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Analysis of The Infulence of Practical-Based Reaction Rate learning on Students' Science Process Skills

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Abstract: Practicum as an important part of the chemistry learning process, trains and develops students' scientific process skills in testing chemical theories. The low science process skills cause students to struggle with understanding work procedures, processing data, and concluding experimental results. This study aims to determine the effect of reaction rate practicum on students' science process skills. This study uses a quantitative approach with a quasi-experimental nonequivalent control group design method. The research sample involved 35 students from class XI-MIPA 1 in the experimental class and 35 students from class XI-MIPA 3 in the control class at MAN 3 Aceh Barat Daya. Research data were collected using observation sheets to measure science process skills and multiple-choice tests to measure the impact of practicum on science process skills. The research results show that the science process skills of students in the experimental class are better compared to the control class. Students demonstrated very good observation and good skills in classifying, asking questions, and hypothesizing. However, they have sufficient skills in interpreting and communicating. The results of the hypothesis test obtained a t-value of 2.67 > t-table 1.65 at a significance level of 0.05, indicating that the implementation of practicum significantly affects students' science process skills in reaction rate learning. An effect size score of 0.18 indicates that practical-based reaction rate learning has a significant impact on students' science process skills. It is concluded that the reaction rate practicum influences the development of students' science process skills at MAN 3 Aceh Barat Daya.

Keywords: Practicum, reaction rate, science process skills.

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INTRODUCTION

The objective of chemistry education is to foster a scientific mindset, solve problems associated with an object, and acquire a direct understanding of a variety of phenomena. In addition, chemistry education is also expected to guide students in enhancing process skills to achieve good cognitive competence (Gultom, 2018). One of the skills needed to develop the potential within students is science process skills. Science process skills refer to cognitive and psychomotor aspects that can create meaningful learning based on students' experiences (Ginting, et al., 2022).

Science process skills are one of the important skills that students must have in the 21st century to meet the demands of the chemistry learning curriculum (Kurniawan, et al., 2023; Darmaji, et al., 2022). Science process skills are scientific thinking skills used by students to explore and discover facts, concepts, theories, principles, and laws of science through independent scientific work procedures (Mardianti et al., 2020; Widya Astuti et al., 2019). These scientific work procedures include students' skills in observing, asking, predicting, planning, measuring, analyzing, evaluating, concluding, and communicating results (Hamidah, 2023; Senisum, 2021; Darmaji et al., 2019). Science process skills are very important to maximize the quality of learning (Abdjul & Katili, 2021) and solve problems (Mu'minin et al., 2020). Science process skills play an important role in chemistry learning because they help improve thinking skills, facilitate discovery, build concepts, and support integrated learning for students (Fajrina et al., 2021).

The current problem found is the low science process skills of students in chemistry learning (Adiningsih et al., 2019; Salima et al., 2023). Students' perceptions reveal that chemical concepts and theories are difficult to learn, making learning boring. In addition, the lack of innovation in the use of media and chemistry learning methods causes low student learning motivation. Teachers tend to pursue material targets so that their relevance to everyday life cannot be optimally integrated to achieve meaningful learning for students. Even in practical activities in the laboratory, students are only directed to prove, not to find theories (Eliyarti & Rahayu, 2019).

The results of a preliminary study at MAN Aceh Barat Daya found that students' science process skills were difficult to guide and develop in learning reaction rates. This is due to the chemistry learning process which only trains students to get used to memorizing theories and formulas (Fadhilah, 2023). In addition, students are also not trained to develop science process skills in chemistry learning (Adiningsih et al., 2019). As a result, most students have very low science process skills in learning reaction rate material (Salima et al., 2023). This phenomenon is evidenced by students who have difficulty understanding practical work procedures, using laboratory equipment, processing data, and concluding experimental results. Students' science process skills need to be continuously trained and developed through appropriate learning, namely chemistry learning based on practical work (Astuti et al., 2019).

Science process skills can be developed in chemistry learning by providing students with direct experience through practical activities (Ikhsan, 2020). Practical work is a scientific discovery activity carried out by students to create meaningful chemistry learning. Practical activities can generate learning motivation, develop science process skills, and scientific approach learning facilities, and support students' conceptual understanding (Setianingsih, 2023; Masruri, 2020).

Chemistry learning based on practical work emphasizes the cognitive aspects and science process skills of students. Students can be directly involved in conducting experiments to prove and link the concepts learned with the results of observations obtained through practical work (Arieno et al., 2023). Chemistry learning based on practical work is useful for students in overcoming difficulties in understanding concepts, associating relationships between concepts, and understanding and applying formulas in solving problems. Chemistry learning based on practical work is closely related to the development of science process skills. In practical work activities, students carry out a series of scientific discovery procedures systematically which are indicators of science process skills (Rini & Aldila, 2023; Asmaningrum et al., 2018). So in implementing practical work activities, teachers can easily train and develop students' science process skills (Maison et al., 2019). Chemistry material that requires proof of theory through practical work-based learning is the reaction rate (Nurkholik, et al. 2020).

Practical activities are very much needed by students in learning reaction rates (Atuti et al., 2019). In the reaction rate material, there are characteristics of sub-materials of factors that influence the reaction rate that requires theoretical proof. The practicums contained in the chemistry curriculum, namely the effect of surface area, concentration, temperature, and catalysts on the reaction rate (Nurrahmah et al., 2023) Through practicum-based learning, students can find and prove the factors that influence the reaction rate to obtain a complete conceptual understanding and practice science process skills (Nadila, et al., 2023). However, the implementation of practicums in chemistry learning often experiences obstacles such as the lack of ability of educators to apply learning strategies, inefficient use of time, inadequate laboratory facilities, and the tools and materials used are not available in the laboratory (Anjani et al., 2023).

Several previous studies on students' science process skills in chemistry learning that are relevant to this study have been reported by Salima et al. (2023) who stated that most students have very low science process skills in the indicator of predicting reaction rates. The results of their study showed that 50% of students had very low reaction rate prediction skills, 27% of students were at a low ability level, 19% were at a moderate level, and only 4% were at a high level. The results of Fitriana et al.'s study (2019) reported that in learning reaction rate material using the *bounded inquiry laboratory model* , students had sufficient science process skills with a percentage of 57.94%. The highest science process skills were obtained in the observation indicator at 76.47% while the lowest was 36.76% in the hypothesis formulation indicator. As many as 56% of students had low science process skills, 35% at a moderate level, and only 9% at a high level. Research conducted by Fadhilah & Yenti (2019) found that in the reaction rate practicum, students had sufficient science process skills in the indicators of observing, communicating, and concluding. Students were less skilled in classifying, predicting, and measuring.

Previous studies have examined students' science process skills on reaction rate material using questionnaires (Salima et al., 2023) and practicum-based learning models (Fitriana et al., 2019). In addition, other relevant studies have examined students' science process skills through reaction rate practicums (Fadhilah & Yenti, 2019). Based on several previous studies described above, students' science process skills can be identified through the implementation of practicum activities in chemistry learning. However, the research that has been conducted has not examined how practicums affect science process skills. The implementation of practicums in chemistry learning has a very important role in training and developing students' science process skills (Rini & Aldila, 2023; Nadila et al., 2023; Maison et al., 2019; Adiningsih et al., 2019; Asmaningrum et al., 2018). Aulia et al., (2023) added that learning based on practical work can affect students' science process skills, so it is necessary to study further whether practical activities in the reaction rate learning process affect students' science process skills. Therefore, this study aims to examine how the implementation of practical work affects students' science process skills in reaction rate learning. This study aims to determine students' science process skills in reaction rate practical work, and the effect of implementing practicum on students' science process skills.

METHODS

This study employs a quantitative technique, with a quasi-experimental research design. The research design employs a nonequivalent control group design, which divides the research subjects into experimental and control classes that must be treated differently (Sugiyono 2018). In this study, the experimental class was treated with reaction rate practicum implementation learning, whereas the control class received treatment with reaction rate practicum video learning. Before the treatment, a pretest was administered in both classrooms to assess the students' initial conceptual grasp. Following the treatment, a posttest was administered to assess the impact of the treatment on the students' science process skills. Table 1 shows the research plan for this study (Abraham & Supriyati, 2022).

Table 1. *Nonequivalent Control Group Design*

Group	Pretest	*Tretament*	Posttest
Experimental class	O_1	X_1	O_3
Control class	O_2	X_1	O_4

X_1 is the learning of reaction rate material through practicum, X_2 is the learning using practicum video, O_1 is a pretest in the experimental class, O_2 is a pretest ini the cotrol class, O_3 is a posttest in the experimental class, anda O_4 is posttest in the cotrol class.

The population in this study were students of class XI-MIPA MAN Aceh Barat Daya. The research sample used was class XI-MIPA 1 consisting of 35 students as the experimental class and class XI-MIPA 3 consisting of 35 students as the control class selected based on the nonprobability purposive sampling technique. This sampling technique is used because in the quasi-experimental design, the selection of subjects to be placed in a particular group is not done randomly (Hastjarjo, 2019).

The instruments used to collect data in this study were observation sheets and science process skills-based test questions. Observation sheets were used to observe students' science process skills during the learning process. Test questions were used to measure students' conceptual understanding before and after treatment. The observation sheet in the form of a checklist represented six indicators of science process skills, namely observing, classifying, asking questions, hypothesizing, interpreting data and communicating. The science process skills test questions used were 15 multiple-choice questions. The research instrument has been declared valid by five expert lecturers in chemistry education.

The data collected in this study were science process skills and student learning outcomes. Students' science process skills were collected through observation techniques. This observation was carried out during the implementation of the practicum activities in the experimental class and control class involving five observers. Indicators of science process skills observed in students include the skills of observing, classifying, asking questions, hypothesizing, interpreting data, and communicating. In addition to observation, this study also uses test techniques to collect data on student learning outcomes. The tests conducted include pretest and posttest. A pretest is a test conducted before treatment is given to students to measure students' initial conceptual understanding of the reaction rate material. The posttest is conducted after the control and experimental classes are given treatment to measure students' conceptual understanding after the reaction rate learning process.

Science process skills are analyzed based on data on student activities and learning outcomes that have been collected. Student activity data obtained from the observation sheet instrument were analyzed by calculating the total score of each indicator of science process skills that had been observed for each student. Furthermore, the percentage of activity for each indicator of science process skills was calculated using the following formula.

$$\text{Activity percentage} = \frac{\text{observation score}}{\text{total score}} \times 100\%$$

After obtaining the activity percentage data, the data is divided into many groups using the following Table 2.

Table 2. *Interpretation of Students' Science Process Skills Activities*

Activity Percentage (%)	Category
81-100	Very good
61-80	Good
41-60	Enough
21-40	Not enough
0-20	Very less

The experimental and control classes' pretest and posttest scores were collected as learning outcome data. The data was evaluated using the N-Gain test and the research hypothesis test. The N-Gain test, which uses SPSS Version 20.0, compares students' growth in conceptual knowledge in the experimental and control classes. The average N-Gain scores for both classes are then divided into tiered categories using the criteria (Hake, 2002) outlined in Table 3.

Table 3. *Interpretation of N-Gain scores*

N-Gain Score	Category
$g < 0.3$	Low
$0.7 > g \geq 0.3$	Enough
$g \geq 0.7$	High

To assess the study hypothesis, the data must first pass normality and homogeneity tests. The normality test, at a 5% significance level, determines if the learning outcome data obtained in this study comes from a normally distributed population of students. The data in this study were normalized using the two-sample Kolmogorov-Smirnov test. If the significance level (Sig.) exceeds 0.05, the research data is regularly distributed. A homogeneity test is then performed using the F-test using the Lavene method to determine whether or not the acquired data is homogeneous at a 5% level of significance. If the significance level exceeds 0.05, the variance of research data is the same or homogeneous. Both tests were examined with SPSS Version 20.0.

An independent sample t-test was used to evaluate the research hypothesis and determine the influence of practical activities on students' science process skills. This test was performed using posttest score data from students in the experimental and control classes by comparing the estimated t value to the t table at a significance level of 0.05. The research hypotheses tested are listed below.

H_o : There is no significant influence between learning reaction rates based on practical work on the science process skills of students at MAN Aceh Barat Daya.

H_a : There is a significant influence between learning reaction rates based on practical work on the science process skills of students at MAN Aceh Barat Daya.

The decision-making criterion states that if the estimated t value is greater than the table t value, Ha is accepted. Conversely, if the estimated t value is less than the table t value, Ho is accepted.

Furthermore, in this study, an effect size test analysis was performed to establish the impact of reaction rate practicum-based learning on students' science process abilities at MAN Aceh Barat Daya. The data tested were students' pretest and posttest results in the experimental class. The effect size score was determined using Cohen's formula (Riyanto & Andhita, 2020) as shown below.

$$Effect\ Size = \frac{(\mathrm{t-value})^2}{(\mathrm{t-value})^2 + \mathrm{derajat\ kebebasan}}$$

To assess the extent of the influence, use the criteria (Rahmandani et al., 2022) as updated in Table 4.

Table 4. *Criteria for Interpreting Effect Size Scores*

Effect Size	Interpretation
$0.2 \leq ES < 0.5$	Small effect
$0.5 \leq ES < 0.8$	Moderate effect
$0.8 \leq ES < 1.3$	Large effect

RESULTS

Students' Science Process Skills on Reaction Rate Learning

The goal of this study was to examine students' science process skills as well as the effect of practicum-based learning reaction rates on science process skills. This study took place during three meetings at MAN Aceh Barat Daya, with the experimental class XI-MIA 1 and the control class XI-MIA 3. This study compared the science process abilities of students in the experimental class who were treated with learning reaction rates based on practicum to students in the control class who were treated with learning response rates via practicum videos. Five observers observed students' science process abilities in the experimental and control courses while they carried out the reaction rate practicum exercises. The identified indications of science process skills include the ability to observe, classify, ask questions, hypothesize, analyze data, and communicate.

Based on the results of observations made during the execution of the reaction rate practicum, the activity of students' science process skills in the experimental class was determined, as shown in Table 5.

Table 5. *Students' Science Process Skills in The Experimental Class*

Skill Indicators	Percentage	Category
Observing	81	Very good
Classifying	79	Good
Asking Questions	75	Good
Hypothesizing	61	Good
Interpreting	54	Enough
Communicating	57	Enough
Average	68	Good

According to the results of the observation data analysis in Table 5, students in the experimental class performed exceptionally well in the observation indicator, with an 81% accuracy. Students enjoy observation tasks during the reaction rate practicum. Students can actively participate in demonstrating changes in reaction rates caused by concentration, surface area, temperature, and catalysts through practicums. Students employ all of their senses to gather observation data based on the contextual scientific items they encounter. Students in the reaction rate practicum are very adept at noticing appropriately presented items and collecting observation data using the right senses.

Table 6 shows the scientific process skills of students in the control class, based on observations from learning activities on reaction speed.

Table 6. *Students' Science Process Skills in The Control Class*

Skill Indicators	Percentage	Category
Observing	62	Good
Classifying	64	Good
Asking Questions	58	Enough
Hypothesizing	53	Enough
Interpreting	60	Enough
Communicating	59	Enough
Average	60	Enough

According to Table 6, there are two indications of science process abilities in the good category in the control class: the observing indicator (62%), and the classifying indicator (64%). This finding demonstrates that students in the control class are adept in observing and categorizing practicum objects. However, they are less adept at asking questions, developing hypotheses, evaluating data, and presenting observed results. This is supported by research data for four other skill indicators: asking questions (58%), hypothesizing (53%), interpreting (60%), and communicating (59%). Students in the control class have sufficient science process skills, with an average of 60%.

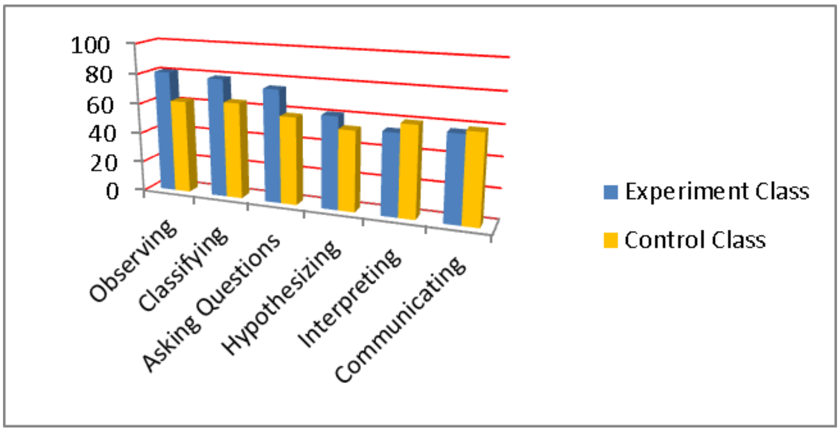

Figure 1. The comparison of students' science process skills activities in two classes

Comparison of Learning Outcomes of the Experimental Class and Control Class

The conceptual understanding of students was assessed through the scores of the science process skills test administered prior to the treatment (pretest) and following the treatment (posttest). In both the pretest and posttest, 15 multiple-choice questions about science process abilities were used to assess conceptual understanding. Table 7 shows the average learning outcomes for students in the experimental and control classrooms.

Table 7. *Average pre-test and post-test scores*

Group	Score of Mean Pretest	Score of Mean Posttest
Experiment	32.94	59.86
Control	26.00	53.56

According to Table 7, the average pretest score of pupils in the experimental class was 32.94, while in the control class it was 26.00. Following treatment, the average posttest score of the experimental class was 59.86%, whereas the control class was 53.56%. By comparing pretest and posttest results, it is clear that student learning outcomes improved in both research classes. The average post-test score in the experimental class was greater than in the control group.

The pretest and posttest scores of the two classes were then compared using the N-Gain test. This test was used to see how much the conceptual comprehension of students in the experimental and control classrooms improved. The findings of the N-Gain analysis are shown in Table 8.

Table 8. *Result of N-Gain analysis*

Group	N-Gain Score
Experiment	0.042
Control	0.034

According to Table 8, after receiving treatment, there was an increase in conceptual comprehension with an N-Gain score of 0.042 in the experimental class. The control class had an N-Gain score of 0.034. Both research classes showed an increase in conceptual comprehension in the sufficient category.

Statistical Test Result

To determine the influence of reaction rate practicum learning on students' science process skills, the pretest and posttest score data in the experimental and control classes were normalized and homogeneous. Table 9 shows the results of the data normality test performed using the two-sample Kolmogorov-Smirnov method in SPSS Version 20.0.

Table 9. *Results of the Normality Test*

Group	Amount of learners	Significance Level	Sig. (2-tailed)	Data Distribution
Experiment	35	0.05	0.794	Normal
Control	39	0.05	0.973	Normal

The results of the data normality test in Table 9 show that for the experimental class, a significance value of 0.794 was obtained and for the control class, a significance value of 0.973. The significance value obtained using the two-sample Kolmogorov-Smirnov test is greater than the significance level of 0.05. This finding indicates that the pretest and posttest score data in both the experimental and control classes are normally distributed.

After determining that the study data is normally distributed, the following step is to do a homogeneity test using the F test and the Lavene method. Table 10 shows the statistical test findings based on the homogeneity test of the pretest and posttest score data using SPSS Version 20.0.

Table 10. *Results of the Homogeneity Test*

Group	Amount of learners	Significance Level	Sig. (2-tailed)	Data Distribution
Experiment	35	0.05	0.145	Homogeneous
Control	39	0.05	0.299	Homogeneous

Table 10 shows that the experimental class significant value is 0.145, whereas the control class is 0.299, based on the findings of the data homogeneity test. The F test produced a significance value larger than 0.05. As a result, it is possible to conclude that the experimental and control classes have identical variances. As a result, both the experimental and control classes have homogeneous pretest and posttest score data.

The pretest and posttest score data in the study's experimental and control groups matched the normal and homogenous distribution criteria. Thus, the independent sample t-test can be used to assess the study's hypothesis. This test was designed to assess the impact of practical activities on students' science process abilities. The hypothesis test yielded a calculated t value of 2.67, which was more than the t table value of 1.65 at a significance level of 0.05. So the decision-making criteria are: Ho is rejected, Ha is accepted. Furthermore, to measure how much influence learning based on practicum reaction rate on science process skills in this study was determined using the effect size score . The results of the effect size calculation based on the t-test using Cohen's formula obtained an effect size score of 0.62.

DISCUSSION

Students in the experimental class are very adept at noticing appropriately presented items and collecting observation data using the right senses in the reaction rate practicum. According to Astuti et al. (2019), when developing observation skills, students utilize their five senses to identify and investigate the properties of objects based on similarities and contrasts between the objects observed. Observation exercises give students with real-world experiences by allowing them to examine scientific phenomena directly, resulting in more relevant learning. Observation skills are the most fundamental starting skills, making them critical for building other science process skills (Matsna et al., 2023).

Students in the experimental class have strong science process abilities such as classifying, asking questions, and hypothesizing. This finding is based on the findings of the analysis of observational data shown in Table 5, which show that the indicator of classifying skills received a percentage of 79%, the indicator of asking questions was 75%, and the indicator of hypothesizing was 61%. Matsna et al. (2023) claimed that students can display classification skills by classifying diverse practical objects based on visible qualities. The findings of this study revealed that students were able to discriminate and group practicum equipment and materials based on the notion of reaction rate with clarity and accuracy.

According to the observation data, students actively participated in asking and responding questions in discussion activities. Furthermore, pupils demonstrated good question formulation skills. This research demonstrates that students in the experimental class can answer, ask questions, and express their viewpoints in group discussion activities. This is due to students' strong interest and curiosity about the objects witnessed during the reaction rate practicum. The findings of this study are supported by Matsna et al. (2023), who indicate that the ability to ask questions is directly related to the observation activities conducted by students to satisfy their curiosity. Students' curiosity about the practicum item can help to develop their questioning skills. Students must be able to ask why and how concentration, surface area, temperature, and catalysts influence reaction speeds.

Before beginning the reaction rate practicum, students learn how to forecast and formulate hypotheses based on the findings of observations. The observation results demonstrate that students can effectively create temporary assumptions in the form of general assertions about the effect of concentration, surface area, temperature, and catalysts on variations in reaction rates. Before the practicum, students in the experimental class had a conceptual knowledge of the topic on factors that influence reaction rates. This outcome is consistent with Matsna et al.'s (2023) research, which found that students who have a conceptual knowledge of the practicum tasks to be carried out may effectively generate hypotheses in the acid-base titration practicum.

Table 5 shows that students in the experimental class achieved 54% understanding skills and 57% communicating abilities. This data suggests that students continue to struggle with evaluating and communicating the outcomes of reaction rate practicum observations. These skills must be regularly trained and developed in reaction rate learning. According to Matsna et al. (2023), students' limited ability to analyze data was caused by the idea that practicums were conducted solely to show the reality of theories and concepts, and that students simply concluded the outcomes of observations in the practicum work report.

Based on the results of data analysis in Table 5, the average percentage of students' science process skills in the experimental class obtained was 68%, which is included in the good category. This finding is different from the research of Fitriana et al. (2019) which reported that in learning reaction rates using the bounded inquiry laboratory learning model, students showed sufficient science process skills with a percentage of 57.94%. The research reported by Fadhilah & Yenti (2019) also differed in that students had science process skills in the sufficient category in the reaction rate material practicum.

Figure 1 compares science process abilities in the experimental and control classes using data on the proportion of student participation in the reaction rate practicum activity. In the observation skills indicator, the experimental class received the highest percentage of 81% in the very good category. This outcome is consistent with the findings of Jannah and Refelita's (2023) study, which found that science process skills in the observation indicator scored the highest at 77% in the colloid practicum. Furthermore, Adiningsih et al. (2019) found that most students demonstrated excellent observation skills in the acid-base practicum. Astuti et al. (2019) found similar results to this study. Students demonstrated excellent observation skills, with an average observation score of 91.34%. However, this contradicts the findings of Fadhilah and Yenti (2019), who found that in the reaction rate practicum, students demonstrated adequate science process abilities in the observation indication.

Figure 1 shows that students in the experimental class have better classification, questioning, and hypothesizing skills than the control class. However, when it comes to classification skills, both groups are categorized as good. However, the control class's ability to ask questions and hypothesize is merely sufficient. According to Adiningsih et al. (2019), hypothesis skills were not trained in practical activities due to time constraints. As a result, the hypothesis indicator reflects the lowest science process skills (Astuti et al., 2019).

According to the examination of the research data in Figure 1, students in both the experimental and control groups demonstrated adequate interpretation and communication skills. This indicates that both indications of science process skills must be regularly trained and developed in learning reaction rates. Rini and Alida et al. (2023) found that students who are rarely trained to get direct experience in learning have less developed science process skills. To train and strengthen science process abilities, students must engage in active discovery of scientific topics. One approach to improving students' science process abilities is to incorporate practical tasks into the learning process (Nadila et al., 2023; Setianingsih, 2023; Masruri, 2020; Astuti et al., 2019; Maison et al., 2019). Practical exercises are essential because they can increase enthusiasm to learn chemistry and build fundamental skills in conducting experiments.

Based on a comparison of the average percentage of each indicator of science process skills, the research findings revealed that students in the experimental class had good science process skills (68%), whereas the control class had adequate science process skills (60%). As a result, pupils in the experimental class outperform those in the control class in terms of science process abilities. This finding is corroborated by Aulia et al. (2023), who discovered that students who participated in practicum-based learning had stronger science process abilities than those who received conventional learning. Chemistry learning through practicum encourages students to actively participate in learning and refine their science process abilities (Sari, 2022; Rahayu, 2020; Astuti et al., 2019).

Based on the analysis of the results of the research hypothesis test, it can be concluded that there is a significant influence between learning reaction rate based on practicum on students' science process skills at MAN Aceh Barat Daya. According to Table 4, the study's effect size score falls between 0.5 and 0.8, indicating that it is fairly influential (Rahmandani et al., 2022). This score demonstrates that learning based on practical reaction rate has a significant impact on students' scientific process skills. The outcomes of this study are consistent with the findings of Aulia et al. (2023), who found that practicum-based biology learning influences students' science process skills in the experimental class. The conclusions of this study are also corroborated by Jannah and Refelita's (2023) study, which found that colloid learning based on practicum can increase students' science process skills.

CONCLUSION

Students in the experimental class had stronger science process abilities than those in the control class, implying that learning reaction rates through practicum can help students build their science process skills. The hypothesis test results revealed that learning reaction rates based on practicum had a substantial impact on students' science process skills at MAN Aceh Barat Daya. Cohen's analysis found that learning reaction rates based on the practicum done in this study had a significant impact on students' science process abilities. This study provides valuable information for educators who are designing, developing, and implementing innovations in tactics, models, approaches, and learning media aimed at increasing students' science process skills in the chemical learning process. The findings of this study are likely to serve as a foundation for future research to build and assess the efficiency of chemical learning process designs based on practicums for improving students' science process skills.

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