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Practicality and Effectiveness of Technical Guidelines Project Based Learning For Enhance Literacy Ability Chemistry of Students on Materials Reaction Rate of Class XI SMA/MA

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ABSTRACT

This study aims to implement technical guidelines for project based learning based on chemical literacy in the material of reaction rate to increase the chemical literacy of class XI students of SMA N 2 Pariaman seen from the pretest and posttest. This type of research is pre-experimental with a one group pretest posttest design. The population and sample in this study were class XI IPA SMA N 2 Pariaman as many as 30 students. The sampling technique in this study was a random sampling technique. The research instrument used was a question in the form of a description of 17 questions. Based on the results of chemical literacy of students per level of questions where it can be concluded that on the results of the p-test students who are at the level of scientific illiteracy (40%), at the nominal level of scientific literacy (38 %), (22%) are at the level of functional scientific literacy, this shows that students' chemical literacy skills are classified as low. Based on the results of the posttest, it is known that students are at the functional scientific literacy level (12%), at the conceptual scientific literacy level (58%), this shows that students' chemical literacy abilities are relatively high.

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1. **Introduction**

Reaction rate is one of the chemistry learning materials discussed in class XI SMA/MA in odd semesters. The reaction rate is one of the materials that is considered difficult for students which shows a low understanding of the concept for students [1]. Students' difficulties in understanding the concept will prevent students from understanding the next concept. Where the characteristics of chemical materials have concepts that are interrelated with one another. Reaction rate material is a prerequisite concept for understanding equilibrium material [2]. Apart from that, the reaction rate material is also applicable in everyday life [3].

Learning using Project Based Learning is a learning model that requires teachers to design learning with the end result of creating a real project, by giving assignments based on a problem at the initial stage, so that students can explore new knowledge and apply it in real life [4]. Project Based Learning integrates problem-based learning with project-based solutions. The project can be an effective solution in improving students' cognitive and psychomotor abilities. This is in accordance with the research of [4], stating that the Project Based Learning learning model can make students develop in terms of cognitive, affective, and psychomotor, students can solve problems on their own with a good level of thinking so as to be able to improve understanding of the material.

Based on an analysis of the observation questionnaire that was given to 3 chemistry teachers at SMAN 2 Pariaman, 66.7% of chemistry teachers at SMAN 2 Pariaman said that learning on the reaction rate material used the Discovery Learning learning model, and 33.4% of teachers used the Problem Based learning model Learning on reaction rate material. In practice this learning model is not applied properly. Learning is more focused on lectures, questions and answers, and assignments. In the learning process, small groups are also not formed for discussion, so students cannot exchange ideas with each other to find concepts.

One part of scientific literacy is chemical literacy [5]. Chemical literacy is a basic ability to obtain the basic concepts of chemistry macroscopically, microscopically and symbolically as well as processes for understanding and describing natural phenomen [6]. Chemical literacy according covers four domains, which consist of knowledge of chemical material, scientific ideas, chemistry in context, high-level learning skills (HOLS), and affective/attitude aspects. To measure chemical literacy skills, clear benchmark indicators are needed. According to Bybee in [7] there are five grouping levels of chemical literacy, namely: (1) scientific literacy, (2) nominal scientific literacy, (3) functional scientific literacy, (4) conceptual scientific literacy, (5) multi-dimensional scientific literacy.

Have developed a chemical literacy assessment. The development of the assessment refers to the literacy concept of [7] and the level of scientific literacy from [8]. Where the assessment is designed in the form of essay questions for class XI which can be used as a single instrument in assessing all aspects of chemical literacy in the matter of reaction rates.

Availability of technical guidelines for Project Based Learning on material Reaction rates for class XI SMA/MA that are valid. However, this guide needs to be followed up in the form of

testing its effectiveness [9]. So the authors are interested in conducting research with the title: "Practicality and Effectiveness of Project Based Learning Learning Guidelines to Improve Students' Chemical Literacy Skills in Material Reaction Rate Class XI SMA/MA".

2. Experimental

This research is a follow-up research from previous development research in which a valid technical guideline for Chemical Literacy-Based Project Based Learning on Reaction Rate Material for Class XI SMA/MA has been valid [10]. The model previously used was the Plomp model which had three stages: (1) preliminary research, (2) prototyping stage, (3) Assessment Stage [10].

In previous research, it has been carried out up to the prototyping stage in the validation stage. This project guide has been declared valid, then in this research practicality and effectiveness tests will be carried out on the Technical Guidelines for Chemical Literacy-Based Project Based Learning on Reaction Rate Material for Class XI SMA/MA. Practicality is the level of use of teaching materials in the learning process. To find out the practicality of this project guide, the researchers tested the Project Guide on students and teachers at SMAN 2 Pariaman. Then teachers and students will be asked to respond to the use of project guidelines in the learning process. The population in this study were all Class XI Science students and teachers at SMAN 2 Pariaman. The instruments in this study were a practicality questionnaire and pretest and posttest questions for the effectiveness test.

Practicality test is a test of the practicality or ease of use of a product that is produced. To determine the practicality we can formulate as follows:

$$Np = R/SM \times 100\%$$

In making decisions based on practicality criteria, technical guidelines for project-based learning based on chemical literacy in the material for class XI SMA/MA reactions. Practical criteria for project guidance in the learning process can be seen in Table 1.

Table 1. Product Practicality Criteria

No	Presentase	Criteria
1	0-40	Impractical
2	21-40	Less Practical
3	41-60	Pretty Practical
4	61-80	Practical
5	81-100	Very Practical

Next, an effectiveness test of the N-Gain Test will be carried out which aims to determine the increase that occurred before and after learning using the project guide that has been made. The stages in determining the N-Gain calculation include:
Determine students' pretest and posttest scores with the formula:

$$student\ value\ = \frac{student\ scores}{total\ score} \times 1$$

After obtaining the student's value, then the N-Gain calculation is carried out with the formula:

$$N - Gain = \frac{postest\ score - pretest\ score}{100 - pretest\ score}$$

The results of N-Gain calculations (normalized gain) are then interpreted using Hake' [9classification as shown in table 2.

Table 2. N-Gain Criteria

N- Gain	Criteria
$g \geq 0,7$	Tall
$0,0,7 > g > 0,3$	Currently
$g \leq 0,3$	Low

It also concludes the level of effectiveness of the project guidelines developed based on the categories of effectiveness interpretation contained in table 3 below:

Table 3. Categories of Interpretation of Effectiveness

Persentase	Criteria
< 40	Ineffective
40 – 55	Less effective
56 – 75	Effective enough
< 76	Effective

3.   Results and discussion

The Technical Guide to Chemical Literacy-Based Learning Project Based Learning on Reaction Rate Material is a problem-based learning guide with project-based solutions. Judging from the level of practicality of learning media can be seen from the table below:

Table 4. Student Practicality Test Results

No	Rated aspect	Persentase	Practicality category
1	Ease of Use	88%	Very Practical
2	Time efficiency	87%	Very Practical
3	Benefit	88%	Very Practical
Overall percentage		**86%**	**Very Practical**

Table 5. Practicality Test Results by Teachers

No	Rated aspect	Persentase	Kategori Kepraktisan
1	Ease of Use	83%	Very Practical
2	Time efficiency	87%	Very Practical
3	Benefit	83%	Very Practical
Overall percentage		**84%**	Very Practical

From the table above we can conclude that the Chemical Literacy-Based Learning Project Based Learning Technical Guide is very practical in the learning process with a practicality percentage of 86% in the practicality test of students while in the practicality of the teacher the category is very practical with a score of 84%. This shows that the developed project guidelines can be used in the learning process. The following is a graph of the practical values of teachers and students as shown in Figure 1.
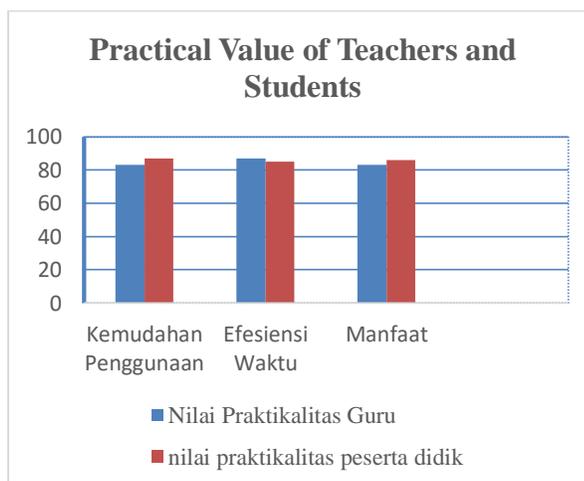

Figure 1. Graph of Teacher and Student Practical Values

3.2 Effectiveness

Data from the chemical literacy test results obtained from students' pretest and posttest data which were analyzed using the Rasch model with the ministep application.

1) Scalograms

The scalogram depicts responses sorted by level of difficulty from left to right (easiest to most difficult) and subjects sorted by ability from top to bottom (from high to low). The scalogram on the pretest data can be seen in Figure 2.

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GUTTMAN SCALOGRAM OF RESPONSES:
Person |Item
|1 1   11    1   1 11
|24135031984675267
|---------------
17 +23212212122012022   17PR
30 +22212212112112122   30PR
2 +21222212201102122   02PR
19 +21222212201102122   19PR
12 +21221122021220000   12PR
25 +12211122111111100   25PR
8 +21212121001101011   08PR
15 +11211102220210000   15PR
3 +23211211100000100   03PR
13 +21112110111010200   13PR
23 +12111112101001011   23PR
1 +12111211111000100   01PR
18 +11222101110010100   18PR
26 +22120110120110000   26PR
14 +12121110100110000   14PR
21 +21211022000000100   21PR
24 +21211121100000000   24PR
29 +12211112100000000   29PR
6 +21021210100100000   06PR
11 +21211110110000000   11PR
16 +21211111100000000   16PR
4 +11211210100000000   04PR
5 +11122110100000000   05PR
10 +11011120011010000   10PR
22 +12110121100000000   22PR
27 +11011010120110000   27PR
9 +21211011000000000   09PR
28 +12111110100000000   28PR
7 +11111110100000000   07PR
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Figure 2. Scalogram *pretest*

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GUTTMAN SCALOGRAM OF RESPONSES:
Person |Item
| 11   1111 1       1
|24545213630768197
|-----------------
2 +44434444444333334   02PO
19 +44444343434344334   19PO
30 +44444343434344334   30PO
6 +44444434433333334   06PO
10 +44444434433333334   10PO
13 +44444434433333334   13PO
4 +44434433433333334   04PO
7 +44433434433433333   07PO
9 +44443334433333334   09PO
16 +44443334433333334   16PO
5 +44433333433333344   05PO
18 +44434433433333234   18PO
14 +44334333343333332   14PO
17 +44334333343333332   17PO
24 +44334333333333333   24PO
26 +43334333333334234   26PO
11 +43443333333333332   11PO
29 +44432343433222324   29PO
3 +43333333233333332   03PO
12 +43343343232333331   12PO
15 +34342334323333331   15PO
23 +43343343232333331   23PO
27 +43334333243333321   27PO
21 +33333332233333332   21PO
25 +43233332233333332   25PO
1 +24432244334211213   01PO
8 +23233433222332332   08PO
22 +33323333233322232   22PO
28 +23232423223333332   28PO
20 +43322232232333322   20PO
|-----------------
| 11   1111 1       1
|24545213630768197
```
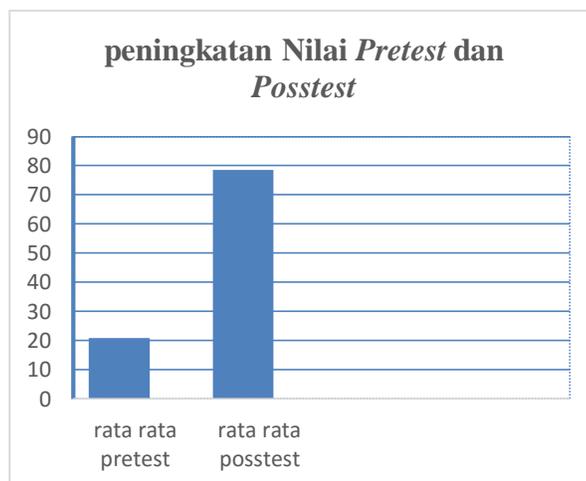
Figure 3. Scalogram *posstest*

Figure 4. Graph of students' pretest and posttest scores

4. **Conclusion**

Technical Guide to Chemical Literacy-Based Learning Project Based Learning on practical and effective reaction rates in improving the chemical literacy skills of class XI students. Where the level of practicality of the learning guide has reached a very practical level with a score of 84% on teacher practicality and 86% on student practical results. Whereas in the effectiveness test it can be concluded that the learning guide has reached an effective level seen from the results of the N-Gain test which is 0.73 which is categorized as high.

Based on the conclusions obtained, the researcher recommends that teachers in the field of chemistry study make Technical Guidelines for Chemical Literacy-Based Project Based Learning on reaction rate material as an alternative teaching material used in the learning process to increase students' chemical literacy, especially on the subject of reaction rates.Acknowledgements

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