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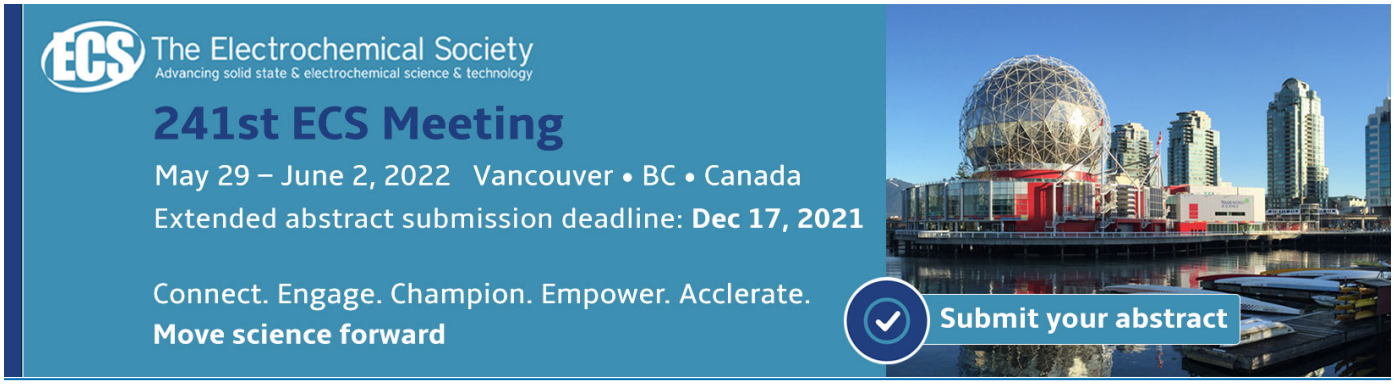

Application of virtual reality assisted probing prompting model to improve critical thinking skills and student learning outcomes

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Abstract. This study aims to find out (1) the improvement of students' critical thinking skills to the application of probing prompting learning models assisted by virtual reality media in colloidal system materials, (2) improvement of students' learning outcomes against the application of probing learning models assisted by virtual reality media on colloidal system materials, (3) the response of students to the application of probing learning models assisted by virtual reality media on colloidal system materials. tudy pretest-posttest design. This study sample was a student of class XI MIPA 4 at SMA Negeri 8 Kota Banjarmasin. Data collection uses to test and non-test techniques. Data analysis techniques use descriptive and inferential analysis techniques. The results showed that: (1) the application of The Probing Prompting learning model assisted by Virtual Reality media could improve the critical thinking skills of students, (2) the application of the learning model probing prompting assisted by virtual reality media on colloidal system materials can improve students' learning outcomes, (3) the application of Probing Prompting learning model assisted by Virtual Reality media gets a good response from students.

1. Introduction

The world of education in the 21st century today requires students to solve problems in life-related to science. Therefore, learning patterns that are still teacher-centred must be changed to student-centred. The 2013 curriculum itself has the fundamental view that knowledge cannot simply move from educator to student. Instead, students are subjects who must have the ability to actively seek, cultivate, construct, and use knowledge [1].

Chemistry learning in schools requires students to explore chemical concepts in a structured and orderly manner. In addition, chemical learning also has a function and purpose, including fostering a scientific attitude that includes a critical perspective to scientific statements and is not easily believed without observation results [2]. The weak learning process is one of the problems in the world of education. Students are less encouraged to develop critical thinking skills. Students are only directed to memorize information without observation. Students must remember and accumulate various information without understanding and connecting with daily life [3].

Chemicals related to problem-solving and often found in everyday life are colloidal system materials. Colloidal system material is mainly in the form of concepts and is widely applied in everyday life. The

characteristics of colloidal material containing theory and application require students to improve critical thinking skills to understand and solve problems thoroughly and see their meaning [4].

Critical thinking skills and learning outcomes can also be trained through the classroom learning process by acquiring new knowledge through problem solving and cooperation. Critical thinking skills involve analyzing arguments, solving problems scientifically, and generating insights into specific things and interpretations. This suggests that critical thinking leads to deep thinking about solving and specific issues [5], [6]. One way to realize improving students' critical thinking skills is by choosing a suitable model. Innovative learning models that can improve and train essential thinking skills are the Probing Prompting model. Probing Prompting learning model is learning by how the teacher presents a series of questions that are guiding and digging. A thought process relates each learner's knowledge and experience to new knowledge being learned [7]–[10].

The Probing Prompting model also complies with the demands of the 2013 curriculum. The probing prompting model is a model that directs students to learn independently, while teachers are only facilitators in the learning process so that learning is centred on the learner [11]. The delivery of a chemical concept will be easily understood and remembered by continuously repeating learning or assisted by a learning medium [12]. Virtual Reality media is a technology that allows users to interact easily in an environment or an event simulated by a computer in an application through a smartphone. Thus, it can be used in the learning process [13]. In pandemics like this, probing prompting models and virtual reality media can also be used in online learning. Because this model does not require face-to-face in its implementation, but by using platforms such as zoom and goggle meet, this model can be implemented so that teachers can give questions to students to answer a problem.

Based on the description above, this study was conducted to improve students' critical thinking skills and learning outcomes by applying the Probing Prompting model assisted by Virtual Reality media on colloidal system materials.

2. Method

The type of research used is pre-experimental using a one-group pretest-posttest design [14]. The population in this study is all students in SMAN 8 Banjarmasin school year 2020/2021. The study sample of class XI MIPA 4 students with purposive sampling techniques. The free variable is the Probing Prompting model assisted by Virtual Reality media. In contrast, the bound variable is critical thinking skills and research data retrieval learning outcomes from May to June 2021.

Research instruments in the form of test and non-test-intrusions. The test instrument used in this study is a matter of description (essay) given at the beginning and end of the lesson (pre-test and post-test) aims to find out the increase in critical thinking skills and learning outcomes and find out how students can answer the given questions. The test used to measure the skills of critical thinking and learning results in the form of a description test consists of 10 points. Non-test instruments used in this study are student response questionnaires that aim to determine the students' response to the learning. Model Probing Prompting assisted by Virtual Reality media of 10 points.

Aiken's V scale created the critical thinking skills problem sheet, learning outcomes, and students' responses. Aiken's V scale was organized in a statement followed by five respondents who showed the level and were given the final score. Descriptive data analysis to analyze critical thinking, learning, and students' response questionnaires while inferential analysis for rhythmic thinking skills aims to test hypotheses that have been proposed, there are differences or no differences in improvement. This analysis uses the t-test to find outH0 is accepted orH0 is rejected. Before performing another test, perform a normality test and a homogeneity test of the initial test*(pre-test)*and the final test*(post-test)*.

3. Result and Discussion

Probing Prompting learning is based on Virtual Reality media in learning that involves students guiding and digging into questions and associating knowledge with previous experiences with new knowledge to be learned. As for the Probing Prompting stage, according to Sudarti, there are seven stages in its implementation 1) confronting students to new situations through images or text that have problems, 2)

teachers waiting for students' answers, 3) asking questions by learning goals, 4) teachers waiting for students' answers, 5) confirming answers, 6) teachers responding to answers, 7) teachers asking final questions. Thus the concept of material learned by students becomes more meaningful and can be applied in everyday life [15, 16].

In learning, in addition to models that support active students, there must be exciting media so that students' attention can be focused and facilitate in understanding the material provided by teachers [17]. *Virtual Reality* media has components capable of providing an engaging look and refers to the use of interactive simulations for users with the opportunity to engage in environments that may seem and are not similar to real-world events [18–21].

Data on critical thinking skills and learning outcomes obtained through pre-tests and post-tests are analyzed descriptively and inferentially. At the same time, the response questionnaire to the Probing Prompting model is based on Virtual Reality media.

3.1 Critical Thinking Skills

Critical thinking skills are a process where knowledge and abilities are applied to solve problems, make decisions, analyze emerging opinions, and conduct investigations or research based on facts, information, and data obtained to produce valid information and conclusions. Critical thinking skills defined that critical thinking is a disciplinary process that is intellectually active and skilled at conceptualizing, applying, analyzing, synthesizing, and evaluating the information gathered has six skill stages [22]. The criteria of critical thinking are FRISCO, i.e., focus, reason, inference, situation, and clarity [22] Overall the increase in the average achievement of critical thinking skills can be seen in Figure 1.

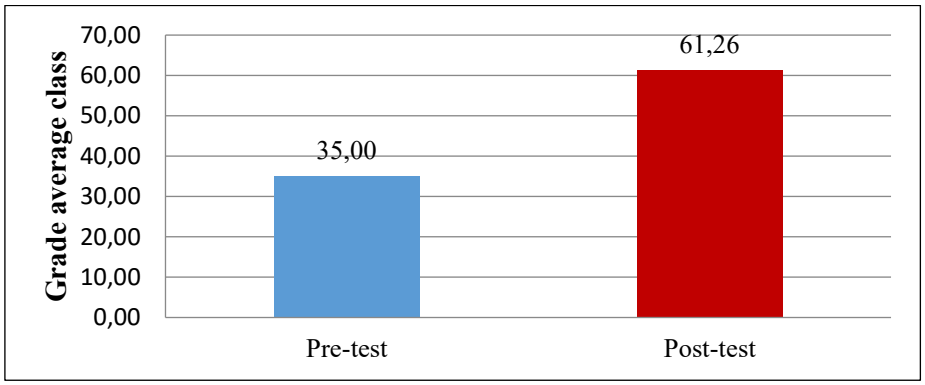

Figure 1 Average pre-test and post-test critical thinking skill values

The average value of students' critical thinking skills at the *post-test* was higher than at the *pre-test*, 61.26 at the *post-test* and 35.00 at the *pre-test.* Differences in the value of critical thinking skills before learning showed that the *Probing Prompting* model assisted by Virtual *Reality* media affected essential thinking skills in colloidal materials. This happens because students are more active in the learning process and more enthusiastic in solving the problems given.

The results of the pre-test and post-test critical thinking skills of each indicator can be seen in Figure 2.

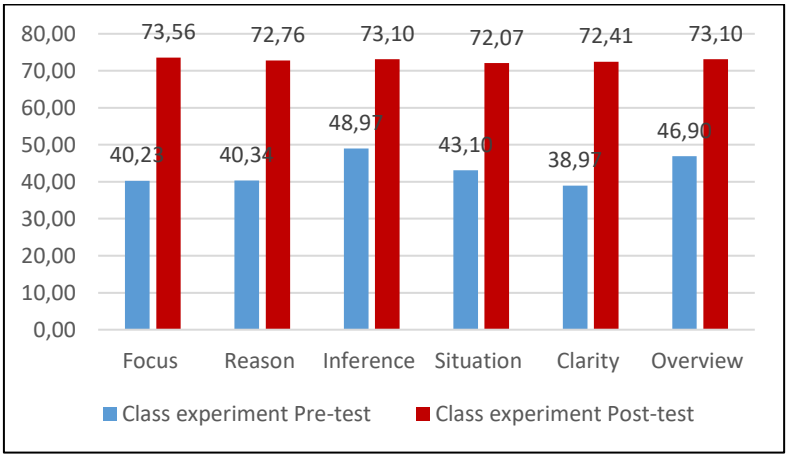

Figure 2 Pre-test results and post-test critical thinking skills of each indicator

After treatment, critical thinking skills at the time of post-test each indicator improved. This is inseparable from the influence of the probing prompting learning model assisted by virtual reality media that always trains students continuously at every meeting with teachers as mentors, especially when identifying and formulating problems. The learning process of the probing prompting model emphasizes problem-solving, discussion, and percentage and is supported by critical thinking tasks specifically designed to improve students' critical thinking skills. Learning that makes students active with teachers as mentors to direct students' thinking will enhance critical thinking skills.

This is in line with the research [23] which states that it is necessary to learn more systematic, structured, role transfer activities to students and oriented to the surrounding environment or daily life so that it will improve students' critical thinking skills. Differences in critical thinking skills improvement in indicators of focus, reason, inference, situation, and clarity increased significantly. The increased tests of students' critical thinking skills on focus indicators are continuously trained at each meeting with the teacher as a guide, especially when identifying and formulating problems. The findings are in line with Anisah & Carlian's (2020) findings, which states that the percentage of achievement results of focus indicators have increased after learning that trains in identifying and formulating problems [24, 25].

Indicators of critical thinking skills are trained when teachers provide opportunities for students to formulate answers to existing problems. In problem, learning is given, then students give reasons based on relevant facts/evidence and convey it when learning takes place. For example, on the critical thinking skills test, students can explain the nature and characteristics of colloids in food. Filsaime (2008) states that a person's critical thinking skills can be improved if he can provide arguments accompanied by supporting evidence to maintain his opinion. This causes critical thinking skills indicators of reason to increase significantly.

Indicators of critical thinking skills are trained when teachers test different hypotheses and students choose the correct hypothesis alternatives. The ability to select and identify problems to make reasoned conclusions, form hypotheses and estimates in considering relevant information and expand the consequences of data or evidence concludes students were increasing. On the test of critical thinking skills, students are already able to determine temporary hypotheses based on available discourse on how to make tofu and colloidal properties that exist in the manufacture This is in line [26] research that shows that using probing prompting models can improve critical thinking skills of inference indicators.

Situation indicators for critical thinking skills are trained when students are faced with the actual situation of a problem. Students must state reasoning, justify reasoning based on evidence and compare with the real situation. Some students are already able to compare and elaborate with colloidal properties in actual conditions, students in delivering their answers based on literature and data from various sources.

On indicators of the clarity of students in stating the results of reasoning, justifying reasoning must be based on evidence from various sources and present reasoning in the form of convincing arguments. According to Layn & Ruslan (2017), students' critical thinking skills are well stated if able to state reasoning following relevant information and facts [27]. Based on the critical thinking skills test, students can already present arguments or reasoning based on evidence on why detergents can remove fat and the event of smoothing kitchen spices before being mixed with food and its relationship with colloidal materials. Strong reasoning can be determined after students find assumptions that have good reason to trust the source.

Critical thinking skills are trained to review or evaluate when analyzing data and determining the most reasonable opinion resulting from data analysis. Based on the critical thinking skills test, students have been able to review or examine examples of events so that they can conclude in their entirety based on facts and evidence about the role of protective colloids.

The t-test was conducted on pre-test data and post-tested students' critical thinking skills in experimental classes tested for homogeneity and normality. Pre-test and post-test data should be normal and homogeneous. The pre-test data and post-test results of the learner's critical thinking skills can be seen in Table 1.

Table 1 Test results-t pre-test data and post-test CTS Students

Result	dk	x	Md	calculated	ttable5%	Conclusion
Pre-test	29	35	26.26	11.01	2.03	There are differences in critical thinking skills
Post-test	29	61.26				

Based on Table 1, the price t-calculated and t-table where t-calculated > t-table (11.01 > 2.03), which means Ho rejected and H1 accepted, so it can be said that there is a significant difference between the average pre-test value and post-test critical thinking skills of students in the moments before and after learning that applies the Probing Prompting model assisted by Virtual Reality media.

3.2 Learning outcomes

Learning outcomes in the field of knowledge of students are measured by learning using the Probing Prompting model assisted by Virtual Reality media. Test results are done before being given treatment (pre-test) and after given treatment(post-test). The Probing Prompting learning model assisted by Virtual Reality media shows the learning atmosphere becomes more directed and uplifting for students in the following learning.

This affects students' learning outcomes; 29 completed students, as many as three people, have not completed 26 students at the pre-test. While at the time of post-test, students are complete as many as 29 people, and nothing is not absolute. The pre-test is the initial test before the application of treatment to measure students' initial knowledge about the colloidal system. At the same time, the post-test is a test done at the end of learning after the application of treatment to measure students' level of understanding of colloidal system material that has been taught. The percentage of completion of learning outcomes can be seen in Figure 3.

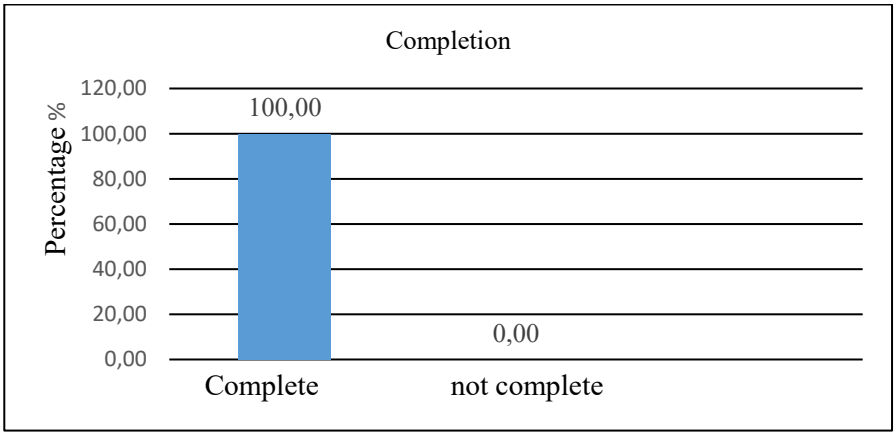

Figure 3 Percentage of the completion of learning outcomes of the realm of knowledge

Based on Figure 3 above, it is explained that the application of the probing prompting model assisted by Virtual Reality media makes the learning outcome of class XI MIA 4 students' knowledge reach completion of 100%, which means students have above the specified KKM value of 75. The improvement of students' learning outcomes can be influenced by the high critical thinking skills of students. With the critical thinking skills, students will use the ability to solve problems, formulate influential factors, find out various facts in the issue, and make the right decisions to improve students' results [28], [29].

This is in line with Wicaksono & Candra's research (2016) which states there is a significant influence of critical thinking skills with increasing learning outcomes, so students answer more critical problems, especially in deep thinking and straightforward and realistic reasons [30], [31]. Therefore, the Probing Prompting learning model assisted by Virtual Reality media can improve students' learning outcomes and achieve a minimum score of ≥ KKM based on the test of learning results provided. Based on the study results, students' completion is 100%, with an N-gain of 0.57 in the moderate category.

3.3 Student response

Students' response to using a probing prompting model assisted by virtual reality media is given at the end of learning, namely after the post-test. The response of students used a questionnaire containing seven positive questions and three negative questions. The results of the assessment of the students' response to learning in colloidal material are presented in Figure 4.

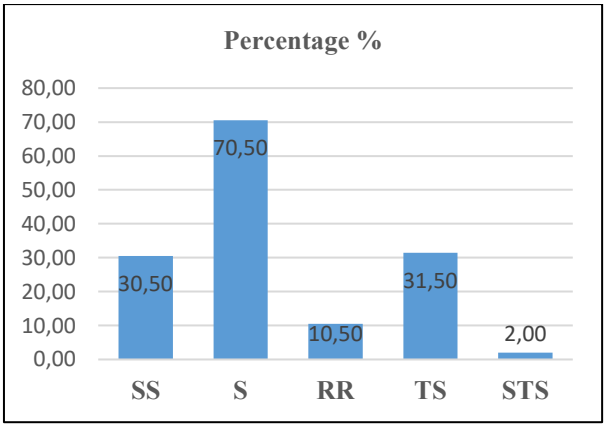

Figure 4 The results of student's response

Figure 4 shows the study for students' response to the probing prompting learning model assisted by virtual reality media in the colloidal system material of the student's experimental class responded well. This can be seen from 30.50% of students who responded strongly agree, 70.50% of students who

responded agreed, 10.50 students responded hesitantly, and 2% of students responded disapprovingly. Thus, based on a table of 18 average scores, students in the experimental class meet the response level of the criteria range well. Therefore, it can be concluded that students in the experimental class responded positively to probing prompting models assisted by virtual reality media. This is supported by Anisah & Carlian's (2020) research, which states that the probing prompting model can train critical thinking skills [24].

The effectiveness of the probing prompting model is shown by increasing critical thinking skills in solving the given questions. The results showed that the activity of students in learning showed an active category with a percentage of 80.52%, an increase in critical thinking skills with an average N-gain of 0.89 in the high category. This supports the positive response to the probing prompting model assisted by virtual reality media, which is reasonably practical and effective.

4. Conclusion

Based on the data above, it can be concluded that there is an increase in critical thinking skills and student learning outcomes before learning and after learning using the Probing Prompting model assisted by Virtual Reality media. Furthermore, students' positive response to using the Probing Prompting model assisted by Virtual Reality media on the colloid system material of students makes learning more enjoyable. In addition, it makes it easier for teachers to convey material or information in learning. Therefore, the Probing Prompting model assisted by Virtual Reality media tested can be considered for chemistry subject teachers to practice critical thinking skills and learning outcomes through online learning.

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