

# Improving Critical Thinking Skills Using Learning Model Logan Avenue Problem Solving (LAPS)-Heuristic

Desi Anggrianto<sup>1\*</sup> Madziatul Churiyah<sup>2\*</sup> Mohammad Arief<sup>3</sup>

Management Faculty of Economics, Universitas Negeri Malang, East Java, Indonesia 65415

## Abstract

This research was conducted in order to know the effect of Logan Avenue Problem Solving (LAPS) - Heuristic learning model towards critical thinking skills of students of class X Office Administration (APK) in SMK Negeri 1 Ngawi, East Java, Indonesia on material curve and equilibrium of demand and supply, subject Introduction to Economics and Business. This research used a Quasi-Experimental Design. The population of the study was the students of class X-Expertise Business and Management SMK Negeri 1 Ngawi, East Java, Indonesia 2015/2016 academic year. Sample selection method used is Simple Random Sampling that obtained from grade X APK 2 which consists of 32 students as the experimental group learning using LAPS-Heuristic and X APK 1 which consists of 31 students as control group learning using conventional learning. The result showed there is a difference between the students in experimental and control group in term of their critical thinking skills.

**Keywords:** Logan Avenue Problem Solving (LAPS) - Heuristic, critical thinking skills, curves and balance of demand and supply.

## 1. Introduction

Education is the tip of the spear in improving the quality of human resources. The adjustment of education with the needs of the days should be one of the steps taken by educators to improve the quality of human resources. One thing that should be owned by the students in this modern era is the ability to think critically (Kemendikbud, 2013). Critical thinking skills are one of the high-order thinking skills other than the ability to problem-solving, decision-making, and creative thinking (Facione, 1990). According Guiller *et al* (Zabit, 2010), critical thinking is a necessary skill to understand comprehensively the theories, evidence and the core issues, and debates in the domain of psychology and other disciplines. "Meanwhile, according to Ennis (1997), critical thinking is reflective and reasoned thinking that focuses on determining what people believe or do. Agboeze *et al* (2013) stated that critical thinking will help students to acquire characteristics such as perseverance, flexibility, metacognition, open-mindedness, transfer of knowledge, problem-solving orientation, and the use of the quality and independence of the desired characteristics of the modern labor.

Given the importance of the ability to think critically, there needs to be equal treatment in learning so that can improve the ability to think critically learners. One of them is to use a learning model that embraces constructivist theory. This is in line with the opinion of Duron & College (2006), who said that it is important that teachers give thoughtful consideration to the current teaching methods and encourage their personal beliefs before planning a particular approach to teaching. Applying critical thinking framework clearly requires a commitment to be active, student-centered learning, at least initially may be somewhat unfamiliar and uncomfortable for both students and teachers. Thomas (2009) also said in his journal that the pedagogical approach that focuses on the student and the learning process is the need to think.

In subject Introduction to Economics and Business at the basic competence curves and balance of demand and supply students are required to master the theory, and in the assessment students should also be able to construct their cognitive abilities to solve everyday problems related to demand and supply. Therefore, in this subject the students are expected to have critical thinking skills to solve problems related to Economics and Business. One of effective constructivist learning model used to train critical thinking skills in accordance with the character of the course is Logan Avenue Problem Solving (LAPS) –Heuristic learning model. LAPS-Heuristic is a learning model that encourages students in solving problems by questioning what the problem is, whether any other alternative solutions, whether it is beneficial, if the solution, and how effective to solve it (Adiarta, 2014). The stages of LAPS-Heuristic are analyzing and understanding the problem, designing and planning a solution, looking for a solution of the problem, and examining the solution (Lidnillah, without year). LAPS-Heuristic will enable the student to analyze a problem coherently and quickly so that students' critical thinking skills can be trained and improved.

There are several studies that are relevant to this study, one of which is research by Mutai in 2014. Mutai et al

(2014) stated that the strategy Gowin Vee heuristic can improve students' conceptual understanding and metacognition. Conceptual understanding is to make the concept clearer for students, allow students to associate with the concept, make connections more complex to science, prevent memorization, and improve performance. Stanovich et al (2008) found that there is a partial simulation between the heuristics and biased against the task assignment syllogism. In addition to some of these benefits, the strategy heuristics can also improve the ability to think logically. Logical thinking will help students to think more realistically and openly.

Critical thinking is closely related to students' outcome, especially on the subjects that require development framework or concept based on experience or knowledge. Seriti et al (2013) found that a group of students who are taught by heuristic learning strategies have better learning outcomes than the group of students who are taught by algorithmic learning strategies on the subjects of Information and Communication Technology. From the research Mutai et al (2014) and Seriti et al (2013) showed that the heuristic is a model of discovering or inventing based on the experience and knowledge is effective in improving critical thinking skills and learning outcomes.

Ristiasari et al (2012) showed that increasing students' critical thinking skills test in experimental class using learning model with Mind Mapping Problem Solving 0.40 (moderate), while the control class of 0.23 (low). The t test results showed that the ability to think critically experimental classes differ significantly from the control class. This research is applied in SMPN 6 Temanggung, although the subjects in this study different levels of education, but basically Problem Solving learning model is effectively used at various levels of education.

Based on the questionnaires distributed by Jacob et al (2008) to the members of online discussion forums of mathematics showed that problem contributes to the understanding of mathematics and critical thinking. This online discussion forum is a discussion forum based on mathematical problem solving. In addition, other results of the questionnaires also showed that 63.6% of respondents stated their problem-solving based online discussions can encourage them to think, or explore mathematics itself.

Based on the background, this research aims to know the effect of LAPS-Heuristic learning model towards critical thinking class X APK SMK Negeri 1 Ngawi, East Java, Indonesia on material curve and equilibrium supply and demand in the subject Introduction to Economics and Business.

## 2. Hypothesis

Based on existing goals, the hypothesis proposed in this study is that there are differences in critical thinking skills of students in learning using LAPS-Heuristic with students who are learning using conventional learning on material curves and equilibrium of demand and supply in the subject Introduction to Economics and Business.

- $H_0$ : There is no difference in critical thinking skills between students learning using Logan Avenue Problem Solving (LAPS) - Heuristic with students learning the material using conventional learning on material curve and equilibrium of demand supply and in the subject Introduction to Economics and Business.
- $H_1$ : There are differences in critical thinking skills of the students learning using Logan Avenue Problem Solving (LAPS) - Heuristic with students learning the material using conventional learning on material curve and equilibrium of demand and supply in the subject Introduction to Economics and Business.

## 3. Method

The research design chosen was a quantitative study with the type of experimental research using pseudo research or *Quasi-Experimental Design*. The object under study is divided into two classes, the experimental and control classes. Experimental class was treated by implementing a LAPS-Heuristic. The untreated control class and continued to have the conventional learning model. The population in this study was the students of class X Expertise Business and Management SMK Negeri 1 Ngawi 2015/2016 school year which consists of five classes. Sample selection method used was *simple random sampling* to test the equality that included test of normality and homogeneity test. The sample in this study is a class X APK 2 a total of 32 students as an experimental class and X APK 1 as many as 31 students as the control class.

The instruments used in this study are an instrument of learning and instruments for assessment. Instrument of learning in the form of learning tools is used for experimental class and control class. Instruments of learning consists of syllabus of subject Introductory Economics and Business class X APK, Lesson Plan (RPP) of LAPS-Heuristic with material curves and equilibrium of demand and supply, and Lesson Plan (RPP) of Conventional learning on material equilibrium of demand and supply, as well as learning observation sheet. Assessment instrument is an instrument used to measure the critical thinking skills of students during the learning process. Assessment instruments consist of observation rubric items of learning and critical thinking

skills. Questions of critical thinking skills such as problem description consist of twelve items. Twelve items critical thinking skills that have been tested the construct validity, content validity, empirical validity, and reliability testing. The test items were then determined the different power level. To determine the differences in critical thinking skills between experimental and control class, done hypothesis test on the *post-test* results by using independent sample t-test.

#### 4. Results

##### 4.1 Preliminary Data Capabilities

In the implementation of this experimental study, there are two classes of experimental class and control class. Experimental class and control class must have equality of what will be tested so that the test conducted equivalence included test of normality and homogeneity test. The data used in this test is the score of equality of test of the end of semester (UAS) in Introduction of Economic and Business semester of the 2015/2016 academic year. Data capabilities initial experimental class and control class is shown in Table 1 and the equivalence test results shown in Table 2.

Table 1. Preliminary Data Capability of Experimental Class and Control Class

Parameter	N	$\bar{X}$	Median	Modus
Experimental Class	32	82.38	82	79
Control Class	31	82.35	83	79

Table 1 showed that the number of students in the experimental class is 32 and the number of control class is 31. From the score of Introduction Economic and Business UAS semester of the 2015/2016 academic year the average score obtained experimental classes are 82.38 and 82.35 for the class control. Experimental class has middle score 82 and mode score 79. The control class has middle score 83 and the mode score 79.

Table 2. Equality Test Results

Parameter	Result	Information
Normality test	.111	normal distribution
Homogeneity test	.838	Homogeneous

Table 2 showed that the normality test results, namely  $0.111 > 0.05$ , which means the normal distribution of data. The results of the homogeneity test is  $0.838 > 0.05$ , which means homogeneous. It can be concluded that the experimental class and control class is similar so it is worth doing the research.

##### 4.2 Analysis of Test Questions

The instruments to assess critical thinking skills in the form of questions about Introduction to Economics and Business subject class X at basic competences (KD) 3.8 and 4.8. The KD 3.8 is students are expected to describe the curve and the balance of demand and supply. KD 4.8 is students are expected to evaluate the demand and supply curves shift. The instruments of critical thinking skills consist of twelve items description included six indicators of critical thinking skills by Ennis (2011). The twenty questions tested contained twelve items are valid and reliable. The results of the analysis of test questions showed as follows.

###### 4.2.1 Validity items

From the results of construct validity and content that have been examined by a material expert that is Mrs. Ambarwati Lestari, S.Pd. teacher of subject Introduction to Economics and Business at SMK Negeri 1 Ngawi, East Java, Indonesia indicated that the questions made is valid. From the result of the empirical validity test, then the questions are considered valid ie  $r_{xy} > r_{table}$  with a value of  $0.344 > r_{table}$  with total of twelve. The twelve questions are used for the *post-test* critical thinking skills and included six critical thinking indicators to be measured.

###### 4.2.2 Reliability items

Table 3. Results of Test Reliability

Cronbach's Alpha	N of Items	Information
0,662	20	Reliabel

Cronbach's alpha value is greater than 0.662 r 0.344 then the table is considered reliable instrument with high

reliability rates.

#### 4.2.3 Distinguishing power

The score of each distinguishing questions that is more than 0.25 which means questions are considered feasible to be used. This is in accordance with the opinion of Nurgiyantoro (2012: 361), if the items have different power of at least 0.25, it is considered feasible for use in research. The results of the distinguishing features of each items is as follows.

Table 4. Item Differentiator Power Questions

No.	1	2	3	4	5	6	7	8	9	10	11	12
DP	.595	.59	.9	.603	.576	.644	.671	.568	.566	.593	.823	.503

#### 4.3 Data Critical Thinking Skills

The execution of the *post-test* students' critical thinking skills held for 60 minutes. The data score of *post-test* critical thinking skills between experimental class and control class can be seen in Table 5.

Table 5. Post-Test Data Critical Thinking Skills

Parameter	Experimental Class	Control Class
N	32	31
$\bar{X}$	6.7559	5.4761
Median	7	5.5800
Modus	5.42	4.42

Data *post-test* critical thinking skills above show that the level of critical thinking skills of students in the experimental class is higher than the control class. The average score of the experimental class at 6.7559, while the average score of the experimental class of 5.4761. Data on the average score of each indicator of the critical thinking skills of students in the experimental class and control class can be seen in Table 6 with the critical thinking skills criteria in Table 7.

Table 6. Frequency Distribution of Critical Thinking Skills

Indicator	Experiment		Control	
	Score	Descriptor	Score	Descriptor
Focus on questions	7.00	Critical	5.00	Quite Critical
Ask and answer questions that require a reason	6.18	Quite Critical	6.67	Critical
Make deduction	7.36	Critical	5.13	Quite Critical
Make Induction	6.13	Quite Critical	4.01	Less Critical
Analyze the reasons	6.50	Critical	5.65	Quite Critical
Make a value judgement	8.94	Very Critical	7.77	Critical

Table 7. Criteria for Critical Thinking Skills

Interval Score	Descriptor
$81.25 < x \leq 100$	Very Critical
$62.50 < x \leq 81.25$	Critical
$43.75 < x \leq 62.50$	Quite Critical
$25 < x \leq 43.75$	Less Critical

Source: Purwanto, et al (Indarti)

Table 6 shows that the results of the *post-test* critical thinking skills overall experimental class is superior to the criteria very critical, critical, and quite critical. On the results of the control class results that are in a critical criterion, quite critical and less critical. To facilitate the analysis of the data from Table 6 is presented in the chart in Figure 1.

Figure 1 shows the indicators of critical thinking of experimental class and control class. There are several indicators that are cognate to be addressed simultaneously from six indicators. On critical thinking skills *Based Clarification* has three indicators evaluated in this study include: (1) focus on the question, (2) ask and answer questions that require a reason, and (3) analyze the reasons. Based on Figure 1, from the three indicators, there are two indicators that are high in the experimental class. In the control class, from the three indicators mentioned, there is only one of the six indicators superior to the control class.

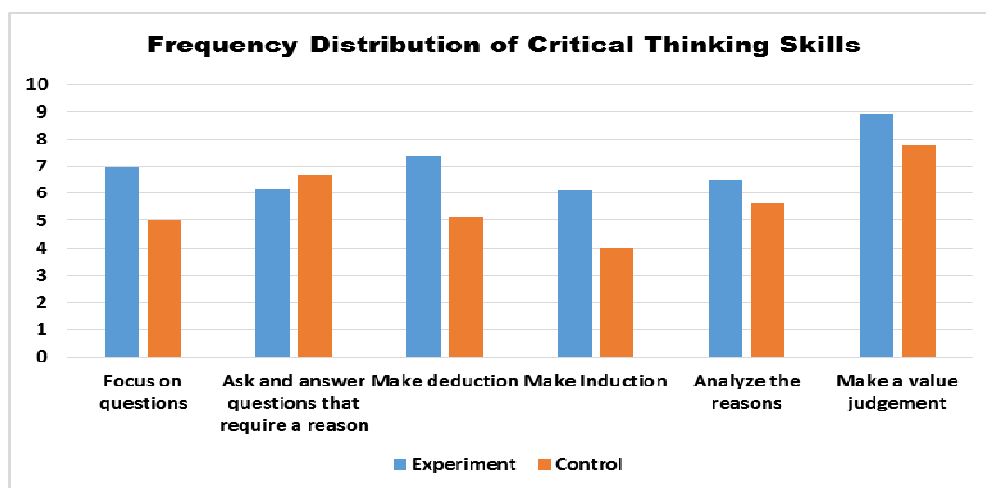


Figure 1. Frequency Distribution of Critical Thinking Skills

The first indicator is the focus on the question, which include: identifying the criteria for determining the question and possible answers, as well as considering the questions and situations. The second indicator is to ask and answer questions, which include interrogative sentence from a statement by reasoned answer. A third indicator is to analyze the reasons, which include: identifying conclusion, the reason or premiums, simple assumptions, irrelevance, understanding the structure of a reason, and summarize.

Three following indicators that the critical thinking skills of *inference* (conclusion), namely: (1) make deduction, (2) make induction, and (3) make a value judgment. From the three indicators, the experimental class has higher results especially in the indicator to make a judgement. The first indicator is to deduce which include: group and logical conditions, interpretation of statements, and qualification the reasons of deduction. The second indicator is the induction which includes: making generalization and explanation of hypothesis. Then, the last indicator is to make a judgement include: the background of the facts, the consequences of receiving or managing a decision, the application of the principles, policy alternatives, and balance, onerous, and decide. From six indicators, in general, the experimental class is still superior to the indicator to make decisions is the highest score at a very critical criterion

#### 4.4 Hypothesis Testing

Prior to test of the hypothesis, the data of the critical thinking skills need to be tested the normality that serves to determine whether the data are distributed normally or not. The data used in the data normality test is the data of *post-test* students' critical thinking skills of experimental class and control class. The normality test result is shown in Table 9.

Table 9. Normality Test Results of *Post-Test* Critical Thinking Skills

Statistical	Class	
	Experiment	Control
N	32	31
Significance	.884	.641

From normality test results above, it can be concluded that the data of each class either in experimental class and

control class are normally distributed. This can be proven from the result of the significance of the experimental class and control class that is greater than 0.05. After the normality test, the hypothesis will be tested using the independent sample t-test. Testing the hypothesis of *post-test* students' critical thinking skills experimental class and control class is shown in Table 10.

Table 10. Hypothesis Test Results of *Post-Test* Critical Thinking Skills

Class	N	$\bar{X}$	Mean Difference	Significance
Experiment	32	6.7559	1.27981	.001
Control	31	5.4761		

Based on the result of hypothesis testing can be seen in Table 10 that significance  $< 0,05$  is  $0.001 < 0.05$ . This shows that  $H_0$  is rejected. Thus, there is a difference between the critical thinking skills students learning LAPS-Heuristic with students who were learning using conventional learning on material curve and equilibrium of demand and supply in subject Introduction to Economics and Business.

## 5. Discussion

### 5.1 Effect of LAPS-Heuristics to Critical Thinking Skills

The school as an institution of education has a responsibility to help students develop high-order thinking skills, one of which is the ability to think critically (Miri, 2007). Critical thinking is one of the high-order thinking skills (Facione, 1990). According Chukwuyenum (2013) "Critical thinking has become one of the tools used in everyday life to solve some problems because it involves logical reasoning, interpretation, analyzing and evaluating to enable taking right and valid decisions".

One model of learning that is expected to improve the ability to think critically is a LAPS-Heuristic learning model. LAPS-Heuristic is a learning model that encourages students in solving problem by questioning what the problem is, whether any alternative solutions, whether it is beneficial, what the solution is, and what should do it (Adiarta, 2014). This learning model is one model of learning that linked to constructivist theory which is more student-centered rather than teacher-centered (Trianto, 2010: 111). This is in accordance with the opinion of Arends (2008: 353) "According to the constructivist view, human knowledge gained is personal and human constructed the knowledge and meaning through the experience. The teacher's role is to provide meaningful experience for learners".

This study used two models, namely LAPS-Heuristics learning model applied to the experimental group and the conventional learning model was applied to the control class. The hypothesis proposed in this study is that there are differences in critical thinking skills students learning using LAPS-Heuristic with students who were learning using conventional learning on material curve and equilibrium of supply and demand in subject Introduction to Economics and Business. Experimental class and control class were sampled in the study after passing a test of equivalence with the result of these two classes are normally distributed and homogeneous thus feasible to do research in.

Data of critical thinking skills of students obtained from the post-test on material curve and equilibrium of supply and demand. Post-test of critical thinking skills consists of twelve items with the six indicators of critical thinking: focus on questions, analyze the reasons, ask and answer questions that require reason, make deduction, make induction, and make a judgement. This data then are used in normality test and t -test Normality test results showed that data are normally distributed. While the t-test results showed there is a difference between the critical thinking skills in the experimental class and control class.

The difference of critical thinking skills between the experimental class and control class in general can be caused from various aspects such as learning materials, learning model, students, teachers, and the learning environment. In terms of material, in accordance with the existing syllabus that material curve and equilibrium of demand and supply in subject Introduction of Economics and Business class X, students are required to have the ability to analyze the curve and able to solve everyday problems related to such materials. Problem solving is often associated to rational critical thinking activities (Jacob, 2008). Problem-solving activity is characteristic of LAPS learning model-heuristic which applied in the experimental class while the control class was more on listening to a lecture. The problem-solving activities will trigger the ability reasoning. Reasoning is a thinking part that is above the level of call (retention), which includes: basic thinking, critical thinking, and creative thinking (Rahyubi, 2012: 252). This showed that the LAPS-Heuristic learning model triggered their critical thinking skills in learning compared to conventional model.

In a constructivist environment, learners are active, means that they must participate and interact with the



surrounding environment (Jacob, 2008). In this study, the experimental class students was actively involved and introduced to various problems so that students become more accustomed to the problem solving activities included: understanding the problem, solution planning, design and planning solution, a solution of the problem, and check solutions. In the control class, learning is still teacher-centered and students are not actively involved. Thomas (2009) stated that a pedagogical approach that focuses on the student and the learning process is the need to think. Rahyubi (2012: 236) also stated in his book that the lecturing method can be said to be the only the most economical method to convey information, however, make students passive. It is very hard to improve critical thinking skills of students with a lecture method, because students would tend to memorize the material (Duron, 2006). Based on students' involvement in the study, it can be concluded that one of the causes of the difference in the ability of critical thinking between the experimental class and the control class are students in the experimental class have a need to think higher than the control class.

In addition, there is not only a difference between the ability to think critically between experimental class and control class, but there are also other results. Another result is that the critical thinking skills students in experimental class higher than the control class on the material curves and equilibrium of demand and supply in subject Introduction of Economics and Business. It can be seen from a comparison of the average score of the result of post-test that experimental class is higher than the control class. In previous explanation, it can be seen that the implementation of learning models LAPS-Heuristics can trigger their critical thinking skills and students in the experimental class have a need to think higher than the control class. Basically, critical thinking skills are not ability that developed as the development of human physical. They require a lot of practices to get used to think critically (Browne, 2012: 12). This is in line with research Calucag (2016) which stated that one of the needs to be an effective problem solver is a repertoire of heuristics that might be useful in various situations of scientific problems and heuristic methods are superior to the direct instruction method. In the experimental class, students are continuously faced with various problems and are required to find solutions to these problems through discussion and presentation activities. This activity is an exercise that stimulates to think, questions, and also an effective strategy to develop critical thinking skills (Agboeze, 2013).

Critical thinking skills that are evaluated in this study are based clarification and inference. From the results of *post-test* critical thinking, in based clarification from the three indicators, there are two indicators that excel in the experimental class and only one indicator superior to the control group. Based clarification is closely connected with question-answer activities. This activity is the main activity related to problem solving in LAPS-Heuristic learning model. Trianto (2010: 115) said that asking question in the learning activity can be seen for teacher to encourage, guide and assess students' thinking skills. For students, asking question activity is an important part in implementing inquiry-based learning, which is obtaining information, confirming what is already known, and to grab attention to the unknown aspect.

Inquiry learning model is another name for heuristic models (Hosnan, 2014: 341). Discussion and presentation activity in order to solve problem and find solution in the experimental class will pose a question and answer activity. Question and answer activity will encourage students to think focus and think critically in obtaining information. So the indicators focus on the question and analyze the reasons for the experimental class is higher with a critical criterion. However, it cannot be denied that the indicators ask and answer questions that require reason the control class is above the experimental class. This is because the conventional learning remains question and answer activities between teachers and students. In addition, the results of interviews with subject teachers of Economics and Business, and one of his teachers majoring in Office Administration, the students in control class does have uniform level of intelligence and generally are superior than the experimental class.

In addition to asking important questions and issues, critical thinkers also formulated clearly, gather and assess relevant information, using abstract ideas, open-minded, and communicate effectively with others (Duron, 2006). Ennis (2011) said that the ideal critical thinkers who have the ability to clarify, to seek and assess bases, to conclude wisely, to imagine and integrate, and to do things with dispatch, sensitivity, and rhetorical skills. In the application of experiment class that formed in a group to discuss related to problem solving will also encourage students to conclude in order to find the best solution. Taking conclusion activity is used to more focus on the source of the problem, the alternative problems, until the determination of the solution based on the strengths and weaknesses of the options. In LAPS-Heuristic learning model, concluding skills is emphasized. So that students in the experimental class have the ability to think inference critically high.

From the six existing indicators, indicator making decisions is the highest score at a very critical criterion. Students' habit in finding a solution to any problem made students accustomed to consider several alternatives. The existing alternatives assessed as a whole includes strengths and weaknesses and impacts. So that the experimental class students are familiar with assessing activity than the control class who tend to listen to the explanation and work on the problems. This supports the differences in the score of the indicator 'make a judgement' between the experimental class and control class significantly large enough.

From the research that has been done as some that have been explained above, it indicates that the learning model LAPS-Heuristic significantly affects the skills of critical thinking on the material curve and equilibrium of demand and supply in the Introduction to Economics and Business. So that the learning model is effective to be used in the process of learning, especially in order to improve students' critical thinking skills.

### *5.2 Strength and Weakness in this Research*

In this study, it indicates that the learning model LAPS-Heuristic is effective to be used in order to improve students' critical thinking skills compared to conventional learning model. This is because the experimental class, students have been accustomed to expose to the problem and analyze problems. Solving problem and finding solution to the problem are the main characteristics of the learning model LAPS-Heuristic. These problem-solving activities will trigger the ability of *reasoning*. *Reasoning* is a thinking part that is above the level of call (retention), which includes: basic thinking, critical thinking, and creative thinking (Rahyubi, 2012: 252).

Learning by using LAPS-Heuristic has many advantages as follows: First, students can identify problems and get used to solve various problems. By giving the various problems, students will meet new problems to solve. This greatly helps the student in adding reference problems and honed their skills in solving problem.

Second, create the mindset of students to think independently and systematically. In this learning, the students are active in the discussion without rely on others' ability in solving existing problem. Discussion formed into groups is in order to train students' ideas and opinions. This will form independent students' thinking and respond to any existing problems.

Third, students become more motivated. This is because students are required to communicate the result of the discussion group to another group. So that students are motivated to provide better solutions and material presentation.

Fourth, students have procedures for problem-solving and analytical ability. Every problem that faced to the students would have to be solved with certain procedures. In the process will require good analytical ability to get a good solution as well.

Fifth, in the discussion session and presentation of the result of problem solving, the students were able to argue and give different critic. In addition, students are also able to compare the solution of native groups and the solution from other groups so that students' thinking is more open to various alternative solutions in solving problem.

The learning model LAPS-Heuristic has many advantages in teaching and learning, yet this model still has some weaknesses as follows: First, the student activity does not directly increase. This happens because the students are not familiar with problem solving in learning so that students need direction and guidance of the teacher more at the first time applied. For the second meeting and the rest of the new students will be more familiar.

Second, the application of these models requires more time. The learning process that starts from the small group discussions that followed a large group discussion takes longer time allocation. Moreover, the presentation of the problem more complicated and complex. This certainly raises a lot of questions and requires their answers so that the time required is also much longer than conventional learning.

Third, teacher has difficulties in the early stages of the using syntax model because students are unfamiliar so that teachers should be actively directing and guiding the students patiently. Teachers are required to assist the adaptation from conventional learning students learning to LAPS-Heuristic.

Although learning model LAPS-Heuristic has many weaknesses that have been mentioned above, this model remains greatly help for students in improving their critical thinking skills. Besides, the teacher is very important factor that contributes greatly to the successful implementation of this model. So it needs patience and perseverance of teachers in the implementation.

## **6. Conclusion**

Based on the research results that have been obtained, it can be concluded that the implementation of learning models LAPS-Heuristic effects critical thinking skill of students of class X APK SMK Negeri 1 Ngawi, East Java, Indonesia in subject Introduction to Economics and Business on materials curves and equilibrium of demand and supply. This is shown by the results of the post-test students' critical thinking skills that the score of experimental class is higher than the control class. In accordance with the characteristic of the learning model LAPS-Heuristics in learning that their activities and their problem-solving activities are to find solutions to problems. These problem-solving activities will trigger their reasoning abilities. Reasoning is a part of thinking which is above the level of call (retention), which includes: basic thinking, critical thinking, and creative



thinking (Rahyubi, 2012: 252).

## References

- Adiarta, I.G.M., Candiasa, I.M. & Dantes, G.R. (2014), "Pengaruh Model Pembelajaran Laps-Heuristic terhadap Hasil Belajar TIK Ditinjau dari Kreativitas Siswa Kelas VIII SMP Negeri 1 Payangan", *Jurnal Ilmu Pendidikan*, 4, pasca.undiksha.ac.id.
- Agboeze, M.U., Onu, F.M. & Ugwoke, E.O. (2013), "Enhancement of Critical Thinking of Vocation and Adult Education Student of Entrepreneurship Development in Nigeria", *Journal for Education and Practice*, IISTE, 4 (17), 116-123.
- Arends, R.I. (2007), "Belajar untuk Mengajar", Terjemahan Helly Prajitno Soectipto, (2008), Yogyakarta: Pustaka Pelajar.
- Browne, M.N. & Keeley, S.M. (2012), "Pemikiran Kritis", Terjemahan Brian R.D, (2012), Jakarta: PT Indeks.
- Calucag, L.S. (2016), "Divergence of Scientific Heuristic Method and Direct Algebraic Instruction", *Journal of Education and Practice*, IISTE, 7 (3), 131-135.
- Chukwuyenum, A.N. (2013), "Impact of Critical thinking on Performance in Mathematics among Senior Secondary School Students in Lagos State", *IOSR Journal of Research & Method in Education (IOSR-JRME)*, 3 (5), 18-25.
- Duron, R., College, H. (2006), "Critical Thinking Framework for any Discipline in Higher Education", *International Journal of Teaching a Learning in Higher Education*, ISETL, 17 (2), 160-166.
- Ennis, R.H. (1997), "Incorporating Critical Thinking in the Curriculum: An introduction to Some Basic Issues", *Inquiry*, 3 (16), 3-9.
- Ennis, R.H. (2011), "The Nature of Critical Thinking: An Outline of Critical Thinking Disposition dan Abilities", 1-8.
- Facione, P.A. (1990), "Critical thinking: A statement of Expert Consensus for Purposes of Educational Assessment and Instruction". *The Delphi Report*.
- Hosnan, M. (2014), "Pendekatan Saintifik dan kontekstual dalam pembelajaran Abad 21", Bogor: Ghalia Indonesia.
- Indarti, M., Soekanto, H. & Soelistijo, D. "Pengaruh Penerapan Model pembelajaran Group Investigation terhadap Kemampuan Berpikir Kritis Siswa SMA", *Jurnal Ilmu Pendidikan*, jurnal-online.um.ac.id.
- Jacob, S.M., Sam, H.K. (2008), "Measuring Critical thinking in Problem Solving through Online Discussion Forums in First Year University Mathematics", *Proceedings of the International Multi Conference of Engineers and Computer Scientists*, IAENG, 1, 19-21.
- Kementerian Pendidikan dan Kebudayaan. (2013), "*Konsep dan Implementasi Kurikulum 2013*", [kemdikbud.go.id](http://kemdikbud.go.id).
- Lidinillah, D.A.M. (Tanpa tahun), "Heuristik dalam Pemecahan Masalah Matematika dan Pembelajarannya di Sekolah Dasar", file.upi.edu.
- Miri, B., David B. & Uri, Z. (2007), "Purposely Teaching for the Promotion of Higorder Thinking Skills: A Case of Critical Thinking", *Res Sci Educ*, 37, 535-369.
- Mutai, D.K., Changeiywo, J.M. & Okere, M.I.O. (2014), "Effects of Gowin's Vee Heuristic Strategy on Secondary School Students' Conceptual Understanding and Metacognition in the Topic of Moments in Physics, in Uasin Gishu County, Kenya", *Journal of Education and Practice*, 5 (29), 193-205.
- Nurgiyantoro, B., Gunawan & Marzuki. (2012), "Statistika Terapan untuk Penelitian Ilmu-Ilmu Sosial", Yogyakarta: Gadjah Mada University Press.
- Rahyubi, H. (2012), "Teori-Teori Belajar dan Aplikasi Pembelajaran Morotik Deskripsi dan Tinjauan Kritis", Bandung: Penerbit Nusa Media.
- Ristiasari, T., Priyono, B. & Sukaesih S. (2012), "Model Pembelajaran Problem Solving dengan Mind Mapping terhadap Kemampuan Berpikir Kritis Siswa", *journal.unnes.ac.id*, 1 (3), 34-41.
- Seriti, N.N., Candiasa & Natajaya I.N. (2013), "Pengaruh Strategi Pembelajaran Heuristik dan Algoritmik terhadap Hasil Belajar Teknologi Informasi dan Komunikasi (Tik) Ditinjau dari Gaya Berpikir Siswa Kelas XI Sma Negeri 3 Amlapura", pasca.undiksha.ac.id.
- Stanovich, K.E., West, R.F., & Toplak, M.E. (2008), "Heuristics and Biases as Measures of Critical Thinking: Associations with Cognitive Ability and Thinking Dispositions", *Journal of educational Psychology*, 100 (4), 930-941.
- Thomas, I. (2009), "Critical Thinking Transformative Learning, Sustainable Education, and Problm-Based Learning in Universities", *Journal of Transformative Education*, SAGE, 7 (3), 245-264.
- Trianto. (2010), "Mendesain Model Pembelajaran Inovatif-Progresif", Jakarta: Prenada Media Group.
- Zabit, M.N.Md. (2010), "Problem-Based Learning On Students" Critical Thinking Skills In Teaching Business Education In Malaysia: A Literature Review". *American Journal of Business Education*, 3 (6), 19-32.