

# Attitude toward chemistry: Student's perception based on learning experience

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**Abstract.** This research is descriptive study that explains students' scientific attitude in learning chemistry. Based on the purpose, a questionnaire which contained several statements about students' scientific attitude was distributed. The number of students who participated was 55 students in two high schools in Yogyakarta, Indonesia. Questionnaire data were analyzed quantitatively as a percentages, then categorized as low, medium and high. The data shows that most students still have scientific attitudes in the low and medium categories. This research is can be additional information for teachers and other researchers to improve students' scientific attitude because scientific attitudes are also related to student achievement.

**Keywords:** *attitude, learning chemistry*

## 1. Introduction

Chemistry basically includes two things, namely chemistry as a product and chemistry as a process. Chemistry as a product includes a collection of knowledge consisting of facts, concepts, and principles [1]. Chemistry as a process includes the skills and attitudes that scientists have to obtain and develop chemical knowledge. The process of carrying out skills related to science is called the scientific process skills, and the attitudes possessed by scientists are called scientific attitudes.

Attitude has an influence on academic achievement [2]. The literature reports that students' attitudes towards learning science still remain positive in secondary schools [3]. The question "How science and technology can be taught in schools to change students' attitudes and aspirations in science and technology has become an important issue [4].

The purpose of science education is not only related to student cognition but also to students' attitude [5]. A positive attitude towards chemistry has been shown to lead to better achievement in chemistry [6]. Both achievements and attitudes can be improved by providing more enjoyable science lessons and learning environments [2]. It is important to achieve positive attitudes in class because attitudes tend to decrease over time [7]. The classroom environment, which is a significant determinant of attitude [8], is one of the key factors in generating interest in science education [9].

The quality of teaching science, which includes a high level of involvement, the use of various teaching strategies and unusual learning activities, changes in positive attitudes toward science chemistry [9]. In other words, attitude change is basically influenced by the type of science teaching experienced by students. This shows the importance of the teacher (science/chemistry) which is the most common reason for liking or disliking subjects such as chemistry, physics, and science [9].



The development of students' attitudes towards learning chemistry has been widely practised by practitioners and academics throughout the world. Various articles and studies that seek to explore students' positive attitudes towards learning chemistry have shown the importance of developing attitudes in student learning success. A number of studies use average data to detect the relationship between teacher habits in the classroom with students' scientific attitudes, whether habits in the classroom can affect students' scientific attitudes [10]. Based on this, the researcher becomes interested in finding out the description of students' scientific attitudes before conducting other studies later.

Attitude is a state of mental and neural readiness that is organized through understanding, exerting a direct influence or dimension on individual responses to all objects and situations related to them. Attitudes develop during socialization that depends on the knowledge and personal experience of an individual [11]. According to Petty, Fabrigar and Wegener [11] there are three components of attitude, namely, affective (feelings and emotions towards an object), cognitive (trust and knowledge) and behavior (a tendency to act).

Attitude is a stable mental unit which expresses itself in a tendency to react to each class member in the same general way. The scientific attitude is an attitude that tends to foster scientific achievement [12]. People's attitude will be spontaneously and consistently from their beliefs and guide appropriate behavior. The components of attitude formation are (a) behavior beliefs, which are beliefs owned by someone about behavior and are beliefs that will encourage the formation of attitudes, (b) evaluation of behavioral beliefs, namely positive or negative evaluations of individuals towards certain behaviors based on beliefs it has [13].

Attitudes quite affect academic achievement because they are considered to have an important role for students in achieving their goals and can be maintained in the long term [14]. Attitudes are directly related to issues such as individual beliefs in their scientific abilities, interests and current and future career goals [15]. Olasehinde & Olatoye [16] defines scientific attitudes as attitudes that can be developed in science and are consistent, rational and objective reactions when facing a problem. Scientific attitude consists of being curious, rational, restraint, open thinking, critical thinking, objectively honest and humble.

Punia & Bala [17] states that someone who has a scientific attitude will have a high curiosity about various things around him and provide an important role in his success. Martin, Sexton, Franklin & Gerlivch [18] describe six scopes in scientific attitudes namely the desire to know and understand, ask questions, collect data and provide meaning based on these data, guide verification, think logically and consider ideas. Scientific attitudes have several indicators, namely rationality, curiosity, openness of mind, anti-myth, objectivity, intellectual honesty and the suspension of decisions [19]. Each indicator of scientific attitude can be described as the followings:

- Rationality  
Rationality relates to the ability to solve problems using a logical approach, look for the cause of each event, identify causal relationships, trust in science and realize that there will be human error.
- Curiosity  
Curiosity is a factor that drives investigation activities. Curious students will look for ways of proving through asking questions, hypothesizing, designing and starting to investigate.
- Open-mindedness  
Openness of mind is addressed through the willingness of individuals to revise opinions and conclusions, the desire to accept new findings, rejection of data that is not supported by relevant theories and respect the opinions of others.

- **Anti-myth**  
Anti-myth is an attitude that does not believe in myths and choose scientific explanations to produce scientific facts. Learners try to find the truth of an information through an investigation.
- **Objectivity**  
Individuals who have an objective attitude will collect and interpret ideas or interpret data and then communicate their findings fairly to achieve an accurate problem solution.
- **Intellectual honesty**  
In investigations, students sometimes obtain different findings so as to produce several different conclusions. in this situation, they still take action to report the results of observations honestly.
- **Suspended Judgment**  
Procrastination is a feeling of dissatisfaction with drawing conclusions before finding authentic evidence or facts that are not supported by evidence and avoiding hasty decision making.
- **Critical-Mindedness**  
The attitude of individuals who are available to examine and evaluate evidence to support certain conclusions.
- **Humility**  
Humility is a complex virtue consisting of simplicity and self-acceptance. The trait of someone intellectually humble is the way he/her cares about his/her cognitive improvement.

Based on this description, it can be concluded that scientific attitude is a logical way of thinking of students in response to certain stimulation based on the ethical rules of science. Scientific attitude is often associated with the habit of scientific thinking, which is a way of thinking logically without prejudice and does not accept any information that does not have authentic evidence. Scientific attitude influences the academic achievement of students, because students who have a positive attitude will be attracted to the life of science. This research associate definition of students' scientific attitude in to several statements related to the definitions of scientific attitudes above. Information about students' scientific attitudes will be used by researchers to improve learning activity in order to improve student's scientific attitudes.

## 2. Research method

This research is a descriptive study that aims to describe students' scientific attitudes in general based on students learning experience in laboratory. The sample in this study were 55 high school students in Yogyakarta. The population in this study were all high school and MA students in Yogyakarta. Samples were selected by convenient sampling technique to facilitate researchers. Samples were given a questionnaire consisting of 36 statements (18 positive statements and 18 negative statements). The questionnaire consisted of two parts namely, instructions for filling out the questionnaire and statement. The questionnaire is made with a Likert scale, consisting of 4 scales. For positive statements (4-3-2-1) and for negative statements (1-2-3-4). The questionnaire used is an instrument of scientific attitude assessment in research conducted by Irwanto, Roaheti and Santoso [20]. This questionnaire is a questionnaire developed by Onder and Celik [21].

## 3. Results and Discussion

Table 1 shows that each aspect of scientific attitude has 4 statements consisting of 2 positive statements and 2 negative statements. Every aspect has almost the same range. The most dominant aspect of scientific attitude is intellectual honesty while the lowest aspect is curiosity.

**Table 1.** Aspect of scientific attitude.

Aspect	Items		Sum of items	Percentage of the domain
	Positive	Negative		
Rationality	2	2	4	76 %
Curiosity	2	2	4	71 %
Open Mindness	2	2	4	79 %
myth	2	2	4	74 %
Objectivity	2	2	4	76 %
Intellectual honesty	2	2	4	79 %
Pending decision	2	2	4	76 %
Critical thinking	2	2	4	77 %
Modesty	2	2	4	78 %

Table 2 scientific Attitude's Level of Trend, shows that the score of students in filling out the questionnaire was divided into three categories, namely low, average and high. Each is distinguished by the type of statement. In positive and negative statements, students are still dominant in the low attitude category. Only 5 students in the high category.

**Table 2.** Scientific attitude's level of trend.

Total Score	Average	Percentage	Level of Trend
For positive item			
96-144	3.5-4	40	Low
49-95	2.5-2.9	36	Average
Below 48	Below 2	5	High
For negatif item			
below 48	3.5-4	51	Low
49-95	2.5-2.9	36	Average
96-144	Below 2	13	High

Many concepts in learning chemistry are abstract, some concepts are even difficult to explain by analogy and model, this is because of the difficult and complex chemical nature [22]. Therefore, in studying chemistry, it is not enough with intelligence alone, but also requires a good scientific attitude. Based on the results students' scientific attitudes are still in the low and average categories. The statement used in this questionnaire in addition to being used to determine students' scientific attitudes in learning chemistry, can also explain students' interest in learning chemistry, as well as explaining attitudes that students will choose if there are certain situations [20].

The learning process that is commonly experienced by students will certainly have an influence on student answers. An example is if previous students are often taught by using practicum methods, then in the aspects of the questions in the questionnaire related to activities in the laboratory, students will more easily answer these statements and contribute to their scientific attitude. Most students will show their interest in learning chemistry because of the experience gained in the laboratory. This is in line with research conducted by Yunus and Ali [23] which states that students have a good scientific attitude in learning chemistry when the teacher gives them the opportunity to conduct chemical experiments in the laboratory, but students do not show a good attitude in learning chemistry when asked to listen to the teacher speak in front of the class.

In this study, the lowest aspect of scientific attitude is curiosity, meaning that students' interest in learning chemistry is still very low. Research conducted by Cheung [24] stated that of the ten students interviewed, seven students expressed no interest in studying chemistry. Whereas the highest aspect of scientific attitude is intellectual honesty. In this aspect, students are given a condition in the laboratory and students become researchers who conduct experiments. Because in this aspect students tend to be high, it means that in this position students still want to be good researchers.

#### 4. Conclusion

Based on the results and discussion it can be concluded that the scientific attitude of students is still in the category of low and medium, so it is necessary to do a variety of approaches to foster students' scientific attitudes. Learning that demands student activity and can foster students' scientific attitudes needs to be applied to overcome this problem.

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