Effectiveness of OIDDE learning model with reading infusion strategy in trained 21st century students’ skills on momentum and impulse materials

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Abstract. The abilities that students must possess as a result of learning are to have critical and creative thinking skills, communication skills and collaborative skills. These skills are called 21st century skills. Those skills are very important to be trained during the learning process. Ones of learning models that considered effective for trained 21st century skills is the OIDDE model. To know the effectiveness of the model, we used reading infusions strategy as a comparison. after learning, students that learning with OIDDE and reading infusion models have increased and get higher score of critical thinking skills and creative thinking compared to OIDDE classes, as well as acquired skills profiles of communication and collaboration skills. Hypothesis test using ANOVA shows the average difference. The effectiveness of the model is shown by the value of d-value with the weak category.

1. Introduction

In the 21st century, education is becoming increasingly important to ensure students have the skills to learn and innovate, the skills of using information technology and media, and can work, and survive by using life skills [1]. 21st century skills are defined in a variety of ways, with the main components being learning and thinking skills (higher thinking, planning, management, cooperation), technology literacy, and the skills of being a leader (creativity, ethics and product creation). The red thread of all those skills is technology [1]. 21st century skills are a new necessity needed in the 21st century [2, 3]. 21st century skills are skills that give students the opportunity to solve problems and do unusual jobs [4].

The 21st century skills Partnership states that this 21st century learning and innovation skill consists of how one thinks (the way of thinking) encompasses creative thinking and innovation and critical thinking skills to solve problems. In addition, how a person works (the way of working) that encompasses communication skills and collaborating skills. By improving the skills of the 21st century will encourage students to develop high thinking skills and problem-solving skills [3]. In line with previous statements, according to the National Education Association to achieve success and be able to compete in the global community, learners must be experts and have the skills as communicators, creators, critical thinkers, and collaborators [5].
The demands of the 21st century in education require a shift in educational goals that is, to prepare learners facing a relatively simple, static, and predictable world toward preparing learners to live in a world that is not easy to predict and requires the power of thought and creative thinking which is high [6]. To answer these challenges and expectations can only be realized through an education that facilitates learners to be able to develop their potential. Learning activities at school should refer to the four 21st century learning characters that are usually formulated in 4C namely critical and creative thinking skill, communication skill and collaboration skill.

Attempts to improve 21st century student skills have been undertaken by several researchers including by Sahin [7-9]. Sahin trains 21st century skills using Project Based Learning (PjBL) learning models on science Olympiad activities so that students can practice 21st century skills through project-based learning. Husin trained 21st century skills through the model of learning of Project Oriented Problem Based Learning (POPBL) using STEM approach. Learning is done by trained 21st century students’ skills through project-oriented learning-based problems that occur in daily life or called real world problem, so students are trained to think critically in solving problems given. The results of both studies suggest that both PjBL and POPBL can trill 21st century skills well. This is evidenced by the students getting an average of 4 out of a scale of 5. However, the limitations of both of these studies are the research instruments still using questionnaires that cannot state the increase and effectiveness of both ways in the 21st century skills [10].

The process of knowledge formation can be done through the implementation of strategies that can facilitate students to have prior knowledge before the learning process takes place, then given the infusion reading strategy. With reading infusion to make students more ready in following the learning activities, and facilitate the ongoing discussion activities in the classroom. Through reading activity students get an information from what they read. The reading material in the form of a real phenomenon that occurs in everyday life and related to the concept of physics that has been studied into the provision of understanding used in the process of solving the problem [11].

Reading and knowledge are two interrelated things. A person can have knowledge through reading and writing. This point is the reason why the activity of reading and writing is fundamental to scientific literature and to being someone who is knowledgeable, educated and educated as a derivative [12]. Anderson argues contrast fully science educators have long-term attention to experimental activities as the core essence of science and neglect the activity of reading and writing [13]. Anderson claims that reading and writing are the mechanisms by which a scientist tries to solve the problem. Scientist creates, disseminates and communicates through writings of notes, tables, graphs, drawings, and diagrams. Based on the exposure, the researcher intends to conduct research on the application of ODDIE learning model (Orientation, Identify, Discussion, Decision and Engage) with Reading Infusion strategy to improve 21st century skills (critical thinking, creativity, communication skills and collaboration skills) of students.

2. Methods
The method used in this research is research by combining two forms of research that is qualitative research and quantitative research. In the opinion of Sugiyono, stated that the method of mixed methods is a method of research combining quantitative method with qualitative method to be used jointly in a research activity so as to obtain more comprehensive, valid, reliable and objective data. The method used in this research is sequential explanatory mixed. The research method is a combination of sequential explanatory model, characterized by data collection and quantitative data analysis in the first stage, and followed by collecting and analyzing qualitative data in the second phase, to reinforce the results of quantitative research conducted in the first stage.

The quantitative data used in this study is data obtained from the results of the students pretest and posttest scores for critical thinking skills and students' rationale given to the students in the experimental class and control class. Data for students' communication and collaboration skills were obtained using an observation sheet and rubric for scoring on each indicator of student communication and collaboration skills in the experimental and control class. As for the qualitative data used in this study is the data obtained from interviews to physics teachers at the school where the study and also as an observer during the study. Interviews were also conducted to students who represented each class.
For the implementation of the research, the method used is quasi experimental method (quasi experimental). The research design used in this research is pretest-posttest Control Group Design [14]. The characteristic of the design of this study is that the sample has been established by the school and not randomly selected and it is not possible to control all relevant variables. This study uses three classes of two classes of experiences (classes learning through the OIDDE model with reading infusion) and one control class (classes learning through the OIDDE model). The ability of both groups was measured by pretest before treatment and posttest after treatment.

3. Result and Discussion

3.1. N-gain score for critical and creative thinking skills
Based on the N-gain score, the improvement of critical and creative thinking skills of students who get OIDDE learning with reading infusion strategy is more significant than the improvement of critical thinking skills of students who get OIDDE learners. This finding is consistent with research which states that reading strategies can improve critical thinking skills, and students’ understanding correlates with critical thinking skills. Reading activity is an activity to gain understanding, through good understanding the students will have good critical thinking skills.

| Skill                  | Class         | N-Gain |
|------------------------|---------------|--------|
| Critical Thinking Skill| Experiment 1  | 0.36   |
|                        | Experiment 2  | 0.56   |
|                        | Control       | 0.16   |
| Creative Thinking Skill| Experiment 1  | 0.23   |
|                        | Experiment 2  | 0.31   |
|                        | Control       | 0.19   |

Based on the data of N-Gain test result in table 1, for critical thinking skill for experimental class 1 and 2 are increasing with medium category. While for the control class has increased with low category. And for the creative thinking skill for experiment class 1 and control class have increased with low category. As for the experimental class 2 increased in the medium category.

3.2. The effectiveness of OIDDE model with reading infusion strategy
To test the effectiveness of the treatment given to each class in improving students' critical thinking skill, the effect size test is done. The effect size test is performed for each indicator of students' critical thinking skills after learning by using OIDDE learning model with reading infusion strategy for experimental class and OIDDE learning model for control class. The recapitulation for the largest d-value and n-gain values of each critical thinking skill in the experimental and control classes is shown in Table 2.

| Question Indicator                                      | No. | Largest Gain | Class  | d-value |
|---------------------------------------------------------|-----|--------------|--------|---------|
| Supports arguments and claims using valid reasoning and evidence | 1c  | 0.57         | Exp. 1 | 0.02    |
|                                                         | 2c  | 1.00         | Exp. 2 | 0.03    |
|                                                         | 3c  | 0.67         | Exp. 2 | 0.01    |
| Analyze arguments and claims using valid reasoning and sufficient and relevant evidence | 4c  | 0.93         | Exp. 1 | 0.02    |
| Giving conclusions based on information and arguments   | 1d  | 0.20         | Exp. 2 | 0.03    |
|                                                         | 2d  | 1.9          | Exp. 2 | 0.01    |
|                                                         | 3d  | 1.60         | Exp. 2 | 0.02    |
|                                                         | 4d  | 1.80         | Exp. 2 | 0.01    |
From Table 2 it can be seen that the use of OIDDE learning model with reading infusion strategy is more effective in improving students’ critical thinking skill than OIDDE model in control class. This is indicated by obtaining the largest gain scores obtained by all students in the experimental and control classes held by students in experimental classes 1 and 2, both of which are given the same treatment of OIDDE learning model with reading infusion strategy with weak effectiveness category based on d-value of any indicator of critical thinking skills.

Table 3. Recapitulation of Result of Effect Size and Largest N-gain of Creative Thinking Indicator

| Question Indicator                                      | No. | Largest Gain | Class   | d-value |
|--------------------------------------------------------|-----|--------------|---------|---------|
| Analyze the advantages and disadvantages of ideas in   | 1a  | 0,50         | Exp. 2  | 0,03    |
| technology                                             | 2b  | 0,80         | Exp. 2  | 0,01    |
|                                                         | 3b  | 1,00         | Exp. 2  | 0,01    |
|                                                         | 4b  | 0,60         | Exp. 2  | 0,81    |
| Analyze and refine ideas in order to maximize creative | 2a  | 0,75         | Exp. 2  | 0,01    |
| effort                                                 | 3a  | 0,75         | Exp. 2  | 0,01    |
| Evaluate an idea or argument in solving a problem      | 3a  | 0,75         | Exp. 2  | 0,01    |
| Elaborate and evaluate your own ideas in order to      | 4a  | 0,65         | Exp. 2  | 0,03    |
| maximize creative effort                               |     |              |         |         |

From Table 3 it can be seen that the use of OIDDE learning model with reading infusion strategy is more effective in improving student’s creative critical skill than OIDDE model in control class. This is shown by obtaining the largest gain scores obtained by all students in the experimental and control classes owned by the students in the experimental classes 1 and 2 which are both given the same treatment i.e. the OIDDE learning model with the infusion reading strategy.

3.3. Profile of student critical and creative thinking skill

To know the profile of communication skill and student collaboration, then observation during learning process using observation sheet of communication skill and observation sheet of student communication skill. Rubrics are made as a value-feeding reference on a scale of 1 to 4 for communication and collaboration skills. The acquisition of communication and collaboration skills scores is shown by picture 1 and picture 2.

Figure 1. Transformation of Student Communication Skills

Figure 4.1 experimental class 1 and experiment class 2 have a more stable score and do not play much decrease in scores like control class. The experiment class 2 improved to the highest score of 4 in the second meeting for the fourth indicator compared to the experimental class 1 and the control class. So, it can be concluded that the OIDDE model with reading infusion strategy is more effective in trained students' communication skills.
Figure 2 show that experimental classes 1 and 2 that experienced increased collaboration scores during the learning process, although the first indicator of the control class had decreased score. While the control class has the same score from the first meeting to the last meeting in the range of score 3. So from the exposure we can conclude that the learning model of infusion reading is more effective in trained students' collaboration skills.

3.4. Results of teacher and student interviews

From the interview with the teacher we can conclude that reading is one of the capitals for someone to add information and update science and technological development, therefore he stated that reading is important and very supportive of student learning, both in class and outside class. However, according to his interest in reading students very less, it is known by the assignment to summarize the material to be studied in the next week rarely done by students, so it can be concluded that students before going to the class did not read the material to be studied.

In addition to the importance of reading, researchers also ask about the learning models that are usually done in the classroom during learning. According to him, learning more often uses lecture methods and occasional experiments in laboratory, even those students are still in full direction of the teacher and only verify the laws or concepts learned. When asked if he knew the problem-based learning models, he replied that indeed he knew but still had difficulties implementing the model in class. One of the models known to him is the PBL. When asked about the OIDDE learning model, he stated he did not know. Due to the specially measured skill of 21st century students, it cannot explain more deeply about students 'critical and creative thinking skills, students' communication skills and collaboration. However, beforehand had conducted discussion activities and asked students to explain some material that they have read before.

Teachers claim that students can work in teams but the lessons become less conducive, this is due to some students who do not work and some students are more prominent and dominate the discussion. As for student communication, when asked to explain the material that has been previously studied, the students are not yet accustomed to speaking in front of the class. The students' ability to conclude and explain is also not good. Students prefer to read their summary results rather than explaining using their own language. After the research, he was given a recapitulation of the students' pretest and posttest results for the control class and the experimental class.

After observing, he stated that the results obtained by the experimental class were better than the control class. This suggests that the OIDDE learning model with the infusion reading strategy is more effective according to Her to improve 21st century skills. In addition, she also stated that during the learning process in the student's expansion class it is easier to understand and solve the problem given than the control class because previously given the opportunity to read in advance in relation to the topic of discussion to be studied.

For opinions on the importance of reading, each student states that reading is very important to add insight. Despite this, student C adds that he rarely reads especially reading school material, even when
the exam is often less prepared even though it is only reading the material to be tested. Unlike A and B students who add that they love to read, although it is rare to read the material before learning if there is no duty from the teacher. Furthermore, students are asked about the differences that they feel if before learning they first read the material to be studied or read articles related to the material to be discussed. All agreed that if they had read before, they found it easier to understand the material while it was learning in class and more interested in the subject matter than not reading at all.

Then the students were asked whether it was difficult to get used to reading. Student C states that he is very difficult to get used to reading, because he feels lazy to read and do not like to read on the grounds of bored and quickly drowsy. In contrast to student C, students A and B state that it is not difficult to get used to reading, because they are already used to reading. They even admitted that they often visited the school library to read or borrow books. Although they admit more often read novels or other reading books than school textbooks or scientific articles.

The next question is how do they feel about the three-way talk of learning compared to the usual lessons learned by the teacher. All students declare learning more interesting though feel confused and not yet familiar with the learning process given. Student B states that he feels more interested now to read articles about emerging technologies than ever before, because during the three meetings an article was given on technologies developed and used and related to the matter discussed ie momentum and impulse. In addition to these questions students were also asked about the discussion activities conducted. According to them discussion activities they do not fully like to learn. Even student A states that he likes to discuss but only with a few friends only. He explains that not all of his classmates can be invited to discuss because it is sometimes difficult to ask them to complete their parts and sometimes assign tasks to certain people without helping to explain them.

After discussion activities, teachers usually ask students to explain the results of the discussions that have been done. According to student B, he felt ashamed to speak and explain in front of his friends and teachers. He reasoned that he felt embarrassed and terribly afraid of being laughed at and teased by his friend. Nevertheless, student A declared courageous because although it was wrong in the end will be explained back by the teacher and get the value of his appearance.

Students are then asked whether the given material is readily helpful to more easily understand the material learned and solve the problem. Students A and B from the experimental class responded that the reading was helpful. They answered that physics is difficult because of the formula without knowing what the formula is used and what it means. But because there is a given reading and not just a given formula, they are a bit interested and better understand what the usefulness of the formula has been learned. When asked whether after the lesson they are more courageous if asked to speak in front of the class. Student A responds boldly, while students B and C still answer shame and fear wrong. In addition, all students are also still difficult to explain and speak with using good and true Indonesian without using the local language. From the students' answers it can be concluded that they are helpful and easier in understanding and solving problems after the lessons learned, especially in the experimental class. So, we can argue that the treatment in the experimental class is more effective in training 21st century skills.

4. Conclusion
Based on the results obtained from the quantitative data we can conclude that the OIDDE model with reading infusion is more effective in tracing critical and creative thinking skills, communication skills and collaborative skills. this is indicated by the gain and d-value values of the experimental class higher than the control class.

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