Wetland environment as learning resource using CTL approach to improve critical thinking in 21st century

A Yunita and M N Aufa
Universitas Lambung Mangkurat, jalan H. Hasan Basri, Pangeran, Kec. Banjarmasin Utara, Kota Banjarmasin, Kalimantan Selatan 70123

amaliayunitaa@gmail.com ; mohamadnoraufa@gmail.com

Abstract. Tidal water habitat, such as fresh, brackish, or salty water from the wetland environment was local wisdom in South Borneo. Wetland environment can be used as a learning resource on the acid base concept in chemistry learning. This research aimed to determine the effectiveness of the CTL approach using wetland environment as a learning resource to improve critical thinking. Critical thinking skill is one of 21st centuries skill needed. This research used quasi-experiment method with non-equivalent control group design. Samples were taken by cluster random sampling technique. The independent variable was learning approach, and the dependent variable was critical thinking skill. Techniques used to analyse data were descriptive and inferential statistics. The result showed that there was significant difference in critical thinking skill in the experimental and control class. This research concluded that CTL learning was better to enhance critical thinking skill caused by the contribution of the CTL approach such as constructivism, inquiry, questioning, modelling, learning community, and reflection supported by the use of learning resource from wetland environment.

1. Introduction
The 21st-century classroom needs students to face real-world problems that engage them in higher-order thinking skills - creativity, innovation, communication, collaboration, critical thinking and problem solving [1]. The 21st-century education concept’s implementation can be applied in the curriculum of the required subject in Indonesia that is addressed to achieve learning and innovation skills competence and also technology and information media skills competence [2]. Learning processes that involve activities such as formulating general questions; research-litterature overview; defining questions; planing research activities, clarifying methods/methodologies; conducting investigations, analyzing data; interpretation and consideration of results; reports and presentation of results will improve students’ critical thinking skills [3].

Students understand to test strong or weak acids only by knowing the pH value [4]. Scientifically, the acidity of a solution is determined by the dissociation of the solution. If the acid is strong, the amount of dissociation will be higher than the weak one. In fact, strong acids or bases will fully dissociate in aqueous solution to produce ions. In this case, students have not been able to use the right strategy to test the acidity of the solution. The critical thinking skills needed in this case are evaluation [5]. Another indicator of critical thinking skill is explanation, which is the ability to explain or state the results of thought based on evidence, methodology, and context. Students have not been able to explain the
concept of acid-base in a global context, for example in the phenomenon of acid rain. This condition explains that students are only able to explain the concepts of acids and bases for simple phenomena in life, but do not understand the larger and more complex phenomena [6].

CTL learning uses a reference to seven main components in effective learning, which consists of constructivism, asking questions, inquiry, learning community, modeling, reflection, and actual assessment. Through this, students are accustomed to thinking openly, think well, think before acting, train the imagination and base conclusions with strong evidence. Critical thinking is the process of searching, acquiring, evaluating, analyzing, synthesizing and conceptualizing information obtained as a guide to develop students’ conscious thinking and the ability of students to take risks and add to their creativity in the use of information [7].

CTL learning was better to enhance student critical thinking. The students’ critical thinking skills who learned using CTL were better as well as significantly different from those who learned to employ expository [8]. The development of critical thinking and practical skills can be done by compiling learning with the CTL approach [9]. An environment-based learning process as a learning strategy will become more meaningful for students. The environment is best utilized as a source of learning and learning tools to create more meaningful learning [10]. The environment that is the basis of learning will be more effective if it is close to the lives of student. One of them can come from the potential of a local environment that is close to the lives of students, namely the wetland environment in South Kalimantan. Besides that, it also gives students an understanding of the problems in the use and protection of wetlands in South Kalimantan, especially with regard to water pollution from household waste [11].

If seen from the discussion of the acid-base theory put forward by figures such as Arrhenius, Bronsted Lowry, and Lewis, the concept of acid-base solution is conceptual. Algorithmic properties can be seen from the procedure for determining the degree of acidity (pH) in acid-base solutions. In addition, if it is seen from the determination of the acidity measured using litmus paper and indicator of natural material, it is procedural. The wetland environment can be used as a source of learning or as an object of problem because it will be more interesting and students tend to be more active. So, learning chemistry in the classroom is not effective on the acid-base concept [12]. The choice of acid-base solution is because the concept is close to the daily lives of student. Although acid and base commonly found in the surrounding environment, the students’ abilities only reach the stage of knowing and understanding acid and base [6].

The integration of the wetland environment in the acid-base concept can be seen from the experiments conducted. One of the wetland environments that used as sample experiments is river water or river environment in the Banjarmasin area which can represent a wetland environment consisting of river water and other components outside the river. In addition, tidal water habitat that is fresh, brackish or salty water can be used as a source of learning from the wetland environment, and many others [10]. Therefore, the learning process is expected to increase the insight of the wetland environment that is owned by student, as well as in helping student to think critically and relating chemistry learning concept with the context of daily life.

The learning process that has been applied at SMAN 7 Banjarmasin uses a scientific approach, which is a learning process that gives students an understanding of knowing, understanding various concept using a scientific approach, where information can come from anywhere, anytime and does not depend on direct information from the teacher. Chemistry learning-based 2013 curriculum using scientific approach can improve HOTS, and one of them is critical thinking skills. The N-gain value was 79% which is in the high category [13]. Based on this background, this research was made as a study comparison to improve critical thinking skills using CTL approach with wetland environment as a learning resource and using scientific approach on acid base concept in SMAN 7 Banjarmasin.

2. Research Method
The research design that has been used is a quasi-experimental research design or quasi-experimental design using a non-equivalent control group design. The population of this study was eleventh (XI) grade students of MIPA at SMAN 7 Banjarmasin in the academic year 2017/2018. The sampling technique
used in this study was cluster random sampling, where two classes among the population selected were XI MIPA 6 as an experimental class that learned acid-base solution using CTL approach using a wetland environment as a learning resource and XI MIPA 1 was used as a control class that learns acid-base solution material with a scientific approach.

The data of this study was collected by using a test and non-test techniques. Technical tests are used to measure critical thinking skills. The instrument used to measure critical thinking skills consisted of 8 essay questions containing 5 indicators of critical thinking skill according to [4]. Data analysis used descriptive and inferential analysis techniques. The inferential analysis used normality test, homogeneity test and t-test to analyze differences in critical thinking skills. The conclusions drawn in this study consider all the results of data analysis both descriptively and inferentially.

3. Result & Discussion
The 21st-century education concept’s implementation can be applied in the curriculum of the required subject in Indonesia that is addressed to achieve learning and innovation skills competence and also technology and information media skills competence [2]. The 21st-century classroom needs students to face real-world problems that engage them in higher-order thinking skills - creativity, innovation, communication, collaboration, critical thinking and problem solving [1]. Based on the results of pre-test and post-test value, the data obtained was processed into n-gain value presented in Table 1.

| Indicator of critical thinking skills | Experiment class | Control class |
|-------------------------------------|-----------------|--------------|
| Interpretation                      | <g>             | Category     |
| Analysis                            | 0,77            | High         |
| Inference                           | 0,37            | Medium       |
| Evaluation                          | 0,80            | High         |
| Explanation                         | 0,78            | High         |
| Mean                                | 0,70            | Medium       |

The difference in the improvement of critical thinking skills in the experimental class and the control class in the inference indicator did not occur significantly. This result shows that the students’ skills in identifying and determining the elements needed to draw conclusions, formulate conjectures and hypotheses, and to assess the logical strength of actual or intended inferential relationships, including statements, descriptions, statements or other representations that did not experience a significant increase. Research findings have shown that students have not been able to give a compelling reason from the conclusions presented. Strong reasoning can be found after students are able to find the connecting assumptions and have good reasons to trust their assumptions. The reason is students have not been able to connect subject matter with the environmental context provided by the teacher. Another reason caused by limitations in this study that students are not only required to have an increase in one indicator of critical thinking skills but in all indicators of critical thinking skills.

Other indicators of critical thinking skills such as interpretation, analysis, evaluation, and explanation have increased which are in the high category. This shows that students already have good interpretation, analysis, evaluation and explanation skills [5]. Students’ explanatory skills are considered good if they meet the following four indicators, namely: providing new information; the topic given can be accepted as fact; when the topic is accepted, then the problem will be solved; and relevant [7].

In developing students to be skilled in critical thinking, long-term training stages are needed. Limitations in this study cause training in developing students’ critical thinking skill only lasts for a certain period of time. Critical thinking needs to be trained continuously; the goal is to think critically into a habit [3]. Furthermore, the pre-test and post-test results were performed a t-test to find out whether there were significant differences in the mean values in the experimental and control classes. Data on the results of t-tests in both classes are presented in Table 2.
Table 2. The results of t-tests

| Test | Class          | Db | $\bar{X}$ | SD$^2$ | $t_{\text{count}}$ | $t_{\text{table}}$ | Conclusion                |
|------|----------------|----|-----------|--------|--------------------|---------------------|----------------------------|
| Pre  | Experiment     | 67 | 15,809    | 72,369 | 1,990              | 1,996               | not significantly different|
|      | Control        |    | 12,143    | 46,399 |                    |                     |                            |
| Post | Experiment     | 67 | 81,740    | 105,234| 2,716              | 1,996               | significantly different    |
|      | Control        |    | 75,000    | 110,294|                    |                     |                            |

Research findings have shown that critical thinking skills can be developed through learning with the CTL approach because all components in the CTL approach have a role in improving critical thinking skills. The first component is constructivism, in which students are helped to build their own understanding of the new knowledge they acquire [14]. Before giving guiding questions to build initial knowledge, students are given a discourse that cannot be separated from the surrounding life. In this activity, students are given the opportunity to observe and understand the discourse presented in a group worksheet. Science learning that involves student to make their own discoveries and relate them to real-life concepts provides a more meaningful learning experience [15]. The relationship of the learning process that applies the CTL approach to improving critical thinking skills is presented in Table 3.

Table 3. The relationship of the learning process, CTL and critical thinking skill

| No. | Learning process                                      | CTL’s component       | Critical thinking’s indicator |
|-----|-------------------------------------------------------|-----------------------|-------------------------------|
| 1.  | Teacher gives problems related to the wetland         | constructivism,       | Interpretation                 |
|     | environment                                           | asking                |                               |
| 2.  | Students are asked to identify problems and relate    | learning community,   | Interpretation                 |
|     | them to subject matter in groups                      | asking, inquiry       |                               |
| 3.  | Each group conducted an experiment that used a        | learning community,   | analysis                       |
|     | sample of experiments from the wetland environment to | asking, inquiry       |                               |
|     | collect data                                           |                       |                               |
| 4.  | Each group analyzes the data obtained based on the   | learning community,   | Analysis                       |
|     | results of the experiment through group discussion    | asking, inquiry       |                               |
| 5.  | Each group makes a conclusion based on the           | learning community,   | Inference                      |
|     | results of the experiments obtained                   | inquiry               |                               |
| 6.  | The teacher asks group members to present the        | learning community,   | explanation, evaluation       |
|     | results of the discussion and other groups provide   | asking                |                               |
|     | responses by asking questions and giving advice       |                       |                               |
| 7.  | Teacher asks the obstacles experienced by students   | reflection            | Evaluation                     |
|     | during learning activities take place                 |                       |                               |
| 8.  | Teacher guides students to draw conclusions and      | learning community,   | inference                      |
|     | connect them to the context of the wetland           | inference             |                               |
|     | environment                                           |                       |                               |

Overall, contextual learning has improved critical thinking skills, where students are able to understand concepts at a higher level of thinking namely analysis, synthesis and evaluation [16]. In addition, a pleasant classroom atmosphere can improve students’ critical thinking skills [5]. This is due to the learning process is the result of students' own observations that are influenced by the learning environment, thus causing students to be more active in each step of learning and become more enthusiastic in solving problems given by the teacher.

The findings obtained are in line with the results of the research into the application of integrated science learning through the CTL approach can be used as a means to practice students' critical thinking skills. The application of contextual approaches can enhance critical thinking which directly makes
active, creative, effective and fun [17]. CTL is a learning approach that can be applied as an effort to improve high-level thinking skills and self-efficacy of students [18]. The reason is the use of an environment that enhances thinking skills because students are confronted directly with the problems that surround them. Based on the research findings and some other relevant sources, it can be concluded that the CTL approach that using the wetland environment as a learning resource can improve students' critical thinking skills. The inquiry component applied in the CTL approach also influences the improvement of critical thinking skills, this is in accordance with the research conducted which states that inquiry learning has a significant effect in increasing students' critical thinking skill in learning science and technology on indicators of interpretation, analysis, inference, evaluation, and explanation. That is because the concept chemistry presented on the application of the CTL approach is not just notified and accepted by students, but is sought in such a way as to find or solve problems by themselves [19] [20]. From some relevant sources and research findings that have been carried out, it can be concluded that the CTL approach that utilizes the wetland environment as a source of learning plays a good role in enhancing students' knowledge of acid-base solution material.

4. Conclusion
Based on the results and discussion, it can be concluded that there is a significant difference in critical thinking between chemistry learning using CTL approach with wetland environment as a learning resource was better to enhance critical thinking more than using scientific approach based on $t_{\text{count}} > t_{\text{table}}$ was $2.716 > 1.996$ after being given treatment. This condition caused by the influenced of the CTL components such as constructivism, inquiry, asking, modeling, learning community, reflection, and supported by using wetlands as learning resources.

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