

# An Analysis of the Relationship between Students' Scientific Attitude and Students' Learning Style in Junior High School

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**ABSTRACT** The objectives of this study were to profile the relationship of scientific attitude level and learning style preference among junior high school students in Bandung. This study utilized a survey research design with a total sample size of 110 students. A scientific attitude questionnaire and a visual, auditory, and kinesthetic (VAK) learning style inventory were administered in this study. The questionnaire measures five aspects of scientific attitude, specifically rationality, curiosity, open-mindedness, aversion to superstition, and objectivity. The VAK learning style inventory evaluates the preferred means of receiving sensory information. The scientific attitude questionnaire provided consistent results, as indicated by its reliability coefficient (0.896). The results show that junior high school students have an average level of scientific attitude and generally prefer a kinesthetic learning style. There was a medium relationship between scientific attitude and learning style among the students (Cramer's V coefficient = 0.239). It is concluded that learning style must be considered in implementing a science lesson, especially in the Indonesian context.

**Keywords** Scientific attitude, VAK learning style, Junior high school student

## 1. INTRODUCTION

Science has always been an essential aspect of everyday life. Its existences have helped human being to cease their activities, including processing information, especially in the educational process. Three primary goals of science education, are including development in science knowledge (cognitive domain), science process skills (psych motive domain), and scientific attitude (affective domain) (Ali Khan, Shah, Makhdoom, Mahmood, & Zareen, 2012). The first two domains have been studied proportionally. However, the assessment of scientific attitude as the affective domain is not as easy as the two others. It's the number of researches less grow proportionally (Punia & Bala, 2009). Due to the hesitation to use affective measures for grading purposes and the result that develop slowly compared to assessment in the cognitive aspect (Krathwol, Bloom, & Masia, 1964). This lack of assessment in scientific attitude has been considered as the factor that is causing poor scientific orientations among science students, which causes a decrease in several aspects of students' daily activities in the society, such as productivity,

development, and values (Zain, Samsudin, Rohandi, & Jusoh, 2010).

An affective domain that being discussed in some science education-related literature is concerning attitudes related to science (Laforgia, 1988). Gardner (1975) suggested two main categories of attitudes related to science; attitudes towards science (e.g., interests in science, attitudes towards scientists, and attitudes towards social responsibility in science) and scientific attitudes (e.g., open-mindedness, honesty, skepticism). Ozden & Yenice (2014) brought out the importance of scientific attitude towards the cognitive process as a must-have skill by science people to reach new knowledge in science. Teaching and learning science supposed to be perpendicular to its function and purposes, which is developing a scientific attitude (Istikomah, Hendrato, & Bambang, 2010).

Oloruntegbe & Omoifo (2005) stated that one of the factors that might cause students to have poor scientific attitude orientation is the lack of assessment in students'

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scientific attitudes. Teachers should give the students chances to develop their scientific attitude (Istikomah, Hendratto, & Bambang, 2010). Teachers could put scientific attitudes through experiments or exploration to give students a chance to develop their scientific attitude because problem-solving skills and scientific attitudes are important things in 21st-century demand. But this importance has again been getting less attention as the learning purpose due to some difficulties found by teachers in designing strategy and document to measure scientific attitude (Widowati, Nurohman, & Anjarsari, 2017).

Curry & Adams (1991) explained that learning style is needed habitually to acquire knowledge, skills, or attitudes. Federico (2000) said that by understanding students' learning styles, students could improve their planning, producing, and implementing educational experiences; thus, the analysis of student attitudes and learning styles will help in designing, developing, and delivering more effective and efficient educational environments. The concept of learning style is a diversity of individual's preferences towards learning approaches (Joy & Kolb 2009). Students in the classroom may have their preferred learning style. Still, those learning styles will generally cover: (1) an attempt to learn maximum knowledge, solely from the lecturer (authority) for later regurgitation or (2) an ongoing commitment to learn and reorganize knowledge, particularly in collaboration with peers and, e.g., the lecturer (El-Farargy, 2010).

Learning style as a concept has been raising interest among professional educators in all education levels. The excitement gets increased regarding its capability of being acceptable to a broader community, not only among the educators but also among parents and the public in general. Pashler, McDaniel, Rohrer, & Bjork (2009) said that this acceptance could happen because learning style has many offerings such as tests, assessment devices, and technologies to help educators in identifying students learning styles, which in the future can be useful to create adaptive and active learning processes. One of the strategies to facilitate the different learning styles is the use of multimedia and innovative approach (Nugraha & Eliyawati, 2019; Suryawati & Osman, 2018).

The popularity of learning styles has been proved by a significant number of researchers in the literature trying to describe learning styles from various points of view. Coffield, Moseley, Hall, & Ecclestone (2004) stated that there had been enormous reviews related to learning styles over the past years, and the number is still growing. In the United States, a very popular learning styles inventory was developed by Kolb in 1984. Kolb's learning styles inventory has two main dimensions: preferred mode of perception (concrete to abstract) and preferred mode of processing (active experimentation to reflective observations), with four classifications: divergers (concrete, reflective), assimilators (abstract, reflective), convergers

(abstract, active), and accommodators (concrete, active) (Pashler, McDaniel, Rohrer, & Bjork, 2009).

Another learning style questionnaire (LSQ) was developed by Honey and Mumford in 1986 by modifying Kolb's. The LSQ classified learners into activists (competitive activities and respond well to challenges), reflectors (need time to prepare in advance), theorists (required to understand complex problems), and pragmatists (seek distinct advantages to learning a given task) (Shaw & Marlow, 1999). Vaishnav (2013) stated that some students might learn best by visual, auditory, and kinesthetic. These three learning styles said as the most popular one and a favorite one in the learning community due to its benefits in providing a broader perspective of students' dominant thinking, learning style, and strengths. Yet, this Visual, Auditory, and Kinesthetic (VAK) Learning Style doesn't overlay Gardner's theory of multiple intelligence or Kolb's theory (Gholami & Bagheri, 2013; Vaishnav, 2013).

Visual, Auditory, and Kinesthetic (VAK) learning style models were developed by Dunn & Dunn (Sanni & Emeke, 2017). They developed the VAK learning style model, which focuses on three main sensory receivers to determine dominant learning. Students with visual learning styles will tend to write what they learned, remembering the shape and color of what they observed and remembered faces easily. Students with auditory learning styles will choose to speak what they learned aloud or to themselves, love to listen to music but easily get distracted by noise, and remember names better than faces. While students with kinesthetic learning styles will show the tendency to learned better from what they have done, love to do physical activities, and found it hard to make them sit still. Based on the theory, one or two learning styles will appear dominantly on learners. The domination shows the best way of learners in filtering information, and it might be changed due to the different tasks given. One's may prefer a learning style on one task and combine two learning styles on another (Penger & Tekavcic, 2009; Magulod, 2019; Weng, Ho, Yang, & Weng, 2019).

The relationship between students' scientific attitudes and students' learning styles has been studied by some researches. Kant & Singh (2015) argued that science students have different learning styles, and achievement in science subjects was not significantly different in some groups of learning styles, but it was significant in the others. While students were having more and less scientific attitudes of various categories of learning style, the learning styles were not substantial overall, but, in some cases, they were significantly different. Sanni & Emeke (2017) showed that age, extroversion, sensing, thinking, and kinesthetic had direct effects on Biology achievement, and gender, age, and thinking had indirect effects on Biology achievement.

Pitafi & Farooq (2012) showed that secondary school students' scientific attitude was moderately scientific about

the element “curiosity” and secondary school students’ scientific attitude was slightly scientific about the element rationality, willingness to suspend judgment, open-mindedness, critical mindedness, objectivity, honesty, and humility. Students have a good attitude when the science lesson is interesting (Kurniawan, Astalini, & Sari, 2019).

Ataha & Ogumogu (2013) found that the level of Students’ Scientific Attitude was average, and there is no significant difference between the students’ scientific attitude acquired by male and female students. And Vaishnav (2013) revealed that the kinesthetic learning style was found to be more prevalent than visual and auditory learning styles among secondary school students. There exists a high positive correlation between kinesthetic learning style and academic achievement. Moreover, there was a significant association between academic performance and the reading/writing learning style preference (Akhlaghi, Mirkazemi, Jafarzade, & Akhlaghi, 2018).

Thus, to reduce the lack of assessment in affective domain and to help students in acquiring scientific attitude, this research brings the urge to develop a suitable measurement of students’ scientific attitude, analyzing students’ learning style, and finding the possible relationship between them into an analysis of students’ scientific attitude and students learning style survey. Elaborating on the research problem, the research attempts to explore the following questions: 1) How is the profile of students’ scientific attitudes in junior high school? 2) How is the profile of students’ learning styles in junior high school? And 3) How is the relationship between students’ scientific attitudes and students’ learning styles?

## 2. METHOD

Since this research included as non-intervention, with the purpose is to describe the tendency of a population, a survey research design was employed. This research addressed two questionnaires to profile the level of

students’ scientific attitude and to analyze students’ learning styles. The data were collected through an online platform. Students’ scientific attitude questionnaire has a reliability coefficient of 0.896, which means that the Scientific Attitude Questionnaire has gained its consistency. The questionnaire consists of 45 statements, with a four-scale Likert scale. Table 1 shows the total statements being included in the final form of the Scientific Attitude Questionnaire. Curiosity aspect has the largest number of statements because the aspect consists of more indicators than another aspect. Also, the Aversion to Superstition aspect has the smallest number of statements because the aspect consists of only two indicators. Each statement is paired with a four-scale Likert scale.

The VAK Learning Style Inventory employed in this research was the VAK Learning Style Inventory developed by Victoria Chislett and Alan Chapman in 2005. This VAK Learning Style Inventory was constructed by 30 statements with multiple choices. The VAK Learning Style Inventory has a reliability coefficient of 0.767, which means that the Scientific Attitude Questionnaire has gained its consistency. Each statement had three different choices that each choice was representing a sensory receiver. Table 2 explains that choice ‘a. Read the instruction first’ is representing visual sensory receiver by its statements that ‘reading’ as the chosen word in the statement. While choice ‘b.’ represents auditory sensory receiver as the word ‘listen’ applied in the statement, and choice ‘c.’ represents visual sensory receiver as the word ‘try’ applied in the statement. Those choices are always representing one sensory receiver; ‘a.’ for the visual sensory receiver, ‘b.’ for the auditory sensory receiver, and ‘c.’ for the kinesthetic sensory receiver.

The population was students of Public Junior High School in Bandung in the 2018/2019 academic year; the targeted population was the 9th-grade students of Junior High School in Bandung in the 2018/2019 academic year. There were eleven classes with a total number of 9th-grade

**Table 1** Items of scientific attitude questionnaire

No	Dimension	Number of statements
1	Rationality	11
2	Curiosity	15
3	Open-mindedness	8
4	Aversion to Superstition	5
5	Objectivity	6
Total		45

**Table 3** Range of students’ scientific attitude point and its level

Range	Level
150 – 200	High
100 – 149	Average
50 – 99	Low

**Table 2** Example of choices in VAK learning style inventory that represent each sensory receiver

No.	Statement	Choice	Sensory Receiver
1.	When I operate new equipment I generally:	a. Read the instruction first b. Listen to an explanation from someone who has used it before c. Go ahead and have a go, I can figure it out as I use it	Visual Auditory Kinesthetic

**Table 5** Mean score of students' scientific attitude

	N	Minimum	Maximum	Mean	S.D	Decision
Scientific Attitude	110	101	180	146.77	16.008	Average Scientific Attitude

**Table 4** Analysis and interpretation of students' answers in VAK learning style inventory

Students' Answers	Interpretation
Mostly 'a'	Visual Learner
Mostly 'b'	Auditory Learner
Mostly 'c'	Kinesthetic Learner

students are 418 students. A simple random sampling was used to determine the sample; the sampling allows every member of the population has an equal and independent chance of being selected (Fraenkel, Wallen, & Hyun, 2013). Thus, the samples are randomly chosen to choose ten students from every class that made the total sample size of 110 students.

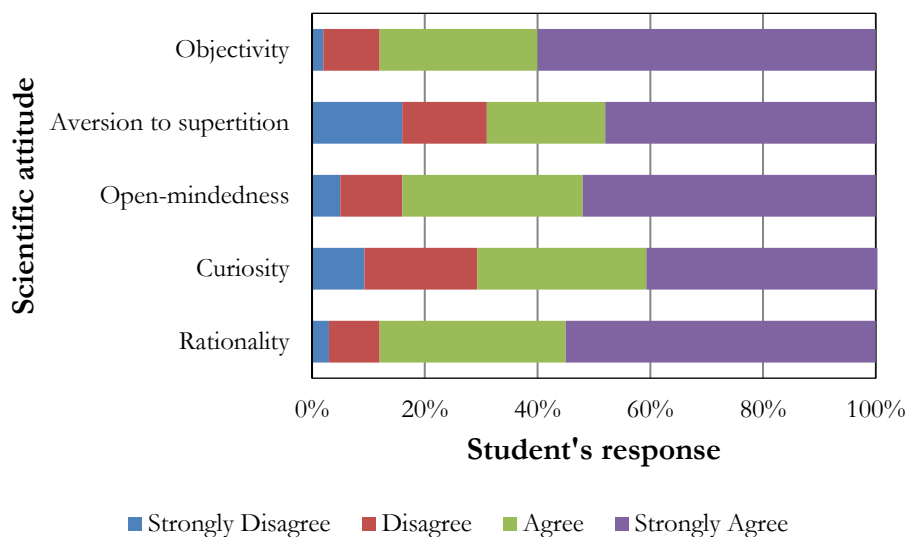
To obtain the result from the Scientific Attitude Questionnaire and analyzed the profile of Students' Scientific Attitude, points gained by the students first need to accumulate. Students who have answered all 45 statements in the Scientific Attitude Questionnaire will gain the minimum point of 45 and the maximum point of 180—the range of the point presented in Table 3.

The range written in Table 3 is the range of points gained by students when they finished answering all the 45 statements in the Scientific Attitude Questionnaire. For example, if a student gained 132 points from all the statements, he/she answered from the questionnaire, he/she will be profiled as having an average Scientific Attitude Level. To be able to analyze the profile of Students' Learning Style, all of the choices made by students need to be summed up. After answering all the 30

statements of VAK Learning Style Inventory, students who have mostly choose a. b. or c. the choice will be analyzed if a student's choice is mostly a. means that the student has Visual Learning Style if a student choice is mostly b. means that the student has Auditory Learning Style, and is a student choice are mostly c. means that the student has a Kinesthetic Learning Style. The interpretation displayed in Table 4.

In order to analyze the relationship between the two variables, Microsoft Excel and IBM SPSS software were applied to analyze, calculate, and find the possible relationship between the two variables. The Microsoft Excel run to convert raw data gained through an online questionnaire, analyze the profile of Students' Scientific Attitude and Students' Learning Style, and also to visualize the data. At the same time, IBM SPSS software was run to find the possible relationship between two variables using the crosstabs Chi-square technique and Cramer's V value.

The Chi-square technique applied to analyze whether a relationship or association existed between two variables because the data collected through the questionnaire were not nominal data (King, Rosopa, & Minium, 2011). Scientific Attitude Questionnaire resulted in ordinal data (low, average, high), and the VAK Learning Style Inventory resulted in categorical data (visual, auditory, kinesthetic). Cramer's V value was applied to determine the power or strength that occurs in the relationship between variables (Gravetter & Wallnau, 2009).

**Figure 1** Analysis of student's responses within each aspect of scientific attitude questionnaire

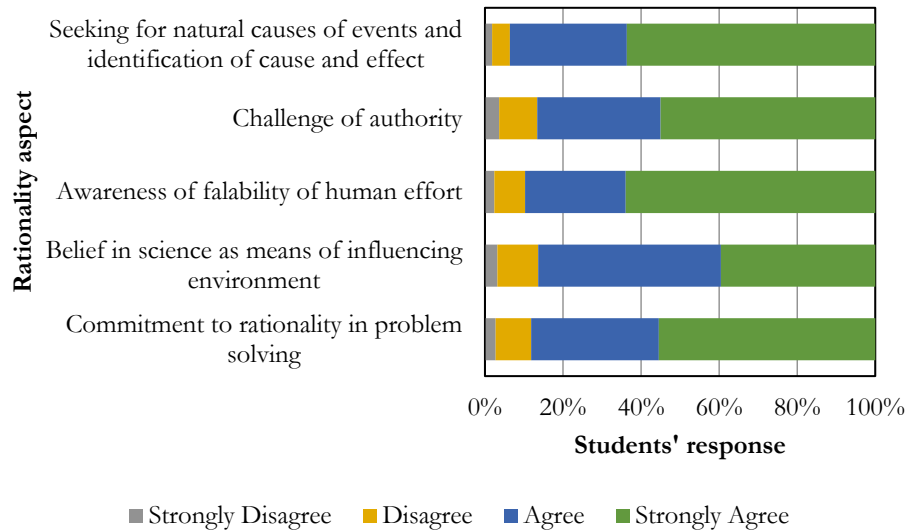


Figure 2 Students' response towards indicators in rationality aspect

### 3. RESULT AND DISCUSSION

#### 3.1. Profile of Students' Scientific Attitude

##### 3.1.1. Level of Students Scientific Attitude

The data collected were analyzed by using SPSS software to obtain a mean score of Students' Scientific Attitude Level in Junior High School in Bandung. To answer the research question, "How is the profile of students' scientific attitude in junior high school?" a summary of the mean score of Students' Scientific Attitude is presented in Table 5.

Table 5. shows that out of 110 samples, the lowest point of Scientific Attitude gained by students is 101, and the highest is 180. The value of Mean shows that most of the students in Junior High School gained 146.77 Scientific Attitude points; thus, it can be decided that students in

Junior High School obtained the Average Scientific Attitude level.

This finding is supported by the previous research, which reported that the scientific attitudes of students in Pakistan secondary schools were moderate (Pitafi & Farooq, 2012). A similar finding also indicated that secondary school students have a scientific attitude at the level average (Ozden & Yenice, 2014). Ataha & Ogumogu (2013) argued that the average level obtained by students is not enough to fulfill the needed scientists in order to scientifically and technologically developing the society to be ready to compete with another country. Ozden & Yenice (2014) stated that the basic science and technology education provided was not very influential to student's scientific attitudes and values. Thus, to develop programs that will increase students' scientific attitude of students in secondary school is needed (Ataha & Ogumogu, 2013).

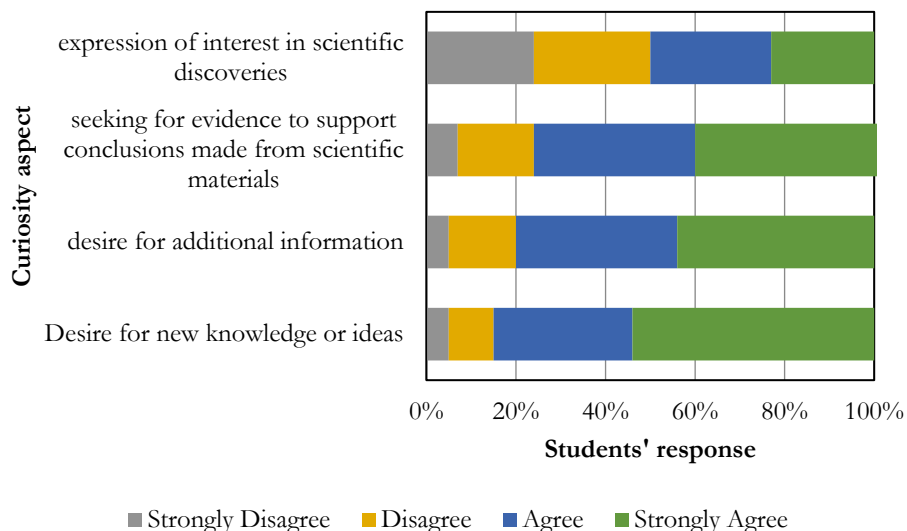


Figure 3 Students' response towards indicators in curiosity aspect



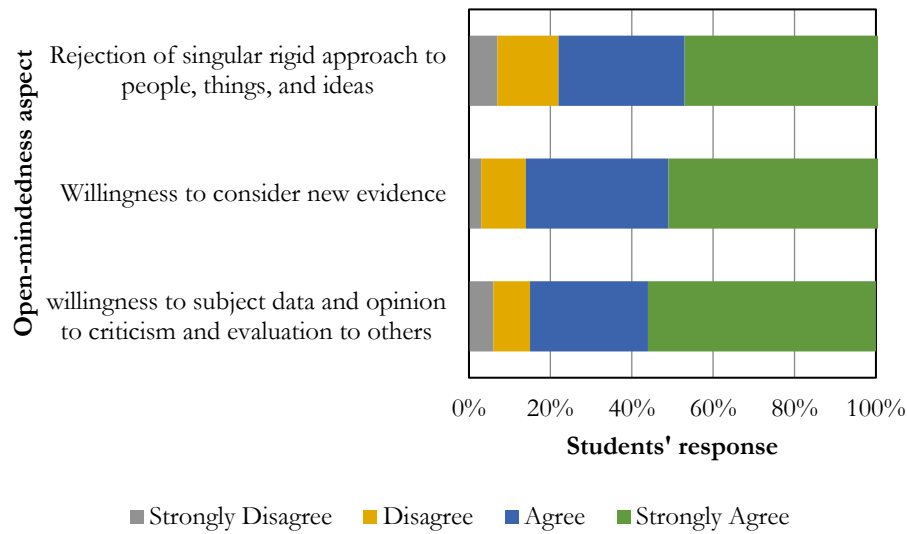


Figure 4 Students' response towards indicators in open-mindedness aspect

### 3.1.2. Aspects Analysis of Students Scientific Attitude

The Scientific Attitude was constructed by 5 aspects; rationality, curiosity, open-mindedness, aversion to superstition, and objectivity. Thus, the analysis of students' responses within each aspect of the Scientific Attitude Questionnaire was necessary to be analyzed. The analysis is summed up in Figure 1.

Figure 1. shows students' responses in each statement of the Scientific Attitude Questionnaire. It shows that students mostly Strongly agree with all statements. Even in the Objectivity aspect, 60% of students state Strongly Agree toward the statements within the aspect dominating all three other degrees of agreement. While in the Curiosity

aspect, only 40% of students state Strongly Agree towards the statements within the aspect. Thus, it can be concluded that students in Junior High School in Bandung are having more Objectivity and Curiosity in their profile of Scientific Attitude. Pitafi & Farooq (2012) also found that students were highly scientific in the Objectivity aspect and moderately scientific in the Curiosity aspect.

### 3.1.3. Indicators Analysis of Students' Scientific Attitude

The Scientific Attitude Questionnaire consists of five aspects; rationality, curiosity, open-mindedness, aversion to superstition, and objectivity. To be able to profile the students' attitudes within each aspect, there were indicators constructed in each aspect.

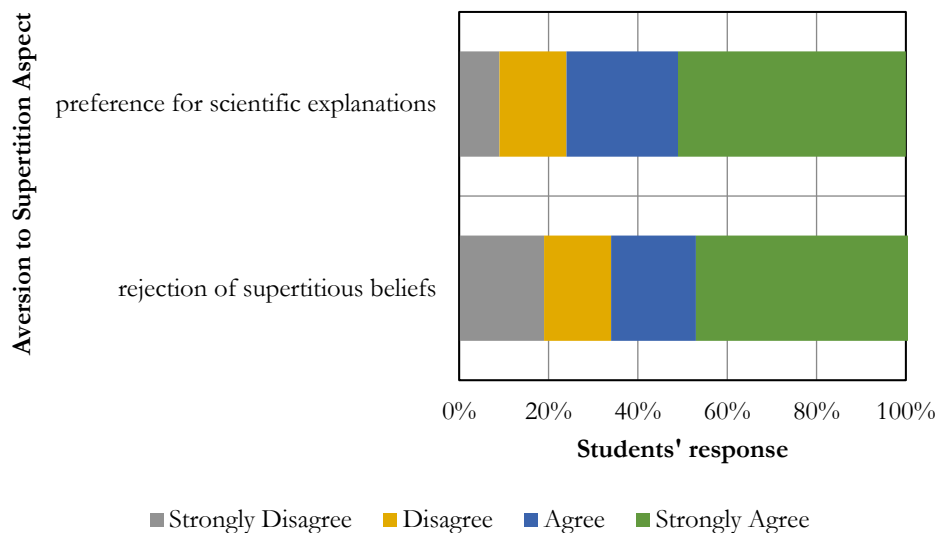


Figure 5 Students' response towards indicators in aversion to superstition aspect

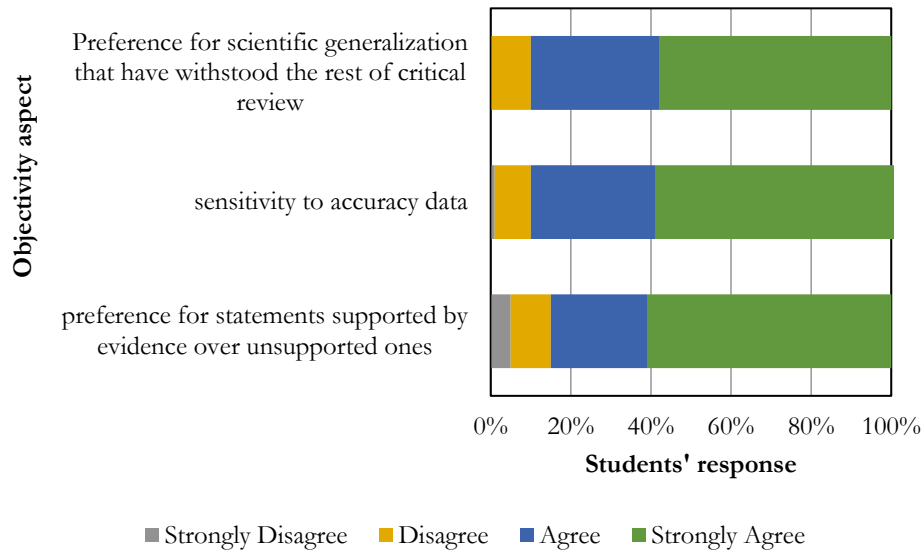


Figure 6 Students' response towards indicators in objectivity aspect

Table 6 Crosstabs calculation between students' scientific attitude and students' learning style

			Learning Style		
			Visual	Auditory	Kinesthetic
Scientific Attitude	Average	Number	18	10	28
		Percentage	32.1%	17.9%	50%
	High	Number	11	21	22
		Percentage	20.4%	38.9%	40.7%

Table 7 Chi-square test of the relationship between students' scientific attitude and students' learning style

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-square	6.279 <sup>a</sup>	2	.043
Likelihood Ratio	6.381	2	.041

Table 8 Symmetric measures

		Value	Approximate Significance
Nominal by nominal	Phi	.239	.043
	Cramer's V	.239	.043

3.1.3.1. Rationality

Rationality aspect consists of five aspects; there are; commitment to rationality in problem-solving, belief in science as means of influencing the environment, awareness of the fallibility of human effort, the challenge of authority, and seeking natural causes of events and identification of cause and effect.

In Figure 2, it shows that there are 64% and 63% of students are Strongly Agree toward the statements representing 'awareness of the fallibility of a human effort' and 'seeking for natural causes of events and identification of cause and effect' indicators, respectively. While in 'belief in science as a means of influencing environment' indicator, only 40% of the students are Strongly Agree toward the statements representing the indicator. As it has been explained, it can be stated that the 'awareness of the fallibility of a human effort' and 'seeking for natural causes of events and identification of cause and effect' indicators are more able to profile Students' Scientific Attitude in Rationality aspect compare to other indicators within the aspect.

In their finding, Pitafi & Farooq (2012) found that students have a high scientific attitude in Rationality aspect while Lacap (2015) found that students were having a moderate scientific attitude, which means that students were less committed in their identification of cause and effect relationship done by nature or human being.

3.1.3.2 Curiosity

Curiosity aspect consists of five aspects; there are; desire for new knowledge or ideas, desire for additional information, seeking evidence to support conclusions made from scientific materials, expression of interest in scientific discoveries, and desire for explanations.

In Figure 3, it shows that there is 54% of students that are Strongly Agree toward the statements representing 'desire for knowledge or ideas' indicator. While in 'expression of interest in scientific discoveries' indicator, there is the almost equally same number of students in each degree of agreement. As has been explained, it safe to state that the 'desire for knowledge or ideas' indicator is more able to profile Students' Scientific Attitude in Curiosity aspect compare to other indicators within the aspect. Lacap

(2015) also found that students. Curiosity was high, and students were showing good traits as science students. While Pitafi & Farooq (2012) found that students' Curiosity is moderately scientific compare to another aspect of Scientific Attitude.

### 3.1.3.3. Open-mindedness

Open-mindedness aspect consists of three aspects; there are; rejection of a singular rigid approach to people, things, and ideas, willingness to consider new evidence, and willingness to subject data and opinion to criticism and evaluation to others.

In Figure 4, it shows that there is 56% of students that are Strongly Agree toward the statements representing 'willingness to subject data and opinion and evaluation to others' indicator. While there is only 3% of the students that are Strongly Disagree toward statements representing 'willingness to consider new evidence' indicator. As it has been explained, concluded that the 'willingness to subject data and opinion and evaluation to others' indicator is more able to profile Students' Scientific Attitude in Open-mindedness aspect compare to other indicators within the aspect. Lacap (2015) found that students with high Open-mindedness aspects of Scientific Attitude determined their good attitude to respect and listened to others' ideas and criticism to accept reliable evidence. Students also had a high willingness to learn new things.

### 3.1.3.4. Aversion to Superstition

Aversion to the Superstition aspect consists of two aspects, and there are; rejection of superstitious beliefs and preference for scientific explanations. Figure 5 shows that there is 20% of students that are Strongly Disagree with the statements representing the 'rejection of superstitious beliefs' indicator. While there are only 9% of the students that are Strongly Disagree toward statements representing 'preference for scientific explanations' indicator. Lacap (2015) also found that students were highly scientific towards this aspect, but this aspect was not significantly

related to students' performance. As it has been explained, it is safe to state that the 'preference for scientific explanations' indicator is able to profile Students' Scientific Attitude in Aversion to Superstition aspect compare to other indicators within the aspect.

### 3.1.3.5 Objectivity

The objectivity aspect consists of three aspects, and there are; preference for statements supported by evidence over unsupported ones, sensitivity to accuracy data, and preference for scientific generalization that have withstood the test of critical review. Figure 6 shows that the indicators almost have a similar amount in Strongly Agree as the degree of agreement. While Lacap (2015) found that students were scientifically high in this aspect, Pitafi & Farooq (2012) found that students are only moderately scientific in this aspect. As has been explained, it safe to state that the statements made for Objectivity indicator are able to profile Students' Scientific Attitude.

## 3.2. Profile of Students' Learning Style

To answer the third research question: "How is the profile of Students' Learning Style in Junior High School?" the processes were needed to be broken down as followed. Students' Learning Style preference in this research was measured using the VAK Learning Style Inventory by Victoria Chislett & Alan Chapman. The inventory consists of 30 statements with multiple choices in each statement. The choices are written in a, b, and c options. Those alphabets represent each learning style. Students with more "a" options preference tend to be Visual Learners, those who choose more "b" options preference tend to be Auditory Learners, and those with more "c" options preference tend to be Kinesthetic Learners. To answer the research question, "How is the profile of Students' Learning Style in Junior High School." The data of the VAK Learning Style Inventory were analyzed and shown in Figure 7.

Figure 7 shows that students who prefer to learn in Visual Learning Style are only 26% of the total sample, it means that students mostly prefer to choose 'a' option as their answer in the VAK Learning Style Inventory. The following are students who prefer to learn in Auditory Learning Style by 28% of the total sample, by having Auditory Learning Style preference, it means that students mostly prefer to choose 'b' option as their answer in the VAK Learning Style Inventory. While students' with Kinesthetic Learning Style dominated overall students with 46% means that they mostly prefer to choose the 'c' option as their answer in the VAK Learning Style Inventory. Previous research by Vaishnav (2013) also resulted that kinesthetic learners are analyzed more than visual and auditory learners in the research.

## 3.3. Relationship between Students' Scientific Attitude and Students' Learning Style

To answer the last research question: "How is the relationship between Students' Scientific Attitude and

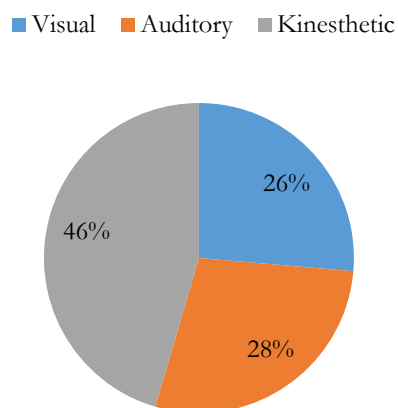
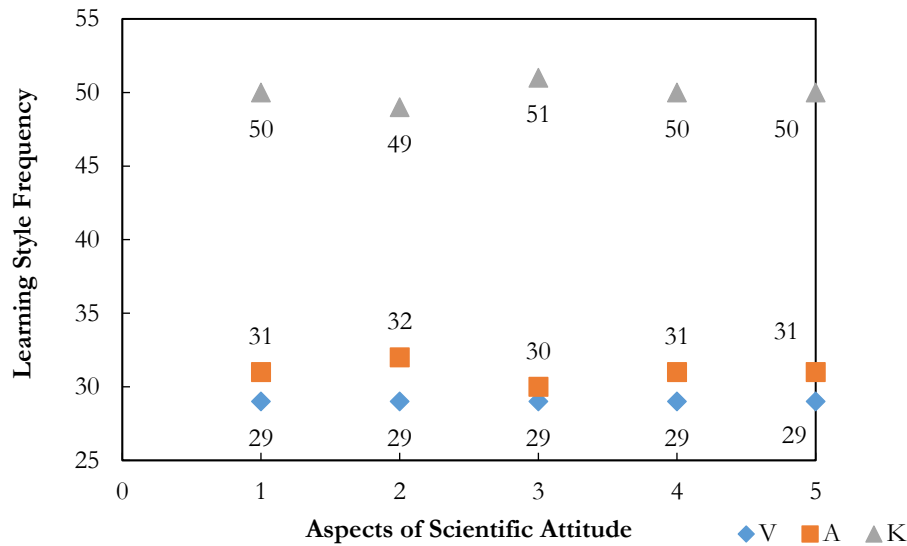


Figure 7 Profile of students' learning style percentage





**Figure 8** Distribution of students' preferred learning style in each aspect of scientific attitude

Students' Learning Style in Junior High School?" the processes were needed to be breaking down in the form of descriptive statistics. The relationship was analyzed through the relationship from each level of Students' Scientific Attitude towards Students' Learning Style, and the relationship from each aspect of Scientific Attitude towards Learning Style.

### 3.3.1 Relationship between Level of Students Scientific Attitude and Students' Learning Style

First, Table 6 shows the relationship between the level of Students' Scientific Attitude (Low, Average, High) and Students' Learning Style (Visual, Auditory, Kinesthetic). As shown in Table 6, students with Kinesthetic Learning Styles are always dominating both levels of Scientific Attitude. Half of the students in the Average level of Scientific Attitude are Kinesthetic Learners, and 40.7% of students in High level of Scientific Attitude are also Kinesthetic learners. It might be caused by indicators of Scientific Attitude that asked students to do more than just observe, but also doing or moving toward something that makes the Kinesthetic Learners have more dominant performance in Scientific Attitude.

To be able to analyze whether there is a significant statistical relationship between two variables, a Chi-square test needs to be conducted. These crosstabs with the Chi-square technique measure the relationship between Students' Learning Style preference with their level of Scientific Attitude. The result shows in Table 7.

The result of the Chi-square test between the two variables shows in Table 7 shows that the value of Pearson Chi-square between the two variables is 6.279. To be able to describe whether the two variables are associated, the counted value of Pearson Chi-square needs to be bigger than the table value of Pearson Chi-square. The table value of Pearson Chi-square shows the value of 5.995 with  $df=2$ .

Thus, it can be concluded that the counted value of Pearson Chi-square is bigger than the table value of Pearson Chi-square,  $6.279 > 5.995$ , or in other words, it can be concluded that there is a statistical association between the two variables. To be able to identify the strength of association, asymmetric measure to determine the Cramer's V coefficient is needed. The result is shown in Table 8.

Table 8 shows that the value of Cramer's V coefficient is .239. The strength of an association determined by Cramer's V association has a range between 0 to 1. If the coefficient is close to zero, then there is no association between the measured variables, and if the coefficient is close to one, then there is an association occurs between the measured variables. By knowing  $df = 2$  from the Chi-square test result, it can be seen that the strength of association between Students' Scientific Attitude and Students Learning Style is a medium association, because the calculated Cramer's V coefficient is .239 or bigger than .21. Thus, it can be concluded that there is a medium association between Student's Scientific Attitude and Students' Learning Style of Junior High School in Bandung. The medium association means that Student's Scientific Attitude and Students' Learning Style must be considered during the science lesson to facilitate the unique and difference of student's learning style and attitude. This difference between learning style and attitude can be explained by the fact that learning styles and attitudes of students are an inner structure that develops from life experiences (Kolb, 1984).

### 3.3.2. Relationship between Aspects of Scientific Attitude and Learning Style

Another relationship that needs to be found in this research is the tendency of Students' Learning Style in each

aspect of Scientific Attitude. Data on the relationship summed up in Table 9.

Table 9 shows the tendency of Students' Learning Style in each aspect of Scientific Attitude. Students who prefer to learn in Visual Learning Style in every aspect of Scientific Attitude share the same frequency, which is 29 persons and 26.36% from the total sample. While for students who prefer to learn in Auditory Learning Style are tend to be varied in each aspect. Open-mindedness aspect tends to have the lowest frequency of students who prefer to learn in Auditory Learning Style, the frequency is 30 persons or 30% of the total sample, while in Curiosity aspect students who prefer to learn in Auditory Learning Style tend to be more than others, which the frequency is 32 persons or 29.09% of the total sample. In Rationality, Aversion to Superstition, and Objectivity aspects, they share the same frequency, which is 31 persons or 28.18% of the total sample prefer to learn in Auditory Learning Style. Same as Auditory Learner, students who prefer to learn in Kinesthetic Learning Style ten to be variously distributed in each aspect of Scientific Attitude.

The frequency is largely distributed in the Open-mindedness aspect with 51 persons or 46.36% of the total sample, and few are distributed in the Curiosity aspect with 49 persons or 44.54% of the total sample. For another three aspects, which are; Rationality, Aversion to Superstition, and Objectivity aspects, they share the same frequency, which is 50 persons or 45.45% of the total sample. The distribution is shown in Figure 8. It can also be said that students who prefer to learn with Kinesthetic Learning Styles are mostly distributed in every aspect of Scientific Attitude. While students who prefer to learn in Auditory Learning Style are moderately distributed in every aspect of Scientific Attitude, and students who prefer to learn in Visual Learning Style are having the same amount of frequency in every aspect of Scientific Attitude and tend to be least distributed in every aspect of Scientific Attitude. Since teaching intervention given in accordance with the learning styles affect the attitude levels towards the lesson (White, 1999), The lessons that will be given during the learning activities, stages should consider the learning styles of students in order to increase the attitude levels towards the lessons and hence the success of the students.

#### 4. CONCLUSION

It is concluded from the study that students in Junior High School in Bandung were profiled as having Average and High Level of Scientific Attitude. In the relationship between the level of Students' Scientific Attitude and Students' Learning Style, it was found that 50% of students with Average Level of Scientific Attitude were preferred to learn with Kinesthetic Learning Style, 32.1% were preferred to learn with Visual Learning Style, and 17.9% were preferred to learn with Auditory Learning Style. Meanwhile, in the relationship between Aspects of

Scientific Attitude and Students' Learning Style, it was found that in all aspects of Scientific Attitude, 26.36% of students were prefer to learn with Visual Learning Style. In Rationality, Aversion to Superstition, and Objectivity aspects, 28.18% of students preferred to learn with Auditory Learning Style, and 45.45% preferred to learn with Kinesthetic Learning Style. While for Curiosity and Open-mindedness aspect, the distribution was found to be different. In Curiosity aspect students who prefer to learn with Auditory Learning Style was 29.09% which is higher than other aspect and those who prefer to learn with Kinesthetic Learning Style was 44.54% which is lower than another aspect. Finding in Open-mindedness aspect shows the opposite from the Curiosity aspect where 27.27% of students preferred to learn with Auditory Learning Style, which is lower than another aspect. In comparison, 46.36% of students preferred to learn with Kinesthetic Learning Style, which is higher than another aspect of Scientific Attitude.

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