APPLICATION OF LEARNING CYCLE MODEL (5E) LEARNING WITH CHART VARIATION TOWARDSTUDENTS' CREATIVITY

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ABSTRACT

This study aims to determine the differences in the application of the model LC (5E) with a technique variation (interrelationship diagram / ID and affinity diagrams / AD) of two classes of different school (XIPA-8 class of SMAN 3 Surakarta and class XIPA-6 of SMAN 3 Boyolali), toward the increase of students' creativity. This research is a qualitative descriptive study. The results of this study, we can conclude that the application of the model LC (5E) with a technique variation at two schools can improve students' creativity despite different levels of improvement

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Keywords: LC models (5E); interrelationship diagram (ID) and affinity diagram (AD); creativity

INTRODUCTION

There are four components of basic skill that must be possessed by every personon the 21st century, they are: communication, collaboration, critical thinking& problem solving, and creativity & innovation. Thoserequirementsare relevant with the content of the National Education Regulation No. 20 of 2003, that national education serves to develop skills and shape good character and dignified civilization in the context of nurturing people's intelligence; aimsto develop students' potentials while having faith to The Almighty;shape noble, healthy, knowledgeable, capable , creative, and independent citizens; andeducate them to bedemocratic and responsible people. Learning should be aimed to create an atmosphere of active, critical, analytical, and creative in solving problems through the development of thinking skills. Creativity becomes strategic to be procured to the learners, as it is closely linked to the ability of divergent thinking; it is the ability of a person to put forward new ideas or apply

existing concepts into new and different situations. Therefore creativity becomes the basis of one's success in competition, which is why ideally (biology) learning should be directed to the development of learners' potential, especially the creative ability.

According to Sternberg and Lubart (1999), creative individuals have what so-called a "synthetic ability" to determine idea / ideas which deserve to be followed and which do not, and the ability to convince others that their ideas are valuable. Marzano (2004) says that in order to be creative, one must review the idea from another point of view. According to Nickerson (2000), a thought will be counted as creative if it is original for the person who made it, not shared by many people and it isnice to be thought.

In general it seems the creativity of learners is still not optimal. The low success rate of Indonesian students in science competition on international forums indicates that aspects of the creativity of learners still need to be improved. Based on data from the Programme for International Student Assessment / PISA in 2012, Indonesia was ranked 64 out of 65 participating countries. While based on the Trends in

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International Mathematics and Science Studies / TIMMS In 2011, Indonesia was ranked 40 out of 45 participating countries (Center for Research and Education Assessment Kemendikbud, 2011). This is worsened by the results of tests that students' creativity is low at 43.56 (<50%).

Based on this, the empowerment of student creativity needs to be pursued in biology learning primarily through the application of constructive models so that students are able to encourage students to construct knowledge independently and sustainably. Based on above description, it needs to be conducteda research related to the increase ofstudents' creativity through the application of the model LC (5E) accompanied by a variety of techniques.

Model LC (5E) is one of the constructivist-based learning model with the characteristics of their stages of systematic and sustained activity (cyclical) includes five phases: engagement, exploration, explanation, elaboration, evaluation (Renner, Abraham and Brinie, 1988; Kurnazz, 2008). The stages in this model will allow students to play an active role in mastering certain competencies. Model LC (5E) has advantages including: 1) student-centered learning; 2) more meaningful learning activities; 3) avoid memorizing; 4) allows students to assimilate and accommodate knowledge through problem solving and information obtained; 5) encourage students to be active, critical, and creative. This is supported by the results of studies that prove the efficacy of the model LC (5E) in improving various aspects of learning such as learning outcomes, motivation to learn, the meaningfulness of learning, broaden their horizons and creativity (Widyaningsih, 2010). However, the application of the model LC (5E) in learning still encountersseveral obstacles. This indicates that besides having advantages, the model LC (5E) surely has its disadvantages. Based on interviews and analysis of various studies relating to the application of the model LC (5E) at the final project (Final Project and Thesis), indicates that the application of the model LC (5E), especially in the exploration phase of the teachers tend to have problems in tapping students' prior knowledge, whereas in explanation phase students tend to have problems when asked to pour their ideas through explanation. Precaution against these obstacles can be done through the use of various techniques that can ease students to link between concepts, simplify the presentation of an argument, optimize brainstorming so that the concept is more systematic, so that the students' ability to construct knowledge can be assured of its sustainability.

The diagram is one of the techniques that can be presented as a companion in the application of a learning model. There are various types of diagrams with different characteristics and can be used in accordance with the learning needs including: why whyanalysis diagram, multi vary analysis diagrams, cause and effect diagram, interrelationship diagrams, affinity diagrams, etc. The existence of the diagram is intended as a guide for students toconnectseveral concepts as a mean to map the interaction of various factors, and it generally involves important issues. According to Duggett (2004) interrelationship diagram / ID has several characteristics: 1) the existence of information collected from various sources to find the root of the problem; 2) use short phrases or sentences as opposed to isolated words; 3) drawing a diagram with the obtained keyword group; 4) draw some diagrams with identified intentsseparately. ID has several advantages such as: 1) a presentation simplifier tool of reasoning arguments for the problem as well as the expected effect whenthe solutions to problems are implemented; 2) encourage or assist in a wide range of alternative causes of the problems and solutions that will be carried out; 3) encourage students to think that the problems faced in the beginning was not a problem but a symptom of a problem, so the root of the problem must be sought by using factual data; 4) train students to have multiple arguments and find many benefits of problem to be solved. Sample IDs can be seen in Figure 1.

Affinity diagram (AD) is a visual tool that allows individuals or groups to classify ideas or problem into a category for further analysis. AD serves to collect verbal data (idea / ideas, statements, etc.) related to the topic of the problem and classify those ideas based on the basic group, so as to better focus on the subjectbeing discussed. AD have the following characteristics: 1) articulation of question (determination of issues); 2) brainstorming to generate ideas / ideas; 3) grouping idea / ideas; 4) manufacturing subtitle (header) to prioritize the idea of the group. The benefit of AD are: 1) encourage students to think in two dimensions so that they can easily map their idea / ideas since they understand the relationship between the concept; 2) optimize the construction of brainstorming in order to obtain systematic concept; 3) optimize the work of the right hemisphere as a center of creativity and emotion, as opposed to the the logic of causality; 4) every idea / notion of group members are respected and accommodated openly (Wiedarti 2005). Example AD in detail presented in Figure

2.

Creativity in the Indonesian Dictionary is defined as the ability to create. According to Hurlock &Sperling (in Purwanto, 2008) parallel creativity with divergent thinking that is capable of generating response of a single problem in vario-us ways. Divergent thinking skills of person refers to an ability to express new ideas or applying existing concepts into new and different situations. Creativity is an activity that brings results that have some properties of novelty, usefulness, comprehensible. Another meaning of creativity is the
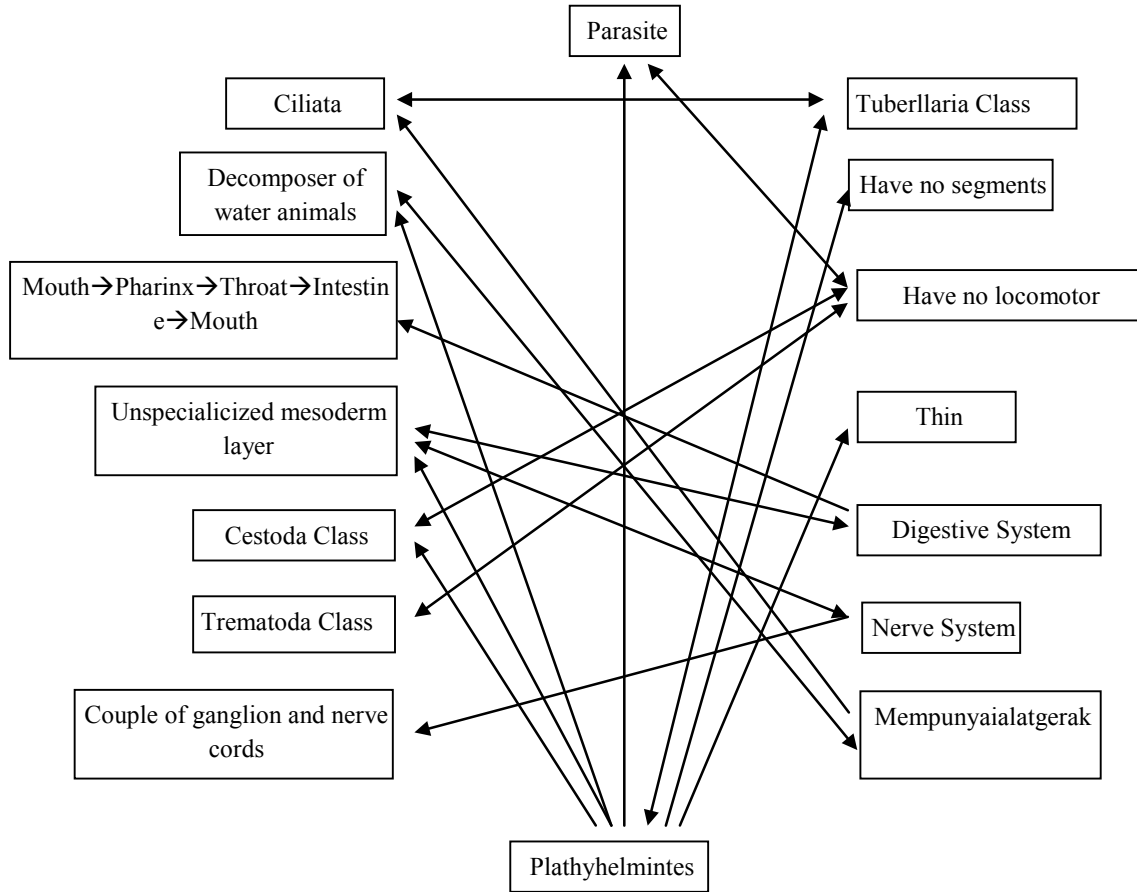
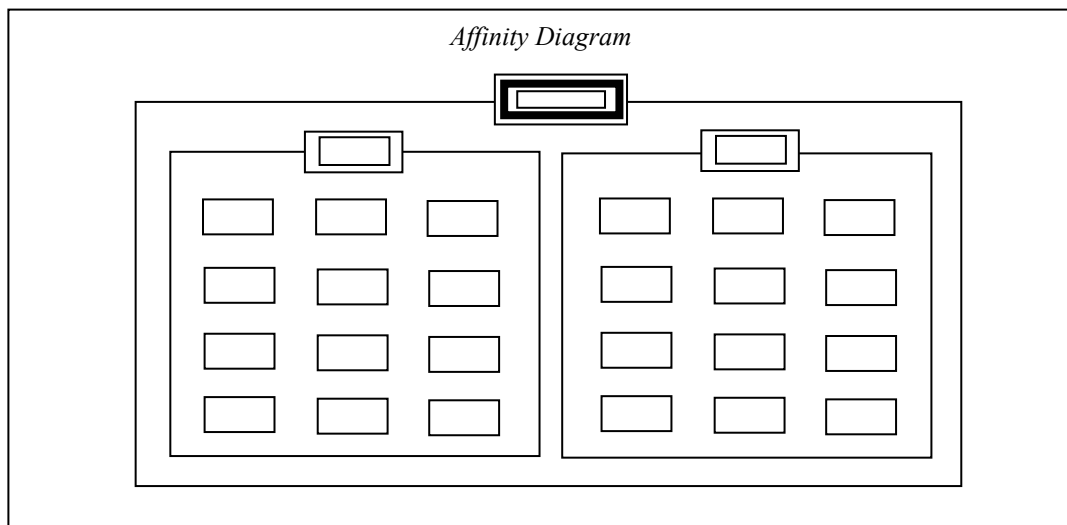**Figure 1.** Example of Interrelation Diagram (Duggett, 2004)

Figure 2. Example of Affinity Diagram (Duffy, 2012)

willingness to create new combinations based on the data, information or elements that exist, the ability of finding many possible answers which emphasis on quantity, efficiency, and diversity of answers to a problem based on the data or information available that reflect the four elements include : 1) Fluency (smoothness), the ability to deliver the idea to solve the problem quickly (smoothly); 2) flexibility, the ability to produce a wide variety of ideas to solve problems outside the usual categories (alternative solutions); 3) Originality (authenticity), the ability to provide outstanding response that comes from himself; 4) elaboration, the ability to express ideas in detail to implement the idea into reality and comprehensible for others. Creativity does not only cover 5 aspects, but there are two other aspects, first is redefinition, the ability to define or interpret certain terms; and second is penetration, the ability to use his/her ideas as the main solution of certain problem. According to Krulik& Rudnick (1996: 2), creativity is the ability to do high-level thinking. Based on the systems, creativity belongs to high-level thinking skillswhich topped the ability to think as shown in Figure 3.
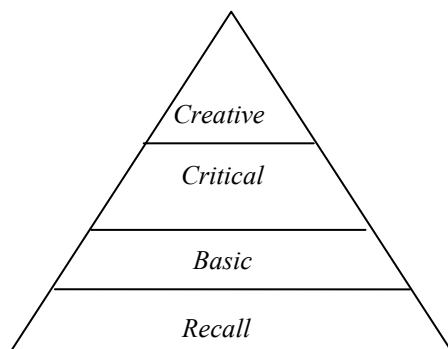

Figure 3. Systems of Thinking (Krulik& Rudnick, 1996)

Judging from the complex aspects of creativity, empowering students' creativity is not an easy thing to do. However, since creativity is the basis of the one's success in competing with others, ideally learning (biology) which aimed at developing the potential of learners especiallytheir creativity needs to be pursued. Thus, the presence of variation diagrams (interrelationship and affinity diagrams) in the application of the model LC (5E) is intended to assist students in finding the connection between concepts, simplifying the argument, encouraging brainstorming optimally, so that their constructed conceptswill be more systematic and sustainable, and student creativity can be developed.

METHOD

This study aims to determine the differences in the application of the model LC (5E) with a variety of techniques (interrelationship diagram / ID and affinity diagrams / AD) in two classes at different school (XIPA-8 class of SMAN 3 Surakarta and XIPA-6 class of SMAN 3Boyolali) to increase students' creativity. This research is a qualitative descriptive study involving 64 students. Creativity data is measured using test which covers four aspects: fluency (fluency), flexibility (flexibility), authenticity (originality), and elaboration (elaboration). The supporting data during the learning process are obtained using non-test technique: observation sheets, questionnaires, and documentation. Data were analyzed using descriptive-qualitative method. Data analysis was performed based on the results of action research in the classroom at 2 schools and presented descriptively. The action researchwill be conducted in several cycles, where each cycle includes three phases of activities (planning, implementing& observation, reflection) with a target of an increase in each aspect of student creativity (fluency, flexibility, originality, elaboration) resulted at 20% score.

RESULT AND DISCUSSION

The results of action research in 3 cycles (Pre-Cycle, Cycle I, II, III) at SMA Negeri 3 Surakarta presented in Table 1 and 2, also Figure 4.

The data in Table 1 illustrates the results of action research during the learning process which includes: Pre-Cycle, Cycle I, Cycle II, Cycle III and the results of observations at each stage consisted of: planning, implementation / observation, and reflection at SMA Negeri 3 Surakarta. Judging from the qualitative aspect, the data obtained showed a gradual increase in the quality of learning that is characterized by a decrease in the number of findings which indicate that the enforceability of the syntax in the application of both models were smoother and both teachers and students no longer had any problems in applying the model LC (5E) + ID at SMA Negeri 3 Surakarta. The data in Table 2 and Figure 4 shows that there has been a gradual increase in learning that is characterized by an increase in the average value of the achievements of students'creativity started from Pre-Cycle, Cycle I, Cycle II, Cycle III up to the target of every aspect of creativity reaching a minimum amount of 20% and then the treatment was stopped or discontinuation of the research. Action research results for 3 cycles (Pre-Cycle,

Cycle I, II, III) at SMAN 3 Boyolali are presented
in Table 3, Table 4 and Figure 5.

Table 1. Findings onPlanning, Implementation, and Reflection phases in the FirstCycle, the Second-Cycle, and the Third Cycle in SMAN 3 Surakarta

Cycle	Planning Phase	Implementation / Observation Phase	Reflection Phase
Cycle I	• Collaborated with teachers to determine actions based on the identification of problems in the class related with action research, lack ofcreativity of the students, LC model (5E) + ID, material. • Collaboration of teacher, researcher, advisor to prepare learning strategy with teacher using appropriate plan of action, preparation of equipment / material • Coordination between the teacher, researcher, observer, students related to the implementation model of LC (5E) + ID in learning	• Teacher shortage of time and difficulties in managing learning • Observers' difficulty in making observations and overwhelmed in response to student questions • Students experienced confusion in the application of the ID.	• Improvedthe lesson plan on the time allocation. • Need to increase the number of observers and give numbers on the table of students. • Teachers gave explanations before the application of ID.
Cycle II	• Collaborated with teachers to improve the lesson plan the distribution of time allocation. • Addedan observer and numbering the tables. • Reminded the teacher to explain the students prior to the application of EN.	• The numbers on each table tended to disrupt the students' activities in group work and confusing the observer when observing each student. • Learning activities seemed in a hurry because time allocation was still lacking, teachers had not been able to manage time well based on lesson plan	• Improve the lesson plan in the distribution of the time allocation as needed. • Modification of numbersto be put on their sleeves. • Teachers needed to manage time more carefully
Cycle III	• Collaboration with teachers toimprove on the distribution of time allocation of lesson plan. • Provision of numbers on each student'ssleeve. • Reminded the teacher to be able to manage time more carefully	• Teachers can conduct lesson in thealotted time according to lesson plan. • Observers had no difficulty in assessing / observing students • Learning could run smoothly and on time. • Students seemed happy and focus on the learning process to the end.	• -

Table 2. Students' Creativity Scorein Pre-Cycle, Cycle I, Cycle II, Cycle III in SMAN 3 Surakarta

Num-ber	Creativity Aspects	Pre-Cycle	Gain (%)	Cycle I	Gain (%)	Cycle II	Gain (%)	Cycle III	Total-Gain (%)
1.	Fluency	84,37	5,95	90,32	6,34	96,66	3,34	100	15,63*
2.	Flexibility	50,00	14,52	64,52	11,34	75,86	17,89	93,75	43,75
3.	Authenticity (*originality*)	31,25	17,14	48,39	20,58	68,97	12,28	81,25	51,00
4.	Elaboration	18,75	29,64	48,39	17,24	65,63	21,87	87,50	68,75
	Total		67,25		55,50		55,38		179,13
	Average								44,78

Table 3. Findings / Recommendations Phase Pencanaan, Implementation, Reflection In the first cycle, the second cycle, Cycle III in SMAN 3 Boyolali

Cycles	Planning Phase	Implementation / Observation hase	Reflection / Suggestion Phase
Cycle I	• Collaboration with teachers to determine the actions based on the identification of problems related with the class the action research would be held, the lack of creativity of the students, the model LC (5E) + ID, the material. • Collaboration between teacher, researcher, mentor teachers to prepare learning devices along with appropriate plan of action, preparation of equipment / material. • Coordination between the teacher, researcher, observer, students related to the implementation of LC (5E) + AD model in learning	• The teacher came late, so time lacking and enforceability of syntax seemed in haste • Group distributionwas less effective, thus the classroom became rowdy and learning time was not well managed. • The presentation by appointting one of the groups was less effective, students did not foucus nor pay attention on the learning. • The questions asked by teachers were less effective because it was delivered orally, thus not all studentsunderstoodand they did not respond well. • Not all group members engaged actively in the image observation, thus the results of psychomotor aspects learning were not optimal. • Group cooperation was less optimal, so that the affective aspects of learning results were not optimal. • Students were confusedto use AD.	• Improved the lesson plan in the distribution of the time allocation. • The division of the group had to be prepared previously. • Designated some groups for the presentations. • Questions on the elaboration phase might be delivered orally but it should have been supported by the visual display. • Teachers walked around to guide and monitor students in the observation phase. • Teachers had to provide a more detailed explanation before the application of AD

Cycles	Planning Phase	Implementation / Observation hase	Reflection / Suggestion Phase
Cycle II	• Collaborated with the teachers to improve the distribution of time allocation in lesson plan. • The presentation was carried out by appointing several groups. • The delivery of questions was done orally accompanied with the display of slides. • Teachers went around to guide and monitor students in the observation phase. • Reminded the teacher to explain to the students before the application of AD	• The teachers presented on time, but the preparation ofLCD took time. Consequently the implementation of studyand syntax were less optimal (in a hurry). • Although the number of the group presented the materials increased to 3 groups, it still seemed not effective because students still tended to be noisy and less focused on learning. • Time spent on the elaboration phase was too long, thus disturbing the allocation of time for other learning activities. • Learning activities seemed in a hurry because time allocation was still lacking, teachers had not been able to manage time learning based on lesson plan.	• Teachers need to prepare toolsearlier. • Teachers should ask all groups presented simultaneously using manila paper. • Teachers needed to use the time efficiently in elaboration phase. • Teachers needed to manage time more carefully.
Cycle III	• Reminded teachers to prepare themedia earlier. • Changed the way of the presentation by asking all groups to do presentations simultaneously using manila paper. • Reminded the teacher to use the time more efficiently in elaboration phase. • Reminded teachers to manage the alloted time more carefully.	• Teachers could implement the alloted time for lesson based on lesson plan. • Learning could run smoothly and on time. • Students seemed happy and focused on the learning process till the end.	• -

Table 4. Students' Creativity Scores in Pre-Cycle, Cycle I, Cycle II, Cycle III in SMAN 3 Boyolali

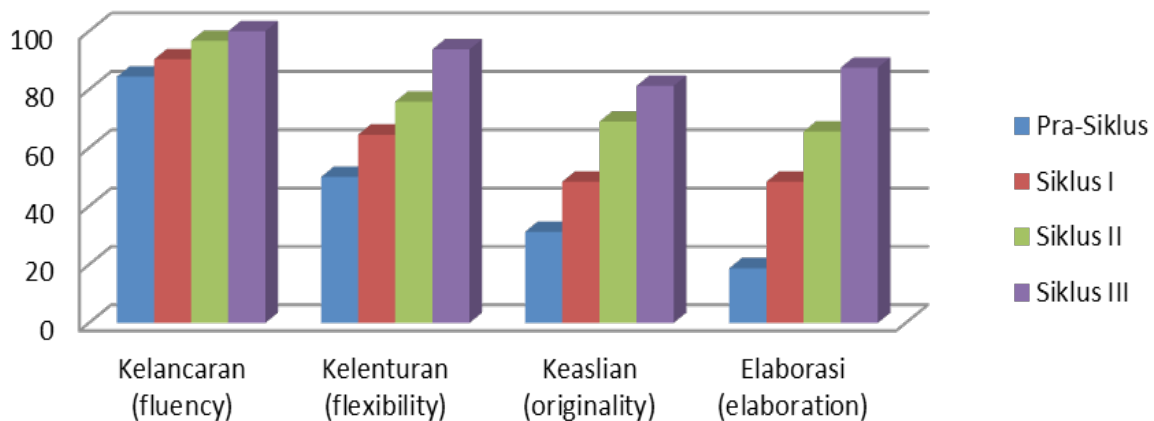| Num-ber	Creativity Aspects	Pre-Cycle	Gain (%)	Cycle I	Gain (%)	Cycle II	Gain (%)	Cycle III	Total Gain (%)
1.	Fluency	30,00	1,78	31,78	20,29	52,07	21,45	73,52	43,52
2.	Flexibility	22,22	0,18	22,40	18,62	41,02	7,42	48,44	26,22
3.	Authenticity (*originality*)	13,00	2,12	15,12	18,80	33,92	14,32	48,24	35,24
4.	Elaboration	11,11	1,50	12,61	8,87	21,48	11,53	33,01	21,90
	Total		5,58		66,58		54,72		126,88
	Average								31,72

Figure 4. The Score of Students' Creativity in Pre-Cycle, Cycle I, Cycle II, Cycle III in SMAN 3 Surakarta
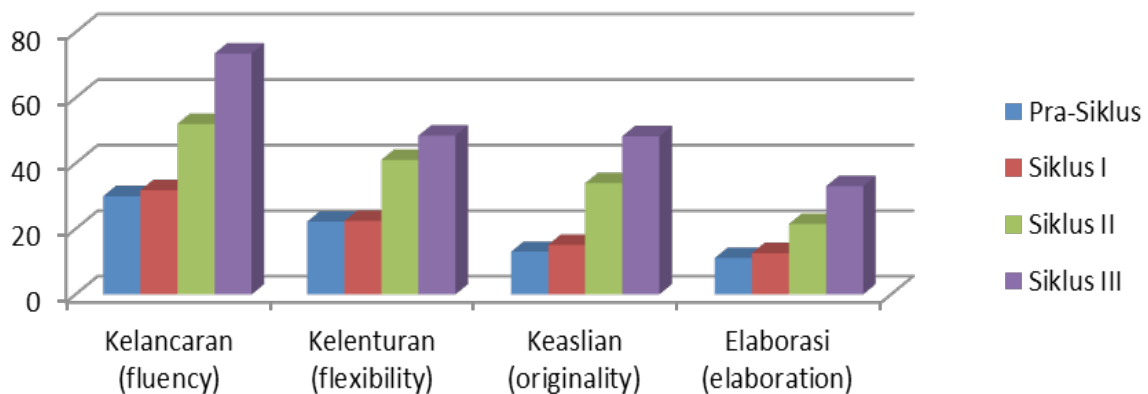

Figure 5. The Scores of Students' Creativity in Pre-Cycle, Cycle I, Cycle II, Cycle III in SMAN 3 Boyolali

The data in Table 3 illustrates the results of action research conducted during the learning process which includes: Pre-Cycle, Cycle I, Cycle II, Cycle III and the results of observations at each stage including: planning, implementation / observation, and reflection in SMAN 3 Boyolali. Judging from the qualitative aspect, the data obtained showed a gradual increase in the quality of learning that is characterized by a decrease in the number of findings which indicate that the enforceability of the syntax in the application of both models were smoother and both teachers and students no longer had any problems in applying the model LC (5E) + ID at SMA Negeri 3 Boyolali. The data in Table 4 and Figure 5 shows that there has been a gradual increase in learning that is

characterized by an increase in the average value of the achievements of students'creativity started from Pre-Cycle, Cycle I, Cycle II, Cycle III up to the target of every aspect of creativity reaching a minimum amount of 20% and then the treatment was stopped or discontinuation of the research. Data on differences in the scores of the students' creativity in Pre-Cycle, Cycle I, Cycle II, Cycle III between SMA Negeri 3 Surakarta and SMA Negeri 3 Boyolali in details are presented in Table 6 and Figure 6.

Based on the data in Table 6 and Figure 6, there is a very significant difference on the students' creativity in both schools. In Pre-Cycle (before the implementation), the average score of students' creativity of SMA Negeri 3 Surakarta in total or in each aspectwere generally higher than in SMAN 3 Boyolali. This means that if the review of the data, students in SMAN 3 Surakarta were more creative than students in SMAN 3 Boyolali. It can be seen from the total score of all aspects of creativity that students of SMA Negeri 3 Surakarta (184.37)were better than the students

of SMAN 3 Boyolali (76.33). Especially the originality aspect which is the main characteristic of creativity, students of SMAN 3 Surakarta scored (51.00) were a lot higher than in SMAN 3 Boyolali (13.00).

Judging from the amount of the increase in every aspect of creativity, in Cycle III in general, all aspects of creativity has reached the minimum target of 20%. In general, the totalscores forall aspects of creativity of students in SMAN 3 Surakarta (179.13) were higher than the students of SMAN 3 Boyolali (126.88). The high score of theaverage score increase in each aspect of creativity of students before and after the treatment showed that the application of the model LC (5E) + AD at SMA Negeri 3 Surakarta (44.78) was more significant than the application of the model LC (5E) + ID in SMA 3 Boyolali (31.72). In detail, the differences of increase in each aspect of creativity in both schools are as follows: 1) aspect of Fluency (15.63 / 43.52); aspect of flexibility (43.75 / 26.22); aspect of authenticity (51.00 / 35.24); aspectsof elaboration (68.75 /

Table 6. Difference of Students' Creativity Scores in Pre-Cycle, Cycle I, Cycle II, Cycle III SMA between SMA Negeri 3 Surakarta and SMA Negeri 3 Boyolali

Number	Cycles	ASPECTS							
		1		2		3		4	
		A	B	A	B	A	B	A	B
1.	Pre-Cycle	**84,37**	30,00	**50,00**	22,22	**31,25**	13,00	**18,75**	11,11
2.	Cycle I	**90,32**	31,78	**64,52**	22,40	**48,39**	15,12	**48,39**	12,61
3.	Cycle II	**96,66**	52,07	**75,86**	41,02	**68,97**	33,92	**65,63**	21,48
4.	Cycle III	100,00	73,52	**93,75**	48,44	**81,25**	48,24	**87,50**	33,01

Explanation
A = SMA Negeri 3 Surakarta
B = SMA 3 Boyolali
1 = Smoothness Aspect (fluency)   3 = Authenticity Aspect (originality)
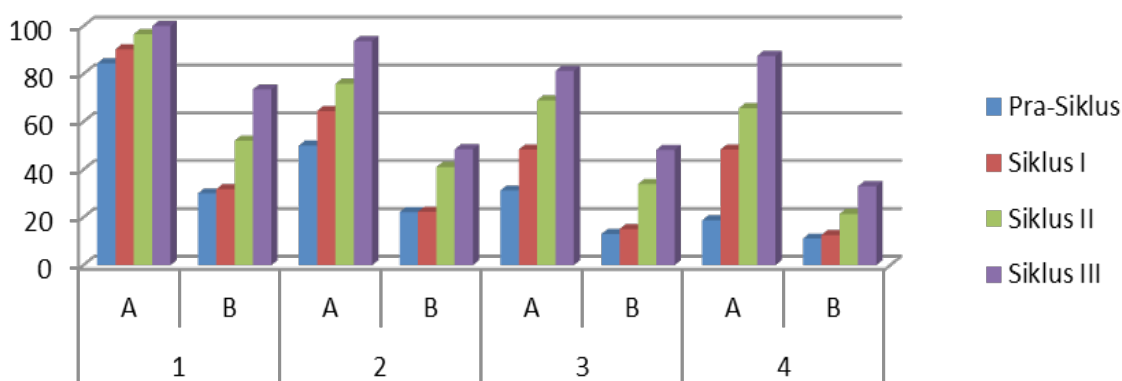2 = Flexibility Aspect   4 = Elaboration Aspect

Figure 6. Difference Value Creativity Students In Pre-Cycle, Cycle I, Cycle II, Cycle III SMA and SMA Negeri 3 Surakarta 3 Boyolali

21.90). The increase of fluency aspect in SMAN 3 Surakarta only reached 15.63% (<20%). This does not mean that research did not reach 20% target, but it happened because the results of creativity test on Pre-cycle was already high (84.37) of the maximum score of 100.

The low achievement of the average score of students' creativity in SMAN 3 Boyolali wascaused by several factors. First, in terms of geographical position, SMAN 3 Boyolaliis located in the district while SMA Negeri 3 Surakarta located in the heart of Surakarta city. This situation affects the differences of students' chances, especially the accessibilityof information and the availability of facilities and infrastructuresrelated withtechnology. Second, the environment between the city and the district is very different,for example the challenges, work ethic, as well as its competitive force. In the city, the challenges and availability of chances aremuch more than in the district. Those aforementioned factors are predicted to give big impact on students' creativity. Thus,social environment and geographical position affect the low achievement of the average creativity score of the students at SMAN 3 Boyolali.

The low creativity of students in SMAN 3 Boyolaliapparently also affectedthe enforceability of the LC (5E) + AD learning model as seen in Cycle I. Although the applications of the LC (5E) model with a variety of techniques in both classrooms on the first cycle were not smooth, but the quality and quantity constraints were obviously higher in SMAN 3 Boyolali. It is proven from the many findings from both teacher and students such as: lack of preparation (tool preparation), indiscipline (arriving late), the less effective strategy in guiding the group presentations, poor time management, inappropriate technique for delivering questions, unclear guidingthe groups, lack of motivation towardthe students to actively engage in learning, and the messy division of the group. On the contrary, the application of the model in SMAN 3 Surakarta had relatively less obstacles. The inadequaciesin the implementation of the model was solely technical for example related with the lack of the amount of observers and the effectiveness of the student numbering techniques. Judging from the level of adherence to the model syntax, the application in SMAN 3 Surakarta was relatively smoother than in SMAN 3 Boyolali. The obstacle in SMAN 3 Surakarta only relatedwith matter of adpatation because the teachers were not familiar with the model LC

(5E) + ID, so they needed more time to get used to the model. The time the teachers of SMAN 3 Surakarta consumed to adapt to the model (LC (5E) + ID) were relatively short (only at the beginning of the first cycle), as opposed to the teachers of SMAN 3 Boyolali (LC (5E) + AD) who took upto the end of the second cycle to adapt with the model.

The increase of creativity that were occured on both schools cannot be set apart from the advantages of thecharacteristics of LC (5E) model and the itsID / AD variation. Syntax models LC (5E) which includes: engagement, exploration, explanation, elaboration, evaluation as well as the technique ID / AD, allowthe students to actively engage in learning so that it becomes meaningful to students since they can understand the concepts better. This is supported by a wide range of similar research results which showed that the model LC (5E) can improve various aspects of student learning (Widyaningsih, 2010). The improvement of students' creativity related with the application of the LC (5E) model is also relevant to Ausubel's theory of meaningful learning (in Dahar, 2011) that meaningful learning is a process of linking new information with the relevant new concepts contained in the student's cognitive structure. Implementation of the model syntax LC (5E) + ID / AD by students in groups are heterogeneous, allowing them to sharethe knowledge between members of the group with diverse abilities. This is relevant to the social theory of Vygotsky who believes that social interaction enables students to absorb information from other group members to be usedinsolving problems.

CONCLUSION

Based on the results and discussion of the research, it can be concluded that: 1) The application of the LC (5E) model with a variety of techniques at those 2 schools can improve students' creativity despite different levels of improvement; 2) Details of the differences in the increase of average score of creativity in the research are: a) increase of the creativity score in the implementation of the LC (5E) + ID model of Pre-Cycle, Cycle I, Cycle II, Cycle III in SMAN 3 Surakarta is: 67 , 25 / 55.50 / 55.38; b) increase of the creativity score in the implementation of the LC (5E) + ID model of Pre-Cycle, Cycle I, Cycle II, Cycle III in SMAN 3 Boyolali is: 5.58 / 66.58 / 54.72.

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