THE EFFECTIVENESS IMPLEMENTATION OF STUDENTS' WORKSHEETS BASED ON METACOGNITIVE STRATEGY IN MATERIALS OF HUMAN INHERITANCE TO TRAIN THE ABILITY OF STUDENTS' METACOMPREHENSION

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Abstract

Students are at an abstract level of operation requiring cognitive ability to solve the problem of character inheritance. The construction of knowledge according Core Competence in Curriculum 2013 is metacognitive. Teacher monitors the students to be confident in solving problems, being able to compare knowledge, as well as write comprehension scores including the process of practicing metacomprehension ability. The study aims to describe the effectiveness implementation of students'worksheets based on metacognitive strategies in terms of implementation, activities, learning outcomes related to students'metacomprehension ability, and student responses. This research is a pre-experiment design with the study design using One Group pre-test and post-test. The research conducted in the Department of Biology, Faculty of Mathematics and Natural Sciences, Univeristas Negeri Surabaya, and then tested in SMA Negeri 1 Lamongan. Completeness of learning outcomes by using metacognitive students'worksheets paired T-test calculations in class XII MIA 4 of -43.570 and XII MIA 5 -46.643 otherwise there is a difference and increasing of learning outcomes between pre-test and post-test because significant value $P < 0.05$. Completeness metacomprehension score in class XII MIA 4 of 3.6 and XII MIA 5 of 3.43 with good enough category. It can be concluded that students' worksheets based on metacognitive strategies are effective applied to train students'metacomprehension ability.

Keywords: *metacomprehension, metacognitive, human inheritance.*

INTRODUCTION

The scientific approach has variants in the implementation of Curriculum 2013. One of its the implementation of learning strategies. Based on the content of Core Competencies involving metacognitive strategies in solving problems, it is necessary to apply the competence on all material one of the material inheritance of human nature. Students are required to know and analyze the concepts related to heredity using the pattern of inheritance mechanisms of human nature (Kemendikbud, 2013).

The concept of the mechanism of human inheritance is a concrete concept that complicated and complex. Students who are at an abstract level of operations require a great deal of cognitive ability to solve the problem of inheritance of human nature (Yasir, 2013). Based on the questionnaire of 30 students of class XII in SMA Negeri 1 Lamongan it is known that 89.7% of students consider the material inheritance character is complicated. As many as 76.3% of students consider the material of characteristic inheritance is the most difficult in the sub-section of human heredity. As many as 82.5% of students said that teachers are less explanatory of the material. Based on field observation, it is known that students' worksheets used has not made students easy to learn, and students' worksheets has not related with the concept of Core Competence in Curriculum 2013.

One of the learning strategies in the construction of knowledge and appropriate Core Competencies in Curriculum 2013 is metacognitive. Metacognitive can make students aware of the concept of the material learned, or the students develop executive control in learning (Baker, 2003). In order to achieve the objectives of 3rd Core Competencies in Curriculum 2013, it is necessary to apply metacognitive learning strategy, that is, teachers give students the opportunity to think, design, analyze, solve problems, know what to do after conscious error, monitor, and evaluate. Students are aware and confident in their answers and able to evaluate knowledge is the process of training the ability of metacomprehension (Blakey and Spence, 1990).

As the Yasir (2013) reported that students' worksheets based metacognif strategy is proper

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theoretically 91%, proper empirically based on completeness indicator result of learning in the amount of 99.31%. There needs to be improvement in metacognitive students' worksheets with the adjustment of Curriculum 2013 by prioritizing cognitive knowledge and metacomprehension capability.

An innovative learning tool and students' worksheets based on this metacognitive strategy which aims to train the ability of metacomprehension in accordance with the core competencies in Curriculum 2013. Based on the previous research, it is necessary to apply students' worksheets based on metacognitive learning strategy to the material of desirable characteristic in class XII SMA Negeri 1 Lamongan. Student Activity Sheet used is students' worksheets developed by Yasir (2013). Implementation of students' worksheets based on metacognitive strategy is expected to be effective and able to train the ability of metacomprehension of class XII students. This study aims to describe the effectiveness of students' worksheets implementation based on metacognitive strategies in terms of learning outcomes related to students' metacomprehension ability.

METHOD

This type of research is a pre-experiment design with study design using One Group pre-test and post-test because it is not used control class as a comparison (Arikunto, 2010). The results obtained in the form of learning outcomes in the form of cognitive products and the ability of students'

metacomprehension. The research was conducted in the Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya (UNESA) and then applied to two real classes namely class XII MIA 4 and XII MIA 5 with 30 students each done in SMAN 1 Lamongan. The study was conducted from February to March 2017.

The research instrument used were (1) Sheet assessment of learning outcomes in the form of cognitive ability in the pre-test and post-test, (2) Self understanding comprehension sheet in the form of students' metacomprehension ability. Data collection techniques used students' worksheets of metacomprehension ability. The ability to assess students' metacomprehension includes: 1) the ability to determine the level of confidence of their answer; 2) the ability to compare concepts; and 3) ability to determine score.

RESULT AND DISCUSSION

The results of the research by applying students' worksheets characteristic inheritance based on metacognitive strategies have obtained data on student learning outcomes, and students' metacomprehension ability.

Students' learning outcomes in the *pre-test* and *post-test* were analyzed based on the passes grade implemented by the school. Students are said to be complete passes out if the score reached ≥ 75.

Remark:
    ■ : Meeting 1   ■ : Meeting 2
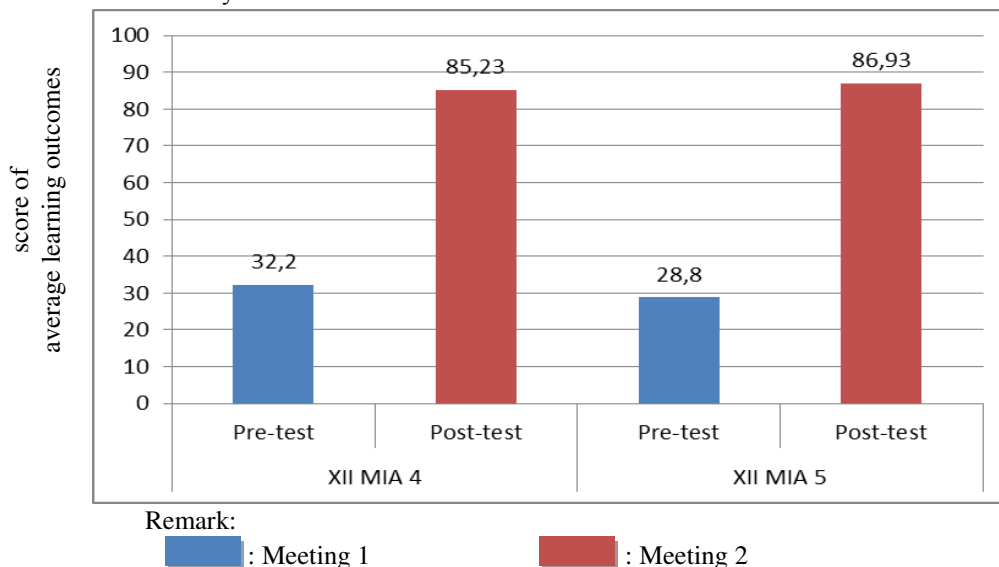
Graph 1. Average Learning Outcomes of Pre-test and Post-Test of Students Class XII MIA 4 and XII MIA 5

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Students in class XII MIA 4 and XII MIA 5 have been declared thoroughly towards the learning outcomes, because there is an increase in passes grade learning outcomes during pre-test to post-test. It is known in Graph 1 the average result of post-test value in class XII MIA 4 is 85.23 whereas XII MIA 5 is 86.93 which resulted in complete category in learning result. The improvement of students 'learning outcomes from *pre-test* to *post-test* is due to treatment by applying students' worksheets based on metacognitive to train students' metacomprehension ability on inheritance material of human nature which held in class XII MIA 4 and XII MIA 5.

Improvement of student learning outcomes from *pre-test* to *post-test* is caused by treatment applying students' worksheets based metacognitive to train students' metacomprehension ability on inheritance material of human nature which held in class XII MIA 4 and XII MIA 5. Data analysis using different test of t paired test to know whether there are differences in learning outcomes between before and after the implementation of students' worksheets based metacognitive strategies on the material inheritance character to train students' metacomprehension skills. This test is done by comparing significant value count with significant level (α) = 0,05.

Table 1. T-Test Paired *Kolmogorov-Smirnov* on SPSS program version 16.0 in class XII MIA 4 and XII MIA 5

Class	t Paired Test	P	Remark
Class of XII MIA 4 Pretest-Postest	-43.570	0.000	There is a difference
Class of XII MIA 5 Pretest-Postest	-46.643	0.000	There is a difference

Based on these statistical analysis, H_0 rejected, it means the average results of *pre-test* and *post-test* students expressed differently or it were proved of effectiveness of the implementation students' worksheets based metacognitive strategy on the characteristic inheritance material to train students' *metacomprehension* ability in terms of student learning outcomes In Class XII Class MIA 4 and Class XII Class MIA 5. The values of student learning outcomes affect the achievement of predetermined indicators. Achievement of indicators based on completeness on *pre-test* and *post-test* results.

Table 2. Completeness of Indicators in Class XII MIA 4 and Class XII MIA 5

No.	Indicator	XII MIA 4 Completeness (%)		XII MIA 5 Completeness (%)	
		Pre-test	Post-test	Pre-test	Post-test
1.	Distinguish blood type ABO system characteristics based on phenotype, genotype, and antygen on the red blood cell membrane and serum antibodies.	6.67	100.00	6.67	100.00
2.	Distinguish the MN blood type characteristics based on phenotype, genotype, membrane glycophorin type, and reaction with anti-M and anti-N.	10.00	93.33	10.00	93.33
3.	Distinguish blood type characteristics Rh (rhesus) system based on Rh type, genotype, and reaction with anti-serum Rh.	10.00	93.33	10.00	93.33
4.	Create a chart of the cross-blood system classification between ABO, MN, and Rh.	10.00	96.67	10.00	96.67
5.	Mention human genetic disorders and diseases by causes.	10.00	100.00	10.00	100.00

No.	Indicator	XII MIA 4 Completeness (%)		XII MIA 5 Completeness (%)	
		Pre-test	Post-test	Pre-test	Post-test
6.	Give examples of genetic disorders and diseases in humans based on their causes.	10.00	100.00	10.00	100.00
7.	Creating a chart of crosses and human genetic disorders based on the causes.	13.33	100.00	13.33	93.33
8.	Determine the number of individuals F1 produced in cross-breeding and genetic diseases in humans by causes.	13.33	93.33	13.33	93.33
9.	Determine the comparison of genotype and phenotype F1 on the crossing of human genetic disorders and diseases by causes.	13.33	100.00	13.33	100.00
	Average of completeness indicator	**10.74**	**97.41**	**10.74**	**96.67**

Remark:

Percentage of average completeness ≤ 65%: Not Complete

Percentage of average completeness ≥ 65%: Completed

Based on interpretation of Likert scale percentage, it is known that in all indicators *pre-test* is not good with the average completeness of indicator in class XII MIA 4 is 10.74% and XII MIA 5 is 10.74%. After the implementation of LKS based on metacognitive strategy on inheritance material, there is an improvement of indicator that can be known through post-test presented in Table 7. Based on Table 7. The average completeness of indicators in class XII MIA 4 is 97.41% and XII MIA 5 is 96.67% with the category of all indicators stated very well (Riduwan, 2007).

The ability to assess students' self-understanding (metacomprehension) includes: 1) the ability to determine the level of confidence of their answer; 2) the ability to compare concepts; and 3) ability to determine score.

Table 3. Recapitulation of Metacomprehension Ability in Class XII MIA 4 and XII MIA 5

Metacomprehensions' score	XII MIA 4				XII MIA 5			
	Worksheet I		Worksheet II		Worksheet I		Worksheet II	
	Σ students	%	Σ students	%	Σ students	%	Σ students	%
1 (Bad)	0	0	0	0	0	0	0	0
2 (Not Good)	7	23.33	2	6.67	6	20	2	6.67
3 (Good Enough)	8	26.67	8	26.67	14	46.67	13	43.33
4 (Good)	15	50	20	66.67	10	33.33	15	50
Total	**30**	**100**	**30**	**100**	**30**	**100**	**30**	**100**
Average	**3.27**	**Good Enough**	**3.6**	**Good Enough**	**3.13**	**Good Enough**	**3.43**	**Good Enough**
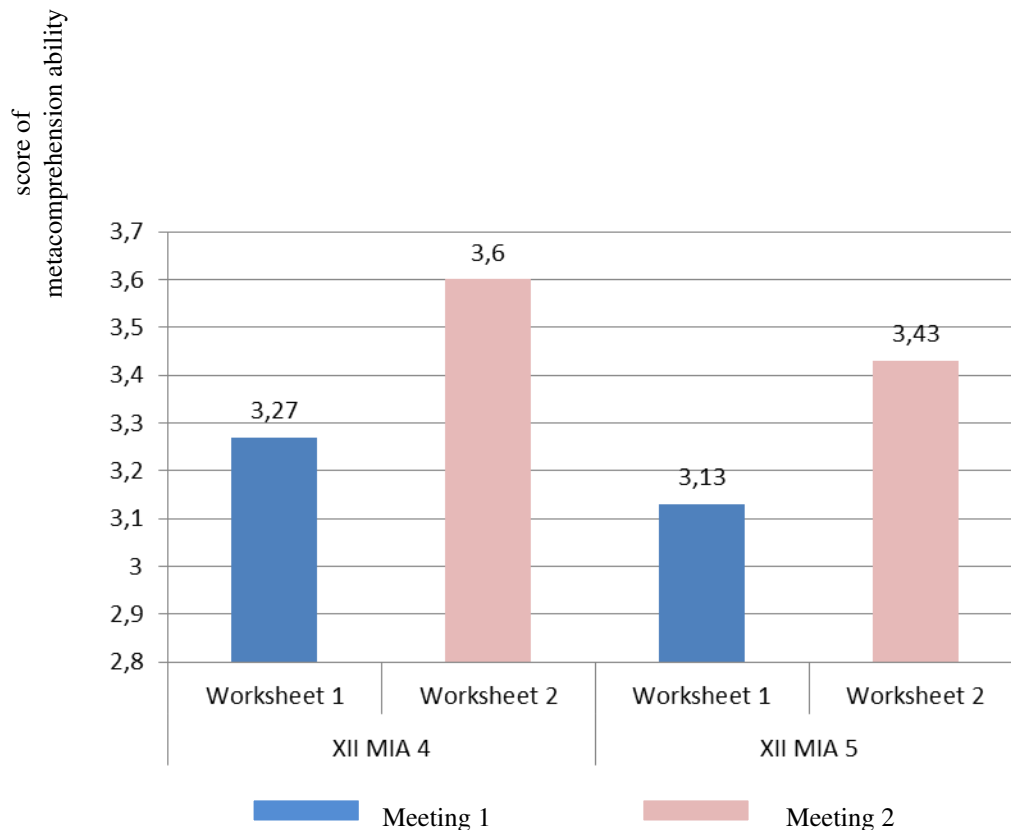
Graph 2. Completeness of Student Metacomprehension Abilities
Class XII MIA 4 and XII MIA 5

Teacher guides students in conducting learning activities based on metacognitive strategies in the form of writing beliefs on answers on individual LKS, comparing the initial concept with the correct concept on group LKS, and write a score on the answer. The teacher guides the students from the beginning of working on individual LKS and guiding students in working group LKS, as well as students listen to teacher explanations when justifying the initial concept of students.

The ability of students' metacomprehension in class XII MIA 4 and XII MIA 5 has increased. This is seen on average in class XII MIA 4 from 3.27 in LKS I to 3.6 in LKS II, while XII MIA 5 from 3.13 in LKS I to 3.43 in LKS II. Both classes have a pretty good category, due to an increase and almost close to good. This is helpful when students compare concepts and determine scores, but students find it difficult to define beliefs about the correctness of answers. Student learning outcomes declared complete with the provisions of knowledge competence and metacomprehension skills with KKM is $\geq$ 75 for knowledge competence, and metacomprehension competence score $\geq$ 3 with good enough category with 2 points completeness. The ability of metacomprehension on the component provisions belief and compare the concepts expressed when the acquisition score of $\geq$ 65, while the ability to write the score declared complete if the difference in student scores with teacher scores between 0 - 10. A good understanding because students' process to finding the concept independently and something earned in this way will be longer remembered (Standioford, 1984).

Osborne (1999) states that intelligent students tend to use more metacognitive strategies than students who are less intelligent. Students who have a formal level of thinking, in these case students have more ability, and students are able to use high thinking skills. Different with students who have a level of concrete thinking, in this case students have low ability. The student can change his bad habits, if after being reminded repeatedly by the teacher. Teachers instill understanding so that students can learn to believe in something that is true and willing to realize mistakes if there is a different understanding. This strategy can help students realize wrong concept and improve them by asking self-questions (Peirce, 2003 and Baker, 2003).

The ability to determine the score on the answers made by the students themselves continuously increased from the first of students' worksheets to second of students' worksheets. Even the component of the ability to determine this score is best when compared with other metacomprehension capabilities. This is because students have been told how to determine the score on each number according to learning objectives (Roebers, et al. 2010). Only the students on the ability to determine the score more see the value of KKM, some students try to write the score above the KKM value. Students are taught by their teachers to evaluate and assess students' work on other materials. Students are also trained honestly in giving a score to the truth of their own answers with reference to the determination of the scores read by the teacher. This honesty becomes the basis of one's thinking skills because if based on good morals will provide many benefits for life (Susantini, 2004). The average student has difficulty in determining the belief in the truth of the answer at the first meeting because at the first meeting discussed is the blood type material, the students get the blood type material only the ABO system, while the MN system and Rhesus system is never obtained, so students are less sure of the answer, however at the second meeting the students experienced an increase in determining the belief in truth answer because students previously learned in advance about the material diseases and abnormalities in the inheritance of human nature. Teacher reiterates the nature of inheritance by linking some of the phenomena concerning the different types of ABO, MN, and Rh blood marriages, and the marriage that one of the individuals attaches to the disease declines to deepen the students' knowledge.

The concepts studied on the material inheritance of human nature in the form of abstract material, students are abstract level of operation with the ability to think critical. This is inversely proportional to student learning requires a lot of cognitive skills, so it takes the level of concrete thinking to solve the problem of inheritance of human nature (Cavallo in Susantini, 2004). Because the abstract concept can not be perceived, students who do not have a formal thinking pattern have great mental difficulties in demonstrating abstract and complex operations on the material inheritance of human nature (Sudjana, 2005). Though this ability could develop the ability of students to monitor the level of understanding and the thinking process of students to given information (Blakey and Spence, 1990).

Supported from the research results of Solichah (2013) note that the low value of students did not make the ability of students metacomprehension to be low 100%. Students declared not complete not when working on worksheet, but students are not complete in determining the score of students' metacomprehension. Similarly, the level of confidence, students are expressed to have good metacomprehension if the student can recognize the answer itself is true, or wrong. So it is concluded that the ability of metacomprehension students to train students to be more confident in recognizing the understanding of the subject matter. The advantages of learning metacognitive strategies are students active in learning activities, and students are able to determine their ability to compare initial concepts of understanding with actual concepts, in addition to train students' honesty and confidence in solving problems in learning activities.

The ability of classical students' metacomprehension, either determines the level of confidence, compare the concept, and determine the score has increased. This shows that students are able to assess self-understanding (metacomprehension). Students already know the nature of learning and how to learn according to ability and level of student thinking.

CONCLUSION

The ability of students' metacomprehension in class XII MIA 4 and XII MIA 5 has increased. This is seen on average in class XII MIA 4 from 3,27 in LKS I to 3,6 in LKS II, while XII MIA 5 from 3,13 in LKS I to 3,43 in LKS II. Both classes have a pretty good category, due to an increase and almost close to good. It has been produced by using students' worksheets based on metacognitive strategy on the material of inheritance of human nature effectively applied to train the ability of students' metacomprehension of SMA Negeri 1 Lamongan which viewed from the student learning result include cognitive process and metacomprehension ability.

SUGGESTION

Need to learning by using LKS based on metacognitive strategy on the material of inheritance of human nature to train students' metacomprehension ability needs to be applied to other material.

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