worksheet. The measurement instruments consisted of test items and a metacognitive skill rubric. The test items used have been validated for content and construct validity, and the reliability of the test items was classified as moderate. The metacognitive rubric used was developed by Corebima (2009). The data analysis technique used was analysis of covariance (ANCOVA) with the assistance of the SPSS for Windows program.

RESULTS AND DISCUSSION

This study was conducted with students from grade X at State High School 4 Ambon, State High School 5 Ambon, and State High School 14 Ambon during the 2014/2015 academic year. The research was carried out in three classes with different treatments. The classes used in this study were selected based on the results of an equivalence test that indicated the three sample classes were equivalent. The first class, which was taught using the RQA model, was at State High School 4 Ambon. The second class, which was taught using the RQA-integrated with TPS learning model, was at State High School 5 Ambon, while the third class, which was taught using the conventional learning model, was at State High School 14 Ambon.

The data obtained from this study consisted of students' cognitive learning outcomes, metacognitive outcomes, and retention. Data were collected at the beginning (pretest) and the end (posttest) of the research process. The students' cognitive, metacognitive, and retention scores were measured through tests, using essay-type questions, and were assessed using a metacognitive rubric. The lowest score for each item was 0, and the highest score was 7, which was then converted to a 0-100 scale. To categorize the scores obtained by the students, a 5-point absolute scale conversion was used, with categories A, B, C, D, and E (Gronlund & Linn, 1990). Based on this conversion, the average score below 20 was categorized as very poor (E), 20-39 as poor (D), 40-59 as fair (C), 60-79 as good (B), and 80-100 as excellent (A).

The results of the study will be presented in the following order with descriptions: 1) the average metacognitive scores of students before the learning process (pretest) and after the learning process (posttest), 2) the average cognitive learning outcomes of biology students before the learning process (pretest) and after the learning process (posttest), and 3) the average retention scores of students' cognitive learning outcomes.

Description of the average metacognitive scores of students

The descriptive statistics summary of the dependent variable, students' metacognitive skills, in each class (RQA, RQA integrated with TPS, and conventional) based on the pretest and posttest scores is presented in Table 1.

Table 1. Average metacognitive scores of students in pretest and posttest

Nu	Learning Model	Pretest	Category	Posttest	Category
1	*RQA*	29,39	Poor	53,89	Good
2	*RQA* integrated with *TPS*	33.80	Poor	53,03	Good
3	Conventional	23,13	Poor	34,15	Poor

Based on Table 1, it can be seen that students in the RQA class experienced an increase in their scores from pretest to posttest by 24.50%. Similarly, students in the RQA integrated with TPS class showed an increase in their scores from pretest to posttest by 19.23%, while students in the conventional class experienced an increase of 11.02%.

Description of the average cognitive learning scores of students

In this study, cognitive learning outcome tests were conducted twice, once before the learning process (pretest) and once after the learning process (posttest). The average scores of learning outcomes before and after the learning process, along with their categories, are explained as follows. The average cognitive learning scores before the learning activity (pretest) for all research subjects, which include subjects that used three different learning models—RQA, RQA integrated with TPS, and conventional learning—are presented.

The descriptive data of the cognitive learning outcomes from the pretest and posttest for each variable used will be presented in Table 2. Based on the calculations in Table 2, it can be explained that the average cognitive learning scores of students in the pretest, or before the treatment in both the experimental and control groups, were categorized as poor. The comparison of the average posttest scores, ranked from highest to lowest, shows that the learning model with the highest average posttest score was 1) RQA integrated with TPS, with an average posttest score of 66.13; 2) RQA, with an average posttest score of 63.51; and 3) conventional, with an average posttest score of 52.69.

Table 2. Average Cognitive Learning Scores of Students in Pretest and Posttest

Nu	Learnig Model	Pretest	Category	Posttest	Category
1	RQA	34,61	Poor	63,51	Good
2	*RQA* integrated with *TPS*	35,27	Poor	66,13	Good
3	Conventional	30,71	Poor	52,69	Poor

Description of the average retention scores of students

Retention scores were obtained through a retention test conducted two weeks after the posttest. The students were not informed in advance that a test would be held to measure the retention of their cognitive learning outcomes. Based on the research data, a summary of the average retention scores for each class—RQA, RQA integrated with TPS, and conventional—was created. From the average retention scores, the retention percentage of students can be calculated. The complete data can be seen in Table 3. The highest to lowest average retention scores were observed in the following learning models: 1) RQA integrated with TPS, with an average score of 59.54, 2) RQA, with an average score of 54.96, and 3) conventional, with an average score of 45.36.

Table 3. Average Retention Scores of Students in Cooperative and Conventional Classes

Nu	Learning Model	Posttest Learning Outcomes	Category	Retention	Category
1	*RQA*	63,51	Good	54,96	Medium
2	*RQA* integrated with *TPS*	66.13	Good	59,54	Medium
3	Conventional	52.69	Medium	45.36	Medium

The Effect of Learning Models on Students' Metacognition

The complete results of the ANCOVA calculation regarding the effect of the treatment on students' metacognitive skills can be found in Appendix 3. A summary of the ANCOVA results is presented in Table 4 as follows.

Table 4. Summary of ANCOVA Results on the Effect of Learning Models on Students' Metacognition

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	8298,198(a)	3	2766,066	40,906	,000
Intercept	14040,603	1	14040,603	207,639	,000
XMKOG	386,201	1	386,201	5,711	,019
KELAS	7522,660	2	3761,330	55,624	,000
Error	6085,837	90	67,620		
Total	221261,639	94			
Corrected Total	14384,035	93			

The results of the ANCOVA statistical test on the effect of the learning strategies on metacognitive skills can be summarized as follows. The effect of the RQA learning model, the RQA integrated with TPS learning model,

and the conventional learning model on metacognition, as presented in Table 4 above, shows that the calculated F value is 0.577 with a p-value of 0.000, which is less than 0.05. Therefore, the null hypothesis is rejected, and the research hypothesis is accepted. This result can be interpreted to mean that the RQA learning model, the RQA integrated with TPS learning model, and the conventional learning model have an effect on students' metacognition in class X at public high schools in Ambon City. The effect of each learning model on students' metacognition is further explained in Table 5.

Table 5. The effect of each learning model on students' metacognition

Class	XMKOG	YMKOG	DIFFERENCE	MKOGCOR	Notation LSD
1=Conventional	23,13	34,15	11,02	32,43	A
2=RQA	29,39	53,89	24,50	54,14	b
3=RQA+TPS	33,80	53,03	19,23	54,68	b

Based on the data in Table 5, it shows that the average corrected score for the RQA integrated with TPS learning model is higher, at 54.68, compared to the other learning models, while the lowest average is found in the conventional learning model, at 32.43. Expressed as a percentage, the class facilitated with the RQA learning model achieved 83.38% higher metacognitive outcomes than the class using the conventional learning model. Furthermore, the LSD notation provides information that the RQA integrated with TPS learning model does not differ significantly from the RQA learning model, but it does differ significantly from the conventional learning model in terms of students' metacognitive abilities in class X at public high schools in Ambon City.

The effect of learning models on students' cognitive learning outcomes

The complete results of the ANCOVA calculation regarding the effect of the treatment on cognitive learning outcomes can be found in Appendix 3. A summary of the ANCOVA results is presented in Table 6.

Table 6. ANCOVA results

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	4039,911(a)	3	1346,637	6,269	,001
Intercept	21571,868	1	21571,868	100,417	,000
XHBKOG	892,286	1	892,286	4,154	,044
KELAS	2449,162	2	1224,581	5,700	,005
Error	19334,000	90	214,822		
Total	368643,626	94			
Corrected Total	23373,910	93			

Based on the ANCOVA calculation results in Table 6, it is found that the F value for the learning strategy is 5.700 with a p-value of 0.000, which is less than 0.05. Therefore, the null hypothesis is rejected, and the research hypothesis is accepted. This means that the learning model has an effect on the cognitive learning outcomes of students in class X at public high schools in Ambon City. The effect of each learning model on students' cognitive learning outcomes is explained in Table 7.

Table 7. The effect of each learning model on students' cognitive learning outcomes

CLASS	XHBKOG	YHBKOG	DIFFERENCE	KOGCOR	Notation LSD
1=conventional	30,71	52,69	21,97	53,50	a
2=RQA	34,61	63,51	28,91	63,18	b
3=RQA+TPS	35,27	66,13	30,86	65,60	b

Based on the data in Table 7, it shows that the average corrected score for the RQA integrated with TPS learning model is higher, at 65.60, compared to the other learning models, while the lowest average is found in the conventional learning model, at 53.50. Expressed as a percentage, the class facilitated with the RQA integrated with TPS learning model achieved 22.61% higher cognitive learning outcomes than the class using the conventional learning model. Furthermore, based on the LSD notation, it is indicated that the RQA integrated with

TPS learning model does not differ significantly from the RQA learning model, but it does differ significantly from the conventional learning model in terms of students' cognitive learning outcomes in class X at public high schools in Ambon City.

The effect of learning models on students' retention

The students' retention data were obtained after a 2-week interval following the posttest on cognitive learning outcomes, after which a retention test was administered without prior notice to the students. The learning models used in this study consisted of three groups: the RQA learning model, the RQA integrated with TPS model, and the conventional model as the control. To determine the effect of the learning model treatments on students' retention, the data were analyzed using ANCOVA statistical techniques. A summary of the calculations is presented in Table 8.

Table 8. ANCOVA statistical

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	13187,411(a)	3	4395,804	51,667	,000
Intercept	578,616	1	578,616	6,801	,011
YHBKOG	9990,765	1	9990,765	117,428	,000
KELAS	298,921	2	149,461	1,757	,178
Error	7657,183	90	85,080		
Total	285487,712	94			
Corrected Total	20844,594	93			

The effect of the RQA learning model, the RQA integrated with TPS model, and the conventional learning model on students' retention, as presented in Table 8 above, shows that the calculated F value is 1.757 with a p- value of 0.178, which is greater than 0.05. Therefore, the null hypothesis is accepted, and the research hypothesis is rejected. This result can be interpreted to mean that the RQA learning model, the RQA integrated with TPS model, and the conventional learning model have no significant effect on students' retention in class X at public high schools in Ambon City.

CONCLUSION

There is an effect of the application of the RQA combined with TPS learning strategy on the metacognitive skills of grade X students at State High School in Ambon. The results of the LSD test show an increase in student scores from pretest to posttest: 24.50% in the RQA class, 19.23% in the RQA combined with TPS class, and 11.02% in the conventional class.There is an effect of the RQA combined with TPS learning strategy on the cognitive learning outcomes of grade X students at State High School in Ambon. The LSD test results show an increase in student scores of 28.90% in the RQA class, 30.86% in the RQA combined with TPS class, and 21.98% in the conventional class. These LSD test results indicate that the RQA combined with TPS learning strategy has a greater effect compared to students who learned using the conventional strategy. There is no effect of the RQA combined with TPS learning strategy on the retention of students' conceptual understanding.

REFERENCES

Arends, R. I. 2008. Learning To Teach: Belajar untuk Mengajar Buku Dua. Yogyakarta: Pustaka Belajar.

Bahri, A. 2010. *The Effect of the Reading, Questioning, and Answering Learning Strategy in Animal Physiology Lectures on Metacognitive Awareness and Cognitive Learning Outcomes of Biology Students at the Faculty of Mathematics and Natural Sciences, State University of Makassar*. Unpublished Thesis. Malang: PPS UM.

BSNP. 2006. *Guidelines for Developing the Curriculum for Educational Units at the Primary and Secondary Education Levels*. Jakarta: Directorate of National Education, Directorate General of Primary and Secondary Education, Directorate of Educational Personnel.

Corebima, A. D. 2006. *Metacognition: A Summary of the Study*. Paper Presented at the Metacognitive Training in Biology Teaching for High School Biology Teachers, Community Service Institute (LPKM) UNPAR, Palangkaraya.

Coutinho, S. A. 2007. *The Relationship between Goals, Metacognition, and Academic Success*. Educate, (Online) 7(1): 39-47. (Accessed from http://www.educatejournalorg, accessed on December 5, 2014.)

Corebima, A. D. 2009. *Experiences in Striving to Become a Professional Teacher*. Inaugural Lecture for the Professorship at the Faculty of Mathematics and Natural Sciences, UM. Presented at the Open Senate Session of UM, July 30, 2009. Malang: UM.

Lyman, F., & McTighe, J. 1988. *Cueing Thinking in the Classroom: The Promise of Theory-Embedded Tools*. Association for Supervision and Curriculum Development Educational Leadership. (This is already in English and does not require modification.)

Mulyasa, E. 2008. *Becoming a Professional Teacher: Creating Creative and Enjoyable Learning*. Bandung: Remaja Rosdakarya.

Tuckman, B. W. 1999. *Conducting Educational Research (5th ed).* New York: Harcourt Bruce College Publisher.