Development of Chemistry Learning Intruments Based on Reading Questiong And Answering Strategy Mixed With Creative Problem Solving

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Abstract. This study aims to produce chemistry learning intruments based on Reading Questioning and Answering (RQA) strategy mixed with Creative Problem Solving (CPS) on acid-base topic to improve students' critical thinking skills. The product development is based on the 4D model which is limited to 3 stages: define, design and develop. The feasibility test of learning instruments was carried out. The percentage of the feasibility of the syllabus, lesson plan, eligibility of student worksheet, and the percentage of critical thinking intruments are 80 %, 77 %, 82 %, and 75 %, respectively. The total percentage of all developed instrument items is 78.8 %. In conclusion, feasibility study shows that the chemical learning intruments based on RQA-CPS is categorized as feasible.

1. INTRODUCTION

The 21st century requires a transformation of education as a whole so that the quality of teachers is built that is able to advance knowledge, training, student equity, and student achievement [1]. Indonesia faces more severe challenges in the development of 21st century education, because it is already in the era of development of the massive open online courses (MOOCs) [2]. 21st century education emphasizes readiness in facing the industrial revolution 4.0 which emphasizes on "the future of education" [3]. Education 4.0 focuses on four components, one of which is having good critical skills and having good problem solving skills [4].

Education does not only prepare students to continue their studies at a higher level, but is also able to solve the challenges and problems faced by students who need critical thinking. Research results put Indonesia at number 4 from the bottom in TIMSS (Trends in International Mathematics and Science) [5]. This shows that Indonesian students only master basic theories of knowledge in the fields of biology, chemistry, and physics at low cognitive levels [6].

Some research results indicate that the use of appropriate learning methods influences students' critical thinking skills and has a positive impact on student learning outcomes [7,8]. Furthermore, the use of appropriate teaching methods influences students' critical thinking skills [9,10]. In facilitating the development of critical thinking skills, it is necessary to develop RQA-CPS strategy.

The results of the study show that reading activity is effective and makes it easier for students to get detailed information [11]. The RQA learning model is better than the conventional learning model [12]. However, the application of this model has a weakness in the training of student cooperation and collaboration attitudes. This weakness can be reduced by the integration with the Creative Problem Solving (CPS) learning model.

Hajiyakhchali's research [13] suggests that the use of the CPS model can improve critical thinking skills and student problem solving. Robitah's research [14], that the CPS model provides opportunities for students to
think critically and organize ideas creatively. The CPS model was developed to improve rational and systematic skills in solving problems [15]. This model also encourages to have a positive outlook and responsibility in problem solving that is in accordance with the style and orientation of the problem [16].

The integration of these two models is expected to be able to optimize the empowerment of students' critical thinking skills and train students' ability to cooperate, as well as enhance collaboration between students. Based on these elaborations, students' critical thinking skills through the RQA-CPS model are expected to provide information that supports the integration of the two models in an effort to empower students' critical thinking skills.

2. METHOD

This research type is Research and Development in which research method used to produce certain products, and test their feasibility. The 4D development model was applied for this research and it was limited to 3 stages: define, design, develop [17]. This study focused on product development in the RQA-based chemical learning instruments combined with CPS on acid-base topic.

The product validation data from the validator is then calculated by using the following formula:

\[
\text{Validity Percentage} = \frac{\text{Validator Total Score}}{\text{Maximum Score}} \times 100\%
\]

The level of instrument validation [18] is depicted in Table 1.

| Score Validation Range (%) | Level of Validation |
|-----------------------------|---------------------|
| 0 – 20                      | Very Low            |
| 21 – 40                     | Low                 |
| 41 – 60                     | Enough              |
| 61 – 80                     | High                |
| 81 – 100                    | Very High           |

3. RESULTS AND DISCUSSION

The learning instruments have been developed on the acid-base topic for chemistry learning in high school level. This learning instruments was developed based on the principles of learning instrument design. It is found that the developed learning instruments based RQA-CPS is feasible to be applied. The students are expected no longer trap in learning of theories and concepts only, but with RQA-CPS-based learning, students will be triggered to be confronted with daily activities/reality during learning processes and student is actively involve in learning.

The results of the feasibility analysis of the learning instruments RQA-CPS based learning devices were obtained through questionnaires. The instruments were validated by 2 experts to assess the feasibility of the product being developed. The feasibility test is depicted in Figure 1.
Figure 1 shows the feasibility test of the learning device product. The percentage of the feasibility of the syllabus is 80%, the percentage of the feasibility of the lesson plan is 77%, the percentage of eligibility of student worksheets is 82.5%, and the percentage of critical thinking instruments is 75.5%. The total percentage of all product items developed is 78.8%. Thus, it can be concluded that the developed chemical learning instruments based on RQA-CPS is categorized as feasible.

This finding is reinforced by the Aisya, Corebima, & Mahana research [19], that in RQA-CPS learning there is an individual critical thinking process then through group discussions both in pairs and larger group students will gain a correct understanding of the concept. Furthermore, RQA-CPS learning improves students’ critical thinking skills because there is a scaffolding process between students which is carried out in student collaboration to solve problems [20].

4. CONCLUSION

The RQA-based chemistry learning instruments combined with the developed CPS is considered feasible. Thus, the product developed is suitable for use as an alternative in the process of learning acid-base topic. This research will continue in the stages of practicality and effectiveness of the learning devices developed.

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