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Do RICORSE Potentially Able to Diminish Student's Cognitive Learning Outcomes on Different Academic?

Nurul Ika Noviyanti, Susriyati Mahanal, Siti Zubaidah
Biology Education–Universitas Negeri Malang
Jl. Semarang 5 Malang, Indonesia 65145. E-mail: nurulikan21@gmail.com

Abstract: Learning outcomes are the students' ability after receiving learning experience. In fact, there are gap in students' cognitive learning outcomes. This gap can be minimized by learning model. The purpose of this research was to investigate the RICOSRE learning model potency in learning outcomes gap on different academic ability. The current study was design as a quasi-experiment with pre-test post-test non-equivalent control group design. Based on data analysis, RICOSRE learning model is able to improve cognitive learning outcomes, so, the students' learning outcomes gap in school with different academic ability is getting closer.

Key Words: cognitive learning outcome, RICOSRE learning model, academic ability

Abstrak: Hasil belajar adalah kemampuan siswa setelah menerima pengalaman belajar. Faktanya masih terjadi kesenjangan hasil belajar kognitif siswa. Kesenjangan ini dapat diperkecil dengan model pembelajaran. Tujuan penelitian ini untuk mengetahui potensi model pembelajaran RICOSRE dalam mempersempit kesenjangan hasil belajar kognitif pada siswa dengan kemampuan akademik berbeda. Desain penelitian menggunakan kuasi ekperimen dengan *pre-test-post-test non equivalen control group design.* Berdasarkan analisis data, model pembelajaran RICOSRE mampu meningkatkan hasil belajar kognitif siswa dengan kemampuan akademik rendah dan tinggi, sehingga kesenjangan hasil belajar kognitif siswa pada sekolah dengan kemampuan akademik berbeda semakin kecil.

Kata kunci: hasil belajar kognitif, model pembelajaran RICOSRE, kemampuan akademik

INTRODUCTION

The 21st century as a century of knowledge requires human resources with the expertise of students in cooperatively working, highly thinking, having cultural literacy, being able to communicate, and being able to learn throughout life (Trilling & Hood, 1999; Galbreath, 1999). 21st century learning requires students to play an active role in learning activities, construct concepts, and interpret learning outcomes that students receive. Learning aims to build students' knowledge through the learning process (Kim, M. & Tan, 2012).

The learning model applied by the teacher facilitates students to construct knowledge that will influence students' cognitive learning outcomes (Davis, 2004). Student cognitive learning outcomes are indicated by changes in the behavior of various mental processes in learning (Anderson, L. W., & Krathwohl, 2015). Aspects of learning outcomes cognitive learning domains are classified into six levels as follows 1) remembering/knowledge relating to memorization and memory, 2) understanding (comperhension) that is understanding a concept, 3) applying (application), students' ability to use what that has been obtained into other concepts, 4) analyzing, the ability to separate, describe information in its parts, and relationships, 5) evaluating , the ability to compile a pattern or structure of existing ones, 6) creating, the ability to create or compose a new one.

Another factor that influences learning outcomes is academic ability (Mamu, 2014). Students' academic abilities are the actual level of competence for scholastic or educational activities (Dharmawan, 2017). Academic ability contributes significantly to student learning outcomes (Yenilmez, Sungur, & Tekkaya, 2006). Admissions to new high school level students in Malang are based on the Minimum Passing Level

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National Exam (MPL NE) which uses a certain National Final Examination (UAN) score in some schools. Such a new student admission system results in indirect grouping of students. High academic ability students gather in one school and school which is a gathering place for lower academic students. This condition results in the occurrence of school quality polarity which has an impact on the gap in student learning outcomes between high academic and low academic (Fauzi, Corebima, & Mahanal, 2013).

Some results of the study found that the learning outcomes of high school students in Malang City were still relatively low. Similarly, from observations at State High School around Malang indicate that learning outcomes in Biology subjects are still relatively low, particularly in schools with low academic abilities. Likewise, some students in schools with high academic abilities have relatively low cognitive learning outcomes. Low cognitive outcomes in low academic ability schools are due to limited training of high-level thinking to students. Students with low academic abilities are also difficult to solve problems independently since they are lack of reading. Students also need more intensive direction and guidance in classroom learning activities. This fact is supported by a study that shows that students 'academic abilities influence students' cognitive learning outcomes (Sholihah, Zubaidah, & Mahanal, 2016). Similar research also shows that students who have high academic abilities have better initial knowledge than low academic ability students (Kurniawati, Zubaidah, & Mahanal, 2016). As a result, it has an impact on high-level thinking skills and cognitive learning outcomes (Rosyida, F., Zubaidah, S., & Mahanal). The failure of the implementation of learning in biology classes in Indonesia is generally caused by teachers who do not pay attention to the initial academic abilities or prior knowledge of students regarding learning materials (Bahri, 2016).

An alternative solution to overcome the low learning outcomes of students with different academic abilities is to apply innovative models. One innovative learning model that can be applied is the RICOSRE learning model. RICOSRE learning model is a problem-based learning model developed based on learning syntax by John Dewey (Carson, 2007), Polya (1988), and Krulick & Rudnick (1996), namely (1) Reading, (2) Indentifying the Problem, (3) Contructing the Solution, (4) Solving the Problem, (5) Reviewing the Problem Solving, and (6) Extending the Problem Solving (Mahanal & Zubaidah, 2017). Based on previous exposure, the researchers conducted research related to the potential of the RICOSRE learning model. The purpose of this study was to determine the potential of the RICOSRE learning model in reducing the gap in cognitive learning outcomes of students with high and low academic abilities.

METHOD

The study was conducted by quasi-experimental method using non-equivalent pre-test-post-test control group design. The population of this study was all students in Public High Schools around Malang. It took class X IPA students at SMAN 1 Malang, SMAN 8 Malang, SMAN 1 Turen, and SMAN 1 Singosari as sample which were determined through the equality test using the results of the answers to the Protista material essay questions. Based on the results, it was obtained SMAN 1 Malang and SMAN 8 Malang as a school with high academic ability, while SMAN 1 Turen and SMAN 1 Singosari as low academic schools. Sampling in each school was determined by random sampling technique. Samples in schools with high academic abilities were 179 students, and samples in schools with low academic abilities were 180 students. Each school consisted of three classes which were used as research samples as follows: one experimental class using the RICOSRE learning model, one positive control class using the PBL learning model, and one negative control class using conventional 5M learning.

Data collection was done by using essay test questions on the material of Viruses and Archaebacteria & Eubacteria. Measurement of answers was done by using the rubric of answers to test questions based on learning indicators. Before the test was given, it should be tested for validity and reliability. The results of validity and reliability tests can be seen in Table 1 and Table 2. The research data that had been obtained, then was tested using two-way children (two-way ancova) at a significance level of 0.05%. Covariate analysis was preceded by a normality test using Kolmogorov-Smirnov One-Sample. Test and homogeneity test using Leven's Test of Equality of Error Variances. The results of the normality test of learning outcomes data obtained p-value of 0.057–0.727, p-value > α (α = 0.05). Thus, it can be concluded that learning outcomes data were normally distributed. The homogeneity test results of cognitive learning outcomes skills data have a p-value of 0.070 and 0.080, p-value > α (α = 0.05). Thus, it can be concluded that cognitive learning outcomes were homogeneous.

Table 1. Validity Test of Cognitive Learning Outcomes Test

Item Number	R count	R table (5%)	Result
1a	0,252	0,1614	Valid
1b	0,324	0,1614	Valid
2a	0,451	0,1614	Valid
2b	0,359	0,1614	Valid
3a	0,489	0,1614	Valid
3b	0,387	0,1614	Valid
4a	0,575	0,1614	Valid
4b	0,612	0,1614	Valid
5a	0,631	0,1614	Valid
5b	0,672	0,1614	Valid
6a	0,531	0,1614	Valid
6b	0,606	0,1614	Valid
7a	0,615	0,1614	Valid
7b	0,650	0,1614	Valid
8a	0,635	0,1614	Valid
8b	0,518	0,1614	Valid

Table 2. Reliability Test of Cognitive Learning Outcomes Test

Cronbach's Alpha	Result
.822	Very High

Table 3. Data Normality Test

		K1M1 K1	K1M1 K2	K2M1 K1	K2M1 K2	K1M2 K1	K1M2 K2	K2M2 K1	K2M2 K2	K1M3 K1	K1M3 K2	K2M3 K1	K2M3 K2
N		59	59	60	60	61	61	60	60	59	59	60	60
Normal Parameters[a]	Mean	28.2373	50.847	24.350	42.766	25.098	42.901	22.650	37.950	24.678	32.067	20.816	30.200
	Std. Deviation	3.16957	7.413	4.631	8.836	3.695	4.407	3.695	4.938	2.903	2.116	3.132	3.521
Most Extreme Differences	Absolute	.109	.119	.089	.143	.127	.108	.153	.165	.150	.174	.153	.111
	Positive	.109	.107	.049	.140	.127	.065	.153	.125	.093	.174	.153	.106
	Negative	-.079	-.119	-.089	-.143	-.084	-.108	-.078	-.165	-.150	-.113	-.078	-.111
Kolmogorov-Smirnov Z		.841	.910	.691	1.108	.992	.840	1.186	1.277	1.153	1.335	1.184	.857
Asymp. Sig. (2-tailed)		.479	.379	.727	.171	.279	.480	.120	.076	.140	.057	.121	.454

Table 4. Homogenity Data Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Pre_Kog	3.087	.080	8.282	357	.000	3.38886	.40916	2.58419	4.19353
			8.285	351.966	.000	3.38886	.40902	2.58443	4.19328
Pos_Kog	3.314	.070	5.429	357	.000	4.95528	.91268	3.16036	6.75019
			5.427	350.151	.000	4.95528	.91303	3.15957	6.75098

Then, the 5% BNT test was carried out if there was influence.

RESULTS

The normality test shows that the overall data was normally distributed, and the homogeneity test also shows that the overall data was homogeneous. The results of the normality test and homogeneity of learning outcome data can be seen in Table 3 and Table 4.

The results showed an increase in learning outcomes. According to the result of pretest to posttest, it was different for all three learning models. The highest increase occurred in the class facilitated by RICOSRE learning, then PBL, and the lowest increase in conventional class. In more detail, the improvement of learning outcomes in different models and academic abilities can be seen in Table 5.

Table 5. Cognitive Learning Outcome Average

Modle*Academic Ability	*Pretest*	*Posttest*	Margin	Gain Score (%)
Conventional High AA	24,67	32,06	7,39	29,94
Conventional Low AA	20,58	31,53	10,95	53,19
PBL Low AA	22,65	35,33	12,68	55,6
PBL High AA	25,09	42,9	17,8	70,93
RICOSRE High AA	21,17	47	22,16	80
RICOSRE Low A	28,23	50,85	21,28	99,6

Table 6. Analysis Test Results Effect of Learning Model on Cognitive Learning Outcomes in students with different academic abilities

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	9852.719	1	9852.719	142.254	.001
	231.470	3.342	69.262[a]		
Pre_Kog	82.961	1	82.961	2.573	.110
	11349.121	352	32.242[b]		
Model	12033.059	2	6016.530	21.849	.042
	559.728	2.033	275.367[c]		
Academic Ability	1469.673	1	1469.673	5.980	.128
	515.917	2.099	245.773[d]		
Model * Academic	586.713	2	293.356	9.099	.000
Ability	11349.121	352	32.242[b]		

Table 7. Post Hoc Test Results with BNT Notation for Cognitive Learning Outcomes

Model*Kemampuan akademik	Corrected Mean	BNT Notation
Conventional Low AA	30,737	a
Conventional High AA	32,016	a
PBL Low AA	38,172	b
RICOSRE Low AA	42,759	c
PBL High AA	42,793	c
RICOSRE High AA	50,315	d

The results of the Anakova analysis of learning outcomes based on learning models and academic abilities can be seen in Table 6.

Based on the two-track anakova test, it is known that in the learning model, the F_{count} = 21.849 and the significance value = 0.042 which is smaller than alpha 0.05 ($p < 0.05$). It means H0 is rejected and the research hypothesis is accepted. These results indicate that there is an influence of the learning model on cognitive learning outcomes. Academic ability in the study has a F_{count} = 5.980 and a significance value of 0.128 > 0.05. It means H0 is accepted, the hypothesis is rejected. There is no influence of academic ability on students' cognitive learning outcomes. The absence of the influence of academic ability on cognitive learning outcomes is likely due to students' initial knowledge of both high academic and low academic abilities.

Interaction of learning models with academic abilities obtained F_{count} = 32.242 and a significance value = 0.042 which is smaller than alpha 0.00 ($p < 0.05$). It means H0 is rejected and the hypothesis is accepted. This means that there is interaction between learning models and academic abilities. BNT test was done to determine its significance. The interaction of learning models with academic abilities on cognitive learning outcomes can be seen in Table 7.

The results of further tests on the interaction of learning models and academic abilities indicate that RICOSRE on high academic abilities has a corrected average that is different from RICOSRE on low academic abilities, PBL and conventional learning. RICOSRE in low academic abilities and PBL of high academic is not different, but both are different from other learning. The mean corrected PBL of low academic ability is different from other learning models, while conventional low and high are both different from other learning. Based on the table, RICOSRE of low academic abilities has a corrected mean that is not much different from PBL in high academic abilities. Based on these results, it indicates that the RICOSRE learning model has more potential to improve student cognitive learning outcomes compared to PBL and conventional models. Thus, the RICOSRE learning model is able to improve the cognitive learning outcomes of students with low academic abilities. In which, the gap of ability seems reducing.

DISCUSSION

The results of the study revealed a higher increase in the RICOSRE learning model than PBL and conventional learning. Students with high academic and low academic levels facilitated by the RICOSRE learning model experienced higher cognitive learning outcomes as follows: 80% (high academic), and 99.6% (low academic) than students facilitated PBL and con-ventional learning models. The corrected mean of the RICOSRE learning model of high academic ability has the greatest value among the other learning models. RICOSRE on low academic ability has a corrected average that is not much different from PBL on high academic students. This is because the two models are problem-based learning models. Problem-based learning as an active learning that can help students to be aware and determine the problem-solving abilities they need, to learn, be able to use knowledge operationally, and do group work in the context of real-life problems (Tandogan & Orhan, 2007). Furthermore, problem-based learning has five special characteristics, namely the submission of questions or problems, focusing on interdisciplinary studies, authentic inquiry, products production and exhibition, and collaboration (Arends, 2012).

Problem-based learning is a learning model which is based on cognitive psychology theory. The first syntax of PBL is student orientation to the problem. At this stage students are introduced to existing problems. The teacher as a facilitator motivates students to be actively involved. After students recognize the existing problems, it is followed by the syntax of organizing. It starts from defining problems. Problem is provided, then students will exchange opinions (brainstorming), then there will be several alternative opinions (Rusman, 2010).The activity of defining this problem will also produce several kinds of information through exchange of opinions. Furthermore, students are required to dig deeper into the information, thus student has their own views (Sani, 2015). Learning with PBL will be more effective if students have the ability to identify problems and make observations.

Information that has been obtained when identifying problems and observations must be processed and delivered with the ability to establish networks (Sani, 2015). This activity is related to the syntax of organizing students for learning. The next activity will be in groups and conduct experiments. The task of the teacher in this stage is to encourage students to gather appropriate information and guide students to carry out experiments to get the appropriate explanation. The next step is to develop and present the work. This activity encourages students to produce a work that is ready to be exhibited, for example a report on the results of research or practicum (Rusman, 2010). The last stage is the analysis and evaluation of the problem solving process. This activity encourages students to reflect and evaluate the investigations and processes they are doing (Sani, 2015).

RICOSRE, in this research context, is also a PBL. It is a development of the common PBL learning model. The results showed that the RICOSRE learning model have a higher corrected average than PBL and conventional. The existence of these differences proves that the RICOSRE learning model has more potential in improving student learning outcomes. This potential is due to the syntax of the RICOSRE learning model which is more complex than the PBL and conventional learning models. The advantages of RICOSRE syntax lie in reading and extending the problem solution that is not found in PBL or conventional learning models.

The syntax of reading in RICOSRE is closely related to improving student learning outcomes. This is since reading requires students to update information from the material being studied. Students will also experience an increase in intellectual level, knowledge of life, and have a broad perspective and mindset, and also enrich vocabulary with material that has been read hence they are able to follow classroom learning well (Amirudin, Corebima, & Zubaidah, 2015). In line with PISA's view, reading activities are closely related to the concept of careful reading. The concept of careful reading has characteristics as follows; 1) requires the reader to be an investigator, 2) requires the reader to be able to know how a text can work, 3) requires the reader to answer questions that arise from the text. Reading activities will guide students to understand, use, reflect, and involve themselves in various types of reading texts in developing their knowledge and potential (Abidin, Mulyati, & Yunansah, 2017).

Reading is very important in science learning because it fits with current literacy learning. Students can develop the ability to understand the contents of the text, find text, develop vocabulary, and understand the structure of the text, understand the purpose of the author, make inferences the contents of the reading, and develop opinion, argumentation and connect various texts through reading activities (Moss, Lapp, Grant, & Johnson, 2015). This reading activity does not only requires students to find literal enlightenment, but also requires students to gain inferential and evaluative understanding. Inferential and evaluative understanding can be obtained by students through repeated reading activities (Tantillo, 2014).

Reading activities can lead readers to identify relevant information and generate a relationship based on the problems containing in the reading (Wilson & Chaves, 2014). Furthermore, students' initial knowledge will be formed after finding and connecting information. This will make the reader be able to engage and interact with the text meaningfully and gain an in-depth understanding of the content of the text (Neuman & Grambell, 2013). A study proves that reading activities through Reading, Questioning and Answering strategies can improve cognitive learning outcomes (Bahri, 2016).

The stage of building solutions is closely related to learning outcomes. The process of building a solution to a problem is not a simple reasoning process. This process requires high level reasoning. Some capabilities are needed at this stage, including the ability to gather information and data, convey arguments, determine supporting theories, decide choices for problem solving processes, have become part of the reasoning process that makes students able to solve problems (Soekisno, Kusumah, & Using, 2015). This reasoning ability is an important part of improving learning outcomes (Hisham & Chee, 2015).

Identifying problems is a process where problems that are not clearly identified by students (Wang, Wu, Kirschner, & Spector, 2018). The stage of analyzing complex problems is an ability that is abstract since it takes place in one's brain (Whimbey, Lohhead, & Ronald, 2013). Students will be aware of existing problems and look for criteria for solutions needed to solve problems at this stage. After finding the problem, students will construct solution to solve the problem. Students will try actively to find what must be done to achieve a goal (Williams & Paltridge, 2017), or determine the plan or strategy that has been proposed to be used in solving problems (Ar & Katranc, 2014).

The problem solving phase in syntax solving problem is also an important part of learning activities because it becomes an important key in improving cognitive learning outcomes. Problem solving is a process that involves cognitive directed to change a particular situation into a destination situation, based on clarity of methods, availability of solutions (Wijnia, Loyens, Derous, & Schmidt, 2016). This is supported by the PISA concept which explains that problem solving is the ability to carry out cognitive processes from abstract situations to be clear context. Students will have the competence to engage in problematic situations in order to start becoming a constructive and reflective person (Lin, 2015). Problem solving competencies are related to the use of cognitive skills in solving complex problems in everyday life (Abidin et al., 2017). Some of the solutions at this stage will be taken and chosen to solve the problem. The stage of determining this solution is related to the reviewing the problem solution syntax.

Another advantage of the RICOSRE model also lies in the syntax of reviewing the problem solution and extending the problem solution. The stage of reviewing the problem solution students will communicate the results of the trial to obtain feedback and expand information from the results of their investigations in solving problems (Williams & Paltridge, 2017). The best solutions that have been set will be taken as a way to solve problems. Students can evaluate the solutions offered with their study groups (Abidin, Mulyati, & Yunansah, 2017). This stage is needed to evaluate the statements made by other students correctly, and encourage them to generate their own appropriate statement (Alias, Masek, & Salleh, 2015). The results of the reviewing the problem solution stage can be used to deepen students' concepts when deciding on the effectiveness and accuracy of the solutions used previously.

Problem solution reviewing results will be used by students in the sixth stage, extending the problem solution. After students check the suitability of the solution, they need to analyze the efficiency of the strategy from the solution chosen, other alternative strategies to solve similar problems better, and generalize the problems that have been solved to be able to solve other similar problems in the future better. This activity is useful to motivate students to apply new knowledge and skills from the stage of resolving previous problems to new phenomena that have never been faced by students (Celik, Onder, & Silay, 2011).

The advantages of the RICOSRE syntax can help students comprehending concepts which effect on cognitive learning outcomes. Results that show the interaction of learning models with academic abilities, as well as a higher percentage increase in low academic ability students in RICOSRE learning prove that the RICOSRE learning model has the potential to eliminate the gap in academic learning outcomes differently. The gap in high-level thinking skills and student learning outcomes can be reduced during the learning process (Amirudin et al., 2015). This is supported by a study that shows that the RICOSRE learning model is able to improve high-level thinking skills and student learning outcomes in different academic abilities. Thus, the RICOSRE learning model has the potential to eliminate the gap in learning outcomes of students with high academic and low academic abilities.

CONCLUSION

The results showed that there were differences in cognitive learning outcomes in learning using RICOSRE, PBL and conventional learning models on different academic abilities. The biggest increase is in the RICOSRE learning model. The mean corrected interaction of learning models with different academic abilities has the greatest results among the two other learning models.

The RICOSRE learning model can be used by teachers to improve high-level thinking skills in different academic abilities in the future. This learning model is also expected to reduce the gap in learning outcomes in different gender.

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