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## The Effectiveness of Model 4A (Phenomenon Analysis, Information Analysis, Data Analysis, Finding Analysis) of Analytical Thinking Skills in Secondary School

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### ABSTRACT

The research aim to describe the effectiveness of model 4A (phenomenon Analysis, information Analysis, data Analysis, findings Analysis) of the analytical skills in secondary school students. Research is conducted with the school population with different accreditation, i.e. accredited A, B, and C. Research samples are class VII students in each school. Research design using quasi experiments. Effectiveness was measured through increased skills of minimal moderate category analytical thinking and a student's positive response to the implementation of the model 4A. Based on data analysis results, it was obtained that there was an increase in analytical thinking skills covering indicators of differentiating, organizing, and attributing with the average N-gain moderates category of each school A, B, and C respectively 0.57; 0.51; and 0.55 and the result a paired t-test, independent t-test, and 2-way variant analysis test showed that there was a change in model 4A impact on analytical thinking skills as well as the student response from schools A, B, and C in ranged between 84-100%; 76-100%; and 75-100% the meaning is very positive. Thus it can be said that the 4A model is effective to improving the analytical thinking skills of secondary school students.

**Keywords:** Model 4A, analytical thinking skills, Secondary School

### INTRODUCTION

Analysis is used to identify intense and actual relationships as long as the statements, questions, concepts, descriptions or forms of representation are to express beliefs, justification, experiences, reactions, information, and opinions (Facione & Facione, 2013). According to Montaku, thinking analysis means sequential thought into related parts based on reason, principle, function or contextual conditions including the ability to organize groups in relation to different topics, to place topics in an important order (Montaku, 2012). Critical thinking, reasoning analysis, and problem solving skills are required in completing the task well (Hersh, 2000). Thus, it can be said that thinking analysis is important especially in resolving daily problems. Consideration of the problems given is an important aspect of critical thinking, reasoning analysis, and problem solving, as well as generating scoring on the task given (Harker, 2013). Natural science is closely related to how to find out about nature systematically, so the natural science is not only mastering the knowledge Group of facts, concepts, or principles only but also is how to find something (McLelland, 2003). According to Irwanto, analytical thinking skills are the basic ability needed to be developed (Irwanto, Rohaeti, Widjajanti, & Suyanta, 2017).

In fact natural science includes three main elements: (1) the scientific attitude is curiosity about everything that appears, natural phenomena, living creatures, as well as causal relationship that raises new problems that can be resolved through the correct procedures, where the natural science is open-ended; (2) the scientific process is the procedure/steps to solve the problem through the scientific method, including the formulation of hypotheses, variable identification, experimental or experimental design, evaluation, measurement, and withdrawal of conclusions; (3) scientific products are facts, principles, theories, and laws (Achmadi, Rasid, Sudibyo, 2007). So, natural science can be interpreted as a discipline that learns the symptoms of nature, its interactions and the factors that influence it. The knowledge is obtained based on a scientific stance to conduct scientific investigations systematically, so that the acquired product can be verified and accountable.

According to Sinan, one of natural science educational objectives is to teach effective thinking that is defined by science process skills. Natural science data education includes a hypothesized emphasis, environmental manipulation, and reasoning-based data. Natural science's educational objectives shift

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from time to time, after the development of the curriculum and instructional purposes of natural science (Sinan, 2012). Analysis is a sequential and systematic thinking skill in solving the problems that are in accordance with the purpose of natural science education that teaches effective thinking. According to Hasyim, the analytical thinking skills are intertwined with the science process skills in science subjects (Hasyim, 2018).

Students' analytical skills in Indonesia are said to be low. Based on The Global index of cognitive skills and educational achievement of The Learning Curve Pearson of The Year 2014, Indonesia is ranked 40 from 40 countries, where students are at a low level of thought and understanding. It is still not able to think high level of the lowest (thinking analysis) (Edupost, 2012). According to Bloom's taxonomy, analytical skills are a sequence of cognitive skills to 4 (four) after knowledge, understanding, and application (Bloom, 1956). According to Sartika, the analytical skills of junior high school students are still low, because students are accustomed to working on knowledge, understanding, and application yet at the analysis stage (Sartika & Budi, 2015).

One alternative solution that teachers do is to implement a learning model that is able to improve the analytical thinking skills of junior high school students. Model 4A (phenomenon Analysis, information Analysis, data Analysis, findings Analysis) developed by Sartika, is able to improve students' analytical thinking skills (Sartika & Budi, 2019). According to Arends, the learning model is the learning objectives, the stages in learning activities, the learning environment, and the management of the class (Arends, 1997). The purpose of Model 4A to improve analytical thinking skills; stages in a Model 4A learning activity include: 1) phenomenon analysis; 2) information analysis; 3) data analysis; and 4) findings analysis; The learning environment for Model 4A can be done in the classroom, outside the classroom, as well as in the laboratory according to the concept of material to be delivered; and management of the Model 4A class is managed by natural science teachers who are equipped to implement Model 4A.

## RESEARCH METHOD

Research uses quantitative research methods for quasi experiments. Data retrieval is conducted in class VII Secondary School, with samples in 3 different accredited schools, which are A, B, and C. Data collection techniques using tests and polls. The instruments used in the study include: 1) test thinking Analysis skills and 2) student response polls. The teaching materials used are the natural science object and its observations. Data analysis techniques for improvement of analytical thinking skills are calculating increased scores, paired-t tests, independent t-tests, and 2-ways analysis of variances, sedation to describe student responses using a student response questionnaire. Natural science learning by applying the 4A model is said to be effective if there is an increase in the results of analytical thinking skills and positive response of students to learning.

## RESULTS AND DISCUSSION

Based on the test results of the analysis thinking skills, with analysis indicators (differentiating, organizing, and attributing) can be presented in table 1:

Table 1: N-gain from the Analytical Thinking Skills Indicators

No	Analytical Thinking Skills Indicators	Rates		N-gain	Kategori
		U <sub>1</sub>	U <sub>2</sub>		
S <sub>3</sub> P A					
1	Differentiating	15.36	26.40	0.62	moderate
2	Organizing	15.76	25.20	0.64	moderate
3	Attributing	16.60	25.16	0.46	moderate
	Total Value	47.76	76.76	0.57	moderate
S <sub>3</sub> P B					
1	Differentiating	12.55	26.87	0.54	moderate
2	Organizing	12.25	24.82	0.67	moderate
3	Attributing	12.00	20.96	0.32	moderate
	Total Value	36.90	72.65	0.51	moderate
S <sub>3</sub> P C					
1	Differentiating	20.50	32.40	0.72	high
2	Organizing	20.29	27.35	0.56	moderate
3	Attributing	18.29	22.75	0.37	moderate

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<b>Total Value</b>	<b>60.00</b>	<b>82.50</b>	<b>0.55</b>	<b>moderate</b>
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With regard to table 3.1 obtained that the three secondary school tend to obtain results that are not much different for N-gain calculation so that all three have the same category that is moderate. The mastery of each of the lowest indicators is the ability to attribute.

Based on table 1, there is an increase in the value of students' analytical skills in both SMP A, SMP B, and SMP C. With regard to the initial test value and the final Test there is an increase in the value for each analysis thinking indicator that distinguishes, organizes, and attributes. The value N-gain of the three schools is almost identical to medium category. However, there is the lowest indicator of the indicators that the other is attributed. According to Anderson and Krathwol, the attribute is to apply views, bias, value/intent, find implied meanings (Hasyim, 2015). Another term is attributed to labeling. Labeling the incident is not an easy thing because it requires analysis steps so that the given label can be accounted for. High analytical thinking skills are distinguishing and organizing, according to the research of Hasyim (2015) and Sudibyo, (2016). Analyzing means breaking the material into constituent parts and determining the relationship between the parts and the relationship between those parts with the whole structure or purpose (Hasyim, 2015).

**Table 2: Paired t-test Results**

School	Mean	Dev. Std.	Err. Std.	95% Confident Interval of The Difference		t	df	Sig. (2-tailed)	p	Conclusion
				Low	Upp					
SMP A	- 25.840	6.737	1.34 7	- 28.62 1	-23.059	- 19. 177	24	0.000	<0.0 5	H <sub>0</sub> rejected (there was an influence)
SMP B	- 20.900	8.188	1.83 1	- 24.73 2	-17.068	- 11. 415	19	0.000	<0.0 5	H <sub>0</sub> rejected (there was an influence)
SMP C	- 17.739	4.779	0.99 6	- 19.80 6	-15.673	- 17. 802	22	0.000	<0.0 5	H <sub>0</sub> rejected (there was an influence)

Based on the paired test-t results in pairs at three schools were obtained that the value of significance was less than 0.05, meaning H<sub>0</sub> was rejected so that there was a model 4A influence on the analytical thinking skills of Secondary School students.

**Table 3: Independent t-Test Results**

Scho ol	F	Sig.	t	df	Sig. (2- tailed )	Mean Diff	Err. Std.	95% Confident Interval of The Difference		p	Conclusio n
SMP A	32.45 9	0.06 0	- 10.94 2	4 8	0.000	- 22.52 0	2.05 8	- 26.65 8	- 18.38 2	>0.0 5	H <sub>0</sub> accepted (there is no diffenece)
SMP B	0.395	0.53 3	- 9.514	3 8	0.000	- 20.90 0	2.19 7	- 25.34 7	- 16.45 3	>0.0 5	H <sub>0</sub> accepted (there is no diffenece)
SMP C	0.520	0.47 5	- 17.55 8	4 4	0.000	- 17.73 9	1.01 0	- 19.77 5	- 15.70 3	>0.0 5	H <sub>0</sub> accepted (there is no diffenece)

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Based on table 3 independent t-test results obtained significance value more than 0.05 meaning  $H_0$  received so there is no difference in analytical thinking skills in three schools, although the three schools have accreditation different.

**Table 4: 2-Ways Analysis of Variance Results**

School	Source	Type Sum of Squ.	df	Mean Squ.	F	Sig.	p	Conclusion
SMP A	Class	0.094	1	0.094	5.115	0.280	>0.05	$H_0$ accepted (there is no diffenece)
	Level	0.167	1	0.167	9.067	0.100	>0.05	$H_0$ accepted (there is no diffenece)
	Class*Level	0	0	.	.	.	.	.
SMP B	Class	0.001	1	0.001	0.045	0.090	>0.05	$H_0$ accepted (there is no diffenece)
	Level	0	1	0	0.007	0.070	>0.05	$H_0$ accepted (there is no diffenece)
	Class*Level	0.044	1	0.044	1.984	.	.	.
SMP C	Class	0.008	1	0.080	12.154	0.070	>0.05	$H_0$ accepted (there is no diffenece)
	Level	0	0	.	.	0.060	>0.05	$H_0$ accepted (there is no diffenece)
	Class*Level	0	0	.	.	.	.	.

Based on the 2-ways analysis of variance test result in table 4, it is obtained that the significance value between class and the level is more than 0.05, meaning that  $H_0$  is accepted so that there is no difference in the results of students' analytical thinking skills different.

Based on table 3.2, the paired test-t results showed that there was a model 4A influence on students' analytical thinking skills. The independent t-test results in Table 3.3 also showed no difference in student analytical thinking skills with Model 4A. In Table 3.4 2-ways analysis of variance test also showed that there were no differences in analytical thinking skills in three schools. The improvement indicates that the model 4A has the syntax: 1) **phenomenon analysis**, 2) **information analysis**, 3) **data analysis**, and 4) **findings analysis** is able to be accepted and applied to secondary school students in natural science learning. This is in line with Joyce and Weil's statements, learning models are used to help students acquire skills, ideas, information, grades, ways of thinking, and self-expressing, as well as teaching how to acquire them (Joyce, Weil, & Calhoun, 2004). Skill in question is the skill of analysis thinking increased through the application of model 4A, no denying the problem presented is in the nearby development zone. Students are able to work on this to understand the problem if they are in the closest development zone (Slavin, 2006) with the ability of critical thinking, problems are able to be solved. Critical thinking capabilities include analysis, evaluation, and reasoning (Hartini & Sukardjo, 2015).

**Table 5: Student Response Poll Results**

Response Aspect	SMP A		SMP B		SMP C	
	Positive Response (%)	Negative Response (%)	Positive Response (%)	Negative Response (%)	Positive Response (%)	Negative Response (%)
Learning material Model 4A	95	5	83	7	84	6
State of the art	93	7	78	22	86	14
Understanding teaching material	84	6	80	20	75	25
Learning activities	86	4	77	23	75	25
Enjoy with learning activities	95	5	76	24	83	17



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Teaching are guiding well	90	10	88	12	92	8
Improve analytical thinking skills	95	5	96	4	100	0
Easy to apply	100	0	96	4	100	0
Making confidence	90	10	100	0	100	0

Based on the results of the students' response poll in Table 5 It was obtained that students respond positively to each component of the device and learning activities by implementing the 4A model.

The results of the response poll in table 5 showed a positive response students, where in SMP A between 84-100%, SMP B 76-100%, and SMP C 75-100%. According to Poerwadarminta, the response means a reaction or response in the form of acceptance, rejection, or indifference to what is conveyed by the communicator in his message [21]. Thus, it can be said that the student's response is positive towards learning model 4A in improving the analytical thinking skills of SMP students on the natural science subjects indicated by the response percentage above 70%. Student response is said to be very positive if 76-100% (Arikunto, 2013). According to Harvey, the response is a form of readiness in determining a good attitude in positive and negative forms of objects and situations (Harvey, 2006).

With regard to the improvement of analytical thinking skills in medium category, the influence of the 4A model on analytical thinking skills, there is no difference in analytical thinking skills in three schools, as well as positive response students to model 4A shows that natural science learning with the model 4A is said to be effective. According to Sinambela, learning is said to be effective when the students are actively involved in organizing and finding information (knowledge) and the relevance of the information provided (Sinambela, 2017). According to Hamalik, it states that effective learning is a learning that provides self-learning opportunities or performs widest activities to students to study (Hamalik, 2001). So, with a model 4A students are able to perform widest activities through phenomenon analysis, information analysis, data analysis, and findings analysis.

## CONCLUSIONS

Based on results and discussion it can be concluded that the 4A model is effective in improving the analytical thinking skills of secondary school students as evidenced by:

1. There is an increase in analytical thinking skills covering indicators of differentiating, organizing, and attributing with the average N-gain category of each school A, B, and C respectively 0.57; 0.51; and 0.55 and the results of a paired t-test, independent t-test, and 2-ways analysis of variance test showed that there was a change in model 4A effect on the analytical thinking skills of secondary school students.
2. Students' responses from schools A, B and C respectively range from 84-100%; 76-100%; and 75-100% the meaning is very positive.

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