

# Profile of Students' Scientific Attitudes Through Practicum Activities Using Student E-Worksheet Based Chemicals at Home

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**Abstract:** Students' competencies in the 21st century can be achieved if the students have various skills and scientific attitudes. Scientific Attitude will affect students' minds or memories and actions that require in making decisions and problem-solving in the future. So, the aim of this study was to describe the profile of students' scientific attitudes through Practicum Activities Using Student E-Worksheet Based Chemicals at Home. This research used a descriptive quantitative method. The research was conducted in Budi Mulia Dua senior high school, Yogyakarta, Indonesia, at the last of the first semester of the academic year 2021/2022. The observation involved 15 of tenth-grade students as the participant. The data was collected using an observation sheet which was developed based on students' scientific attitude aspects. The instrument has been validated by expert learning lecturers so that it is feasible to use. The data obtained from the students were analyzed descriptively and quantitatively. The results of students' scientific attitudes were in the good category ie. 75.8%. Therefore, teachers need to innovate the learning process in order to improve students' scientific attitudes.

**Keywords:** Chemicals at home; Practicum activity; Scientific attitude; Student E-Worksheet

## Introduction

State 21st-century education requires students to have skills including critical thinking, creativity, collaboration and communication (Rais, Yahya, Jamaluddin, & Purnamawati, 2021). These skills can be achieved if the students have scientific skills and scientific attitude. The national curriculum, the independent learning curriculum, is a new breakthrough to create quality and character human resources that are globally competitive (Ayu & Kusumah, 2022). One of the characters that students must have are positive attitudes including the willingness to accept and respect others, teamwork, honesty, skepticism, and curiosity (Hadiati, Kuswanto, Rosana, & Pramuda, 2019).

The Covid-19 has been arriving in Indonesia in the 2020 had an impact on every aspect of life including education. All schools were closed to prevent the spread of the corona virus. The learning system has shifted from

face-to-face to distance learning. The online learning during pandemic has affected learning process, one of which was practicum activities. Based on the results of the needs analysis at Budi Mulia Dua Senior High School, the practicum activities were not carried out. In addition to affecting the student's skills, the absence of practicum had an impact on the student's attitude in science learning or so-called scientific attitude. Several previous studies stated that students' scientific attitudes are relatively still low (Adiansyah, Corebima, Zubaidah, & Rohman, 2021; Genc & Acar, 2021; Hastuti, Nurohman, & Setianingsih, 2018; Ilmi, Sukarmin, & Sunarno, 2020; Jaenudin, Syaodih, Sopandi, & ..., 2022).

Scientific attitude is defined as attitude related to readiness, honesty, curiosity, and willingness that are needed to take action in science process (Adiansyah et al., 2021; Rohaeti, Prodjosantoso, & Irwanto, 2020). Other researchers stated that scientific attitude is the ability/capacity to take an action consistently, rationally, and objectively in problem-solving or conducting the

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process of research that is reflected through one's behavior (Astuti, Sugiyarto, & Ikhsan, 2020). Scientific attitude consists attitude of curiosity, open-mindedness, attitude of discovery, open attitude, honesty, critical thinking, objective, responsibility, cooperation, firm stance is someone who has a scientific attitude (Adiansyah et al., 2021; Astuti et al., 2020; Hadiati et al., 2019; Islam Pitafi, Farooq Principal, & Khadzai, 2012; Rohaeti et al., 2020) and perseverance (Dwi Ananda & Eko Atmojo, 2022; Ekawati, 2017; Gauld & Hukins, 1980; Ilmi et al., 2020; Isnaeni, Sujatmiko, & Pujiasih, 2021; Sunariyati, Suatma, & Miranda, 2019). Previous studies mention that the three aspects of scientific attitude including curiosity, open-mindedness, and objectivity had crucial roles in the learning process (Fitriani, Zubaidah, & Susilo, 2020; Hastuti et al., 2018). Other researcher mentioned that diligently, optimistically, careful in working, and thinking positively are also dimensions of scientific attitudes besides those mentioned above (Juhji & Nuangchalerm, 2020).

The students' scientific attitudes can be improved with various learning models and learning media. Several previous studies stated that students' scientific attitudes can be improved through the implementation of learning media such as 3D visualization (Astuti et al., 2020), laboratory-problem solving work (Hadiati et al., 2019), and Student Worksheet-based inquiry science issues (Hastuti et al., 2018). Research conducted by Fitriani et al. (2020) stated that the PBLPOE model had a higher potential to improve the students' scientific attitudes compared to PBL and POE (Fitriani et al., 2020). Scientific attitude also can be honed through the implementation of PBL integrated local wisdom (Hikmawati, Suastra, Suma, Sudiatmika, & Rohani, 2021). In general, Asriyadin et al. pointed out that scientific attitude can be trained through a scientific approach (Asriyadin, Yulianci, Kaniawati, & Liliawati, 2021; Zahara, Haji, & Syukri, 2018). So, in this study, students' scientific attitude had improved through practicum activity-based discovery learning integrated chemicals at home. The at-home-based laboratory experiment can be an alternative solution for implementing practicum activity in a mass pandemic covid-19 (Destino & Gross, 2022; Panebianco, Latridis, & Weiser, 2022). This effort can improve students' hands-on activity and students' learning motivation, including students' scientific attitude (Destino & Cunningham, 2020).

Based on the results of the needs analysis at Budi Mulia Dua Senior High School, during the pandemic, the practicum activities were abolished even though the practical activities are more important than conventional learning in terms of opportunities for students to promote various skills including scientific attitude. In this study, practicum-based chemicals at home were used to analyze the scientific attitude of students post-

online learning. Student worksheets-based discovery learning can help students become active in the learning process. In online learning, the discovery learning model was rarely to be implemented, meanwhile, direct learning is often. The topic material carried out in this research was redox reaction topic. The practicum skill indicators used in this study include curiosity, responsibility, objectivity, open-mindedness, and cooperation. Therefore, it is very important to conduct research to measure students' scientific attitudes through practicum activities. This is an important step to improve the various skills including of scientific attitude students needed in the 21st-century learning. So, the objective of this study was to describe the profile of students' scientific attitudes through Practicum Activities Using Student E-Worksheet Based Chemicals at Home.

## Method

This study uses the descriptive quantitative method. This study was conducted on 15 of tenth-grade students in Budi Mulia Dua Senior High School, Yogyakarta, Indonesia, at the last semester of the academic year 2021/2022. The data was collected using an observation sheet with a five-point Likert scale and supported by a rubric. This instrument was adapted from the previous studies and suited to the topic material used. The instrument used in this research has been validated together with the lecturer in the chemistry teaching innovation class so that it has been obtained the feasibility of being used in data collection. The scientific attitude aspect used in this study is the result of synthesis from previous studies. There are five aspects, including curiosity, responsibility, objectivity, open-mindedness, and cooperation, with two sub-indicators of every aspect. The aspects of practicum skills used can be seen in Table 1.

**Table 1:** Indicators of Scientific Attitude

| The Indicators of Scientific Attitude | Sub-indicators of Scientific Attitude  |
|---------------------------------------|--|
| Curiosity                             | Pay good attention to the object being observed  |
| Responsibility                        | Enthusiastic in practicum activity   |
|                                       | Responsible for the cleanliness and safety of laboratory equipment                         |
| Objectivity                           | Completing assignments on time   |
|                                       | Presenting data according to facts<br>Processing data by not copying from the other groups |
| Open-Mindedness                       | Listening to the opinion very well<br>Asking the challenging questions                     |
| Cooperation                           | Able to work with groups<br>Active in group discussions and investigations                 |

The scores obtained by students from observations then be analyzed using the ideal percentage. The results of the analysis are presented in a graph and described as a profile of students' scientific attitudes. The mean score and ideal percentage of every aspect are classified into criteria based on the ideal rating category. The rating category used can be seen in Table 2.

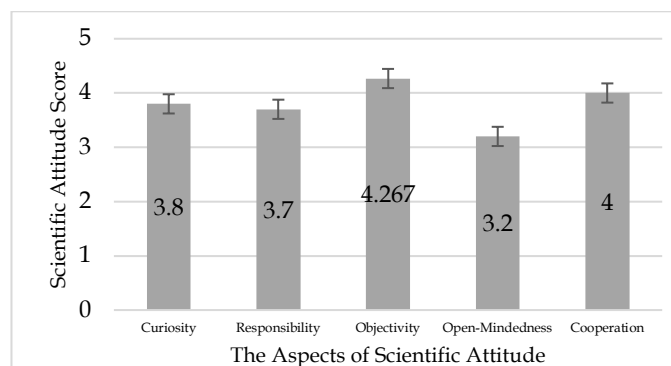
**Table 1:** Ideal Rating Category (Nais, Sugiyarto, & Ikhsan, 2018)

| Score Interval   | Category  |
|--|-----------|
| $\bar{X} > \bar{X}_i + 1.8 SBi$                          | Very good |
| $\bar{X}_i + 0.6 SBi < \bar{X} \leq \bar{X}_i + 1.8 SBi$ | Good      |
| $\bar{X}_i - 0.6 SBi < \bar{X} \leq \bar{X}_i + 0.6 SBi$ | Enough    |
| $\bar{X}_i - 1.8 SBi < \bar{X} \leq \bar{X}_i - 0.6 SBi$ | Poor      |
| $\bar{X} \leq \bar{X}_i - 1.8 SBi$                       | Very poor |

Note: SBi = ideal standard deviation;  $\bar{X}_i$  = ideal average;  $\bar{X}$  = average score of student's scientific attitude.

## Result and Discussion

Profile of students' scientific attitudes on overall and each aspect are show on Figure 1 and Table 3.



**Figure 1.** Mean score of students' scientific attitude

Figure 1 and Table 3 show that students' scientific attitudes in curiosity, responsibility, objectivity, open-mindedness, and cooperation were identified in the

good category. The highest score obtained by students is objectivity, this may be because students can present data based on facts and do not plagiarize from other groups. Meanwhile, open-mindedness appears as the lowest score achieved by students. This is because there are no students who ask challenging questions that describe students' open-mindedness to chemistry. Students who have good open-mindedness will show an attitude of interest in a topic and can raise deeper questions about the object being observed. The comparison of each sub-aspect of students' scientific attitude can be seen in the Table 4.

Based on Table 4, it can be seen that overall the result of students' scientific attitudes are good category. The details of the sub-aspects showed that the highest from the aspect of curiosity is enthusiastic in practicum activity which obtained an average score of 4.2 with a percentage of 84% in the good category and the lowest indicators of curiosity is pay good attention to the object being observed with a percentage of 68% in the enough category. The indicator of responsible for the cleanliness and safety of laboratory equipment from the aspect of responsibility attained an average score of 4.4 with a percentage of 88% at the very good category, meanwhile the indicator of completing assignments on time obtained an average score of 3.0 with a percentage of 60% at the enough category. The objectivity aspect which consisting of two indicators, presenting data according to facts and processing data by not copying from the other groups given obtained of same average score of 4.27 with a percentage of 85.4% in the very good category. The indicators of listening to the opinion very well and asking the challenging questions respectively given obtained an average score 4.2 and 2.2 with a percentage of 84% and 44%. The indicator able to work with groups from cooperation aspect attained an average score of 4.33 with a percentage of 86.6% at very good category. Meanwhile, the indicator of active in group discussions and investigations as a part of cooperation aspect attained an average score of 3.67 with a percentage of 73.4% at the good category.

**Table 3.** The Result of Students' Scientific Attitudes

| Scientific Attitude Aspects | Mean | SD     | Minimum Score | Maximum Score |
|-----------------------------|------|--------|---------------|---------------|
| Curiosity                   | 3.80 | 0.6102 | 1.00          | 5.00          |
| Responsibility              | 3.70 | 0.9878 | 1.00          | 5.00          |
| Objectivity                 | 4.26 | 0.4497 | 1.00          | 5.00          |
| Open-Mindedness             | 3.20 | 1.1264 | 1.00          | 5.00          |
| Cooperation                 | 4.00 | 0.5872 | 1.00          | 5.00          |
| Overall Scientific Attitude | 3.79 | 0.8615 | 3.40          | 4.30          |

**Table 4.** The Result of Students' Scientific Attitudes

| Aspects        | Sub-aspects  | Average | (%)   | Criteria  |
|----------------|--|---------|-------|-----------|
| Curiosity      | Pay good attention to the object being observed                    | 3.40    | 68.00 | Enough    |
|                | Enthusiastic in practicum activity                                 | 4.20    | 84.00 | Good      |
| Responsibility | Responsible for the cleanliness and safety of laboratory equipment | 4.40    | 88.00 | Very Good |
|                | Completing assignments on time                                     | 3.00    | 60.00 | Enough    |

| Aspects         | Sub-aspects  | Average | (%)   | Criteria  |
|-----------------|--|---------|-------|-----------|
| Objectivity     | Presenting data according to facts                   | 4.27    | 85.40 | Very Good |
|                 | Processing data by not copying from the other groups | 4.27    | 85.40 | Very Good |
| Open-Mindedness | Listening to the opinion very well                   | 4.20    | 84.00 | Good      |
|                 | Asking the challenging questions                     | 2.20    | 44.00 | Poor      |
| Cooperation     | Able to work with groups                             | 4.33    | 86.60 | Very Good |
|                 | Active in group discussions and investigations       | 3.67    | 73.40 | Good      |
| Overall         |  | 3.79    | 75.80 | Good      |

The profile of students' scientific attitude also was described according to the students' percentage on each indicator of scientific attitude. The percentage of every indicator can be seen in Figure 2.

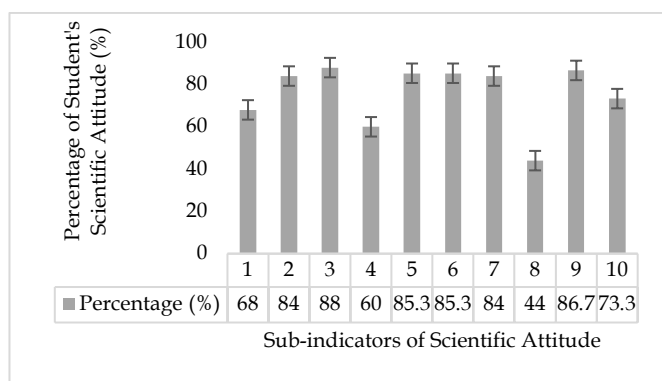


Figure 2. Percentage of scientific attitude

Figure 2 shows that the highest percentage is in the aspect of responsibility and the indicator of responsible for the cleanliness and safety of laboratory equipment. Meanwhile, asking challenging questions from the aspect of open-mindedness is the lowest percentage because during the pandemic student are rarely trained to ask critically in chemistry learning. The conventional learning that was implemented in online learning tends to make the students learn by memorizing than reasoning, so their critical thinking skills are less honed. In addition, conventional learning, especially in practical activities, only emphasizes scientific products and does not focus on scientific processes and attitudes (Kustijono, Jatmiko, & Ibrahim, 2018). Hence, that is important to develop students' scientific attitudes because it would affect students' spirit in the learning process and improve the science activity's performance (Ekawati, 2017; Erdogan, 2016; Zulirfan, Iksan, Osman, & Salehudin, 2018). In science learning, students' scientific attitude will help students understand concepts easily and affect their learning outcomes (Supardi, Istiyono, & Setialaksana, 2019; Thahir et al., 2020). Moreover, scientific attitude included in the cognitive components will gives a significant impact on the student in making a decision or taking action (Adiansyah et al., 2021). This is also confirmed by Fitriani et al. (2020) that students with an excellent scientific attitude will not easy to believe and accept

unproven and illogical information scientifically (Fitriani et al., 2020).

The learning model that can improve scientific attitudes is process-based learning (Jaenudin et al., 2022). The previous study also stated that students' scientific attitudes can be improved through the learning process that occurred during the practicum/experimental activities (Sunariyati et al., 2019; Wahyudiati, 2022). In this study, a profile of students' scientific attitudes was measured through practicum activity on redox reaction topics. The practicum was conducted using students' worksheets based on chemicals at home. The practicum activity is about the determination oxidation number of Mn (manganese) based on the color changing of the solution that occurred. The materials based on chemicals at home were used consisting of red onion, Accu water, food vinegar, baking soda, PK powder, bleach, and citric acid. The tools needed in the practicum can use the tools at home such as a spoon, knife, stick of ice cream, candle, and used mineral glass. Due to the practicum activity conducted in offline learning at Budi Mulia Dua Senior High School, the tools used in their equipment laboratory. The following is a student practicum activities and media used in Figure 3 and Figure 4.



Figure 3. Illustration of student E-Worksheet



**Figure 4.** Students' practicum activity

Based on Figure 4, it can be seen that the students are enthusiastic and joyful in the learning process. In line with the previous research, the at-home-based laboratory experiment can improve lab work skills and students' learning motivation (Destino & Cunningham, 2020). The previous study also stated that one of the strategies to improve the students' skills and interest in science during a pandemic is the application of educational kits that can be explored at home (Toma, 2021). The spirit/motivation of students in science learning gives an impact on their interest in science so this will improve students' scientific attitude. The students with low scientific attitudes tend to have low decision-making skills which will affect their problem-solving skills in the future.

## Conclusion

The Based on the result of the observation that has been conducted, it can be concluded that the profile of students' scientific attitude in Budi Mulia Dua Senior High School in Yogyakarta at the good category with a percentage of 75.8%, with details of the aspect curiosity 76%, responsibility 74%, objectivity 85.34%, open-mindedness 64%, and cooperation of 80%. Therefore, teachers need to develop a strategy of learning, learning models, or learning media in order to enhance students' scientific attitudes.

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