# C4. Muntari

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# THE PRACTICALITY OF PROBLEM-BASED LEARNING TOOLS ASSISTED BY INTERACTIVE SIMULATIONS TO IMPROVE STUDENTS' CREATIVE THINKING ABILITY

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**Abstract:** Learning tools are important to facilitate students in improving creative thinking skills. The ultimate goal of this research is to produce practical problem-based learning tools assisted by interactive simulations. This research uses a 4D development model: define, design, develop, and disseminate. The interactive simulation-assisted problem-based learning tool that was developed consisted of a syllabus, lesson plans, worksheets, and evaluation instruments. The research subjects used were students of class XI MA in Mataram City. The practicality test is carried out by observing the implementation of learning, the process of creative thinking skills during learning, and teacher and student responses related to learning and learning tools. The results of the practicality test showed in the practical category. They received a positive response from both teachers and students, with the percentage range of the practicality of all indicators being 60% to 80%.

**Keywords:** *Practicality, Problem Based Learning, Interactive Simulation, Creative Thinking Ability*

## INTRODUCTION

Chemistry is one part of the Natural Sciences that studies natural events that allow research with experiments, measurements, and mathematical presentations based on the scientific method [1-2]. In chemistry learning activities, students are not only taught concepts or theories (cognitive aspects) but also hone process skills (psychomotor aspects) and foster scientific attitudes (affective aspects) of students [3]. Integrated chemistry learning is closely related to the 2013 curriculum, which is designed with the aim that students can develop attitudes, knowledge, and skills and apply them in various situations in school and society [4].

Based on previous research, students find it difficult to learn chemistry in class. Students feel that the concepts presented have not been able to assist students in achieving the goals of learning chemistry. In addition to student factors, teacher factors also affect chemistry learning in the classroom. Suryani [5] states that chemistry teachers have not fully used scientific methods when teaching and have not trained students in process skills. The learning pattern in schools generally uses conventional learning that emphasizes the dominance of teacher activities, even though modern learning wants a center for learning activities centered on students [6]. Applied chemistry learning still takes place classically and only relies on textbooks with the memorization method rather than understanding concepts. The teaching method developed is predominantly lectured, so learning is teacher-centered [7]. This activity is considered less than optimal because it only forms a one-way interaction, namely teacher interaction with students [8].

Chemistry learning activities need to be directed at the active activities of students by linking learning materials to real situations [9]. One way is to use problem-based learning. Problem-based learning (PBL) is a constructivist approach-based learning method where students become the center of learning and solve problems in life based on shared knowledge in groups or teams [10]. Problem-based learning is learning that links the concepts learned with everyday life so that students can connect the knowledge they learn with phenomena that occur in their environment [11]. Problem-based learning also provides opportunities for students to conduct experiments related to the problems presented [12].

In addition to the learning model, the role of the media is also very important in learning [13] [14-15]. One of them is the use of interactive simulation media. According to Prior [16] and Kirsner [17], interactive learning media is a form of learning media that can create a link between the user and the learning media by influencing each other and providing mutual action and reactions to one another in helping deliver learning material. The interaction of students with the media can create a pleasant learning environment and increase the involvement of students to play an active role in finding new concepts [18].

Based on this, problem-based learning tools assisted by interactive simulations will be able to improve students' creative thinking skills if they meet the practicality criteria. Practicality is the use of learning media developed [19].

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## RESEARCH METHODS

The type of research used in this research is quantitative research. The test of the practicality of a product aims to determine the level of product practicality after the trial process is carried out. This form of testing is part of Research and Development (R & D). The technique of collecting data sheets was filling out practical questionnaires by research subjects. To find out the practicality of the learning tools developed, the researchers conducted product trials. Researchers conducted product trials at SMAN 3 Mataram in two classes (71 students).

The practicality test of learning tools is carried out through observing the implementation of learning, the process of creative thinking skills during learning, teacher responses to learning tools, and student responses to the learning process. The data from the practicality test were analyzed to determine the level of implementation, the process of creative thinking skills during learning, and the responses of teachers and students using the percentage of practicality as follows.

$$\%\text{Practicality} = \frac{\text{Total Score}}{\text{Maximum Score}} \text{x}100\%$$

Learning tools are categorized as practical if the percentage of implementation, creative thinking ability process, and teacher and student responses is at least 61%.

## RESULT AND DISCUSSION

Learning tools that have been validated and revised based on suggestions from the validator (draft 2) are then carried out in a limited trial to determine the device's practicality [20]. Learning tools are said to be practical if experts and practitioners state in theory that these tools can be implemented in the field, and the level of implementation is in a good category [21]. The practicum indicators for learning tools consist of observing the implementation of learning, assessing the process of creative thinking skills during learning, and teacher and student responses to learning tools.

### Observation of the Implementation of Learning

The analysis of the learning device data implementation is to see how much the device implements in the learning process. The observations on the implementation of learning using the implementation learning are listed in Table 1 below.

Table 1. Learning Implementation Results Data

| Meeting | Class XI MIPA-1 | | Class XI MIPA-2 | |
|---|---|---|---|---|
| | Average Value (%) | Category | Average Value (%) | Category |
| I | 65.44 | Practical | 60.66 | Practical |
| II | 71.32 | Practical | 64.71 | Practical |
| III | 79.41 | Practical | 70.22 | Practical |
| IV | 79.78 | Practical | 77.57 | Practical |
| Average (%) | 73.99 | | 68.29 | |
| Category | | Practical | | Practical |

Table 1 shows that the implementation of learning in both classes is in the practical category. The average value of class XI MIPA-1 is greater than class XI MIPA-2. At the first meeting, the sub-material concepts of acid-base and acid-base indicators obtained a 65.44% in class XI MIPA-1 and 60.66% in class XI MIPA-2. The results of observations showed that at this meeting. Several activities had not been carried out because students were not accustomed to using problem-based learning modes assisted by interactive simulations. Such as activities providing opportunities for students to give opinions about problems in the LKS, activities asking and guiding students to open material contained in the Adobe Flash application on each existing computer or cellphone, and giving students time to find facts related to the material discussed. The teacher reflects on deficiencies by directing students to prepare for learning and explaining the problems to be solved.

At the second and third meetings, the sub-material pH of the acid-base solution obtained a score of learning implementation in the practical category for both classes. However, some activities are not carried out by the teacher, such as checking students' attendance and asking students to open the material that the teacher has prepared. The teacher does not ask students to ask questions they have made at the third meeting. The fourth meeting of the sub-material pH salt solution obtained a learning implementation score of 79.78% for learning in class XI MIPA-1 and 77.57% for learning in class XI MIPA-2. The learning implementation score obtained shows that the fourth meeting is practical.

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At the fourth meeting, all activities were carried out well.

The implementation of learning by teachers has increased. Every teacher meeting reflects on the activities carried out by correcting deficiencies during the learning process, ranging from deficiencies in preliminary activities, core activities, and closing. The study results align with research conducted by Zakaria [23], which states that the implementation of learning using problem-based teaching materials developed is 88.6%, with a very positive category.

**Assessment of Creative Thinking Ability Process during the Learning Process**

The implementation of the learning process carried out by the teacher impacts the activities carried out by students in the classroom. The data measured in the learning process is the creative thinking ability of students based on the results of LKS work by giving a score of 0-4 according to the rubric that has been made. The worksheets carried out by students include these four indicators, namely creative thinking at every step of the activity in it. The indicators of creative thinking skills contained in the worksheets include flexibility, fluency, originality, and elaboration. The data on the results of students' creative thinking ability during the learning process can be seen in Figure 1 below.

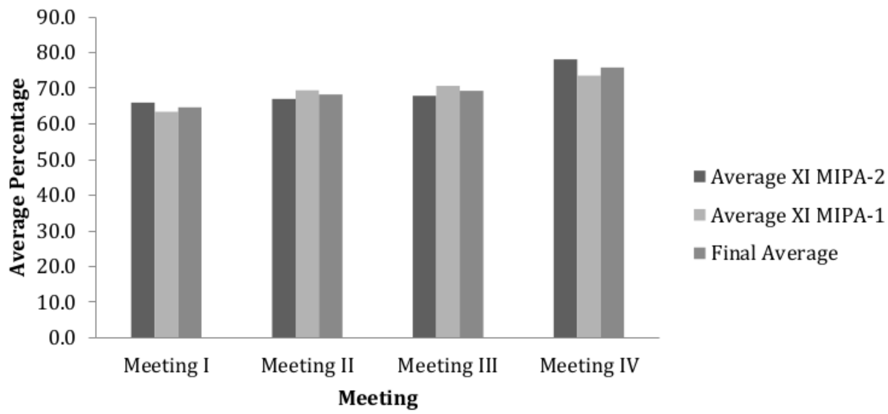


Figure 1. Average Percentage of Creative Thinking Ability in Each Meeting

The picture above shows that in every meeting, the creative thinking process of students through working on student worksheets always increases. At the first meeting, the average percentage of students' creative thinking abilities was 64.68% in the good category. At the second meeting, it was 68.24% in the good category, at the third meeting, it was 69.30% in the good category, and at the fourth meeting, it was 75.85% in the good category. Based on the overall score on the student worksheets, it appears that at the first meeting with the sub-material, identifying the nature of acid-base solutions had the smallest value among the percentages at the second, third, and fourth meetings. It happens because students are still not used to working with worksheets that contain indicators of creative thinking ability. In addition, students are also less familiar with the terms or commands in the student worksheets.

The results of this study are in line with research conducted by Faturohman & Afriansyah [24], which states that when working on worksheets, students still need to be guided by researchers because students are not accustomed to using worksheets as learning media. However, learning can be conditioned according to the plan at the second and subsequent meetings. Research conducted by Wijayanti & Widiyatmoko [25] also showed that each meeting experienced an increase in the percentage of creative attitudes, wherein in four meetings, students made creative presentations according to the designs that had been designed.

In addition to each meeting, it is also analyzed based on students' creative abilities indicators. The following is Figure 2 regarding the creative thinking ability of students for each indicator based on the worksheets that are done.

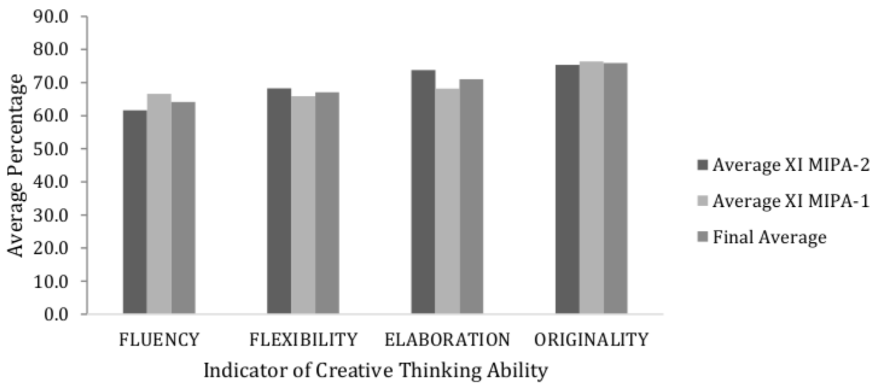


Figure 2. Average Percentage of Creative Thinking Ability in Each Indicator

Figure 2 shows that the average percentage of indicators of creative thinking abilities of students XI MIPA-1 and XI MIPA-2 are different. The average percentage of the fluency indicator is 64.12% in the good category, the flexibility indicator is 67.06% in the good category, the elaboration indicator is 71.00% in the good category, and the originality indicator is 75.89% in the good category. Based on this, the highest gain is the originality indicator, while the indicator with the lowest average percentage gain is the fluency indicator.

The highest average percentage gain on the originality indicator is because students can solve problems by looking at them from another point of view. It is evidenced by students giving different ways, and all the steps for solving them are correct. However, students' creative thinking ability for the originality indicator declined at the second and third meetings but progressed again at the fourth meeting. The results of this study are in line with research conducted by Siswono [25], which states that the originality indicator is placed in the highest position among other creative thinking indicators. Findings during the learning process also showed that students were enthusiastic and active because the experimental activities were new experiences that students rarely did when the practical tools were limited.

**Teacher's Response to Learning Tools**

Analyzing teacher response data aims to determine the teacher's response to the learning tools developed. The teacher's response was analyzed from the results of the questionnaire filled out by the subject teacher. The results can be seen in the figure 3.

Based on the picture above, it is known that the percentage score of each aspect of the learning device varies. In physical/display feasibility, the percentage score is 62.50%. In comparison, in the content feasibility aspect, it is 71.88%, in the practical aspect, it is 75,005, and in the language aspect, it is 66.67%. The percentage score obtained in each of these aspects is in a positive category, so it can be concluded that the learning device based on the teacher's response is practical. The results of this study are in line with research conducted by Lembang [26-28], which stated that the results of teachers' response to problem-based chemistry learning tools obtained a P = 3.75 in the "practical and not revised" category.

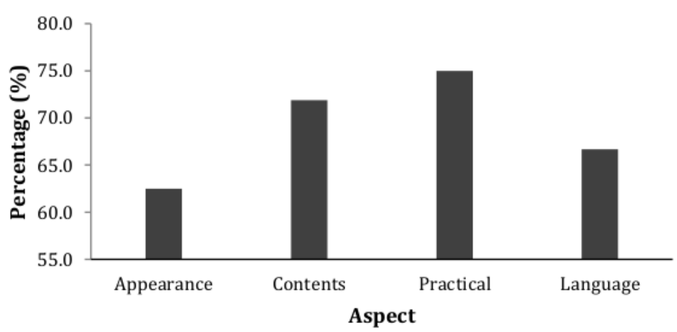


Figure 3. Teacher Response to Learning Tools

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**Student Responses to the Learning Process**

The primary purpose of analyzing student response data is to determine student responses related to the learning process that has been carried out. Data from student responses can be seen in the figure 4.

Figure 4 shows that the average percentage of student responses to the learning process using a problem-based learning model assisted by interactive simulations is different for each aspect. In motivation, the students' response was 74.61%, the aspect of material mastery was 76.69%, the cooperation aspect was 68.89%, the presentation aspect of the discussion results was 73.33%, and the award aspect was 75.37%. The average percentage of each aspect is in a positive category. It shows that the learning process is carried out using practical developed learning tools. The results of this study are in line with research conducted by Amir [29-30], which showed that student responses to all aspects were above 70%, meaning that the aspects of the learning tools were responded to positively by students. The learning process was said to be effective.

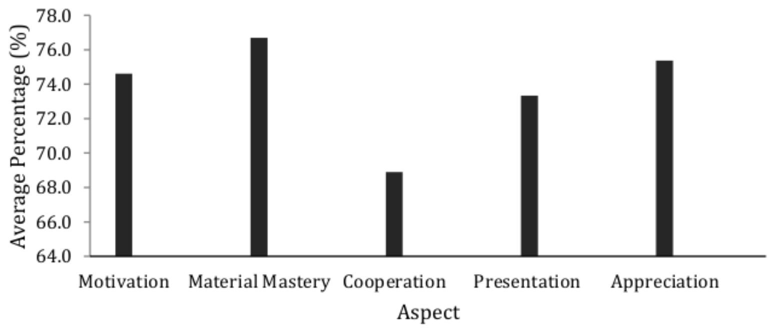


Figure 4. Average Student Responses to the Learning Process

**CONCLUSION**

This study indicates that the practicality of problem-based learning tools assisted by interactive simulations developed based on the implementation of learning, creative thinking processes during learning, teacher responses, and student responses received a percentage score in the practical category. These learning tools can be used in further research.

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