The effect of problem-based video animation instructions to improve students' critical thinking skills

S Ritonga, S Safrida, I Huda, Supriatno and M A Sarong
Department of Biology Education Universitas Syiah Kuala, Banda Aceh 23111, Indonesia
E-mail: ismulhuda@unsyiah.ac.id

Abstract. In the 21st century, people must have soft skills so that they can enter the workplace. One of the skills which must be acquired by students is critical thinking skills. Students’ low level of critical thinking skills is caused by the use of learning style that does not promote their thinking skills so that the students are not able to identify a problem, observe, and consider an observation result. Besides, the students are not able to make consideration, draw a conclusion, identify and consider a term. The purpose of this study is to analyse the effect of problem-based video animation instructions to improve students' critical thinking skills. A quasi-experimental with one group pretest-posttest design was used in this study. The data were analysed using N-gain and analysed using the Wilcoxon test at a significant level of 0.05. The result of the study is \( p < \alpha \), which is 0.001 < 0.05. The conclusion of this study is about students' critical thinking skills in terms of basic clarification, giving reasons for a decision, concluding and further clarification. This criterion indicates that the problem-based video animation instruction model is effective to improve students' critical thinking skills.

1. Introduction
In the 21st century, information can be accessed quickly by everyone in the world. Every individual must have qualified soft skills to enable them to get into the world of work and be ready to compete. One of the skills that students must possess is critical thinking skills, which can be obtained through education. Education is the main alternative at preparing students to be able to compete in this century. One way to promote students’ critical thinking skills is by giving them problems based on the experience they have gained.

Based on observation done on biology teachers and second graders students of Islamic Senior High School, it was found that the students’ critical thinking skill is low. The low level of critical thinking skills of students at Islamic Senior High School is caused by the use of learning style which can not promote their thinking skills so that they are not able to identify a problem/question, observe, and consider an observation result.

Problem Based Video Instruction (PBVI) can improve student satisfaction, empathy, and learning achievement in the context of Korean teacher education [1]. Also, the use of video disc-based instruction can help students improve their problem-solving skills and students' attitudes [2]. Problem based video instruction at the college level shows that problem-based video groups are superior to problem-based text groups on student understanding tests [3].

Learning by using animated videos, the students can enrich their experiences and competencies in various learning materials [4-7]. Video animation can provide a stronger visual appearance of various
phenomena and abstracts information which can improve the quality of learning processes and learning outcomes [8].

2. Research method
A quasi-experimental with one group pretest-posttest design was used in this study. The participants of this study were the second-grade students of Islamic Senior High School, which consisted of 51 students. To determine the research sample, the researcher distributed pre-test to find out the standard deviation of each class. The same standard deviation is presented as samples because it has the same skills. A random cluster sampling was adopted.

Critical thinking skill was measured by using essay test questions in the form of pre-test and post-test [12]. Pretests are administered to the students to determine their initial abilities. Posttest is carried out to measure students' knowledge after learning using first-grade video animation instruction (treatment).

In addition to the questions used in the test, the assessment rubric is also compiled based on indicators of critical thinking skills namely basic clarification, giving reasons for a decision, concluding and further clarification [10]. Based on the rubric, researchers can determine whether or not the students meet each indicator of critical thinking skills in solving the problems contained in the problem [11].

The percentage value of critical thinking skills obtained from the calculation is then categorised [12]. According to Table 1.

| Score  | Criteria          |
|--------|-------------------|
| 81-100 | Very critical     |
| 61-80  | Critical          |
| 41-60  | Moderate critical |
| 21-40  | Less Critical     |
| 0-20   | Very Less Critical|

Table 1. Criteria of critical thinking

After obtaining the value of critical thinking skills, it will be analysed by using a paired-sample t-test. The t-test aims to show whether or not there is a significant increase between the pretest and posttest. Paired t-test used to measure the comparison of the means of the two correlated (paired) groups, which is critical thinking skill scores (one pretest and one posttest measured), the two measures that are compared are normally distributed, and the measurement scale is ratio. Before the t-test, the normality test was carried out first. t-test criteria if (p < 0.05) there is a significant increase [3].

3. Result and discussions

3.1. Comparison of average pretest and posttest scores
The average score of students' critical thinking skills is presented in Table 2.

|       | N   | Minimum | Maximum | Mean  | Std.Deviation | Variance |
|-------|-----|---------|---------|-------|---------------|----------|
| Pretes| 51  | 25      | 39.58   | 30.39 | 3.36          | 11.31    |
| Posttes| 51  | 77.08   | 89.58   | 84.27 | 3.51          | 12.38    |

Table 2. Data description scores of students' critical thinking skills.

This data shows an increase in the average score of students' critical thinking skills. In the pretest, the average score is 30.39. Whereas in the posttest, the average score is 84.27. These results indicate
that problem-based video animation instruction is effective for improving students' critical thinking skills.

3.2. Result of N-Gain analysis of student's critical thinking skills

The scores of students' critical thinking skills are seen in Table 3.

| Indicator of critical thinking skill | The average value of pretest | The average value of the posttest | N-gain | Criteria |
|-------------------------------------|-----------------------------|----------------------------------|--------|----------|
| Elementary Clarification            | 35                          | 90,36                            | 0,85   | High     |
| The Basis for The Decision          | 31,21                       | 85,95                            | 0,79   | High     |
| Inference                           | 28,59                       | 82,35                            | 0,75   | High     |
| Advanced Clarification              | 25,98                       | 78,43                            | 0,70   | Low      |
| All aspects                         | 30,19                       | 84,27                            | 0,77   | High     |

Overall, the N-Gain score from each aspect of critical thinking skills increased with a very high category. Increasing every aspect of critical thinking skills is presented in Figure 1.

![Figure 1. Increasing every aspect of critical thinking skills.](image)

Every aspect of critical thinking skills has a different improvement from each aspect. Overall, these results show that every aspect is improved. Students' skills in analysing obtained by identifying problems so that they get the concepts through their learning experience.

3.3. Result of Paired Sample t-test

The pretest and posttest data were analysed by using paired data tests with data normality tested first, as a prerequisite for further testing carried out parametric or nonparametric. The results of the normality test are presented in Table 4.
Table 4. Result of normality test data value of critical thinking test.

|            | Statistic | df | Sig.  |
|------------|-----------|----|-------|
| Pretest    | 0.184     | 51 | 0.001 |
| Posttest   | 0.177     | 51 | 0.007 |

The results of testing the normality of critical thinking skills get the Sig < 0.05 which means that the data is distributed abnormally. Because the data is not normally distributed, the Wilcoxon test is carried out. The results of the Wilcoxon test of students' critical thinking skills presented in Table 5.

Table 5. Result of Wilcoxon of student’ critical thinking skills

| Variable | The average score of pretest | The average score of posttest | Sig.  |
|----------|------------------------------|------------------------------|-------|
| pretest-posttest score | 30.39 | 84.27 | 0.001 |

Non-parametric test results for paired data show Sig. 0.001. The criteria for concluding are if the significance level is (Sig.) < 0.05. Wilcoxon results show that the use of the learning of problem-based video animation instruction can improve students’ critical thinking skills. The average pretest score was 30.39, and the average posttest score was 84.27, so it increased by 53.88.

The use of the problem-based video animation instruction makes students already accustomed to using their critical thinking skills in learning, as evidenced by fluency in formulating the problem. The most significant indicator of critical thinking skills is increasing students' skills in basic clarity, and students can formulate problems based on observations of problem-based video animation instruction. Students also have no difficulty in planning and conducting an investigation process through the use of problem-based video instruction based animation videos. Students are also able to observe and consider the results of the observation. The presentation phase also went smoothly, and each group had the opportunity to present the solution to the problems found. Students have no difficulty in making conclusions.

The use of problem-based video animation instruction can help students acquire their knowledge by thinking about finding problems and finding solutions based on animated videos, animated videos enrich students' experiences and competencies in various learning materials and visualise material to be more real.

The findings of this study show that animated videos can improve critical thinking skills. Based on the previous study conducted by [1] comparing the use of problem-based video instruction with problem-based text instruction. Using problem-based video instruction can improve student satisfaction, understanding and retention. So problem-based video instruction based video animation is more effectively used to improve students' critical thinking skills compared to using videos without conventional animation and learning.

Video provides a more flexible media to support students’ learning activities which able to explain concepts related to mechanisms or processes, can be repeated and stopped according to the needs of students [14-17]. Videos can also attract students' attention in class, clarify ideas and illustrate concepts so students can get long-term memory from the material [18,19]. The use of animation as one of the effective tools of information technology in education has increased recently, and it is highly recommended to use animation to improve the learning of individuals with special needs besides individuals with distinctive developments [20]. The use of audiovisual media, students can see concretely the material that is being presented before them without having to imagine abstractly that sometimes bores students [21].
4. Conclusions
Based on the results of this study, the learning of problem-based video animation instruction is effective in improving the skills to think critically in the human respiration system concepts. From the results of this study, it is recommended to other researchers to enhance the creativity and innovation in learning such as by using current technology for example problem-based video animation instructions to support learning in the classroom so that students' critical thinking skills can be improved.

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