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# Analysis of Students' Science Process Skills (SPS) in the Problem Based Learning Model of Class XI SMAN/MAN in Luwu Regency

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A R T I C L E I N F O

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A B S T R A C T

This study aims to analyze the level of students' Science Process Skills (SPS) in the Problem Based Learning model in class XI SMAN/MAN Luwu Regency on the reaction rate material. The research sample consisted of 93 students from SMAN 1 Luwu, MAN Luwu, SMAN 7 Luwu, and SMAN 18 Luwu in the 2024/2025 academic year. The instrument used was descriptive questions on the reaction rate material. Data were collected by giving questions at school and analyzed using descriptive statistics. The results showed that the level of students' SPS was in the poor category with an average score of 40.76. Two SPS indicators, namely applying concepts and observation, were in the fairly good category, while the other three indicators were in the poor category.

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## INTRODUCTION

21st century education demands more interactive, creative, and innovative learning, where students are expected to develop critical thinking and problem-solving skills. Traditional learning models that focus more on delivering information from teachers to students are starting to be abandoned, replaced by more student-centered learning models. One of the significant changes in education is the development of skills needed to face the challenges of globalization, the technological revolution, and future job demands. Critical thinking, collaboration, communication, and creativity skills are now competencies that are highly needed in the world of education (Trilling & Fadel, 2009).

In the context of science learning, including chemistry, students are not only taught scientific concepts but are also given the opportunity to develop the skills needed to understand and apply science practically. One effective learning approach to achieve this goal is the Problem Based Learning (PBL) model. PBL places students as active subjects in learning, where they are given real problems that must be solved using critical thinking skills and other scientific skills. This approach has been proven to be able to develop students' Science Process Skills (SPS), which include the ability to observe, classify, conclude, and apply concepts in science experiments (Silaban et al., 2023).

However, even though the Independent Curriculum has been implemented which is oriented towards student-based learning, in reality many students still have difficulty in connecting the theories they learn with real applications, such as in chemistry material, especially reaction rate material. Initial observation results in several senior high schools in Luwu Regency showed that although students had learned chemistry concepts, they often only remembered facts and formulas, without really understanding their application in everyday life. Therefore, this study aims to examine the application of the PBL model in improving students' science process skills, especially in reaction rate material in class XI senior high schools in Luwu Regency.

## LITERATURE REVIEW

### *Science Process Skills (SPS)*

Science Process Skills (SPS) are a set of skills used by students to conduct scientific investigations to discover principles or theories in science. Suryani et al. (2021) explain that SPS provide students with a deep understanding of the nature of science and how scientists work to produce knowledge. SPS are divided into two main categories: basic process skills and integrated process skills. Basic process skills include the ability to observe, classify, predict, measure, communicate, and conclude, while integrated process skills include formulating problems, designing experiments, controlling variables, and applying concepts in experiments (Adiningsih et al., 2019). These skills not only help students understand scientific concepts but also develop their ability to think critically and solve complex problems.

According to Eliyana (2020), scientific skills also involve important scientific attitudes, such as curiosity, skepticism towards information that does not have a strong evidence base, and the ability to accept differences of opinion

and collaborate in scientific investigations. Developing these scientific attitudes is essential so that students can see science holistically, not just as a collection of facts, but as a process that involves critical thinking and collaboration.

***Problem Based Learning (PBL) Model***

Problem-based learning (PBL) model is a student-centered approach where they are faced with real problems that require solving. Lianti & Zuhra (2021) stated that in PBL, students work in groups to find solutions to the problems given, while the teacher acts as a facilitator and moderator. PBL requires students to think critically, identify problems, design experiments, collect data, and draw conclusions, which ultimately helps them develop science process skills. In the context of science education, PBL allows students to connect the concepts learned to real-world situations, which not only improves their understanding of the material but also improves their practical skills in science (Sariani et al., 2020).

Research by Hanafiah (2015) shows that PBL has a significant influence on the development of students' KPS, especially in science subjects. Students involved in PBL not only learn theory, but also hone their scientific skills through deeper experiments and investigations. PBL also allows students to apply science concepts in solving everyday problems, which makes learning more relevant and meaningful to them (Yunita, Nurhadi, & Kusumawardani, 2018).

***Implementation of PBL in Science Education in Luwu Regency***

Although problem-based learning (PBL) has been implemented in several schools in Indonesia, including in Luwu Regency, many students still have difficulty in connecting the concepts they learn with real-world applications. This can be seen from the results of discussions with chemistry teachers at several senior high schools in Luwu Regency, which showed that although students have been taught through a more active approach, they still tend to be passive in participating, especially in asking questions and connecting learning materials with everyday life. This study aims to address this problem by further exploring the application of PBL in improving science process skills, especially in the material of reaction rates which is a topic that students often face in chemistry learning.

## METHODOLOGY

This study uses a quantitative descriptive method. Descriptive research aims to analyze and describe existing phenomena, both natural and human-engineered. This study examines the form, activity, characteristics, changes, and relationships of similarities and differences with other phenomena. This study was conducted in the odd semester of the 2024/2025 academic year in four MAN/SMAN level schools in Luwu Regency, South Sulawesi Province.

The population in this study were all students of class XI MAN/SMAN in Luwu Regency. The samples used were students of class XI from four schools

in Luwu Regency, namely MAN Luwu, SMAN 1 Luwu, SMAN 7 Luwu, and SMAN 18 Luwu.

Data collection was carried out by providing instruments to students who were samples in this study. The instrument used for data collection was a science process skills test. The test is a written test designed to measure students' science process skills. This written test consists of five descriptive questions related to the reaction rate material.

The data obtained were then analyzed using descriptive statistics. Descriptive statistical analysis was used to describe the scores and results of the study, including the average value (mean), median, mode, standard deviation, highest score, and lowest score. The analysis of the research data was processed using the SPSS statistical analysis application program version 25. The categorization of the science process skills criteria is as follows:

Table 1. Science Process Skills Ability Category Scale

| Value Interval | Category |
|---|---|
| < 20 | Very less |
| 21 – 40 | Not good |
| 41 - 60 | currently |
| 61 – 80 | Good |
| 81 – 100 | Very good |

**RESEARCH RESULT**

***Students' Science Process Skills with PBL Model on Reaction Rate Material***

In this research data analysis, descriptive statistical tests were carried out, which can be seen in the following table:

Table 2. Descriptive Analysis of Students' Critical Thinking Skills

| No | Statistics | Results |
|---|---|---|
| 1 | Number of Respondents | 93 |
| 2 | High Score | 12 |
| 3 | Low Score | 5 |
| 4 | Ideal Score | 20 |
| 5 | Standard Deviation | 1.254 |

Meanwhile, the description of the science process skills category of students at SMAN/MAN Luwu Regency is as follows:

Table 3. Description of Science Process Skills Categories of Students of SMAN/MAN Luwu

| School name | Number of Samples | Score Average | | KPS Value | Category |
|---|---|---|---|---|---|
| SMAN 1 LUWU | 25 | 8.36 | | 41.8 | Currently |
| MAN 1 LUWU | 25 | 8.32 | | 41.6 | Currently |

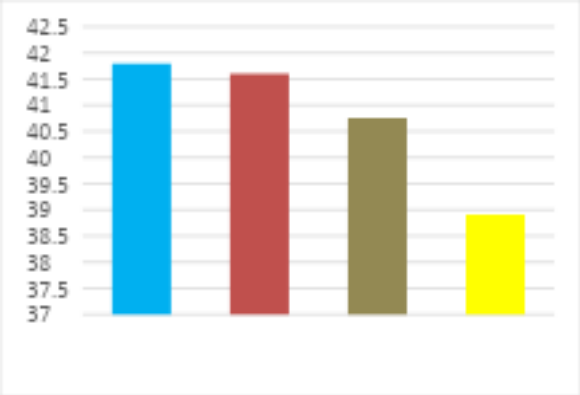
| | | | | | |
|---|---|---|---|---|---|
| SMAN 7 LUWU | 23 | 8.15 | | 40.75 | Currently |
| SMAN 18 LUWU | 20 | 7.78 | | 38.91 | Not good |

Furthermore, the categories of each indicator of students' science process skills at SMAN/MAN Luwu Regency are as follows:

Table 4 Categories of Each Indicator of KPS SMAN/MAN Luwu Regency

| **KPS Indicators** | **KPS Value** | **Category** |
|---|---|---|
| Implementing the Concept | 43.28 | Currently |
| Conducting Observations | 41.94 | Currently |
| Classifying | 38.98 | Not good |
| Ask a question | 40.32 | Not good |
| Conducting Communication | 39.52 | Not good |

The KPS achievements of each school can be seen in the following graph:




Graph 1. KPS Indicator Achievement

## DISCUSSION

Science process skills (SPS) refer to the abilities needed to conduct scientific investigations and understand science concepts through hands-on experience. These skills are essential in science education because they allow students to be actively involved in the learning process. Previous research by Hidayah & Pujiastuti (2016) showed that the Problem Based Learning (PBL) model has a significant positive effect on the science process skills of fifth grade students of SD Gugus 3 Kotagede. In addition, Bungel's research (2014) also revealed that the application of PBL with five stages of learning, namely basic concepts, problem definition, independent learning, group discussion, and assessment, can improve the learning outcomes of junior high school students. Haryono (in Sole, 2013) also found that the application of a learning model based on science process skills was quite effective in improving students' science process abilities and their learning outcomes.

Furthermore, the indicators of students' science process skills analyzed in this study are as follows:

***Implementing the Concept***

The skill of applying concepts emerges when students apply the knowledge and skills learned in new situations, such as conveying information, conclusions, and theories in different contexts (Bakar & Halim, 2015). The results of the study showed that this skill is still in the poor category, with a KPS value of 43.28. However, students have started to be active in solving new problems based on the results that have been learned. The application of the PBL model increases students' enthusiasm in finding and applying information independently.

***Observation Skills***

Observation skills are basic skills that are very important in science. Observation involves more than just seeing, but also requires attention, careful recording of phenomena, and the ability to draw conclusions based on the data obtained (Darmayanti et al., 2021). Although students showed observation scores that were still in the poor category (41.94), they seemed serious in observing the reaction rate experiment. They recorded observations carefully and used equipment carefully to understand the reaction rate by placing an "X" as a visual clue under the beaker. All observation data was recorded in the table in the LKPD.

***Classify***

Classification skills are very important in science education, as they help students organize and analyze scientific information. This skill involves students' ability to group data or phenomena based on relevant characteristics that can be used to analyze and draw conclusions (Ilhami et al., 2023). The results of the study showed that this skill was still in the poor category with a score of 38.98. However, students have grouped reaction data by recording them in table form. Some students only recorded the reaction time without filling in the information about the reaction that occurred, which indicates the need for improvement in completing experimental data.

***Ask a Question***

Questioning skills emerge when students ask questions related to the problem being studied. The results of the study showed that questioning skills were still in the poor category with a score of 40.32. However, in the problem orientation in LKPD, students began to ask about the steps in the conversation and also found several problems in the material being taught. Questioning skills need to be trained more so that students are accustomed to asking critical questions that can encourage their thinking skills. Continuous questioning practice can improve students' critical thinking skills (Nugraha et al., 2017).

***Communication***

The students' communication skills in this study were in the poor category with a score of 39.52, the lowest among the five aspects of KPS analyzed. Presenting the results of the experiment in front of the class is an opportunity for students to develop their communication skills. In this activity, although some

students have tried to convey the results of their observations clearly, there are still difficulties in conveying ideas in a structured manner. However, they have started to interact with their friends and try to present the results of the experiment more openly. To develop these communication skills, students need to practice more in conveying their ideas confidently and in an organized manner.

Several factors that contribute to students' low science process skills include poor study habits, limited background knowledge, and the use of textbooks as the only source of learning. In addition, the lack of exploration in science process skills, as well as learning that only emphasizes mastery of concepts without involving active student roles, also affect the development of these skills (Arsad Bahri et al., 2022). By implementing a problem-based learning model, which invites students to be actively involved in solving real problems, it is hoped that it can improve students' science process skills.

Problem-based learning models require the role of teachers who are not only as material deliverers, but also as facilitators who guide students through the learning process. Hidayah & Pujiastuti (2016) emphasized that teachers in the PBL model act as facilitators who help students develop critical and creative thinking skills in solving problems. Handika & Wangid (2013) also stated that PBL is interesting for students because it connects them with real problems, increases discussion among students, and helps them build their knowledge actively

## CONCLUSIONS AND RECOMMENDATIONS

The conclusion of this study is that the level of science process skills category of grade XI students of SMAN/MAN Luwu Regency in the PBL model on the reaction rate material is classified as less good with a KPS value of 40.76.

Improvements are needed in the application of the Problem Based Learning (PBL) model to improve the quality of students' science process skills (SPS). More interactive teaching and based on the development of practical skills need to be strengthened, especially in indicators that still show poor categories, such as classifying, asking questions, and communicating. Schools need to increase the availability of learning resources, such as relevant books and materials, as well as laboratory facilities that can support the development of students' science skills, especially in schools with B and C accreditation.

## ADVANCED RESEARCH

This study has several limitations that need to be improved in further research. First, the limited sample only covers a few schools in Luwu Regency, so research needs to be conducted with a wider and more diverse sample so that the results can be generalized. Second, the duration of the study which is only one semester is not enough to see significant changes in students' science process skills, so further research with a longer duration will provide a more long-term picture. Third, external factors such as students' educational background and family support are not fully controlled, so it is important to consider these factors in further research. Suggestions for further research are to

involve more schools from various regions, use more varied assessment instruments, and consider external factors that influence students' science process skills.

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