The Influence Of Double Loop Problem Solving Learning Models to Senior High School Learners Spatial Thinking Ability

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Abstract

The purpose of this research is to know the influence of the using Double Loop Problem Solving (DLPS) learning models to Spatial thinking ability. This research is an experimental design. Data collected in this research consisted of interviews, field observations, and written test. Experimental research involves two classes of senior high school as a research subject, namely Social Class XI 5 as experimental class and Social Class XI 4 as control class. The results of this research showed the presence of gain score in experimental class and control class. Experiment class gain score is 15.8 while control class gain score is 9.5. There is a difference gain score between both of classes. Experimental class showed higher average of gain score. It can be noted that the use of models learning DLPS in learners give significant effects againts tha spasial thinking ability.

Keyword: Double Loop Problem Solving, Geography Learning Models, Spatial Thinking Ability.

Introduction

Updates in the world of education are an action that has the goal to improve the quality of Human resources. Updates in the world of education can include several aspects, namely, the curriculum, the improvement of the quality of learning, as well as the application of appropriate learning models. In terms of the use of appropriate learning models, there is a wide selection of learning methods. This research chose DLPS models learning. DLPS learning models is a learning models based on problems as well as Problem Based Learning, but has some variations. Variations on DLPS are located on the issue which is used as a learning base has been examined deeper. There are two procces at DLPS problem examined. The purpose of examining the issue to find causal or cause major problems. Its mean, not only seing the issue superficially just on the cause seemed. On this models also analyzed other causes that allow the emergence of these problems. DLPS models its also learning models that's use feedback from past. Feedback from that has from some observation guide to understand problem that happen today. So the problem solution can be found clearly. Learning with DLPS models, not only prioritizes the base issue as it special fiture. This learning also has a characteristic form of decision making towards the solution of the problem with very well (Aminah 2016 [1]; Argyris 1978 [4]; Dooley 2009[10]; Kantamara and Ractham 2014 [17]).

Learning with the DLPS models is one approach that can create a reliable solution. In contrast with learning are usually to do, this approach gives influence on how effectively we can anticipate changes, adapt to new situations and generate new solutions to the challenges faced. DLPS learning models can be like that because there is a step on DLPS learning models that guided learners to observer the problem faced correctly. Most efforts are focused on the process of problem solving the work is intended to make the process more efficient and more reliable. This DLPS models has a systematic structure in problem solving, as well as the steps that must be followed so that the solutions implemented to solve the problem is the main solution. These steps are writing down the problems of the beginning, classify the symptoms of problems, make improvements in the writing problems, identifying the causal or cause, solution implementation, identification of the main causes of early, find the right solutions, options and main solutions imlementasi (Lucky:2015[20] ; Dooley 2009[10])

DLPS have some advantages that can encourage learners to showed mathematical ideas through writing, oral or demonstration it. In addition this models approach is through learners can comprehend, interpret and evaluate mathematical ideas orally, in writing or other visual forms properly. Another advantage owned by DLPS, that is, first, DLPS is learning that is based on the issues. Problem based learning, can sue the learners to always pay attention to the environment, as well as increase sensitivity to surroundings. Second, DLPS have a step which Scientific Approach. Third, DLPS is learning that aims to assist learners in finding answers to the issues

facing independently. So that will create an independent learners ' personal and creative.(Lucky:2015[21]; Argyris:1978[4]).

The main feature of which is contained in the DLPS models are analytical study based on the gaved issue to be discussed by the learners. In this study there are two loops that have to be undertaken to resolve the problem. Results or solution is the main solution that can fix the problem with effective. (Nurjanah 2015[27]; Argyris 1978[4]; Argyris 1976[5]).

DLPS is a type of mathematical problem-solving approach that emphasizes on searches the main cause of the problem. The ability of mathematical literacy demands the learners to be able to identify problems, formulate the problem, resolve the problem to interpret mathematical problem solving that has been done in accordance with existing concepts and context. Other measures of DLPS learning models was writing the initial problem statement, classify symptoms, wrote the revised problem statement, identifying the causal, solution implementation, identification of the main causal, find the main solution options, and the main solution implementation. These measures are more appropriate applied to learning geography. (Lucky:2015[20]; Argyris 1978 [4])

Based on the steps above then the researcher using the steps of DLPS: (1) Problem identification, (2) Identification of the causal, (3) Initial solutions, (4) Identification of deeper causal, and (5) Determine the main solutions.

1. Problem identification. Problem identification is doing by observation of natural resource management as a source of learning to know the problems that occurred in the area. Then take note of key points the observations.
2. Identification of the causal. Identification of the causal performed by learners is grouped in small groups. Identification is done by analyzing the problems that have been found from the observations, and then look for the cause of these problems.
3. Initial solutions. The initial solution is a temporary solution that can be done immediately by the learners to address the problem based on the causes found.
4. Identification of deeper causal information done by way of doing evaluation and analysis of the results of the implementation of the initial solution so finding loopholes or shortcomings in the initial solution, as well as other causes of the incidence of the problem.
5. Determine the main solutions. At this stage after performing an analysis of further problems, as well as the evaluation of the initial solution, learners will find the choices the main solution which can overcome the problems in depth up to the roots.

Spatial thinking ability has some concept. Spatial ability serve as abstract concept with include the spatial relations, term of reference, the relations proyektif, conservation and spatial representation of distance and menal rotation. Another concept of spatial thinking ability noted that spatial thinking ability is the ability of the perception of an object or image which is influenced by the object orientation. This opinion shows that the spatial thinking ability leaning more on an object seen from different view points/direction (spatial orientation). Thus the spatial thinking ability is the ability to identify an object from the point of view of different (orientation). So it can be inferred that the spatial thinking ability is the ability of the individual in understanding the different spatial concepts such as distance, direction, space as well as the relationships between space and the delivery of the knowledge. (Jo: 2007[15]; Piaget and Inhelder 1971[16]; Giaquinto: 2007[12]).

There are five indicators of spatial thinking ability, that is: 1) Spatial Perception; 2) Visualization; 3) Mental Rotation; 4) Spatial Relation; 5) Spatial Orientation. Spatial Perception is concerned to the ability to observe objects vertically or horizontally. Visualization is concerned with the ability to recognize changes of an object. Mental Rotation ability related to rotate an object precisely and accurately. Spatial relation associated with the ability to understand the relationship between spaces. Spatial Orientation with regard to the ability to observe objects from various directions/state. (Maier 1998[22]; Piaget dan Inhelder 1971[16]; Velez 2006[33]).

Based above indicators, this research uses three indicators adaptation from Maier indicator. Thai is, (1) Visualization, is concerned with the ability to recognize changes to the object. (2) Spatial Relation, related to the ability to understand relationships between spaces. (3) Spatial orientation, with regard to the ability to observe objects from various directions/condition.

This research not using spatial perception and mental rotation indicator because, this two indicators did not match with geography learning this teme. Spatial perception that concerned to the ability to observe objects vertically or horizontally, can't be used in the observe natural

resources in this case. Mental rotation is ability related to rotate an object precisely and accurately is no match to used, because learners are not imposible to rotate their environment. So in this research, researchers not used the spatial perception and mental rotation indicators. This spatial thinking ability needs to be owned by learners, especially in geography lessons. Because geography is the science that has spatial characteristics.

The ability to think every individual affected by various aspects of human life. Including spatial thinking ability. Spatial thinking ability is also affected by several factors, namely: access to resources, a factor of cultural history, geographical factors, family factors, and situational factors. (Armstrong:2013; Peter and Joachim:2005)

1. Factors in access to resources, related to whether someone in easy to access tool for training of spatial thinking ability.
2. Historical-cultural factors, related to the history or culture of community surroundings.
3. The geographical factor, linked to the geographical condition of the person.
4. Family factors, related to the living conditions of the person's family.
5. Situational factors relating to the circumstances at the time of the person developing the intelligence spasialnya.

Trial use of DLPS to know its effects on spatial thinking ability, based on the existence of a link between DLPS models advantages with factors that affect spatial thinking ability. The link between the two can be seen in the following diagram:
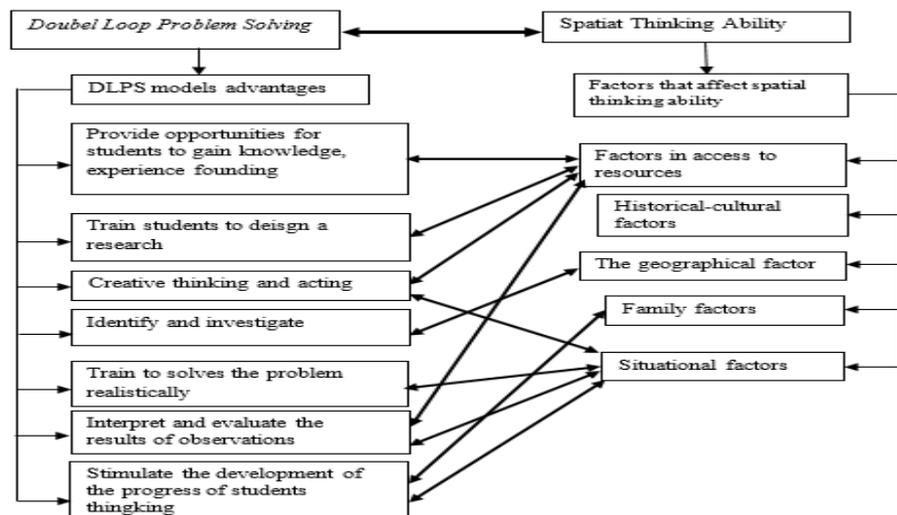
Picture 1. Diagram of link between DLPS models advantages with factors that affect spatial thinking ability

This research has a purpose to know the influence of DLPS learning models to spatial thinking ability. Base on the introduction above, DLPS is has some influence to spatial thinking ability. So the researcher experimented these learning models.

Methodology

The research approach used leads to qualitative research, with this type of research experiments. The experiments used in this study included in this type of research experiments quasi. The implementation of this research using a pretest-posttest design control group design in which the subject of the research consisted of two classes include experimental and control classes. Researchers at the research this time acting as a party planner, executor, observers, and the perpetrators of reflection against the course of learning model. The design of the research conducted in this study as follows.

E	O_1	X	O_2
C	O_1	-	O_2

Table 1. Experimental research design

Information:
E1   : Experimental grup
E2   : Control grup
O1   : Pretest
O2   : Posttest
X   : Treatment at experimental class with
        DLPS learning models

This research was doing in State Senior High School 01 Kota Batu. The subject consists of one experimental class, namely Social Class 5 with 32 learners, as experimental class. And Social Class 4 with 32 learners as control class. The selection of subjects of research based on the results of observation and interviews preresearch, showed that both these classes belong to homogeneous, with a value equivalent to the geography of subjects. Analysis on the research aims to find out and expose the existence of a learning model of influence after carrying out the study using a model lesson on geography DLPS in experimental class. Data analysis in research activities is an analysis to know the influence of the use of the model of learning in the DLPS by t-test or independent sample t-test.

Finding and Discussion

Research on the influence of model learning of spatial thinking ability against DLPS includes experimental research. Experimental research has two groups of the subject. As for that being a subject in this study was student of High School 01 Batu. Class that chossed as subject, according to the early observation is Social Class XI 4 and Social class XI 5. Social class XI 5 s experimental class and Social Class XI 4 for control class. Group learning activities in experiments done with with DLPS model. While in class learning activities control is done in classical. Material learning in experimental class and control class is the same material that is natural resource management. Research results showed the existence of differences of spatial thinking   ability   significant among   the learners   who learn   to use model DLPS with learners learn to employ the use of classical learning. This difference indicates the presence of the influence of DLPS learning model to learners' spatial thinking ability.

Research results this time in the form of value of pretest and posttest from control and experiment learners. Then the results of this research have been analysis the gains score to find out the successful of treatment. Results of the research showed not every question on test changing learners gain score. However, in the results of the total gain score each student undergoes changes. At both the experimental or control classes. Changed of gain score on experimental classes are larger then to the control class

Its homogeneity of the subject can be known through the value of the pretest conducted a test of its homogeneity. The class is said to be homogeneous when the value significance > 0.05. The significant value of its homogenity test subjects showed significant value of 0.74. The value of 0.74 > 0.05. So both classes as the subject belongs to homogeneous classes.
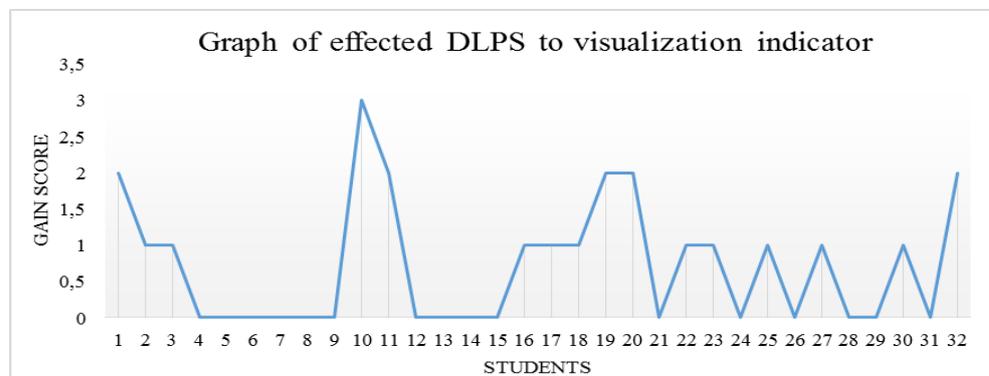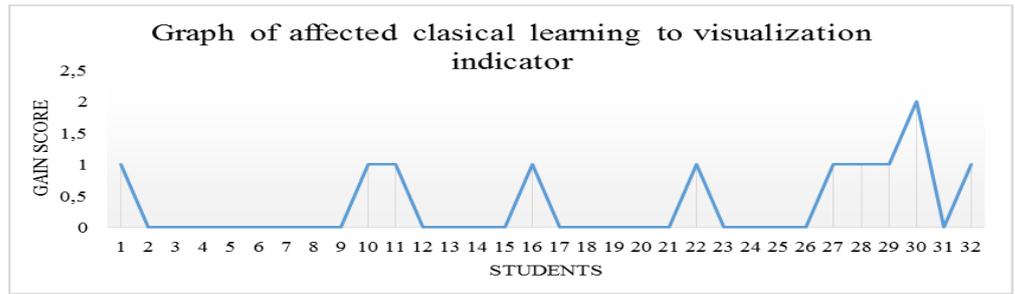

Picture 2. Graph of affected DLPS to visualization indicator from spatial thinking ability, at experimental learners.

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Picture 3. Graph of affected Clasical learning to visualization indicator from spatial thinking ability, at control class learners.

Graph 2 and 3 above showed learning models influence to spatial thinking ability in visualization indicator. From that graph ca is seen DLPS gave significant influence. This influence is shown through changes the value or gain scores for learners' experimental class pretest and posttest. 50% of experimental class learners do not suffer changes gain score on indicators of visualization. On the second graph shows the influence of the classical learning models against the spatial thinking ability especially at visualization indicator. The study with classical learning also contained changes to gain score. But 68% of learners in the control class do not change the gain score. Both of gain score visualization showed that experimental class has smaller percentage learners with lowest gain score. The results of both the known that use of model learning DLPS provides significant effects on spatial thinking ability, on visualization indicator.

Other influences from DLPS models can also be known through another indicators of spatial thinking ability. These indicators are spatial orientation and spatial relationships. As for the influence DLPS models against both indicators can be known through some of the following charts.
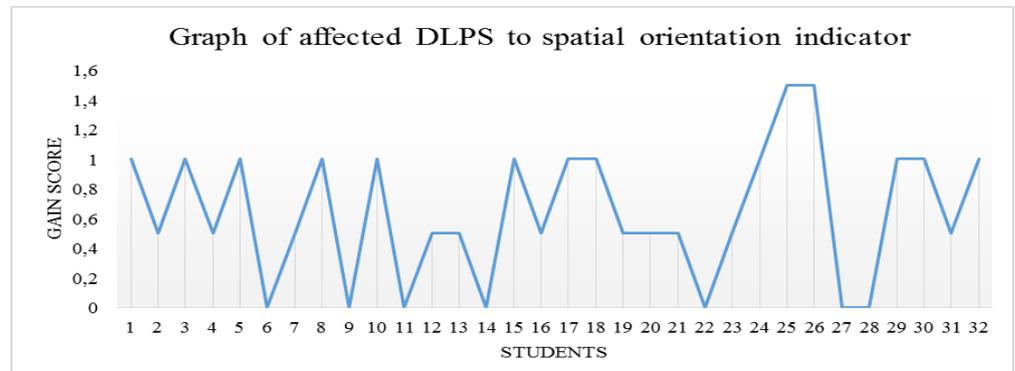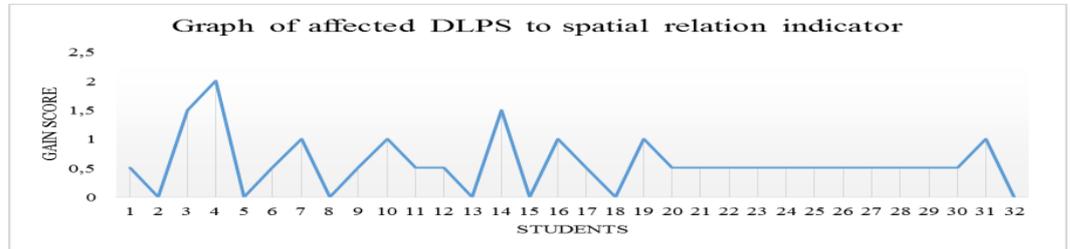

Picture 4. Graph of affected DLPS learning to spatial orientation indicator from spatial thinking ability at experimental learners
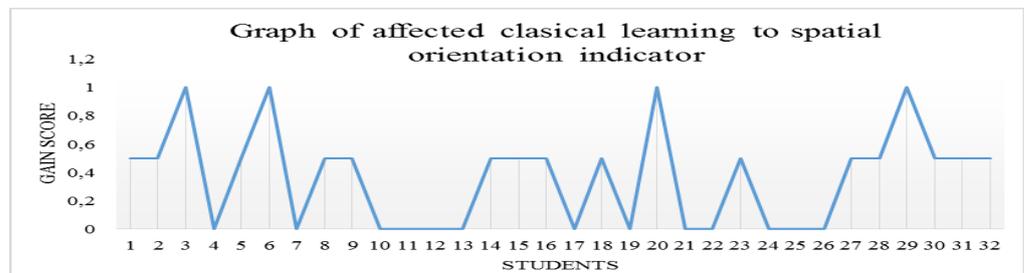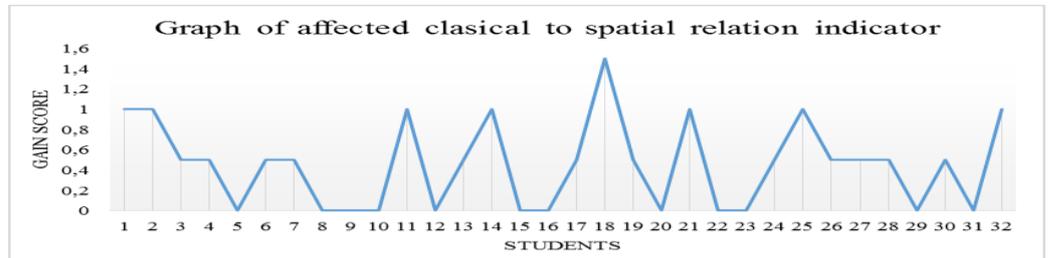

Picture 5. Graph of affected clasical learning to spatial orientation indicator from spatial thinking ability at control class learners

The graph above showed the gain score experimental and control class learners on spatial orientation indicator. On spatial orientation indicator, experimental class shows a higher gain score. 22% of learners in the experimental class does not increase the gain score. However, in the control class there are 41% of learners who did not getting increase the gain score. Percentage of the lowest value on the control class higher than experimental class. This showed the existence of DLPS influence significantly to spatial orientation indicators.

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Picture 6. Graph of affected DLPS learning to spatial relation indicator from spatial thinking ability at experimental learners.


Picture 7. Graph of affected clasical learning to spatial relation indicator from spatial thinking ability at control class learners.

Next is the gain score on indicators of spatial relation. On this indicator, the using of DLPS models also gives a better influence. Based on charts 6 and 7 can be seen that the average of gain score on experimental class higher than the control class. As spatial orientation indicator, on this indicator are also there are 22% of learners in the class of experiments that have no gain score. However, in the control class there are 37% of learners who do not have gain score. The percentage lowest gain score on the control class was higher than the experimental class. Same as the other indicators, the using of DLPS models on this indicator also showed significant effects.

Class	Average *pretest*	Average *Posttest*	Average *gain score*
Experimental	13,16	16,31	3,16
Control	12,81	14,78	1,97

Table 2. Average of Gain Score
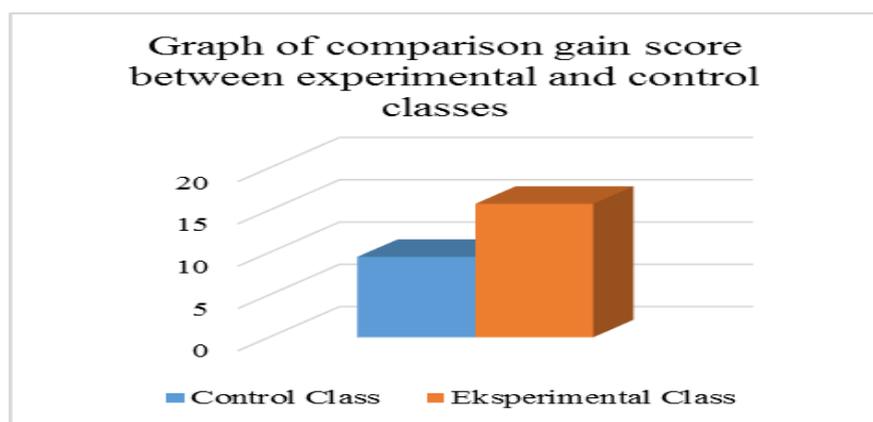
Picture 8. Comparison gain score average between experimentl and control class

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Posttest	Equal variances assumed	.013	.911	3.270	61	.002	7.530	2.303	2.926	12.135
	Equal variances not assumed			3.268	60.632	.002	7.530	2.304	2.922	12.139

Table 3. The result of hipotesis test using t-test

In the table above can be seen the results of the hypothesis test with the value significance of 0.002. Category significance test is < 0.05. Of the hypothesis test results it can be concluded that Ho is rejected, because the value of the significance of 2-tailed 0.002 < 0.05.

DLPS learning model is a model of variation in Problem Solving learning model. This model invites learners to be able to solve problems independently and creatively. This model included in one part of the theory of konstrutkivistik. This theory demands the learners play an active role in the learning they do. So this model give a good influence for learners form an active role in learning, thus improving the ability of thinking include spatial thinking ability. Its application, model DLPS more use of activities that engage learners as active as discussion groups, observation, and presentation. Compared to classical learning in the form of lectures, DLPS model can help learners better understand the lessons quickly and precisely. Because there are activities shared thinking making subject matter comprehensible learners with better.

Study on the control class that uses the model of classical shows the average value of the changes which tend to be low. From table 2 and picture 8 can be seen the comparison between experimental and control class. The result showed that experimental class has higher gain score. Its mean that the treatment of using DLPS learning models is affected to spatial thinking ability.

Clasification	Score	Qualification	Frequency	%
A	18 - 20	Very good	4	12,5
B	15 - 17	Good	14	43,8
C	12 - 14	Middle	13	40,6
D	9 - 11	Bad	1	3,1
E	< 9	Very Bad	0	0
Total learners			32	100

Table 3. Percentage score of control class learners

Clasification	Score	Qualification	Frequency	%
A	18 - 20	Very good	9	28,1
B	15 - 17	Good	18	56,3
C	12 - 14	Midle	5	15,6
D	9 - 11	Bad	0	0
E	< 9	Very Bad	0	0
Total Learners			32	100

Table 4. Percentage score of experimental class learners

Based on the table note that learner of experimental class has the percentage score of spatial thinking ability higher than student at control class. At very good qualification experimental classes have a percentage of 12.5% while control classes have a percentage of 28.1%. There is a difference of 15.6% between them. On good qualificatins experimental class also excelled with the difference in the percentage of 12.5%. On the experimental class there are no less-qualified learners, whereas in the control class there is still less-qualified learners of 3.1%. This indicates an increase in the experimental classes better than control class.

The purpose of this research is to know the influence of DLPS learning models to spatial thinking ability. This research developed from previous research on the using of DLPS models, but using different bound variable. Previous research done by Aminah. On the Aminah research of, note that DLPS gives the significant influence in the form of improved learning outcomes in students in the study of history. Other studies have linked DLPS models are also done by Nurjanah. Research conducted by Nurjanah aims to know the influence of DLPS models to

learners creative thinking ability. In his research reveals that learning model DLPS has an impact on the ability of creative thinking. (Aminah:2016[1]; Nurjanah:2015[27])

Research on the models of the DLPS are done on geography learning belongs to the new research. Previous research still use model DLPS on other types of lessons. In the subject of geography, to enhance the ability of spatial thinking DLPS models showed good results. Based on the results of the t-test of spatial thinking ability of students class experiments is higher compared to the control class. Ability in experimental classes are higher because of the use of the model of the DLPS.

Using DLPS models is also demanding the learners to actively construct what they learn through leraning stages. This is in accordance with the konstrutivistik theory which states that the knowledge of a person obtained from independent construction learners through activities conducted. The teacher in this case acts as a facilitator. All learning activities centered on the activities of their learners. (Bettencourt 1989 in Suyono and Harianto:2011[31]). The application of DLPS model learning gives better results against the learners spatial thinking ability because it has a number of advantages, namely: (1) Provide opportunities for learners to gain knowledge, experience finding, recognizing and solving problems in a structured. (2) Train learners to design an invention. (3) Teach learners to think creatively and act creatively. (4) Teach learners to solve the problem realistically. (5) Teach learners to perform identification and investigation. (6) Invite learners to interpret and evaluate the results of observations, and (7) Stimulate the development of the student's thinking progress.

Conclusion

The results of the analysis and discussion of this research showed that spatial thinking ability of learners' experimental class with DLPS models of learning higher than spatial thinking ability learners of control class with classical lerarning models. So it can be inferred that the DLPS learning models influence on spatial thinking ability of learners Social Class XI at Senior High School 01 Batu.

Advice based on research that's been done is: (1) Learning using DLPS learning model needs to be applied in the Geography learning in order to improve the spatial thinking ability. (2) The application of model DLPS requires preparation for quite a while, so hopefully in its application of teachers can split time with well.

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