

The Influence of Collaboration of Discovery Learning and ARIAS on Students' Critical Thinking Abilities

Diyah Kusuma Wati^{1✉}, Amin Yusuf² & Sungkowo Edy Mulyono²

¹ Public Elementary School Kebonagung 2 Demak, Jawa Tengah, Indonesia

² Universitas Negeri Semarang, Indonesia

Article Info

History Articles

Received:
July 2019
Accepted:
August 2019
Published:
December 2020

Keywords:

ARIAS,
critical thinking ability,
discovery learning

DOI

<https://doi.org/10.15294/jpe.v9i3.33232>

Abstract

The purpose of the study was to analyze the influence of discovery learning model, ARIAS model, and the collaboration of the discovery learning and ARIAS model on the critical thinking ability of the fifth-grade elementary school students. This study applied a quantitative method in the form of quasi-experimental design using pre-test and post-test scores. The samples in this study were taken by using purposive sampling technique. There were three elementary schools participated in this study, and fifth-grade students at Public Elementary School Kebonagung 2, fifth-grade students at Public Elementary School Kebonagung 3 and fifth-grade students at Public Elementary School Prigi 2 Pekojan, Kebumen. The data collection techniques used were descriptive test questions. The results showed that there was an influence of discovery learning model, ARIAS, and the collaboration of the discovery learning and ARIAS model on the critical thinking ability of students. The average value of students' critical thinking skills tests using discovery learning models = 79.38 (good category). The average value of the students' critical thinking skills tests on the implementation of the ARIAS model = 85.12 (good category). The average value of the application of the collaboration of discovery learning and ARIAS model = 89.03, included in the excellent category.

© 2020 Universitas Negeri Semarang

✉ Correspondence address:

Mintreng-Godong Kebonagung RT.04/RW.05 Delok,
Demak, Jawa Tengah, 59573
E-mail: diyahkusumawati8@gmail.com

[p-ISSN 2252-6404](#)

[e-ISSN 2502-4515](#)

INTRODUCTION

Natural Sciences (IPA) are subjects related to natural phenomena or events. In elementary school, natural science subjects as a vehicle to learn themselves, the environment, nature, and apply in everyday life. Science subjects aim that students have good knowledge, skills, and attitudes to adjust to the development of science. Science provides an opportunity for students to find out a concept through discovery and critical thinking.

The ability to think critically is the cognitive process of students in analyzing problems, differentiating problems carefully and thoroughly, and identifying and studying information to plan problem-solving strategies (Azizah, Sulianto, and Cintang, 2018). PISA data in 2015 showed an increase in educational attainment in Indonesia by 22.1 points. These results explain that the ability of thinking of Indonesian students is still low. Also, according to the Ministry of Education and Culture in Azizah, Sulianto, and Cintang (2018) the ability of Indonesian students to solve problems by reasoning showed very low ability. As explained by Wijayanti, Pudjawan, and Margunayasa. (2015) in their study, the average critical thinking skills of elementary school students were relatively low.

Students' critical thinking skills are low because learning focuses students more on memorization, without paying attention to their thinking abilities (Surtriyanti, Panjaitan, and Sudin, 2017). Meanwhile, according to Wijayanti, Pudjawan, and Margunayasa (2015) students' critical thinking skills are influenced by several factors. The first factor is a disrupted physical condition so students cannot concentrate on answering questions. Second, student motivation is lacking in learning activities. Third, anxiety arises automatically if there is an excessive stimulus and cannot be handled by students. Fourth, intellectual development. Fifth, the teacher interaction with students which make the learning atmosphere becomes less comfortable. Such conditions make the students having difficulty during learning and become less

able to conclude the material. Therefore, the ability to think critically is an ability that must be developed to achieve the learning objectives.

Based on the observations toward teachers and the fifth-grade students at the elementary school on group Ahmad Yani, obtained a result that the students' critical thinking skills were still low. Students still find it difficult in solving problems provided by the teacher. Students often cheat on tests. This will not foster the aspects of critical thinking ability of the students, and this makes the student learning outcomes in the science subject less than KKM. A learning model is required to overcome these problems.

According to Kristin, and Rahayu (2016), the discovery learning model is a learning model that has the benefits of encouraging students to learn by discovering their knowledge actively. The syntax of discovery learning models is stimulation, problem statements, data collection, data processing, verification, and generalization. There are only several students who are active in the learning process. Also, the ARIAS model is still not optimally applied in the learning process. ARIAS (Assurance, Relevance, Interest, Assessment, Satisfaction) is a learning model that can influence student motivation in learning (Keller in Andriyani, and Soeprodo, 2013). The learning model of the discovery learning model has not collaborated with ARIAS learning model so that most students still find it difficult to solve the problems encountered. Students also still have lack confidence in their knowledge. Therefore a collaboration of discovery learning models and ARIAS model is necessary.

The discovery learning and ARIAS collaboration model that has been studied by Khansa, Pramudya, and Kuswardi (2018) showed that there is an increase in the understanding of mathematical concepts and student learning motivation in the material relations and functions of grade VIII A in Public Junior High School 16 Surakarta in the academic year of 2017/2018. The similarity of this study compared to the previous one is on the use of the collaboration of discovery learning and ARIAS in the learning process. The difference lies in the subject matter. Besides, the previous studies focus

on the analysis on the understanding of concepts and learning motivation, whereas, the current study measuring the understanding of the concepts of the fifth-grade students of an elementary school on science subjects of water cycle material.

This study is intended to analyze the effect of the discovery learning model on critical thinking ability, analyze the effect of the ARIAS learning model on critical thinking ability, analyze the effect of the collaboration of discovery learning and ARIAS learning models on the critical thinking ability. The application of this learning model is expected to be an alternative in supporting and improving the learning process.

METHODS

This research applied a quantitative research model in the form of quasi-experimental design. The design used in this study was the results of pre-test and post-test scores. The sampling technique was chosen using the purposive sampling technique. The sample used in this study were three elementary schools, they were grade V students in Public Elementary School Kebonagung 2, 31 students, grade V students in Public Elementary School Kebonagung 3, 27 students, and grade V students in Public Elementary School Prigi 2, 28 students. Discovery learning was held at Public Elementary School Kebonagung 3, ARIAS was held at Public Elementary School Prigi 2, and the collaboration of discovery learning model and ARIAS were implemented at Public Elementary School Kebonagung 2.

The data collection technique was done by using a test. The critical thinking ability was measured using the test item of descriptions or essay test. The testing on the test questions in this study using validity, reliability, level of difficulty, and distinguishing power test.

The data analysis was performed on pre-test data and post-test data using normality, homogeneity, and hypothesis test. The normality test was done using the one-sample Kolmogorov-Smirnov. It was done to determine the normality

of the data used in this study. Homogeneity test was carried out by using the Levene's test for equality of variances to determine whether the sample taken for the study sample is homogeneous or inhomogeneous population. The hypothesis test was done using the paired samples test using SPSS 22. It was done to analyze the effect of the learning model on critical thinking ability.

RESULTS AND DISCUSSION

Critical thinking is one of the stages of high-level thinking needed in daily life (Purwanto, Nugroho, and Wiyanto, 2012). The critical thinking ability of students will build knowledge of various thoughts in solving problems.

Critical thinking is a key competency that must be possessed by students in solving problems needed to live successfully and responsibly to face the challenges of the present and the future (Nugraha, Suyitno, and Susilaningsih, 2017). Critical thinking is developed in elementary schools since it can improve the quality of thinking of a student to skillfully analyze, assess, and reconstruct the thought to solve problems.

There are five indicators of critical thinking ability according to Etnis, and they are providing simple explanations, building basic skills, concluding, giving further explanations, managing strategies and tactics (Martaida, Bukit, and Ginting, 2017).

The data from the results of research conducted in three elementary schools with different treatments. The first class was given the discovery learning model, the second class was given the ARIAS learning model, the third class was given with the collaboration of the discovery learning model and ARIAS learning model. Students' critical thinking ability can be seen from pre-test and post-test scores.

The analysis of data of the paired samples test on the critical thinking ability using discovery learning models can be seen in table 1.

Table 1. Results of t-test Discovery Learning Model

Model			
Test	t	df	Sig. (2-tailed)
Pre-test – Post-test	-9.10	26	.000

The average score of pre-test on students' critical thinking ability is lower than the average score of post-test. The average score of pre-test of the critical thinking ability is 60.25, categorized as moderate. Meanwhile, the post-test score = 79.38 categorized as a good category. The difference between the post-test score and pre-test score = 19.14. The difference between pre-test and post-test average scores indicates the effect of the discovery learning model on the critical thinking ability of elementary school students. In line with a statement of Purwanto, Nugroho, and Wiyanto (2012) that the influence of the students' critical thinking ability can be determined using the results of the average score of pre-test and post-test that have been given in the learning using the discovery learning model.

The discovery learning model implemented in the learning process encourages students to find their knowledge by being accustomed to think critically about the questions in the exercise that have been given to measuring the critical thinking ability (Kurniati, Pujiastuti, and Kurniasih, 2017). Students can find their experience and knowledge during the discussion with friends working on LKPD and reading the materials related to water cycle learning material. From the activeness of students in discussing problems with their friends can train the students' critical thinking ability. The students will always remember the experience obtained by students during the interaction with a group of friends in a discussion.

Discovery learning model has a positive impact on the learning process to improve the students' critical thinking ability. Discovery learning can trigger the students' curiosity, build social skills during a discussion in groups, improve the public speaking ability, and try to find and explore information to obtain the correct concepts in the learning materials of the water cycle (Sari, Ridlo, and Utami, 2016).

The critical thinking ability of students on the five indicators can be seen in figure 1.

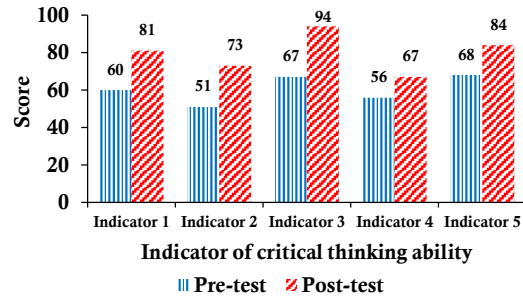


Figure 1. Critical Thinking Ability Discovery Learning Model

There are differences that appear on the five indicators of critical thinking ability between pre-test score and post-test score. The indicator of critical thinking ability at post-test scores is higher than the indicator of pre-test scores.

The average scores of pre-test on the classical of critical thinking ability is categorized in the moderate category. From the number of 27 students of grade V in Public Elementary School Kebonagung 3, there were nine students belong to the low category, fifteen students in the moderate category and three students in the high category. In the average of pre-test, each indicator of the category that was described, giving simple explanations, concluding, giving further explanations, and arranging the strategies and tactics was belong to the low category. Indicators on building the basic skills belonged to the low category.

From the 27 students in Public Elementary School Kebonagung 3, post-test scores of critical thinking ability were in a good category. There were three students who belong to the moderate category, 18 students in the good category, and six students in the excellent category. Post-test scores of critical thinking ability in the indicator of concluding have belonged to an excellent category. Indicator of providing simple explanations, building basic skills, and arranging strategies and tactics belonged to the good category. Indicator of providing further explanation belonged to the moderate category.

Changes in the indicators of critical thinking ability between pre-test scores and post-test scores indicated that the discovery learning model affects the students' critical thinking ability. This is in line with the research conducted

by Haeruman, Rahayu, and Ambarwati (2017) showing that the results of data analysis on the scores of students' critical thinking ability are strongly influenced by the discovery learning model.

The analysis of critical thinking ability data using the ARIAS learning model. The components of the ARIAS learning model, Assurance, Relevance, Interest, Assessment, and Satisfaction can be presented in Table 2.

Table 2. Results of t-test on ARIAS Model

	t	df	Sig. (2-tailed)
Pre-test – Post-test	-18.13	27	.000

In learning using the ARIAS model, there is a difference between pre-test scores and post-test scores. Since there are differences appear, it can be interpreted that there is an effect of the ARIAS model on critical thinking ability.

The critical thinking ability at the average score of pre-test = 58.21, in the moderate category. The average score of post-test = 85.12, in the good category. In general, the average score of the pre-test is lower than the average score of post-test. The difference between pre-test and post-test score = 26.91. Thus, the ARIAS learning model affects the critical thinking ability of the fifth grade of elementary school students which are presented based on average pre-test score which is lower than the post-test average score (Rodiah, and Irianto, 2017). The ARIAS learning model influences the difference between pre-test and post-test average scores of critical thinking ability.

The ARIAS learning model provides opportunities for students to develop reasoning abilities and put forward ideas in their minds to practice critical thinking (Mustafa, and Sabirin, 2017). The ability to think critically can encourage students to achieve learning goals and attract students' interest or attention.

The application of the ARIAS model in the learning process has an assurance component that can foster motivation for students. In the relevance component, can link the subject matter with daily life so that students can find out the benefits of the learning. The ARIAS learning model can foster students' critical thinking ability

due to pleasant learning and avoiding learning atmosphere which is boring so that students do not hesitate to ask questions that are not understood well (Andriyani, and Soeprodjo, 2013).

The increase in students' critical thinking ability after using the ARIAS learning model is due to an assessment component, which is an evaluation of the learning process. Evaluation makes students think critically in the learning process so that students try to do a better solution to the problems (Sulistyaningrum, Karyanto, and Sunarno, 2015). The satisfaction component is related to feeling proud of the success of solving the questions that have been done to improve the critical thinking ability.

The indicators of critical thinking ability in the learning model of ARIAS can be seen in Figure 2.

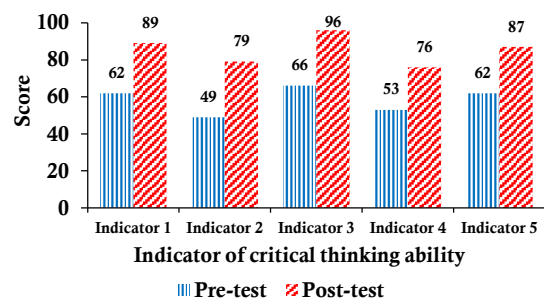


Figure 2. Critical Thinking Ability ARIAS Model

Indicators of critical thinking ability on the average score of the pre-test are lower than the average score of post-test. Pre-test score of indicators of critical thinking ability to build basic skills and providing further explanation was included in the low category. Indicator of providing a simple explanation, concluding, arranging strategy and tactics was in the moderate category.

In the post-test score, the critical thinking ability of indicator providing further explanation, concluding, arranging strategies and tactics was included in the excellent category. Indicator of building basic skills and providing further explanation was in good category.

Instead of the discovery learning model and ARIAS, students' critical thinking ability is

also influenced by the collaboration of the discovery learning model and ARIAS learning model. This learning model can help students to grow their critical thinking ability easily.

Analysis of the data of paired samples test of critical thinking ability was using the collaboration of discovery learning model, and ARIAS learning model can be seen in Table 3.

Table 3. Result of t-test Discovery Learning and ARIAS Model

	t	df	Sig. (2-tailed)
Pre-test – Post-test	-18.13	27	.000

The average score between pre-test and post-test is different. Since there are differences, it can be interpreted that there is an effect of the collaboration of the discovery learning and ARIAS model on the critical thinking ability and understanding concepts.

The average score of critical thinking ability at pre-test and post-test scores is different. The average score of pre-test of the critical thinking ability = 56.77, included in the moderate category, meanwhile, the average score of post-test = 89.03, belong to excellent category. Pre-test score is lower than the post-test score. The difference between pre-test score and post-test score = 32.26.

The effect of the collaboration of the discovery learning and ARIAS learning model on critical thinking ability appear since students are given a stimulus in the form of images to stimulate the student curiosity so that they can think critically about the material being studied and figure out its benefits in everyday life. At the problem statement stage, students are given a problem in the form of questions then students are told to formulate hypotheses for the questions that are relevant to daily life provided by the teacher. When formulating the hypotheses, a student's ability to think critically arises in answering questions (Widiadnyana, Sadia, and Suastra, 2014) — in addition, giving rewards in the form of verbal and nonverbal to students at the satisfaction stage successfully inferring material that has been studied and able to improve the critical thinking ability (Andriyani, and Soeprodjo, 2013).

Critical thinking ability measured in this study consists of 5 indicators. Differences appear in each indicator between pre-test and post-test. Pre-test indicators of critical thinking ability increased since the students were treated using the collaboration of the discovery model and ARIAS. The difference is presented in Figure 3.

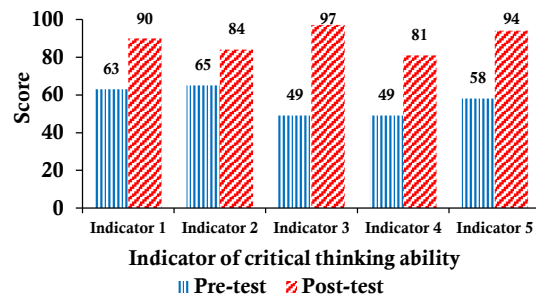


Figure 3. Critical Thinking Ability Collaboration of discovery learning and ARIAS Model

Each indicator of critical thinking ability provides different categories. For the indicator of providing explanations, the pre-test score was in moderate category, and the post-test score belonged to excellent category. The indicator of building the basic skills of pre-test score belonged to moderate category, and the post-test score was in a good category. The indicator of concluding on pre-test score is included in the low category and post-test score was in the excellent category. The indicator of providing further explanation on pre-test score was in the low category and the good category for the post-test score. Indicator of arranging the strategy and tactics of pre-test scores was in the moderate category, and post-test scores were in the excellent category.

The collaboration of the discovery learning and ARIAS model can influence each indicator of the critical thinking ability since students can play an active role in the learning process, providing opportunities for students to cooperate when discussing the solving problems with critical thinking.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the discovery

learning model, ARIAS model, as well as the collaboration of the discovery learning and ARIAS model can influence the critical thinking ability of the elementary school students in grade V of water cycle material. The ability to think critically using discovery learning is included in good category. In the ARIAS learning model, critical thinking ability was included in good category. The collaboration of the learning model of discovery learning and ARIAS model towards critical thinking ability was included in excellent category.

REFERENCES

- Andriyani, W., & Soeprodjo. (2013). Peningkatan keterampilan berpikir kritis siswa dengan penerapan model pembelajaran arias. *Chemistry in Education*, 2(2), 134-140. Retrieved from <https://journal.unnes.ac.id/sju/index.php/chemined/article/view/1493>
- Azizah, M., Sulianto, J., & Cintang, N. (2018). Analisis keterampilan berpikir kritis siswa sekolah dasar pada pembelajaran matematika kurikulum 2013. *Jurnal Penelitian Pendidikan*, 35(1), 61-70. Retrieved from <https://journal.unnes.ac.id/nju/index.php/JP/article/view/13529>
- Haeruman, L. D., Rahayu, W., & Ambarwati, L. (2017). Pengaruh model discovery learning terhadap peningkatan kemampuan berpikir kritis matematis dan self-confidence ditinjau dari kemampuan awal matematis siswa sma di bogor timur. *Jurnal Penelitian dan Pembelajaran Matematika*, 10(2), 157-168. Retrieved from <http://jurnal.untirta.ac.id/index.php/JPPM/article/view/2040>
- Khansa, S. L., Pramudya, I., & Kuswardi, Y. (2018). Penerapan model pembelajaran discovery learning dengan strategi arias untuk meningkatkan pemahaman konsep dan motivasi belajar pada materi relasi dan fungsi. *Jurnal Pendidikan Matematika dan Matematika SOLUSI*, 2(4), 259-272. Retrieved from <https://jurnal.uns.ac.id/JMMS/article/view/22698>
- Kristin, F., & Rahayu, D. (2016). Pengaruh penerapan model pembelajaran discovery learning terhadap hasil belajar ips pada siswa kelas 4 sd. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, 6(1), 84-92. Retrieved from <https://ejournal.uksw.edu/scholaria/article/view/185>
- Kurniati, I. W., Pujiastuti, E., & Kurniasih, A. W. (2017). Model pembelajaran discovery learning berbantuan smart sticker untuk meningkatkan disposisi matematik dan kemampuan berpikir kritis. *Kreano, Jurnal Matematika Kreatif-Inovatif*, 8(2), 109-118. Retrieved from <https://journal.unnes.ac.id/nju/index.php/kreano/article/view/5060>
- Martaida, T., Bukit, N., & Ginting, E. M. (2017). The effect of discovery learning model on student's critical thinking and cognitive ability in junior high school. *IOSR Journal of Research & Method in Education*, 7(6-1), 1-8. Retrieved from <http://www.iosrjournals.org/iosr-jrme/papers/Vol-7%20Issue-6/Version-1/A0706010108.pdf>
- Mustafa, D., & Sabirin, M. (2017). Efektivitas model pembelajaran ARIAS (assurance, relevance, interest, assessment, and satisfaction). *Tarbiyah: Jurnal Ilmiah Kependidikan*, 6(1), 41-52. Retrieved from <https://jurnal.uin-antasari.ac.id/index.php/jtik/issue/view/219>
- Nugraha, A. J., Suyitno, H., & Susilaningih, E. (2017). Analisis kemampuan berpikir kritis ditinjau dari keterampilan proses sains dan motivasi belajar melalui model pbl. *Journal of Primary Education*, 6(1), 35-43. Retrieved from <https://journal.unnes.ac.id/sju/index.php/jpe/article/view/14511>
- Purwanto, C. E., Nugroho, S. E., & Wiyanto. (2012). Penerapan model pembelajaran guided discovery pada materi pemantulan cahaya untuk meningkatkan berpikir kritis. *Unnes Physics Education Journal*, 1(1), 26-32. Retrieved from <https://journal.unnes.ac.id/sju/index.php/upej/article/view/768>
- Rodiah, S., & Irianto, D. M. (2017). Influence of arias learning model based on saintific approach to student critical thinking in learning concept of natural concept in class v sd. *Jurnal Khazanah Sekolah Dasar*, 5(1). Retrieved from <http://antologi.kd-cibiru.upi.edu/index.php/PGSD/article/view/141>
- Sari, E. N., Ridlo, S., & Utami, N. R. (2016). Pengaruh model pembelajaran discovery learning dengan mind mapping terhadap hasil belajar siswa pada materi sel di sma. *Unnes Science Education Journal*, 5(3). Retrieved from

- <https://journal.unnes.ac.id/sju/index.php/usj/article/view/13171>
- Sulistyaningrum, D. E., Karyanto, P., & Sunarno, W. (2015). Pengembangan modul berbasis model pembelajaran ARIAS untuk memberdayakan motivasi dan berpikir kritis siswa pada materi ekosistem. *Inkuiri: Jurnal Pendidikan IPA*, 4(1), 104-116. Retrieved from <https://jurnal.uns.ac.id/inkuiri/article/view/9576>
- Surtriyanti, E., Panjaitan, R. L., & Sudin, A. (2017). Pengaruh metode pembelajaran pictorial riddle terhadap keterampilan berpikir kritis siswa sd pada materi pelestarian lingkungan. *Jurnal Pena Ilmiah*, 2(1), 331-340. Retrieved from <http://ejournal.upi.edu/index.php/penailmia/article/view/10668>
- Widiadnyana, I. W., Sadia, I. W., & Suastra, I. W. (2014). Pengaruh model discovery learning terhadap pemahaman konsep ipa dan sikap ilmiah siswa smp. *Jurnal Pendidikan dan Pembelajaran IPA Indonesia*, 4(1), 1-13. Retrieved from http://oldpasca.undiksha.ac.id/e-journal/index.php/jurnal_ipa/article/view/1344
- Wijayanti, D., A., I., Pudjawan, K., Margunayasa, I. G. (2015). Analisis kemampuan berpikir kritis siswa kelas v dalam pembelajaran ipa di sd no. 1, 2, dan 3 kaliuntu gugus x kecamatan buleleng. *MIMBAR PGSD Undiksha*, 3(1), 1-12. Retrieved from <https://ejournal.undiksha.ac.id/index.php/JJPGSD/article/view/5740>