

# Analytical Thinking Skills Through The 4A Learning Models on Science Education

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**Abstract-** The study aims to investigate the improvement of analytical thinking skills through the 4A (analysis phenomenon, analysis information, analysis data, and analysis finding) learning models on science education. Research methods use the quasi-experiment, with one group pre-test and post-test design with a class VII sample on the subject matter of climate change. Through the gain-score test, the results of the 4A learning model that has the syntax of phenomenon analysis, information analysis, data analysis, and analysis of findings were able to improve the analytical thinking skills moderate level average of secondary school students in natural science subjects.

**Keywords-** 4A learning models, analytical thinking skills, secondary school, natural science subject

## I. INTRODUCTION

The analysis is used to identify intense and actual relationships as long as the statements, questions, concepts, descriptions or forms of representation are expressed to express a belief, justification, experience, reaction, information, and opinion [1]. Analysis and evaluation are recognized skills required by each student in various fields of science, such as analyzing computer programs, laboratory test results, infographics, and so on [2]. Natural Sciences is one of the disciplines that study the symptoms of nature and its interactions. The essence of natural science consists of scientific attitudes, scientific processes, and scientific

products. This scientific process is known as the scientific method. According to [3], a simple experimental method consists of three (3) operations, i.e., observing, explaining, and testing from the described event based on Lampiran Permendikbud No. 68 Tahun 2013 [4]. The objectives of science learning revitalize the natural science process skills for students, teachers, and prospective teachers as the main mission of learning science teaching in school to develop observation skills, plan investigations, interpret (interpretation) data and information (narrative, drawings, charts, tables) and conclude. To be able to conclude then needed analysis thinking skills.

Amer et al. [5] expressed thought analysis is a powerful thinking tool to understand the parts of the situation, defined as 1) the ability to examine and parse the facts and thoughts into strengths and weaknesses and 2) Develop the capacity to think wisely, intelligently, resolve problems, analyze data, remember and use information.

Students' analytical thinking skills are still low. It is based on The Global index of cognitive skills and educational achievement of The Learning Curve Pearson of The Year 2014 [6], Indonesia is ranked at 40 from 40 countries, where students are still at a low level of thought, namely knowledge and Understanding. This also emphasized with preliminary studies conducted by researchers at Secondary school in Sidoarjo that the skills of

analytical thinking students are categorized low because of the ability of students still stage of memorizing, understanding, and applying yet at stage analyzing [7]. Normally, every problem has a constraint, uncertainties, and various solutions, and there are no formal techniques that can produce the best solution [8].

Thinking analysis is a relationship with the scientific process; thinking synthesis is expressed in planning, building, and developing the essence of the design process [9]. Thinking analysis is also a part of high-level complex thinking with the application of important learning for students [10]. According to [2], analysis and evaluation are recognized as crucial skills that all students must master. On learning activities need to guide teachers about: 1) basic knowledge of thinking analysis; 2) analysis thinking process, and 3) Manage classes to develop analysis thinking [11]. Based on the study, a model of learning is needed to practice analytical thinking skills. Another way is to teach by following the objectives of the curriculum. Teachers can apply teaching methods emphasizing on thinking development to improve their students' ability. It is not only in content but the thinking skills as well [12].

Actual learning models, among others, help students acquire skills, ideas, information, grades, ways of thinking, and self-expressing and also teach how to acquire them. The 4A learning model is a valid model of content and a construct to practice the analytical thinking skills of junior high school students in science subjects. The 4A learning Model has four syntaxes: phenomenon analysis, information analysis, data analysis, and findings analysis.

Fourth learning model syntax 4A theoretically and empirically trained analysis thinking skills. The syntax of analysis phenomenon aims to distinguish contrasting phenomena to formulate problems. The syntax of information analysis aims to organize relevant and irrelevant information so that students

can formulate hypotheses. The data analysis syntax aims to obtain findings from experiments/ experiments to distinguish and organize the data that is further analyzed. The syntax of the findings aims to attribute or to make conclusions from the results of previous findings. Thus the indicators of the analysis thinking include distinguishing, organizing, and catalyzing the training in each syntax.

In preparing the students for creative thinking skills and analysis required a balance between inter and transdisciplinary as well as a habit of mind patterns to cultivate the skills of the 21<sup>st</sup> century [13]. Also, empirical learning of science improves student confidence and motivation; Help learns about yourself; Develop problem-solving, psychomotor, and mental skills; give meaningful lessons; Improve analytical thinking skills; and support the relationship between natural science and everyday life [14]. Thus it is very appropriate if the analytical thinking skills begin to be trained for students.

## II. IDENTIFY, RESEARCH AND COLLECT IDEA

Research design using one group pre-tests and Post-test group for, with class VII trial class in secondary school. The technique of data collection using test techniques, i.e., giving test thinking analysis skills before and after given treatment by applying learning model 4A. The data analysis technique uses the gain score from the pre-tests and post-test values. The value of this increase was used as a reference model of the 4A learning can improve the analytical skills of secondary school students in natural science subjects.

## III. RESULTS OF FINDINGS

Data on analytical thinking skills that contain analysis indicators: distinguish, classify, and attribute can be seen in the following Table 1:

**Table 1.** Percentage of Improved Analytical Thinking Skills

N-gain	Level	Percentage (%)
0.91	High	9.68
0.61	Moderate	90.32

Based on Table 1, it is acquired that improved analytical thinking skills at a moderate level average in 90.32%. This is evidenced by the performance of a 4A learning model syntax that includes analysis phenomenon, analysis information, analysis data, and analysis finding was a good category.

The assessment of the students' answers when the tests were carried out is the data describing the level of students' analytical thinking skills [15]. Students' analytical thinking skills are measured using analytical thinking skills tests that contain analytical indicators, including distinguishing, classifying, and attributes. Test result analytical skills students with strong analytical skills have a pattern and detail, able to identify the elements of the situation and determine the parts that have relations [16]. By observing the results of increased tests gained that the criteria for improvement are moderate and high, it means that students have a pattern and detail.

According to Mulyasa [17], good planning will help teachers in the process of teaching and learning activities. The achievement of learning objectives is also influenced by how to lesson plan strategies are designed that is certainly by the characteristics of students to be taught. Teachers in teaching natural science subjects in addition to the characteristics of students also need to pay attention to the characteristics of teaching materials.

The process of analytical thinking skills is the development of activities directly through the process of thinking [18]. Analyzing means breaking material into constituent parts and determining the relationship between the parts and the relationship between those parts with the overall structure or purpose [10]. Anderson and Krathwol [19] expressed analysis involving separation of material into its core parts and determining how those parts relate to each other or overall. This category of

processes includes cognitive processes that distinguish, organize, and attribute. Analytical thinking is blended with critical thinking, especially as a part of the problem-solving process, considered essential for providing the skills required to prepare children for more complex life and work environment in 21st century [20].

Robbins expressed thought analysis was a chain of uniform behavior but involved an element of investigation and further situation with the results and parameters that were poorly structured [21]. Thinking analysis is needed when the ambiguous situation that students need in identifying or creating problems to be resolved. Courses in Computational Thinking have demonstrated success in many schools; however, this research demonstrates its effectiveness in improving analytical skills in majors as well as non-majors [22].

A basic skill requires the foundation for analysis thinking that is not only done by data [23]. Literacy is a way to develop logic, analysis, and scientific Thinking [24]. Thinking analysis is the competency of identifying and classifying is a different aspect where objects, stories, or events are a small part that fused and found the relationship of components, cause consequences, to understand Relation [11]. Thus the analysis is done for some things, not just for data analysis. Based on learning theory, a dynamic process results from interactions with both individuals and the environment, intelligence as a creation from prior knowledge and understandings, and cognitive growth as autonomous which includes both social settings and the physical environment of the learning [25].

#### IV. CONCLUSIONS

Based on data analysis results, it was acquired that a significant learning model 4A was able to improve the analytical thinking skills of secondary school students in natural science subjects.

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