The implementation of LKS based on the concept attainment model to improving student's analytical thinking ability

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Raddina Aprilia Putri [1], Yunin Hidayati [2, *], Irsad Rosidi [3], Wiwin Puspita Hadi [4]

Natural Science Education, Faculty of Educational Sciences, Trunojoyo University, Indonesia
[1] ukhti.raddinaaprilia@gmail.com, [2] yunin.hidayati@gmail.com *, [3] irsad.rosidi@gmail.com,
[4] wiwin.puspitahadi@trunojoyo.ac.id
* Corresponding author

ARTICLE INFO	ABSTRACT
	Concept attainment models are learning models that can bring students to analytical thinking, and their phases are indicators of analytical thinking. This study aims to determine the application of student worksheets based on the concept of attainment models on the topic of the interaction of living things with their environment to improve analytical thinking skills. This research is a quasi-experimental study with One Group Pretest-Posttest research design. The sample is students of class VII-G of SMP N 1 Arosbaya, sampling technique with a purposive sampling technique. Data collection techniques using analytical thinking skills tests, and then the test results were analyzed statistically. The results showed that the N-Gain value was 0.46 (medium). Paired t-test shows the significance value of 0.000, if sig < 0.05 then H0 is rejected ($- t_{count} < t_{table} < t_{count} = -14.020 < 2.052 < 14.020$). Based on the N-Gain Score and the comparison of the critical values of t table and t count, there is an increase in students' analytical thinking skills after learning using student worksheets based on the concept attainment models. Analytical thinking skills will facilitate students in the process of solving problems and drawing conclusions.

Introduction

Education is a conscious effort that is used as an indicator to measure the progress of a nation. Education gets an important position as an indicator of the progress of the nation because it can create competent and quality human resources. An important key to realizing competent, quality, and highly competitive resources is through a student-centered learning process. Kurniati, Harimukti, and Jamil (2016) asserted that student-centered learning activities will create high-quality human resources through analytical thinking skills.

Student-centered learning will involve students directly in the learning process, such as the discovery process independently. Facts in the field show that the teacher's role is still focused always conveying concepts to students without involving students' thinking abilities in the learning process. Of course, this will have an impact on students' thinking abilities in achieving concepts. Where, students can only accept concepts without being able to understand the concepts themselves.

Rosidi (2015) emphasized that the learning process that refers to the old paradigm is that the teacher only conveys the concept and students only accept the concept as such, so students cannot understand the concept being learned.

The learning process, especially science learning, actually encourages students to play an active role in involving thinking skills, especially analytical thinking, so that students are able to reach the concept as a whole. Rose and Nicholl (2015) explained that analytical thinking is one of the higher-level thinking skills that can solve a problem, subject, or provide decisions through logical and systematic thinking. Indonesia is a developing country with low student analytical thinking skills. Ilma, Hamdani, and Lailiyah (2017) confirmed that according to Rupini a report from Mckinsey Indonesian's Today and a number of data from the Ministry of Education and Culture in 2015 showed only 5% of Indonesian students had analytical thinking skills, while most of the other students were new at the level know and understand. Related to the low ability of students' analytical thinking, then help is needed in the form of teaching materials for students who practice analytical thinking skills.

Analytical thinking is one of the thought processes that train students in the process of taking decision, solve problem and to analyze and rate the situation (Rose & Nicholl, 2015). Analytical thinking ability teach the student through reasoning logical with give out arguments in complete the problem around students. Analytical thinking ability according to Karadag (as cited in Lopez & Tancinco, 2016) are classified in seven main points, that is demonstrating, give a reason, symbolization, presentation, proof, abstract, and mathematical.

Student worksheets (LKS) are teaching materials that can be used as a solution for students to practice analytical thinking skills. In line with the opinion of Atika and Amir MZ (2016) that the use of worksheets will encourage students to be actively involved in learning that triggers the use of higher-order thinking skills. For example, students will use their thinking skills when solving the problem at LKS independently. Furthermore Prastowo (2011) also emphasized that the worksheets function as teaching materials that minimize the role of the teacher and maximize the role

of students. Students who can maximize their role during the learning process will easily improve higher-order thinking skills, such as analytical thinking. Analytical thinking ability can be achieved when students are active in the learning process. However, all this time the worksheets often presented cannot involve students actively in the learning process. In accordance with the results of research conducted by Azizah (2014) that the existing worksheet has not been able to actively involve students in learning. Therefore, new variations are needed to support the actual functioning of the worksheet.

Concept Attainment Model first introduced by Jerome S. Bruner. Learning concept attainment model teach the student for understand concept through the process of differentiating and to compare some example concept relevant and not relevant (Kumar & Mathur, 2013). Furthermore, Wulansari (2014) emphasized that concept learning model was designed for develop students ability to think inductive and analytical. This matter be a solution that can be used by teachers to be combined with LKS in the learning process, to support the general function of worksheets and can improve students' analytical thinking skills. The implementation of the concept attainment model is to make the learning process centered on students and to practice thinking skills, especially analytical thinking.

Joyce, Weil, and Calhoun (2011) explain the concept attainment model is a learning model of achieving concepts that require students to look for and register traits that can be used to distinguish appropriate and incorrect examples from relevant concepts. Concept attainment models are models which teaches students how to classify, how to think and how to accept concepts independently. Concept attainment models that are integrated with LKS will guide students to be actively involved in using analytical thinking skills. Based on research conducted by Wulansari (2014) that LKS-based on the concept attainment models can facilitate students in understanding concepts through the discovery process while also being able to train students' analytical thinking skills. Concept attainment model as a learning model that can support students to achieve concepts through higher-level thinking skills and worksheets as a medium to

support independent learning. That matter in line with the results research Ostad and Soleymanpour (2014) stating that concept attainment model affects the achievement of student's academic abilities and student's metacognition skills. Learning process concept attainment model as a research base to improve students' analytical thinking skills on abstract material such as the material interactions of living things with environment. The material is directly linked to the existing problems around the student with LKS based assistance concept attainment model. It aims to practice analytical thinking skills.

Method

Type research that is quasi-experiment with the research essay used is One Group Pretest-Posttest Design (Sugiyono, 2017). As stated in Table 1.

This research was conducted at SMP N 1 Arosbaya in class VII students. The sample in this study of VII-G class were selected Purposive Sampling, this matter based on students' basic abilities related to

results learn the student on meeting previous.

Table 1. One group pretest-posttest design

Pretest	Treatment	Posttest
O1	X	O2

Information:
O1 = Analytical Thinking Skill Test before learning
X = The application of LKS is based on the concept attainment model
O2 = Analytical Thinking Skill Test after learning

Implementation research executed on material the interaction of living things with its environment in semester 2 of class VII of middle school. Learning implemented five meeting times with the details that is (1) three times staring advance learning with apply concept attainment model and (2) twice analytical thinking tests, at the beginning and at the end learning. In this study there are instruments used to support the improvement of the analytical thinking ability of junior high school students. The instrument used that is Analytical Thinking Test (see Table 2).

Table 2. Analytical thinking test instruments

Indicator	Type	Shape	No. Question	Realm cognitive
Non-Analytical	Writing test	Essay	1, 2, 7	C2
Differentiating			3, 4	C4
Organizing			5, 8	C4
Attributes			6, 9, 10	C5

Analytical thinking test instruments were used to find out the increase in the analytical thinking ability of junior high school students. The data obtained will be analyzed statistically using paired sample t-test. In addition, to see the percentage increase in analytical thinking using *N–Gain score* in formula 1 (Richard R Hake, 2002).

$$g = \frac{posttest\ score - pretest\ score}{100 - pretset\ score} \quad (1)$$

Analysis of N-Gain results is divided into three criteria, namely:
(1) Learning with "high gain", if <g>≥ 0.7.
(2) Learning with "medium gain", if 0.7> <g>> 0.3.
(3) Learning with "low gain", if <g> ≤ 0.3.

The results of analytical thinking ability obtained from test analytical thinking, analyzed with formula 2.

$$x = \frac{Skor\ yang\ diperoleh}{Skor\ maksimal} x\ 100 \quad (2)$$

Interpretation of analytical thinking criteria adaptation of Sudijono (2017) can be seen in the Table 3.

Table 3. Criteria for analytical thinking

Score	Criteria
x ≥ 72.41	High
45.59 < x < 72.41	Is
x ≤ 45.59	Low

Furthermore, the data obtained were also analyzed using statistics is paired sample t-test with a significance level of 5%.

Results and Discussion

LKS based on the concept attainment model as teaching materials which is used to practice students' analytical thinking

skills. LKS material, i.e. the interaction of living things with its environment, divided Becomes three sub material which are given on each meeting, among them (1) Ecosystem components and energy flows in ecosystem; (2) The interaction between creature life and its surroundings; and (3) The role organism and survival of living creatures. The LKS-based on the concept attainment model applied to the learning process supports the principle of Vygotsky's constructivism theory explained by Rachmawati and Daryanto (2015) that students can build their knowledge independently through assignments that have never been studied. The elements presented in the LKS based on the concept attainment model can support students constructing their knowledge independently by involving higher-level thinking skills, especially analytical thinking skills.

Students' analytical thinking skills are obtained based on the results of the pretest-posttest from the item test analytical thinking skills. Rose and Nicholl (2015) emphasized that analytical thinking is one of the patterns of thinking by making decisions, differentiating, solving problems and analyzing and assessing situations. Three indicators of analytical thinking ability are Differentiating, Organizing, and Attributing. In line with the score results pretest-posttests how's that the analytical thinking ability of students in terms of the indicators on the results of the pretest is in the low category. According to Suprijono (2016) students who are familiar with learning activities on the behavioristic paradigm will find it difficult to apply analytical thinking skills. While the results of the posttest in terms of each indicator have reached the medium category. The following results of recapitulation of students' analytical thinking ability scores can be seen in Table 4.

Table 4. Recapitulation of analytical thinking ability scores in terms of each indicator

Indicator	Pretest	Posttest
Differentiating	13.62	51.12
Organizing	16.96	58.04
Attribute	11.31	51.04
Average	13.96	53.40
Criteria	Low	Medium
N Gain	0.46	
Criteria	Medium	

The low score of analytical thinking obtained by students in the pretest questions outlined in the Table 4 because students only succeed in answering questions on C2 cognitive category indicators. Meanwhile, on questions with analytical thinking indicators in category C4, students answer the questions with intuition without logical explanation. This, in line with the statement of Ilma, et al. (2017) that students' analytical thinking skills in higher-order thinking is still very low. Based on Table 4 From the posttest results, the analytical thinking indicator that got the lowest score was the Attributing indicator which was 51.04. In the Attributing indicator students are directed to assess an assumption through the characteristics or characteristics of the translation of these assumptions. Based on the results of student answers there are still many wrong answers from the Attributing indicator. Students no longer write intuitive reasons, but the answers written are not in accordance with the concept. This is because in the learning process, students do not really involve the senses to support the active learning process so that what students have done previously cannot be stored in memory for a long period of time. Kosasih (2016) explains that the use of students' sensory potentials can further strengthen their memory, comprehension, and the ability to perform assessments of some events or assumptions.

The next indicator of analytical thinking, namely Differentiating with the total score obtained is 51.12 and Organizing with the total score obtained is 58.04. In both indicators of analytical thinking, students are able to give the right answers and with reasons-logical reasoning.

In the Differentiating indicator students are able to distinguish several examples of true and false examples based on the characteristics of the two examples. In accordance with the principles of the Bruner discovery theory described by Joyce, et al. (2011) the discovery process can be obtained through the process of distinguishing some examples of right and wrong on a concept.

Organizing is the indicator that gets the highest score. At the learning stage which refers to the Organizing stage, students actively participate in these activities. Students in groups classify

several pictures based on the criteria of true examples and false examples using mind maps. In accordance with Piaget's cognitive theory explained by Santrock (2013) that at the age of eleven to fifteen, students are able to reason through the process of differentiating and organizing.

Along with the use of worksheet based on the concept attainment models in the learning process can train students in analytical thinking through the process of concept discovery independently. Based on Table 4, shows that the application of LKS-based on the concept attainment models can train students' analytical thinking skills. This is in line with Vygotsky's constructivist theory described by Suprijono (2016) that in the learning process, teachers do not necessarily transfer knowledge to students perfectly. The teacher only acts as a facilitator to guide students in independent learning activities, so students can understand the concept as a whole.

The level of students' analytical thinking skills before learning by using a student worksheet based on the concept attainment model is included in the low category. The following is the percentage of student pretest scores outlined in Figure 1.
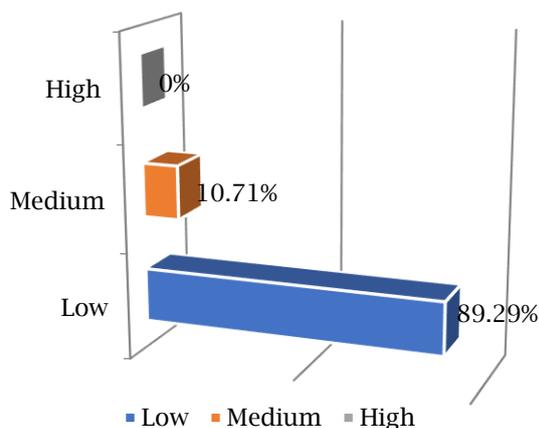
Figure 1.Percentage level student analytical thinking before treatment

On Figure 1, shows that the pretest score data recapitulation is known that students' analytical thinking ability is still low. The percentage of students 'posttest scores to measure students' analytical thinking skills experienced a significant increase from the percentage of pretest scores. The elucidation of the percentage of students 'posttest scores to find out the criteria of students' analytical thinking ability after the use of LKS-based on the concept attainment models is presented in Figure 2.
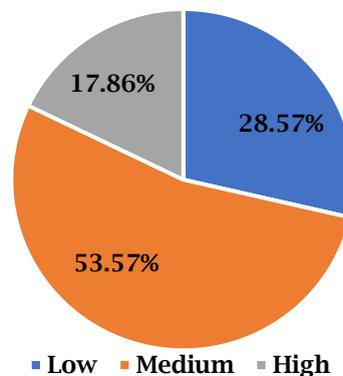
Figure 2.Percentage level student analytical thinking after treatment

According to Figure 2 that as much as 89.29% of students get a score of analytical thinking in the low category, then as much as 10.71% get a score in the medium category and no students or 0% of students get a score in the high category. The low score of analytical thinking obtained by students on pretest questions can be seen from the results of students' answers. Students only succeed in answering questions in numbers 1, 2 and 7 with cognitive categories C1 and C2. Meanwhile, in questions with analytical thinking indicators, students only answer questions with intuitive reasoning. This is in accordance with the statement of Ilma, et al. (2017) that most new students reach the level of knowing and understanding. The learning process that still refers to the old paradigm certainly affects the ability of students to practice higher-order thinking skills.

It was proven after the application of LKS-based on the concept attainment models the percentage of students' posttest scores had changed. In accordance with Figure 2 that the percentage of students who score in the low category decreased to 17.86%. The percentage of students who scored in the medium category increased to 53.57%. The percentage of scores of students who got the high category score increased to 28.57%. The application of the worksheet based on the concept attainment model can provide guidance to students for the

process of achieving the concept, so students are able to analyze the right and incorrect examples from various categories. This is reinforced by the opinion of Kumar and Mathur (2013) that the concept attainment model is a learning model that can guide students to find, assess a concept through examples that are relevant to involve higher-order thinking skills (see figure 3).
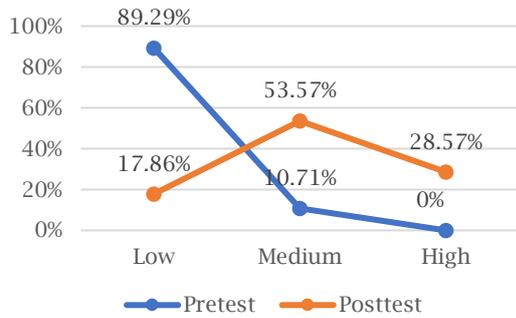
Figure 3. Data recapitulation of the percentage of analytical thinking ability scores before and after the use of LKS based on the concept attainment model

Increased analytical thinking skills after the application of LKS-based on the concept attainment models because students are able to answer each indicator of analytical questions with the right answers accompanied by logical reasons and in accordance with the concept. This, according to the opinion of Ostad and Soleymanpour (2014) that the output resulting from the application of the concept attainment model is to minimize the confusion of concepts, strategies to achieve concepts, apply analytical and logical thinking in investigating new concepts. Through LKS-based on the concept attainment models that are applied to the material interaction of living things with the environment are able to bring students to distinguish and classify appropriate and incorrect examples based on the characteristics of relevant concepts.

Factors that cause students to still get scores in the low category after learning by using a worksheet based on the concept attainment model are: (a) Students' high-level thinking skills are never honed well during the learning process. Students are only focused on understanding concepts through the lecture method so that, when confronted with a problem that requires high-level (analytical) thinking ability students find it difficult. Students need to be significantly guided and directed to improve their analytical thinking ability.

According to Rose and Nicholl (2015) high-quality thinking skills such as analytical thinking require a lot of practice, practice and discipline. (b) The low ability of students to independently build knowledge. Students who are still passive in participating in learning activities such as discussion in group learning, cause students to find it difficult to develop their knowledge independently. This certainly has an impact on the low ability to think at a higher level, especially analytical thinking. This is in line with the explanation of Suprijono (2016) related to Vygotsky's constructivist theory which focuses on social interaction (group discussion) and underlies the emergence of cognitive strategies that control thought processes such as problem solving abilities and analytical thinking ability. It can be concluded based on the constructivist theory of Vygotsky that students will not be able to construct their knowledge if they are not directly involved in learning activities, especially group discussions. (c) Low involvement of students in learning activities (use of sensory devices).

In learning activities students are not active in involving the senses to support the learning process. Students are still having difficulty listening and observing. This of course can have an impact on the ability to think analytically. Kosasih (2016) explains that learning by involving many senses can develop higher-order thinking skills, as well as analytical thinking.

Table 5. Increased students' analytical thinking ability

Indicator	Pretest	Posttest	N-Gain	Criteria
Differentiating	13.62	51.12	0.43	Medium
Organizing	16.96	58.04	0.55	Medium
Attributing	11.31	51.04	0.45	Medium
Average	13.96	53.40	0.46	Medium

Analytical thinking criteria can be seen from the average of each indicator on the

pretest results getting a low score while based on the results of the posttest getting

a medium score. In line with this, it is related to the improvement of analytical thinking ability through the application of LKS-based on the concept attainment models to obtain N-Gain criteria in a medium position. The following N-Gain results obtained are seen from each indicator of analytical thinking in the Table 5.

In accordance with the statement of Hake (1999) "medium-g", if $0.7 > (g) > 0.3$. Based on Table 5 shows that the N-Gain calculation that has been done on the results of the pretest-posttest is on the average value obtained 0.46 with the medium category. Improved students' analytical thinking abilities reach the medium category, according to the calculation of the average of each indicator of analytical thinking. The fundamental reason is related to the increase in students' analytical thinking abilities, because of the role of the LKS-based on the concept attainment model that supports students to achieve concepts independently through thinking skills. According to Joyce, et al. (2011) the concept attainment model focuses on the process of thinking skills through the categorization of concept formation through its characteristics. In addition, students are really interested and directly involved in obtaining information to determine the characteristics of concepts through listening, observing and doing activities in the worksheet. In line with the opinion of Bhargava (2016) that the concept attainment model itself is a learning model which can help students to learn how to classify, how to think at a higher level and how to provide meaningful understanding to students. This variety of opinions is the biggest reason to trigger an increase in students' analytical thinking abilities.

In accordance with the theory of findings from Bruner explained by Kosasih (2016) that students are able to receive information through hands-on experience that involves many sensory devices such as seeing, listening, and doing (feeling) independently, so that what is learned will be easily understood and not easy be forgotten. Students who are accustomed engage directly to construct knowledge that is owned will easy to find the characteristics of an information based on the right concept. In line with the results of research from Mayer (2012) explains that

the implementation of the concept attainment model can provide maximum results in the learning process and discover the characteristics of a variety of new information through the process of analytical thinking abilities.

Paired sample t-test is conducted to find out the extent to which the application of the student worksheet based on the concept attainment model can improve analytical thinking ability before and after learning is done. Based on the results of the paired sample t test obtained a significance of 0.000. In accordance with the criteria for decision making if sig < 0.025 then H_0 is rejected. The results of the next hypothesis test are compared with the critical price t_{table}. From the paired sample t-test results obtained a critical value of t_{count} of -14.020 with degrees of freedom (df) of 27 and a significance level of 0.025 so that a critical price of t_{table} of 2.052 can be seen in Table 6.

Table 6. Paired sample t-test results for analytical thinking ability

	dF	Elementary school	t	Sig.
Paired t-test	27	12.118	-14.020	0.000

Based on the critical value of t_{count} and t_{table}, it can be explained that $-t_{count} < t_{table} < t_{count}$ $(-14.020 < 2.052 < 14.020)$. According to Sudijono (2017) that the sign "minus" at the price of criticism t is not a sign of algebra. So, the price of criticism of t_{count} of -14.020 can also be read the price of criticism of t_{count} of 14.020 so it can be concluded that H_0 is rejected and H_1 is accepted. In accordance with the alternative hypothesis (H_1) that is "there is an increase in students' analytical thinking abilities before and after learning using the worksheet based on the concept attainment models". Based on the results of the hypothesis test states that the LKS-based on the concept attainment model is significant enough to improve students' analytical thinking abilities. In line with the explanation of Prastowo (2011) LKS as supporting teaching materials that are rich in assignments and can train students' thinking abilities in understanding material. LKS-based on the concept attainment models provide space for students to continue to hone the ability to think analytically through assignments contained in the worksheet which refers to

the syntax of the concept attainment model.

Apart from the role of worksheets that can train students' analytical thinking skills, the application of concept attainment models cannot be separated either. According to Muhammad, Djufri, and Muhibbuddin (2014) through the concept attainment model students are able to practice analytical thinking skills that express reasons, identify relationships between two assumptions that have correlation values, and analyze and classify examples for concept achievement. It is evident in Figure 1 of each indicator of analytical thinking that is differentiating, organizing, and attributing has changed from a low category in the pretest results and increased to a medium category in the posttest results. The data is confirmed by statements from Ostad & Soleymanpour (2014) that concept attainment models can help students to practice how to distinguish several examples based on concepts that have been understood, then organize these examples, and can help and guide students to check, assess, and give opinions on various assumptions. In this case, it can already be proven scientifically and theoretically that the worksheet combined with the concept attainment model can be applied to train students' analytical thinking. In line with the theory and the data obtained that all this cannot be separated from the advantages of the concept attainment model. In addition, in accordance with the explanation of Suprijono (2016) related to the advantages of the concept attainment model, namely, activate mental involvement and attitude so that the concepts obtained by students can be understood thoroughly and have a positive impact on learning outcomes. This is proven in the recapitulation of the data in Figure 2 related to the percentage of analytical thinking ability scores before and after the use of LKS-based on the concept attainment models.

Analytical thinking ability is very important for students to optimize the achievement of concepts. So, students not only know the concept but also know the basics of the origin of the concept. Therefore, the teacher must always practice the students' analytical thinking skills. In line with opinion of Tang (2017) that developing students' analytical thinking skills is needed to support the achievement of meaningful learning, where students not only know the concept but students can reach the concept itself. Students with high-level thinking skills that are constantly honed, for example analytical thinking, can make it easier for students to solve problems, make reasoning related to the cause and effect of a theory, and draw conclusions that will lead students to meaningful learning. In accordance with the statement from Intany, Saptono, and Retnoningsih (2016) that the ability to think analytically is needed by students to solve various problems through causal reasoning so that later conclusions can be drawn. Therefore, it is important for students to be accustomed to analytical thinking (higher order thinking).

Conclusion

The application of the LKS based on the concept attainment model in the learning process can improve students' analytical thinking abilities. according to the N-Gain results obtained from each indicator that is 0.46 with the medium category. Furthermore, based on the results of the hypothesis test, a decision was obtained that H_1 was accepted, namely there was an increase in students' analytical thinking abilities before and after learning using the LKS-based on the Concept Attainment Model ".

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