

## **The Impact of Learning Method and Logical Thinking Ability towards the Skills to Write Scientific Work to Students of Private University in Surakarta**

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### **Abstract**

This study is an experiment with a 3x2 design. Manipulations performed on variables of learning methods. The experimental group was given special treatment, respectively MM learning method, PBL, CIRC. The experimental group was divided into students who have the logical thinking ability are good and less good. The population in this study was student private university in Surakarta in Academic Year 2012/2013, while sample of this research is students of UNWIDA and UNIVET Surakarta taken mathematical studies program with multi stage area random sampling Data skills to write scientific work obtained from tests made in the form of scientific work papers, while the level of ability to think logically with psychological tests. The analysis of the data by two-way analysis of variance techniques. The conclusions of this research are skills of scientific papers writing to student group who attended MM and CIRC learning method is better than the PBL method, while the skills of writing scientific work to student group who attended MM learning methods as well as methods of CIRC. There is interaction between learning method and logical thinking ability in influencing the scientific work writing skills. Such interactions include: the group of students who have the ability to think logically good or less good, the application of learning with MM and CIRC method is better than the application of PBL teaching method.

**KEYWORDS:** learning methods mm, pbl, circ, scientific writing skills, logical thinking ability.

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### **INTRODUCTION**

Student as a degree candidate and scientists, prepared not only to be consumers of knowledge but also as a producer in the scientific field. Students have a duty not only to read the scientific literature, but also to be able to write their own works of a scientific papers. Therefore, the student must continue to hone their ability to control, develop, and disseminate knowledge.

Writing skills of scientific work is one of the important skills in order to meet these obligations. So that, each student needs to know the way to make the writing of a scientific work and have the writing skills to write a scientific work. The Writing skills is an ability to express ideas, thoughts, knowledge, and experience in writing form

Phenomenon occurs, though at secondary school level have been taught about writing scientific papers, but generally, the students still have many weaknesses in scientific writing. That was stated by Anshori (2004: 395), the students does not have sufficient experience of writing, scholars as well as most can not afford to pour his ideas in the form of writing language (non verbal) . Similarly, the results of preliminary studies

of Cahyani (2005: 7), there are several causes of difficulties for students to pour an idea in a papers, namely the fear and start making mistakes write a topic. In addition, students are less capable of organizing essay, developing paragraphs, arranging language effectively, especially sentences, placing the appropriate vocabulary, and use writing mechanism, especially writing techniques.

The Success in learning to write, one of which is determined by the selection of learning methods, since the application of learning methods adapted to the students conditions , the material being taught, learning objectives to be achieved, as well as students involvement in the learning process, it would be more effective in the formation of student writing competence.

Each learning method from a variety of existing methods have the accuracy or the usefulness of certain advantages and drawbacks when used in the practice of the learning process. In order to develop competence in the form of a scientific work writing skills, can be identified the presence of several learning methods that may be used effectively and efficiently, to be assessed in relation to the goal of improving scientific writing skills, describes methods: 1) Problem Based Learning (PBL ); 2) Mind Mapping (MM); and 3) Cooperative Integrated Reading and Composition (CIRC).

Another aspect of thinking, writing skills of scientific work is essentially an implementation of thinking skills, particularly in terms of the ability to think logically. Logical thinking is thinking with logic or thinking by using reasoning. Meanwhile, the logic itself can be classified into two kinds, namely inductive logic and deductive logic. Thus, the ability to think logically be defined as the ability to think by using inductive logic and deductive logic.

By such a background, it can be considered that the importance of research on the application of PBL method, MM, and CIRC to develop the skills of writing scientific work in the review of the factors the ability to think logically. As for the fundamental problem of this study are as follows: 1). Are there any differences of scientific writing skills between groups of students who attend the learning of PBL methods, MM, and CIRC?; 2). Are there any differences of Scientific writing skills between groups of students who have the ability to think logically good and less good?; and 3). Are there any interactions between learning method with the ability to think logically on writing skills?

## **MATERIALS AND METHOD**

Literature review in this study include those related to: the definition of a scientific work writing skills, logical thinking skills, and methods of learning Mind Mapping (MM), Problem Based Learning (PBL), Integrated cooperative composition (CIRC)

### **1. Scientific Writing Skills**

Writing skills is one of the productive language skills and expressive that is used to communicate indirectly and not face to face with the other party (Tarin, 2008: 3), further scientific work is scientific essay that presents facts and written according to the methodology of writing the good and true (Brotowidjoyo, 2002: 46)

### **2. Understanding Logical Thinking**

Logical thinking is the thinking goes according to certain patterns and use reasoning (Suriasumantri, 1985: 43), by ordering, comparing, contrasting, evaluating, and selecting (Stevens, 1996 : 6)

### **3. Learning Method**

#### **a. Mind Mapping Learning Method (MM)**

Mind map is a method that makes it easy to record creative can remember a lot of information, it means that the mind map is an outline of the main categories and tiny thoughts which is described as a branch of a larger mind (De Porter, et al., 2005: 175 - 176)

#### **b. Learning methods of Problem Based Learning (PBL)**

PBL learning method is a method of learning that exposes students to authentic problems that can lead students in inquiry and the inquiry (Arends, 2004: 391)

#### **c. Integrated Learning Method Cooperative Composition (CIRC)**

Cooperative learning method that integrates a thorough reading and composing later become an important parts (Slavin, 2010: 20). CIRC is a method for learning to read and to write. Reading can enhance vocabulary mastery indirectly, while very useful vocabulary mastery for writing skills (Nagy and Herman, 1987: 24).

## **RESEARCH METHODS**

### **1. Type of research**

This study is experimental. The design used in this study was a 3x2 factorial design, and involves two factors, each of which consists of 3 and 2 levels. Independent variables, namely manipulative learning method which includes 3 levels: 1) Problem Based Learning (PBL); 2) Mind Mapping (MM); and 3) Cooperative Integrated Reading and Composition (CIRC). Independent variables, namely attributive Logical Thinking Ability which includes 2 levels: 1) high logical thinking; and 2) a low logical thinking. Dependent variable: Scientific Writing Skills.

### **2. Research Procedure**

This research has four research procedure as follows: 1) Do a test of logical thinking ability of high and low for the entire population of 245 students, and 100 students were taken as a sample; 2) Form a group of three members of the sample of 100 students with the details of each of the 36 students who have the ability to think logically high and low and follow the method of learning with MM, 33 students who have a high ability to think logically and follow the method of learning PBL, 31 students who have the ability to think logically high and followed the method of learning by CIRC; 3) Each group was given treatment with the material to write scientific papers. The treatments were given in accordance with predetermined learning methods; and 4) Once treated, then students are given a test to make a scientific paper in the form of paper.

### **3. Locations**

This study was conducted in private universities in Surakarta: University Veterans (Univet) and the University of Widia Darma (UNWIDA).

### **4. Data Collection Techniques**

Data collection techniques of scientific writing skills used in this study is an instrument to write papers that have been tested and the validity and the reliability of the opinion adopted (Sarwiji, 2006), while the indicators that refer to scientific writing skills

in this study is the Content, Organization bouquet , Grammar, diction, spelling, and Scientific Notation.

### 5. Data analysis technique

The data analysis technique used in this study is the analysis of variance (ANOVA) with two cells is not the same way, ie : to test the mean difference writing scientific papers skills. The design research used a factorial design 3 x 2.

**Table 1.**

**The Research Design Used a Factorial Design 3 x 2.**

Learning Method (A)	Logical Thinking Ability (B)	
	High (B1)	Low (B2)
MM (A1)	A <sub>1</sub> B <sub>1</sub>	A <sub>1</sub> B <sub>2</sub>
PBL (A2)	A <sub>2</sub> B <sub>1</sub>	A <sub>2</sub> B <sub>2</sub>
CIRC (A3)	A <sub>3</sub> B <sub>1</sub>	A <sub>3</sub> B <sub>2</sub>

If the results of the analysis indicate a difference in teaching methods and the interaction, then the continued analysis of Scheffe Test '

## RESEARCH RESULT

### Differences in the Scientific Writing Skills Learning with Learning Methods Following MM, PBL, and CIRC

The results of a comparison test between cells in the same row with the Scheffe test as follows: (1) the writing skills of students who follow the scientific papers of MM learning methods and learning methods that follow the PBL obtained significance value  $\rho = 0.000 > 0.05$ , so H0A1.2 rejected. (2) the writing skills of students who follow the scientific work learning method MM (A1) and the following learning methods CIRC (A3) obtained significance value  $\rho = 0.986 > 0.05$  so H0A1.3 accepted. (3) scientific paper writing skills of students who follow the CIRC and learning methods that follow the PBL method obtained significance value  $\rho = 0.000 > 0.05$ , so H0A2.3 rejected.

### Differences Scientific Writing Skills Students Who Have High Logical Thinking Ability and Low Logical Thinking Ability

From the analysis of different test average, using the student t test obtained by the group that has the ability to think logically high and low logical thinking skills obtained significance value  $\rho = 0.000 > 0.05$ , so H0B1.2 rejected.

### Interaction between Students Following Three Methods of Learning and Logical Thinking Skills

The results of a comparison test between cells in the same column with the Scheffe test as follows: (1) the writing skills of students who follow the scientific papers of MM learning methods that have the ability to think logically high (A1B1) and were followed PBL method that has the ability to think logically high (A2B1 ) obtained significance value  $\rho = 0.000 > 0.05$ , so H0A1.2 rejected. (2) the writing skills of students who follow the scientific papers of MM learning methods that have the ability to think logically high (A1B1) and were followed CIRC learning methods that have the ability to think logically high (A3B1) obtained significance value  $\rho = 0.957 > 0.05$  so H0A1.3 accepted. (3) keterampilan write scientific papers of students who follow the CIRC

learning methods that have the ability to think logically high (A3B1) and were followed PBL method that has the ability to think logically high (A2B1) obtained significance value  $\rho = 0.000 > 0.05$ , so  $H_{0A2.3}$  rejected. (4) the writing skills of students who follow the scientific papers of MM learning methods that have the ability to think logically low (A1B2) and were followed PBL method that has the ability to think logically low (a2b2) obtained significance value  $\rho = 0.000 > 0.05$ , so  $H_{0A1.2}$  rejected. (5) the writing skills of students who follow the scientific papers of MM learning methods that have the ability to think logically low (A1B2) and were followed CIRC learning methods that have the ability to think logically low (A3B2) obtained significance value  $\rho = 0.946 > 0.05$  so  $H_{0A1.3}$  accepted. (6) write scientific papers skill of students who follow the CIRC learning methods that have the ability to think logically low (A3B2) and were followed PBL method that has the ability to think logically low (a2b2) obtained significance value  $\rho = 0.000 > 0.05$ , so  $H_{0A2.3}$  rejected. (7) the writing skills of students who follow the scientific papers of MM learning methods that have the ability to think logically high (A1B1) and were followed MM learning methods that have the ability to think logically low (A1B2) obtained significance value  $\rho = 0.000 > 0.05$ , so  $H_{0A1.2}$  rejected. The results of a comparison test between cells in the same row with the Scheffe test as follows: (1) the writing skills of students who follow the scientific work PBL learning method that has the ability to think logically high (A2B1) and were followed PBL learning methods that have the ability to think logically low (a2b2) obtained significance value  $\rho = 0.000 > 0.05$ , so  $H_{0A1.3}$  rejected. (2) write scientific papers skill of students who follow the CIRC learning methods that have the ability to think logically high (A3B1) and were followed CIRC learning methods that have the ability to think logically low (A3B2) obtained significance value  $\rho = 0.000 > 0.05$ , so  $H_{0A2.3}$  rejected.

## DISCUSSION

Based on the results of hypothesis testing can be conveyed discussion of the results of the study are as follows:

### 1. The First Research Hypothesis (difference between the Scientific Writing Skills Students Taught by MM method, PBL, and CIRC)

In testing the first hypothesis which states there is a difference between the writing skills of students who follow the scientific work of MM methods and methods of PBL and verified CIRC method. The test results showed the average value of writing skills that students learn scientific work with MM learning method is 3.5044 and the average value of writing skills that students learn scientific work with PBL teaching method for students studying is 3.3242 whereas the CIRC learning method is 3.4997. This means, generally, when it seen in different methods of learning regardless of ability to think logically high or low logical thinking, learning methods MM shows the average student score higher than the average value of students studying with CIRC and PBL teaching method.

This is due to the students who are taught by the MM method can learn the techniques to create structured notes that are easy to understand and remember, and do not require a long time. In addition to the learning process is not boring because it can draw attention to the eyes and brain poured in records created colorful images that can connect between the information with other information, making it easier for students to

concentrate in receiving the information provided by the lecturer. The lecturer's role as a mentor or advisor in learning, and helping students to undertake an assessment that has been achieved by the students. The approach used by the lecturer is an open approach between faculty and students, it aims to foster a harmonious relationship between lecturers and students at the time of study. This finding supports the idea of Buzan (2004: 9) states that through the material MM methods can be brief, despite extensive study material, stimulate thinking more logically organized and structured, stimulate imaginative and creative thinking, configure and integrate information more effectively. In addition, the learning process fun and not boring.

Further proved that the group of students who studied with CIRC learning method is more effective than learning with PBL method. This is due to groups of students who attend lessons with CIRC method can integrate a thorough reading and then compositing it becomes the important parts.

Furthermore, it is evident that the group of students who studied with PBL teaching method is not more effective than learning by teaching methods MM and CIRC. This is because the PBL learning method is a method of learning that exposes students to authentic problems and to demand the students to be able to solve a problem, PBL is a learning process that is the starting point of learning based on real-life problems in the past on this issue stimulated students to study the problem is based on knowledge and experiences they have had before so it will form a new knowledge and experience. Using small group discussions are the main points in the application of PBL.

PBL is a learning process in which the problem is the main guide to the direction of learning. Thus, there is a problem which is used as a means for students to learn something that can contribute their knowledge. But in fact the students are not familiar with things like that because the students are usually only as a learning object and teachers just limited to provide knowledge to students can deliver their contribution to improve an outcomes at individual and group learning. in fact such an unusual learning process experienced by students, in which the learning process for the students to act as learning objects, lack of activity and argues asked to make learning becomes monotonous, so that when students are faced with a problem-solving, they are less able to resolve the problem.

## **2. The Second Research Hypothesis (The Differences of Scientific Work Writing skills between Students Have High Logical Thinking Ability and Logical Thinking Low)**

Testing the second hypothesis which states there is a difference of scientific papers student writing skills that enabled students to think logically high with a low-capable logical verified. The results show that the scientific work of students writing skills that enabled a high contrast to logical thinking that enabled students to think logically low. The difference in the form of average values than students who have the ability to think logically high of 3.5146 better than the average value of students who have the ability to think logically low of 3.3412. the results of this study correspond to Sahat opinion (2007:15) in order to be able to think logically, it should be understood that the logic of the argument of a verbal map that consists of three parts and show a progressive idea, namely: (1) the rationale or reality beachhead, (2 ) argument or rationale for how to put together, and (3) conclusions or results achieved by applying the argument on the premise

### **3. The Third Research Hypothesis (Interaction Between Learning Method and Logical Thinking Ability to writing scientific work skills )**

Based on the results of two-way ANOVA calculations obtained sig F at 0.00 <0.05, it means HOAB rejected which means no interaction between learning method and logical thinking skills to writing scientific work skills. The existence of such interactions, it is necessary to test multiple comparison between cells, and can be summarized as follows:

- a. The differences of writing scientific work skills between students who taught by using MM method and students who taught by using PBL method on Student Learning Method that has high logical thinking ability. Based on a descriptive analysis performed, the mean value of scientific work on the writing skills of students who have the ability to think logically higher who taught by MM learning methods at 3.5668. The mean value of scientific work on the writing skills of students who have high logical thinking skills taught by PBL learning method for 3.3974. Further testing is then performed with the Scheffe test, the results showed a significant difference. It appears that students who have the ability to think logically higher learning methods taught by MM have scientific writing skills better than the ability to think logically lower the PBL learning methods.
- b. The differences of writing scientific work skills between students who taught by using MM method and students who taught by using CIRC method on Student Learning Method that has high logical thinking ability. Based on a descriptive analysis performed, the mean value of scientific work on the writing skills of students who have the ability to think logically higher that taught by MM learning methods at 3.5668. The mean value of scientific work on the writing skills of students who have the ability to think logically higher that taught by the CIRC learning methods at 3.5744. Further testing is then performed with the Scheffe test, the results showed significantly differences. It appears that students who have the ability to think logically higher learning methods taught by MM have scientific writing skills better than the ability to think logically high with CIRC learning methods.
- c. The differences of writing scientific work skills between students who taught by using CIRC method and students who taught by using PBL method on Student Learning Method that has high logical thinking ability. Based on the descriptive analysis performed, the mean ability of the students in writing scientific papers which have high logical thinking skills that are taught with PBL teaching method at 3.3974. The mean value of the student's ability to write scientific work which have high logical thinking skills that are taught with methods of CIRC of 3.5744. The results of a further test using Scheffe test showed a significant difference. This suggests that students with high logical thinking skills that are taught with PBL learning method has the ability to write scientific papers are not the same as a student who has a high logical thinking skills that are taught with methods CIRC.
- d. The differences of writing scientific work skills between students who taught by using MM method and students who taught by using PBL method on student learning method which has low logical thinking ability. Based on the descriptive analysis performed, the mean ability of the students in writing scientific papers that have the ability to think logically low that taught by MM learning methods at 3.4064. The mean value of the student's ability to write scientific papers that have the ability to think

logically lower taught by the PBL method was 3.2250. The results of a further test using Scheffe test showed a significant difference. This suggests that students with low ability to think logically is taught by MM learning method has the ability to write scientific papers are not the same or higher with students who have the ability to think logically lower taught with PBL method.

- e. The differences of writing scientific work skills between students who taught by using MM method and students who taught by using CIRC method on student learning method which has low logical thinking ability. Based on the descriptive analysis performed, the mean ability of the students in writing scientific papers that have the ability to think logically low taught by MM learning methods at 3.4064. The mean value of the student's ability to write scientific papers that have low logical thinking skills that are taught by CIRC method is 3.3962. The results of a further test using Scheffe test showed a significant difference. This suggests that students with high logical thinking skills that are taught by MM learning method has the ability to write scientific works better than the students in writing scientific papers which have high logical thinking skills that are taught with methods CIRC.
- f. The differences of writing scientific work skills between students who taught by using CIRC method and students who taught by using PBL method on student learning method which has low logical thinking ability. Based on the descriptive analysis performed, the mean ability of the students in writing scientific papers that have the ability to think logically lower taught by PBL learning method is 3.2250. The mean value of the student's ability to write scientific papers that have logical thinking skills that are low taught by CIRC method at 3.3962. The results of a further test using Scheffe test showed a significant difference. This suggests that students who has ability to think logically low taught by PBL teaching method (a2b2) have the ability to write scientific works closely with CIRC students in writing scientific papers that have low logical thinking skills that are taught with methods.
- g. The differences of Scientific Writing Skills between students who have the ability to think logically High and Students Who Have Low Logical Thinking Ability on MM Learning Method. Based on the descriptive analysis performed, the mean value of scientific work on the writing skills of students who have the ability to think logically higher taught by learning MM methods at 3.5668. The mean value of scientific work on the writing skills of students who have the ability to think logically low taught by MM learning methods at 3.4064. Further testing is then performed to test the Independent Sample T-test, to test for differences in the average, the results showed a significant difference. It appears that students who have the ability to think logically higher learning methods taught by MM have scientific writing skills better than the ability to think logically lower the MM learning method.
- h. The differences of scientific writing skills between students who have the ability to think logically high and Students who have the ability to think logically lower the PBL learning methods. Based on descriptive analysis performed, the mean value of scientific work on the writing skills of students who have the ability to think logically higher taught by PBL learning methods mean value of 3.3974 scientific work on the writing skills of students who have the ability to think logically higher taught by learning PBL methods at 3.2250 Further testing is then performed to test the Independent Sample T-test to test for differences in the average, the results showed a

significantly difference. It appears that students who have high logical thinking ability taught by PBL learning methods have scientific writing skills better than the ability to think logically lower with PBL teaching method.

- i. Scientific Writing Skills Among Students with High and logical thinking skills that students have the ability to think logically lower the CIRC learning methods. Based on descriptive analysis performed, the mean value of scientific work on the writing skills of students who have the ability to think logically higher learning methods taught by the CIRC at 3.5744. The mean value of scientific work on the writing skills of students who have low logical thinking skills taught by CIRC learning methods is 3.3962. Further testing is then performed to test the Independent Sample T-test to test for differences in the average, the results showed a significantly difference. It appears that students who have the ability.

## CONCLUSION

There is a difference to write papers between the writing skills of students who studied a MM learning methods with a group of students who studied PBL teaching method. The difference in the form of a paper writing skills of learned students with a group of MM learning method better than learning with PBL teaching method, whereas the MM and CIRC learning methods are just as good. There are different skill groups of students to write papers that have the ability to think good logically with a group of students who have the ability to think logically is not good. The difference in the form of a paper writing skills of student groups that have good logical thinking ability is better than the group of students who have the ability to think logically is not good. There is an interaction between the kinds of using the learning methods and logical thinking ability for influencing skills writing papers. This interaction can be described below. In the writing papers learning skills of students that have the ability to think logically good or less good, MM and CIRC learning method is better than the PBL learning methods.

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