



## The meta-analysis study of SAVI learning model on student's cognitive aspects in biology learning



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### ABSTRACT

The meta-analysis study for currently do not have the latest research on the SAVI learning model on student's cognitive aspect in learning biology, especially about education level, region, and the dependent variable. This research aims to analyze the effectiveness of application of the SAVI learning model on student's cognitive aspects in Biology learning. The method used is meta-analysis, that is the analysis that present the results of publication scientific research in electronic journal nationally concern the influence of the SAVI learning model on student's cognitive aspect. The sample used was 14 articles from 35 scientific articles published in accredited national journals, after filtering the articles. The instrument used is in the form of a category coding sheet for articles. The results showed that the overall results of SAVI learning model were able to improve the cognitive abilities of student in the experimental group with an effect size of 0.2246. Based on the education level at the elementary, junior, and senior high school levels with the effect size category, respectively obtained 0.2282, 0.1196, and 0.6162. Based on the region, the effect size in each region was obtained that is in Central Java 0.1389; East Java 0.2460; West Java 0.0394; Bali 0.3069; South Sumatra 0.0242, and 0.3057 in Southeast Sulawesi. Based on the research dependent variable with the results were obtained problem solving skill 0.0742; achievement 0.2916; critical thinking 0.1086; communication skill 0.0242; and reasoning ability 0.3057.

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### INTRODUCTION

The quality of human resources are one of the important factors that lead to the success of overall development. The quality of human resources is also determined by quality of education.

Through the education, a nation can build a superior civilization that becomes the identity of the nation itself.

According to Law Number 20 of 2003 concerning the National Education System, Article I Paragraph 1 acknowledge that education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by himself, society, nation, and state. "The aims of teaching is achieved or not, it can be seen from the learning achievement achieved by student. With high achievement, students have a good indication of knowledge (Hamdu & Agustina, 2011).

Learning is a part of science learning, which is a part of the education system that holds an important role in education. According to Nisak & Septiani (2019) "Learning is a conscious effort from a teacher to teach his students (directing students to interact with sources) in order to achieve the desired goals". Cognitive ability is one of the main indicators of the success of the learning process in addition to affective and psychomotor aspects. Cognitive development is defined as the level of student's ability to understand a concept or principle. Therefore, analyzing student's cognitive development is very important in an effort to determine the right learning strategy to achieve learning objectives (Prabowo & Widodo, 2018).

Student achievement in cognitive learning is still relatively low. The statement is based on "The results of the PISA tests and surveys obtained in 2015 have been published and in 2015 Indonesia became one of the participants who joined the PISA. From the PISA data in 2015, it can be seen that Indonesia's average score is below, compared that of other countries. Indonesia is ranked 63rd out of 72 countries. Indonesia is still under Singapore, Japan, and Chinese Taipei, which incidentally come from Asia. Aspects of science assessment in PISA include knowledge, competence, and student's attitudes in Physics, Biology, and Geography. The aims of the test are to assess the extent to which the cognitive abilities and skills owned by students. The PISA survey in 2015 focused on science, reading, mathematics, and collaborative problem solving as assessment scope. The countries were participating in the survey in science ability for Indonesian students with an average score of 403. This score is still far below the international average score of 493. The mathematical problem-solving average determined by the OECD is 490, while the score obtained by Indonesia only 386 (Kusumaningrum, 2018; Utami, 2019).

The results of the PISA assessment show that Indonesia has only reached the level Ia for science proficiency level. Level Ia represents that students are able to explain scientific phenomena in simple terms, identify causality or simple correlational and interpret graphical or visual data at a basic cognitive level. The achievement occurred as a result of the learning process which was mostly carried out in the traditional way, specifically the teacher as a learning center without actively involving student (Utami, 2019).

The discourse method is more often used because it is considered easier to apply, but in the end the results obtained by students are not optimal. Improving the quality and effectiveness of Biology learning has been carried out through various efforts. As a facilitator, the teacher must establish itself as a person who gives direction and instruction in order to students can learn optimally. Both with learning media and learning models that are appropriate and in accordance with the subject matter being taught (Suherlin, Bardi, & Taher, 2017).

The SAVI learning model was carried out in a way, the teacher acts as a motivator and facilitator of student activities, while students are given the opportunity to communicate and interact socially with their friends to achieve learning objectives. Learning that has the characteristics of somatic, auditory, visualization, and intellectually. The SAVI learning model also emphasizes students to be actively involved by combining physical movement and intellectual activity and directing students to search alternative information from various sources obtained

through the five senses (Puspitasari, Hermahayu, & Purnanto, 2018). The choice of learning model will give direction to the teaching and learning process that determines success in the learning (Sutarna, 2018).

This means that in this learning, active activity with knowledge are built by students themselves, and students are responsible for their achievement. Preliminary observations were carried out by researchers by observing the most widely conducted research data files and published in various accredited national journals. As a result, researchist discovered 35 research of the SAVI learning model on student's cognitive aspects published in the span of 2010-2020.

The average conclusion of research on the SAVI learning model has a positive impact on students. Data from various preliminary research in education scope is available quite abundantly in the form of published journals and also student theses from various campuses around in Indonesia. However, at the moment, there are not many research and studies about research results to summarize and re-examine the results effectiveness of a research theme. Research based on existing data can produce a new theory regarding the researched theme, furthermore the results can also be used to strengthen the results of preliminary research. The research can be carried out using meta-analysis research method. Meta-analysis is a systematic method study accompanied by statistical techniques to calculate the conclusions of several research results. This research uses literature in the form of preliminary research results (thesis, theses, dissertations, research reports) or published scientific articles as data sources. Researchist will take several researches which have the same topic or theme. This method is used to summarize, embrace, and obtain the essence of the findings from a number of researches.

However, until this moment there is no recent meta-analysis research in particularly concern the SAVI learning model in Biology learning at the education level, region, and dependent variable. Starting from the problem and background, the researchist finally conducted a meta-analysis of national journals to behold the effect of application the SAVI learning model to be applied as a whole, with the research title The meta-analysis study of SAVI learning model on student's cognitive aspect in biology learning.

## RESEARCH METHODS

### Research Design

The research method used is meta-analysis, that is the analysis to presents the results of publication scientific research in electronic journals nationally concern the influence of the SAVI learning model on student's cognitive aspect. Descriptive research is research to provide a description of the phenomenon or social tendency, researched by describing the value of independent variables, either one or more variables (independent) based on indicators of the variables studied for exploration and classification by describing a number of concern variables with the result that not to doubt the associative and comparative between the existing research variables.

### Population and Samples

The population in this research is scientific publication articles from national journals in Indonesia about the application of the SAVI learning model. The samples be accepted were scientific publication articles about the SAVI learning model with the variety of research categories: (1) articles made by general researchist and students; (2) articles using experimental research methods; (3) articles from national journals accredited by the Ministry of Research, Technology, and Higher Education of the Republic of Indonesia (Ristekdikti) at Sinta Indonesia and indexed at <http://sinta2.ristekdikti.go.id/>; (4) the article is a quantitative research and satisfy the statistical efficiency data; (5) articles published in the last 10 years; (6) an article with the theme of the SAVI learning model on the concept of student's cognitive aspect; (7) the sample of education level in

the article is at the elementary school (SD), junior high school (SMP), and senior high school (SMA) levels; and (8) the research area in the article is carried out in the Indonesian region.

### Instruments

The instrument used in this research was a coding sheet. The variables used in the data coding to collect information about the effect size of research on meta-analytical studies of the SAVI type are: (1) the name of the researcher; (2) the years of research; (3) the subject of education; (4) independent and dependent variables; (5) implementation time; (6) research design; (7) sample size.

### Procedures

The stages carried out in this research are: (1) Determine the problem or topic to be studied, that is the type of SAVI. (2) Search and collect research reports in national journals related to the problem or topic to be researched and determine the period of research findings that are used as source data, which is published in 2010-2020. (3) Reading the research reports to behold if the content is in accordance with the problems that have been determined, focusing research on problems in the form of aspects of research methodology and categorizing each research or in other words collecting as much information as possible in the research reports. (4) Determine the effect size on each research report from each data obtained. (5) Analyzing research reports that have been published based on the study of methods and data analysis used, in order to the conclusions can be drawn from the meta-analysis research conducted.

### Data Analysis

The basic unit of the meta-analysis study is the effect size, then to answer the research problem formulation, calculations using the effect size analysis technique. Calculate effect sizes for each study, to assess consistency of effects in all studies, and calculate summary effects. Piggot (Kadir, 2017) stated that there are three basic types of effect sizes, that are: standardized mean difference, correlation coefficient, and log odd ratio. The standardized mean difference is the most common form of effect size when the research focused between two independent groups such as the treatment and control groups. Correlation coefficients are usually used when synthesizing observational studies, when the research question is concerned with estimating the strength of the relationship (association) between two measures. The log odds ratio can be calculated to compare the assumptions between the two groups. The effect size formula used is the eta-square formula ( $\eta^2$ ). The criteria used to form the results interpretation of effect size using references from Gravetter and Wallnau, it can behold in Table I.

**Table I.** Results interpretation of effect size

No	Range result	Category
1	$0.01 < \eta^2 \leq 0.09$	Small effect
2	$0.09 < \eta^2 \leq 0.25$	Medium effect
3	$\eta^2 > 0.25$	Big effect

(Kadir, 2017).

## RESULT

The data of the SAVI learning model in this research amounted to 14 scientific publication articles that could be analyzed, which were accepted from 35 articles that were collected. The effect size of scientific publication articles on the SAVI learning model based on category is presented in Table 2.

**Table 2.** The effect size based on category

No	Article Code	Total of Sub Effect Size	Effect Size	Average Effect Size	Category	N Article
1	A12	1	0.0429	0.0430	Small	4
2	A17	1	0.0788	0.0788	Small	
3	A24	1	0.0242	0.0242	Small	
4	A30	1	0.0394	0.0394	Small	
5	A1	2	0.0896 0.1281	0.1089	Medium	3
6	A5	1	0.1668	0.1688	Medium	
7	A15	1	0.1086	0.1086	Medium	
8	A33	1	0.6103	0.6103	Big	6
9	A13	1	0.1688	0.1471	Big	
10	A14	1	0.3270	0.3270	Big	
11	A18	3	0.0901 0.2298 0.3561	0.2253	Big	
12	A19	1	0.7269	0.7269	Big	
13	A28	1	0.3057	0.3057	Big	
14	A31	1	0.6162	0.6162	Big	
<b>Average Effect Size</b>				<b>0.2246</b>		
<b>Total sub Effect Size</b>				<b>17</b>		
<b>SD</b>				<b>0.22</b>		

**Table 3.** The effect size based on education level

No	Education Level	N Article	Article Code	Effect Size	Average Effect Size	SD
1	SD	9	A5	0.1688	0.2282	0.22
			A33	0.6103		
			A12	0.0430		
			A13	0.1471		
			A14	0.3270		
			A15	0.1086		
			A17	0.0788		
			A18	0.2253		
			A19	0.7267		
2	SMP	4	A1	0.1089	0.1196	0.13
			A24	0.0242		
			A28	0.3057		
			A30	0.0394		
3	SMA	1	A31	0.6162	0.6162	-

The results of the data analysis in Table 2 show that there are four articles with a small effect size, three articles with a medium effect size, and six articles with a big effect size. From the calculation, the average effect size is 0.2246 in the big category and the standard deviation is 0.22.



Based on the education level, one of the aspects that can be analyzed is Elementary School (SD), Junior High School (SMP), and High School (SMA). The data on the effect size results of the SAVI learning model based on education level is presented in Table 3.

The data summarized in Table 3 show that the application of the SAVI learning model at the elementary school level (SD) contains nine articles with an effect size of 0.2282, at the junior high school level (SMP) there are four articles with an effect size of 0.1196, and senior high school (SMA) only has one article with an effect size of 0.6162. Visually, the average influence based on education level is presented in Figure I.

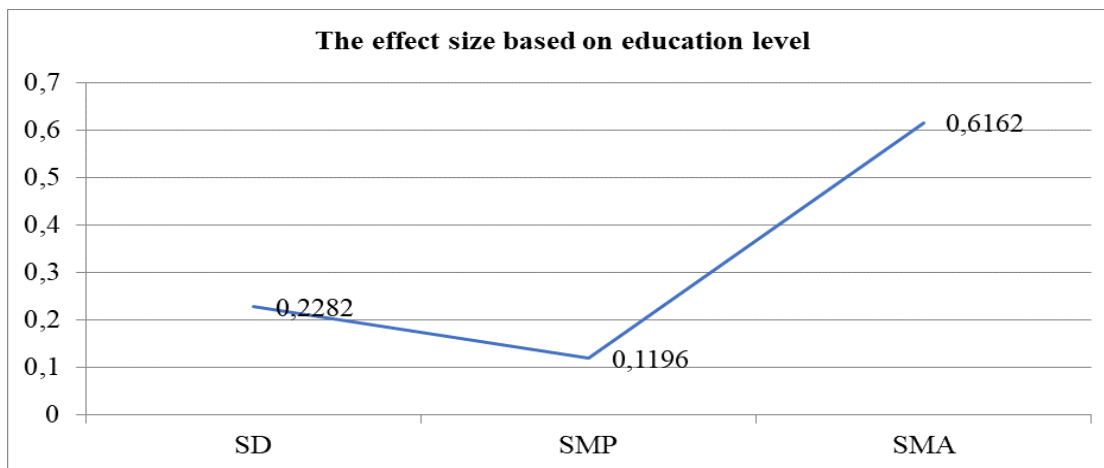


Figure I. The effect size chart based on level education

Figure I shows that the three levels of education at the junior high school level are in the lowest category and the elementary level has a medium effect, while senior high school shows the highest value. This finding reveals that the level is the most effective, although the highest effect has limited data. However, there are still few researches using the SAVI learning model at the senior high school level. The effect size can also behold based on the use of the model in the territory of Indonesia, in order to the application can be mapped, this can behold in Table 3.

Table 3. The effect size based on region in Indonesia

No	Region	N Article	Article Code	Effect Size	Average Effect Size	SD
1	Jawa Tengah	3	A1	0.1089	0.1389	0.04
			A5	0.1688		
			A33	0.6103		
2	Jawa Timur	3	A12	0.0430	0.2460	0.32
			A17	0.0788		
			A31	0.6162		
3	Jawa Barat	1	A30	0.0394	0.0394	-
			A13	0.1471		
4	Bali	5	A14	0.3270	0.3069	0.25
			A15	0.1086		
			A18	0.2253		
			A19	0.7267		
5	Sumatera Selatan	1	A24	0.0242	0.0242	-
6	Sulawesi Tenggara	1	A28	0.3057	0.3057	-

Table 3 illustrates that the application of the SAVI learning model in Bali is most widely used, there are five articles, while the smallest use is in West Java, South Sumatra, and Southeast Sulawesi with one article. However, when viewed from the effect size, all of them show the big criteria with the highest effect size occurring on the island of Bali, that is 0.3069. Visually, the average of influence quantity based on the archipelago in Indonesia is presented in Figure 2.

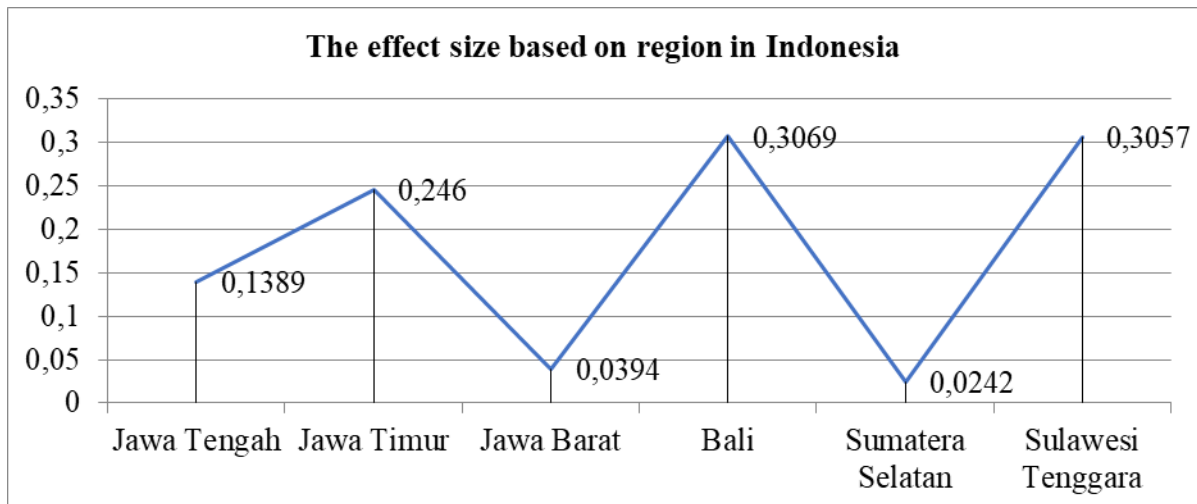


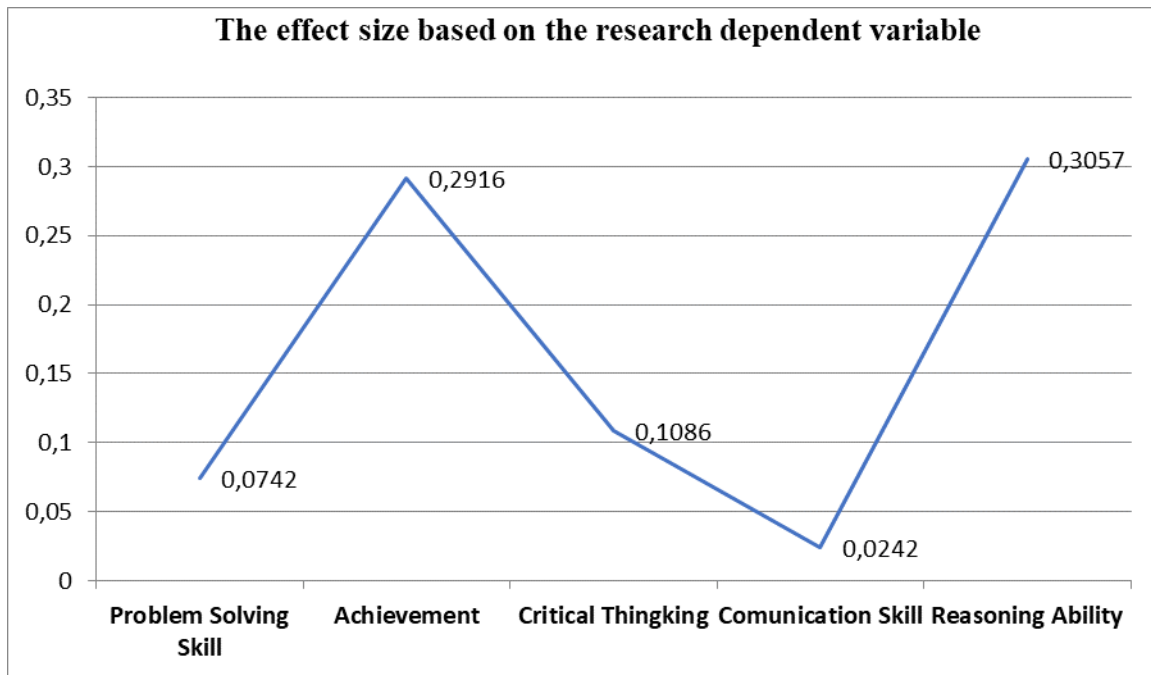
Figure 2. The effect size chart based on region in Indonesia

Figure 2 shows that the effect is highest on the island of Java and the island of Bali is the most effective in using the SAVI learning model compared to other islands in Indonesia. Based on the research dependent variable, the data result from the effect size based on the research dependent variable in the SAVI learning model can be held in Table 4.

Table 4. The effect size based on the research dependent variable

No	Research Dependent Variable	N Article	Article Code	Effect Size	Average Effect Size	SD
1	Problem Solving Skill	2	A1	0.1089	0.0742	0.05
			A30	0.0394		
			A5	0.1688		
			A12	0.0430		
			A13	0.1471		
2	Achievement	9	A14	0.3270	0.2916	0.25
			A17	0.0788		
			A18	0.2253		
			A19	0.7267		
			A31	0.6162		
3	Critical Thingking	1	A33	0.6103	0.1086	-
			A15	0.1086		
4	Communication Skills	1	A24	0.0242	0.0242	-
5	Reasoning Ability	1	A28	0.3057	0.3057	-

Table 4 of scientific publication articles displays research on the dependent variable of research concern the application of teaching in the form of the expected output, that is achievement with the highest number of articles with nine scientific publications, followed by problem solving skills with two scientific publication articles, while critical thinking skills, communication skills, and reasoning ability amounted to only one research article. Visually, the average influence based on the research dependent variable is presented in Figure 3.



**Figure 3.** The effect size chart based on the research dependent variable

Figure 3 describes that the highest average effect is obtained when the SAVI learning model is used on student's metacognitive ability, that the SAVI learning model is very effectively used to improve student's metacognitive ability.

## DISCUSSION

This research aims to determine the effect of the SAVI learning model on student's cognitive aspect using the meta-analysis method. To determine the effect generated in this study, it is necessary to calculate the effect size then that it can be mapped and analyzed the influence involved in the SAVI learning model. Effect size shows the magnitude of the influence of a treatment or the strength of the relationship between two variables, is the most important unit in the meta-analysis because it is able to provide information from the summary results. By determining the effect size of each research, overall, it can be discovered and determined how much the influence of a treatment. Of the 35 scientific articles that were collected and summarized in coding form, only 14 scientific articles suitable the criteria and the effect size could be determined through calculations using a predetermined formula.

The effect size calculation is carried out on the raw data contained in the statistical data of scientific publication articles. The results of this calculation form the basis for the subsequent meta-analysis. There are many scientific articles that the effect size calculation process cannot do due to the incompleteness of the data and the required article criteria then finally it had to be eliminated and did not meta-analysis was carried out on the article.



The research findings reveal that the average overall influence of the learning is 0.2246. This means that the treatment of the SAVI learning model in metacognitive learning is able to improve student's achievement in the experimental group of 0.316 times the influence of the control group. This explains that learning using the SAVI learning model is effective for use in the process of teaching and learning activities with a high effect size category, therefore the SAVI learning model is able to influence students in learning.

The SAVI learning model becomes something interesting to study and analyze in metacognitive learning. This is a fact that describes the situation of achievement in the experimental group have a greater influence and are higher than the control group based on the effect size obtained.

This explains that the treatment in the experimental group of the SAVI learning model has a more effective influence or provides higher achievement than the control group. With the effect size results in this research, we are able to behold the effectiveness of SAVI learning model is by using the involvement of the comparison group, specifically the control group in each sub-research, then the achievement obtained are the effects or consequences of the treatment given to the experimental group. Therefore, the SAVI learning model is an alternative that can be used in learning to improve student achievement. This finding is parallel with the research result of Putri, Panjaitan, & Sujana (2017) which states that the application of SAVI learning can improve student's cognitive achievement. The same thing was also expressed by Husita (2014) that the learning process with the cooperative model in SAVI type can improve student's learning completeness. Research by Wijayanti, Prayitno, & Marjono (2013) also provides support by stating that the SAVI approach through the cooperative learning model in STAD type can improve achievement in the cognitive domain.

Based on the results of the effect size data, the influence of the SAVI learning model on Biology learning from the point of view of the education level which is interpreted in Table 2 is able to improve the student's achievement in the experimental group by 0.2282 for elementary education level, for junior high school level of 0.1196 and 0.6162 for senior high school level. The application of the SAVI learning model at the senior high school level provides a large enough effect compared to other levels, this shows that the use of the SAVI learning model is effective and feasible to use at the senior high school level, followed by the elementary school and junior high school levels. Although the effect size at both levels of high school is classified as a large criterion, at the junior high school (SMP) level the application of the SAVI learning model has a smaller average effect than the application at the senior high school level (SMA). This result is parallel with the research result of Utami's (2019) which states that the results of the analysis show that the cooperative learning model applied at the junior high school level has an average effect size that is not much different from the senior high school level. In general, average of the influence of cooperative learning model in experimental class when viewed from the application at the senior high school level gives results that do not change much in the control class. Otherwise, the average results of the experimental class at the junior high school level showed a significant change compared to the results of the control class.

The high average influence at these two levels of education has implications for children's cognitive development, where student's psychologically at the junior and senior high school levels are in the formal operational stage based on Piaget's theory of cognitive development, specifically at the age of 11 years to adulthood. In the formal operational stage, children begin to think about experiences outside of concrete experiences and are able to abstract thinking independently, ideally, logically, more scientifically, and develop attention to social issues. The abstract quality of formal operational thinking is behold in problem solving, the problem can be solved through the use of systematic experimentation. At this stage, adolescents begin to speculate about the ideal qualities

they want in themselves and in others. This idealistic thinking can be fantasy or illusion. Deductive hypothesis reasoning contains the concept that adolescents can formulate hypotheses about how to solve problems and reach systematic conclusions. This is parallel with Bujuri's research (2018) which states that in the teaching and learning process, children have applied constructivism and inquiry learning models which in principle require high reasoning and require students to actively think, have ideas, and draw meaning from empirical and abstract things. Research by Nuryati & Darsinah (2021) also states that the stages of child development affect how to get new knowledge. The stages of children's learning development are not only influenced by the level of different student's understanding, but also influenced by the models and methods and the handling used must be varied and adapted to the stages of their age.

The contribution given to the application of the SAVI learning model at the senior high school level is that the average effect size is greater with a slight difference from the junior high school level on student's achievement. The development of children from the formal stage does not occur suddenly (directly) or perfectly, but requires a gradual process. Then at the junior high school level, which is commonly referred to as the early adolescence period, they are in the process from the concrete cognitive stage to the formal cognitive stage, and it could be in the first years when the child is in the early adolescent period (formal cognitive stage). Abstract thinking is still not fully developed, in many cases it may still require the help of visual aids or realistic media. At this stage, the child is also able to think logically about various things, including things that are somewhat complicated, but on the condition that these things are presented in a tangible way (presented in a form that can be captured by the five senses). Without concrete objects, children will have difficulty understanding many things and in thinking logically. However, there is no theoretical and empirical evidence to draw the inference that the psychological maturity factor in cognitive development if it is associated with the level of education can affect the achievement, therefore further studies are needed.

The research findings provide an explanation that the use of the SAVI learning model in terms of region in student's metacognitive learning with an average big effect size of 0.2246 at regions in Indonesia, consist of Central Java 0.1389 East Java 0.2460, West Java 0.0394, Bali 0.3069, South Sumatra 0.0242, and Southeast Sulawesi 0.3057. Based on Table 3, it is revealed that the application of the SAVI learning model in metacognitive learning is effectively used with different geographical backgrounds. From a number of research results studied, it turns out that the island of Bali occupies the highest position providing an average effect size of 0.3069 times the control group compared to other regions. These results illustrate that the SAVI learning model contributes the most on the island of Bali to metacognitive learning.

The interesting thing that needs to be studied is that the island of Bali has the influence of SAVI learning with the highest effect size. In terms of distribution and development of the island of Bali, the speed of information and communication technology is more rapid, because the island has a unique nature and is one of the famous islands in Indonesia. It is also possible that areas other than the island of Bali also have facilities and technology that can support the student's learning process to achieve learning objectives, which can be created with environmental conditions and local conditions adapted to the concept of learning.

The SAVI learning model is effectively used and has a major influence on cognitive learning because it is in line with utilizing a variety of sources of knowledge, learning is collaborative, communicative, and cooperative as well as being able to develop reasoning and problem solving abilities. The SAVI learning is able to improve student's cognitive abilities with effect size of problem solving skill 0.0742, achievement 0.2916, critical thinking 0.1086, communication skill 0.0242, and reasoning ability 0.3057. The results that have been described are in line with Kusumawati & Gunansyah (2013) which states that the SAVI learning model is proven

to be more effectively used to improve student's learning motivation, motoric activity, and intellectual of students, which can have an impact on improving student's achievement and student's problem solving skills. The same thing was also expressed by Taneo (2016) that student's problem-solving abilities in classes using the SAVI learning model with a contextual approach were better than classes with conventional learning. Fitriyani, Suwatra, & Kusmariyatni (2015) also stated that learning with the SAVI model has an influenced on critical thinking skills in science subjects. Research by Sulaksana, Margunayasa, & Wibawa (2018) also states that the application of the SAVI learning model assisted by LKS has a positive influence on student's science achievement.

## CONCLUSION

Based on the findings and analysis of the research result that has been done, it can be concluded that overall SAVI learning is able to improve student achievement in the experimental group with a big effect size of 0.2246 from the control group. The implication of the research is that SAVI learning has a more effective influence and is suitable for use in learning, be it for the education level, region, and the dependent variable that has been determined. The large influence on the application of SAVI learning based on education level is able to improve student's achievement both at the elementary school, junior high school, and senior high school levels with the effect size category, respectively obtained 0.2282, 0.1196, and 0.6162. The effect size of SAVI learning based on region is obtained by the effect size in Central Java 0.1389, East Java 0.2460, West Java 0.0394, Bali 0.3069, South Sumatra 0.0242, and 0.3057 in Southeast Sulawesi. This means that the SAVI learning model in Indonesia is able to improve student's achievement in the experimental group with obtaining the highest effect size in Bali. Based on the research dependent variable, SAVI learning was able to improve the cognitive abilities of students with the effect size result of problem solving skill 0.0742, achievement 0.2916, critical thinking 0.1086, communication skill 0.0242, and reasoning ability 0.3057.

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