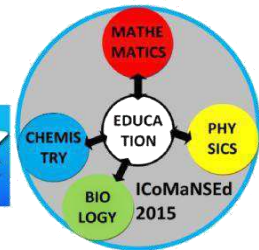




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Prof. Dr. Cosmas Poluakan, M.Si.
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COOPERATIVE SCRIPT METACOGNITIVE (CSM) LEARNING BY EMPOWERING CAPABILITY OF THE STUDENTS TO THINK CRITICALLY

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Abstract

This research developed learning package, which could empower capability of the students to think critically, Cooperative Script (CS) strategy that was integrated with Metacognitive (M) in the form of self assessing or CSM. Results of such development were experimented to eighth grade students of State Junior High Schools in Manado. Results of the analysis showed that average score of the students who have high-academic capability (AT), and low-academic capability (AR) who applied CSM strategy, have beyond the critical thinking capability of the students who have high-academic capability and low-academic capability by applying conventional strategy (Konv): 1) Average score of the CSM-AT group, 23.187% higher than Konv-AT, and 29.52% higher than Konv-AR, 2) Average score of the CSM-AR group, 9.00% higher than Konv-AT, and 14.65% higher than Konv-AR. The improved percentage occurred on CSM-AR group 628.94% for capability of critical thinking.

Keywords: Cooperative Script, Metacognitive, Critical Thinking

1. Introduction

In this knowledge century nowadays, which is marked by rapid growth of information and technology, individuals are demanded to learn for the rest of their lives. Therefore, it demanded the individuals to learn autodidactic (Geremek, 1996). However, most learning in Indonesia has not been able to make the students to be autodidactic learner.

One region where considered as having low learning level is North Sulawesi, especially in Manado. A survey research showed that most students of the State Junior High Schools have not reached Minimum Completeness Criteria.

Survey on 14 State Junior High Schools in Manado, which was conducted on June-July 2008, showed that the average scores for learning results of the seventh grade students during even semester in the academic year of 2007/2008 were generally under Minimum Completeness Criteria ($KKM \leq 75$). Low grade for biology learning in Manado was due to such learning has not developed thinking skill. Results of the survey showed that 24.39% of the respondents who developed capability to think critically in learning, even though 43.90% of the respondents admitted that critical thinking should be involved in learning and 34.14% stated the importance of learning empowerment (Warouw, 2011).

Corebima (2005) stated that without emphasizing on thinking, deep understanding about the real content of learning would be impossible. Suriasumantri (2005) stated that thinking is an activity to find out the right knowledge. Thinking that applies basic thinking processes (thinking skill) to analyze arguments and create a view, which has specific meaning and interpretation, is so-called critical thinking (Costa, 1985 in Warouw, 2011). Proulx (2004) stated that critical thinking is a process to analyze, examine, and evaluate arguments.

Empowering critical thinking capability can be done using metacognitive strategy, but 36.58% of the respondents (biology teachers) have not recognized such metacognitive learning, 46.34% gave no answers (did not know category), and 17.07% has recognized it based on interview, in which the respondents have only recognized it through textbooks, whereas in fact metacognition (metacognitive) plays the most important role in achieving success in learning (Livingstone, 1997 in Warouw, 2011).

Based on some empirical findings on biology learning in Manado, further research is required to develop a set of learning equipment, which is more empowering critical thinking capability and oriented to constructivism principle such as Cooperative Script (CS). Such CS learning strategy does not only have theoretical superiority, but also considered as learning model that develop mutual cooperation to reach mutual goal, to improve learning results of the students (Dansereau, 1985 in Warouw, 2011), and it could improve understanding and memory of the students (Jacobs, 1996). Furthermore, Brousseau (2002) stated that CS learning is an explicit learning contact between teachers and students as well as among students collaboratively. Therefore, one of CS learning benefits is the agreement among students and between teachers and students in solving specific problem on learning, collaboratively.

Reference that related to CS strategy benefit has not given comprehensive explanation on thinking empowerment during learning process. This strategy will be more effective if metacognitive strategy is integrated in learning syntax. Metacognitive strategy is not only effective in empowering thinking capability, but also makes the students to be more self-supported in learning.

Metacognitive strategy involves regulation process or executive regulation, which is directed to regulation about steps in thinking that includes decisions, which will help in: (1) allocating the available sources to complete the task, (2) determining steps in finishing the task, and (3) determining intensity, or speeding up in doing and finishing the task (Livingstone, 1997 in Warouw, 2011).

Both CS and metacognitive strategies are 2 strategies of learning, which can be applied simultaneously in learning process. The objectives are to train the students to think critically during learning and assist the students to complete their study (Warouw,2011). The research is expected to give a strategy of learning, which is not only able to complete the learning, but also could empower the student's capability to think critically.

2. Method of the Research

This research was conducted in two steps, developing the learning apparatus and experimental-quasi research.

2. 1. Developing the Apparatus

Development of this learning apparatus was performed by applying Kemp's system approach (1994), which included: a) Analysis of learning objective, b) Student's analysis, c) Task's analysis, d) Formulating objective of the learning, e) Arranging learning result test, f) Arranging material order, g) Selecting learning strategy, presentation, i) Selecting materials/media, j) Arranging learning activity/learning prototype, k) apparatus validation (by experts, students, on field), l) Revision, and m) specific RPP testing-Revision (final equipment obtained) is ready to be implemented on experimental research. In this research, the developed apparatus include CSM syllabus, RPP CSM and CSM worksheets. Development of this learning apparatus was performed by considering empirical facts that

related to biology learning at State Junior High Schools in Manado, as well as its appropriateness with KTSP. An essay test as an instrumental evaluation has been developed to measure the success in learning.

2.2. Experiments

The complete Quasi experiment design of the research is “pretest-postest Non-equivalent Control Group Design” of factorial version 5 X 2, as shown on Table 1 below:

Table 1 The Experiment Procedure of “Pretest-Postest Non-Equivalent Control Group Design” (Wiersma, 1995).

	O ₁	X ₁ Y ₁	O ₂
	O ₃	X ₁ Y ₂	O ₄
	O ₅	X ₂ Y ₁	O ₆
	O ₇	X ₂ Y ₂	O ₈
	O ₉	X ₃ Y ₁	O ₁₀
	O ₁₁	X ₃ Y ₂	O ₁₂
	O ₁₃	X ₄ Y ₁	O ₁₄
	O ₁₅	X ₄ Y ₂	O ₁₆
	O ₁₇	X ₅ Y ₁	O ₁₈
	O ₁₉	X ₅ Y ₂	O ₂₀

Description : O_{1,3,5,7,9,11,13,15,17,19} = Pretest
 O_{2,4,6,8,10,12,14,16,18,20} = Postest
 X₁ = Cooperative Script + Metacognitive (CSM)
 X₂ = Reciprocal Teaching + Metacognitive (RTM) Strategy
 X₃ = Cooperative Script (CS) Strategy
 X₄ = Reciprocal Teaching (RT) Strategy
 X₅ = Conventional Strategy
 Y₁ = High-academic capability
 Y₂ = Low-academic capability

The whole research was conducted at State Junior High Schools in Manado during even semester on 6 selected schools, which were chosen by Cluster Sampling. By determining the class randomly, 5 classes were considered as having high-academic capability: Class VIII 1 of SMP Negeri 4 that applies CS+M syntax; Class VIII D of SMP Negeri 1 that applies CS syntax, Class VIII L of SMP Negeri 1 that applies RT+M syntax, Class VIII B of SMP Negeri 1 that applies RT syntax, and Class VIII A of SMP Negeri 10 that applies Conventional syntax. Furthermore, 5 classes that were considered as having low-academic capability: Class VIII 10 of SMP Negeri 7 that applies CS+M syntax, Class VIII D of SMP Negeri 3 that applies CS syntax, Class VIII 7 of SMP Negeri 8 that applies RT+M syntax, Class VIII 13 of SMP Negeri 8 that applies RT syntax, Class VIII 7 of SMP Negeri 7 that applies Conventional learning syntax. Such academic capability categorization was based on data of their Final Result Reports (NR) during odd semester, in which each of these 5 classes that having high-academic capability (NR>75) did not have significant difference, and 5 classes that having low-academic capability (NR<75) did not have significant difference as well.

This article was written based on results of the research, which related to the influence of CSM and conventional learning strategies among students who have high-and-low-academic capabilities. The average number of students at each class is 36-40 students. 20 students were taken at each strategy, except for conventional strategy of high-academic capability, which took 16 students, therefore, the samples comprised of 76 students.

The arranged evaluation instrument is an essay test of critical thinking capability, which applies column that was developed by the researcher referring to Hart (1994).

3. Result and Discussion

3.1. Result of the Research

3.1.1. Developing CS+Metacognitive Learning Apparatus

Steps in cooperative script and metacognitive (CSM) learning, result of such development is shown on Table 2 below.

Table 2. Steps in CS+Metacognitive Learning

Teacher's Activities	Student's Activities
<p>A. Initial Activities</p> <ol style="list-style-type: none"> 1. Teacher motivates the students, by exploring initial knowledge of the students. 2. Presenting objective of learning. 3. Teacher organizes the students in group (9 groups, that comprises of 4 students, and formed in pair, by throwing coin in order to determine who is going to be the Partner of A (speaker) and Partner B (listener) 	<p>A. Initial Activities</p> <ol style="list-style-type: none"> 1. Students prepare themselves to learn. 2. Listening the presentation: Objective of learning. 3. Students are paired in group as partner A (speaker), and partner B (listener)
<p>B. Main Activities</p> <ol style="list-style-type: none"> 1. Teacher distributes discourse/reading material to each student, and they should make a summary. 2. Teacher directs both partners to read the same part, then asks them to make summary on the worksheet. 3. Teacher gives an opportunity to Partner A to read the summary to Partner B, and Partner B detects/corrects each mistake of the question, answer, and summary of the partner A by <ul style="list-style-type: none"> - showing incomplete ideas, and - assisting to remind the main ideas by relating them to the previous material or other materials. 4. Teacher gives opportunity to both partners to cooperate in establishing the summary along with obvious and proper information. Then, opportunity is given for presentation. 5. Teacher gives opportunity to students to make self assessing toward the learned material by writing it down on their worksheets and journal. 6. Teacher directs both partners to read the next materials. 7. Teacher asks the students to repeat steps 3-4, both partners exchange their roles, Partner A as speaker will be turned into listener, and vice versa. 	<p>B. Main Activities</p> <ol style="list-style-type: none"> 1. Students read and pay attention on the discourse/ reading material to make a summary. 2. Both partners read the same part, and then they make the summary on the worksheets. 3. Partner A reads the summary to Partner B, and Partner B detects/corrects each mistake of the question, answer, and summary of the partner A by <ul style="list-style-type: none"> - showing incomplete ideas, and - assisting to remind the main ideas by relating them to the previous material or other materials. 4. Both partners cooperate in establishing the summary along with obvious and proper information. Then it is followed with presentation. 5. The student makes a self assessing toward the learned material by writing it down on their worksheets and journals. 6. Both partners read the next materials. 7. Steps 3-4 are repeated, both partners exchange their roles, Partner A as speaker will be turned into listener, and vice versa.
<p>C. Closing Activities</p> <ol style="list-style-type: none"> 1. Teacher directs the students to draw some conclusions as a result of their reflection by writing down on their journal. 2. Giving opportunity for the students to submit their worksheets. 3. Giving task, drawing some conclusions for the next materials. 	<p>C. Closing Activities</p> <ol style="list-style-type: none"> 1. Draw some conclusions as a result of their reflection by writing down on their journal. 2. The students submit their worksheets. 3. Doing their homework by making summary for the next material.

Description: Integrated by the Writer

Explicitly, Table 2 describes learning process, which using CSM learning strategy, and oriented to develop critical thinking capability of the students.

3.1.2. Experimental Research

The developed-learning syntax was tested its influence toward capability of the students to think critically. The collected data will be analyzed using anakova. Summary of the covarians analysis result is presented completely on Table 3.

Table 3. Summary of the Analysis Result Concerning with the Influence of Learning Strategy Toward Critical Thinking of the Students

Source	Type III Sum of Squares	df	Average Square	F	Sig.
Corrected Model	8799.297(a)	10	879.930	18.147	.000
Intercept	71246.433	1	71246.433	1469.336	.000
Prekbbk	34.867	1	34.867	.719	.398
Strategy	4192.755	4	1048.189	21.617	.000
Academic	3060.904	1	3060.904	63.126	.000
Strategy*Academic	1191.975	4	297.994	6.146	.000
Error	8970.438	185	48.489		
Total	1036153.457	196			
Corrected Total	17769.735	195			

Based on Table 3 above, it shows that significance related to strategy and academic capability is 0.000 as well. Therefore, H_0 for strategy and academic capability is rejected and each research hypothesis is accepted. Therefore, this article is written, based on result of the research that related to both conventional and CSM learning strategies, and then result of the LSD test, which includes both strategies are given below.

Table 4. Result of the LSD Test Concerning with the Influence of Learning Strategy and Academic Capability Toward Capability of the Students to Think Critically

STRATEGY	ACADEMIC CAPABILITY	XKKB	YKKB	DIFFERENCE	KBKCOR	Notation
3 = Conventional	2 = low	9.592	62.535	52.943	62.283	A
3 = Conventional	1 = high	11.329	65.496	54.167	65.483	A
1 = CS+M	2 = low	9.827	71.633	61.806	71.413	B
1 = CS+M	1 = high	15.520	80.103	64.583	80.667	B

Based on result of LSD test that concerning with the influence of learning strategy, it reveals the difference of average scores for critical thinking capability of the students on the treatment group and control group. The corrected average for critical thinking capability of the students who learned using CSM learning strategy was 76.040 and 19.03% higher than the corrected average for critical thinking capability of the students who applied conventional learning strategy as much as 63.883. Result of the analysis showed average difference of critical thinking capability of the students who have high-and-low academic capabilities. Average score for critical thinking capability of the students who have high academic capability is 76.134, and it is 12.34% higher than average score for critical thinking capability of the students who have low academic capability, 67.766.

Based on Table 3, average score for critical thinking skill of the students who have high academic capability and learn using CSM learning strategy, is 80.667, and it is 12.95% higher than average critical thinking skill of the students who have low academic capability and learn using CSM learning strategy, and 23.18% higher than average critical thinking skill of the students who have high academic capability and learn using conventional learning strategy. The reverse thing can be seen on critical thinking skill of the students who have low capability and learn using CSM learning strategy, and it increases higher, 628.94% in comparison with average score of the students who have high academic capability and apply CSM strategy, which increase to 412.12%. Related to this, average score for critical thinking capability of the students who have low academic capability is increased higher than previous

capability in comparison with average score for critical thinking capability of the students who have high academic capability and learn using CSM strategy.

3.2. Discussion

3.2.1. Influence of CSM Strategy toward Critical Thinking Capability

Result of data analysis showed the influence of CSM learning strategy toward critical thinking capability of students of State Junior High Schools in Manado. Average score for critical thinking capability of the students who learned using CSM learning strategy was higher than average score for critical thinking capability of the students who learned using conventional learning strategy. Berg (1993), which referred in Hadi (2007), Warouw(2011) described that students who participated in CS learning program had good achievement in comparison with students who learned in autodidact.

Critical thinking capability should be developed earlier. Eggen and Kauchak (1996) stated that critical thinking and high thinking include combination of deep understanding on specific topics, competency in using basic cognitive process effectively, understanding and control over basic cognitive process (metacognition), as well as attitudes and character. Critical thinking capability of the student will be improved along with the applied learning strategy; therefore, learning should be able to empower critical thinking capability of the students (Ibrahim, and Nur, 2000). Critical thinking capability of the students will be measured by considering the students' answers. It conformed to Ennis (1993), and Marzano (1988) who described that critical thinking components, which should be trained are as follow: 1) doing induction, deduction, 2) giving arguments, 3) making evaluation, and 4) deciding and implementing.

Besides it is influenced by learning strategy, the analysis results have shown that critical thinking capability of the students are also determined by their academic capabilities. Average score for critical thinking capability of the students who have high academic capability is higher than average score for critical thinking skill of the students who have low academic capability, but it has indifferent meaning, therefore implementation of the CSM strategy could minimize differences between students who have high-and-low academic capabilities. Other researches, which paralleled to findings of this research, were performed by Winarni (2006), Tindangen (2006), and Santoso (2007), which concluded that students who have different academic capabilities will show similar results for their studies if they were given specific treatment using equivalent learning strategy.

3.2.2. Superiority and Effectiveness of the CSM Learning Strategy as Finding of the Research

Learning strategy has been developed by infusing metacognitive strategy into Cooperative Script learning. O'malley and Chamot in Henia (2006) divided the learning strategy into 3 groups, such as: 1) social-affective, 2) cognitive, and 3) metacognitive. Based on these grouping, specific learning strategy should be developed to improve result of learning, which simultaneously effective in improving critical thinking capability of the students. Infusion of such metacognitive strategy into learning strategy, which is oriented to cognitive development, is believed to be able to develop learning results of the students that related to metacognitive skill, cognitive capability, as well as critical thinking capability of the students.

Self assessing as part of metacognitive strategy is applied by training the students to make evaluation over the recognized concepts, which have not known before during learning

process, and the way they develop the recognized knowledge. This activity performs at the final part of learning, in which the students are obligated to write down self assessing on their worksheets provided by the teacher. Through such self assessing, the students are trained to control their cognitive process continuously and permanently, therefore they will become self-regulated learners.

Learning activity on CSM strategy emphasizes learning on exploration over the reading materials. Peirce (2004) stated four strategies of effective learning and reading, such as: (1) asking questions and answers, (2) making a summary, (3) writing down description or extension, and (4) using regulated-strategies. Effectiveness of learning strategies, which oriented to this thinking empowerment, will be tested in experimental research performed by the eighth grade students of State Junior High Schools in Manado. Discussion concerning with results of the experimental research, superiority, and effectiveness of the CSM strategy in improving critical thinking capability of the students, will be described below.

Integrating CS learning strategy and metacognitive strategy of self assessing, has both superiority and effectiveness in improving critical thinking capability of the students, which lies on: activity in making summary and self assessing. Students divided into groups, in which each group comprises of 2 students. Then, the students should make a summary based on reading material provided by the teacher. Summary of the student A will be presented and corrected by its partners, and vice versa. The student B will present his/her summary and it will be corrected by student A. After that, the students should give reflection over the cognitive process by writing down what they have known, what they have not known, as well as how they develop what they have known.

Superiority of other CSM strategies is relative greater availability for the students to correct their summaries by turns, as well as giving reflection over their learning results. Arends (2001) describes that metacognitive leads the learners to think about thinking and their capabilities in utilizing specific learning strategy properly.

4. Conclusion

Infusion of metacognitive strategy in CS (CSM) learning strategy will be able to improve critical thinking capability of the students. Students who have used to apply metacognitive strategy will intentionally create themselves to be self-regulated learners in learning activity, and it activates them to have high-level thinking capability. Based on conclusion of the research result, it is suggested for the student teacher and biology teachers to pay more attention in selecting the proper learning strategy in order to empower critical thinking capability of the students. CSM strategy can be implemented extensively to develop critical thinking capability of the students.

References

- Arends, R.I. 2001. *Learning to Teach*, Fifth edition. New York: McGraw-Hill Company, Inc.
- Corebima, A.D. 2005. *The Training PBMP (Empowering Thinking pass through Question) in Learning for Teachers and Biology Sains University Student in the framework RUKK VA*. June 25.
- Corebima, A.D. 2008. *Review on: Learning Strategies Having Learning Strategies Having Bigger Potency to Empower Thinking Skill and Concept Gaining of Lower Academic Students*. Redesigning Pedagogy International Conference. December 2008.

- Darling L, Austin. K, Cheung. M, dan Martin. D, Tanpa Tahun. Thinking About Thinking: Metacognition. Stanford University School of Education. http://www.learner.org/channel/courses/learningclassroom/support/09_metaco_g.pdf. Diakses 16-12-07.
- Eggen, P.D. and Kauchak, D. P. 1996. Strategies for Teachers. Teaching Content and Thinking Skill. (Third Edition). Boston: Allyn and Bacon.
- Geremek, B. 1996. Education For the Twenty-First Century. CONF. ESCC/96/5-R.1. 21 May 1996.
- Hadi, S. 2007. The Effect of Learning Strategy Cooperative Script Toward Critical Thinking, Metacognitive Skill, and Biology Cognitive Capability on Senior High School Laboratory Students Malang State University. Thesis. Unpublished. Malang: PPS Malang State University.
- Hart, D. 1994. Authentic Assessment A Handbook for Educators. New York: Addison-Wesley Publishing Company.
- Henia, N.D. 2006. Applying Metacognitive Strategies to Skimming Research Articles in an ESP Context. English Teaching Forum. Number 1.
- Jacobs, G.M., Lee, G.S., & Ball, J. 1996. Learning Cooperative Learning Via Cooperative Learning. A Sourcebook of Lesson Plans for Teacher Education on Cooperative Learning. Singapore. SEAMEO Regional Language center.
- Kemp. J.E., Morrison, G.R., and Ross, S.M. 1994. Designing Effective Instruction. New York: MacMilan College Publishing Company.
- Livingstone, J.A. 1997. Metacognition: An Overview State Univ. of New York at Buffalo. (Online) <http://www.gse.buffalo.edu/fas/shuell/cep564/-metacog.html>. Diakses 28-12-2007.
- Nur, M. 2000. Study Strategies. Surabaya: UNESA-University Press.
- Proulx, G. 2004. Integrating Scientific Method & Critical Thinking in Classroom Debates on Environmental Issues. The American Biology Teacher, Volume 66 No. 1.
- Suriasumantri, J.S. 2005. Philosophy of Science. Popular Agents of One. Jakarta: Pustaka Sinar Harapan.
- Tindangen, M. 2006. Implemented Biology Concept Mapping Contextual Learning of Junior High School On Student Different the First Capability in Malang and The Effect Toward Higher Order Thinking Ability and Cognitive Learning Result. Unpublished Doctoral Dissertation. Malang Programe Postgraduate UM.
- Warouw, Z.W.M. 2011. Cooperative Script Metacognitive (CSM) Learning By Empowering Retention Capability Of The Students To Think Critically. Proceedings. Percentage on International Conference “Future Education in Global Challenges” in University of PGRI Adi Buana Surabaya, 19 April 2011. Page 592-601. ISBN 978-979-8559-50-1.
- Wiersma, W. 1995. Research Methods in Education. Sixth Edition. Boston: Allyn and Bacon.
- Winarni, E.W. 2006. The Effect Learning Strategy Toward Biology Sains Concept Comprehension, Critical Thinking Ability, and Scientific Attitude of Student 5 Grade Elementary School With Different Academic Achievement Level in Bengkulu. Unpublished Doctoral Dissertation . Malang: Postgraduate Malang State University.