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Analysis of students' scientific literacy in contextual-flipped classroom learning on acid-base topic

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Abstract. This study aims to determine students scientific literacy skills after learning with a contextual-flipped classroom model. In flipped classroom-contextual learning, students study the lesson material through contextual videos outside the classroom, then conduct discussions in class and lab work. This study used a qualitative method with 36 students in class XI at senior high school in Jakarta. Data collection were carried out through scientific literacy tests, observation, interviews, and reflective journal of students. The students' scientific literacy skills in this study refer to the scientific literacy of PISA. The results showed that 16.7% students had achieved scientific literacy at level 6; 38.9% at level 5; 11.1% at level 4; 27.8% at level 3; 5.6% at level 2 and 1. In addition, the results of the study show that aspects of scientific literacy have also been mastered by students. Mastery of scientific literacy aspects, concerning: aspect of the scientific context is 83.92%, aspect of science knowledge is 84.36%, and aspect of scientific competence is 84.06%. Thus, it can be concluded that acid-base learning with a contextual-flipped classroom model can improve students scientific literacy skills.

1. Introduction

Scientific literacy according to the Program for International Student Assessment (PISA) is the ability to engage in issues related to science and use these abilities to identify questions, acquire new knowledge, explain scientific phenomenon, and draw conclusions based on evidence about science related issues. Miller describe that literacy is the ability to read and write in order to communicate with society, so that scientific literacy is defined as the level of understanding scientific and technological concepts which is used to take the role of a member in the modern industrial society [1].

Based on the results of the 2015 PISA study, the students literacy in Indonesia are still low, and Indonesia is ranked 64th out of 72 countries with an average score that is still far below the International standard, which is 500. This research show that most of the students have not been able to apply scientific knowledge to complex life situations with a high cognitive level, but only able to apply scientific knowledge to life situations with a low cognitive level. Based on this, the teacher have to improve the students scientific literacy through the learning process carried out in school.

The learning model that is currently developing is the flipped classroom, which is a learning model that makes the learning process in the classroom becomes more effective, by "reversing the class". According to Lage, Platt, and Treglia, "flipping classroom" is a learning activity that is doing inside classroom, now it is doing outside classroom [2]. Submission of information can be done using online media, such as reading or watching learning videos made by the teacher. Furthermore, when in the classroom there will be reciprocal activities, such as discussion, problem solving or tests.



Some studies reveal that the use of the flipped classroom model in schools has a positive impact on student achievement when compared to ordinary classes [3]. In chemistry subjects, the flipped classroom learning model can improve student learning outcomes [4]. Flipped Classroom models combined with active learning strategies can improve the performance and attitudes of students [5]. The flipped classroom model combined with active learning, such as inquiry, project based learning, collaborative learning, can improve student learning outcomes [6–8].

In this study, a combination of flipped classroom model with contextual learning was conducted to find out the students' scientific literacy. In contextual learning, context has more meaning than just the connection of certain physical environments at certain times, including the mental and emotional context of each individual, social context and cultural context. Thus, contextual understanding has a broader meaning than applicative learning [9]. So if the flipped classroom model combined with contextual learning, this might develop students' scientific literacy, because the focus of learning is not only on results but on the process of acquiring science itself. The implementation of the flipped classroom-contextual learning model in this study was conducted on acid-base material that has many applications in everyday life.

2. Method

This study aims to determine students' scientific literacy in chemistry learning on acid-base topic using contextual-flipped classroom learning model. Acid-base learning in this study uses 3 videos of learning, i.e acid-base, acid rain, and acid-base experiment. The students' scientific literacy skills refer to the scientific literacy of PISA. The subjects of the study were 36 students of class XI at senior high school in Jakarta. The research method used in this study is a qualitative method. Data collection techniques were carried out through scientific literacy tests, interviews, observation, and reflective journals of students. Then the data were analyzed through stages: data reduction, coding, data presentation, and conclusion.

3. Results and Discussion

The research data obtained from reflective journals, interviews, and observations were reduced and then coded and classified into five parts, i.e students' scientific literacy in the contextual-flipped classroom learning, the activeness of students in contextual-flipped classroom learning, the level of difficulty of the contextual-flipped classroom learning model, strengths and weaknesses of the flipped classroom-contextual learning model.

3.1. Students' Scientific Literacy in Contextual-Flipped Classroom Learning Model

Based on the results of the study, student's scientific literacy scores were obtained which showed the achievement of scientific literacy levels. Students who have reached level 6 are 16.7%, meaning that students can consistently identify, explain and apply science knowledge and knowledge about science in various complex life situations, can connect information sources with different explanations and use scientific facts to make decisions. Students who have reached level 5 are 41.7%, meaning that students can identify scientific components in complex situations, apply both concepts of science knowledge and knowledge of science and can compare, choose, and evaluate scientific evidence that is appropriate response to life situations. Students who reach level 4 are 11.1%, meaning that students can work effectively with situations and problems that may involve explicit phenomena and require students to draw conclusions about the role of science and technology. Students who have reached level 3 are 27.8%, meaning that students are able to identify problems clearly at the level of the scientific context. Students can solve facts and knowledge to explain phenomena and apply simple models or inquiry strategies. Students at this level are able to interpret and use scientific concepts from scientific disciplines and are able to apply them directly. Students are able to form short statements by using facts to make decisions based on scientific knowledge. Students who reach level 2 and level 1 are 2.8%, meaning that students have sufficient scientific knowledge to explain in context or draw conclusions based on simple

investigations and students have limited scientific knowledge, so that they can be applied in familiar situations. Figure 1 is students' achievement towards scientific literacy.

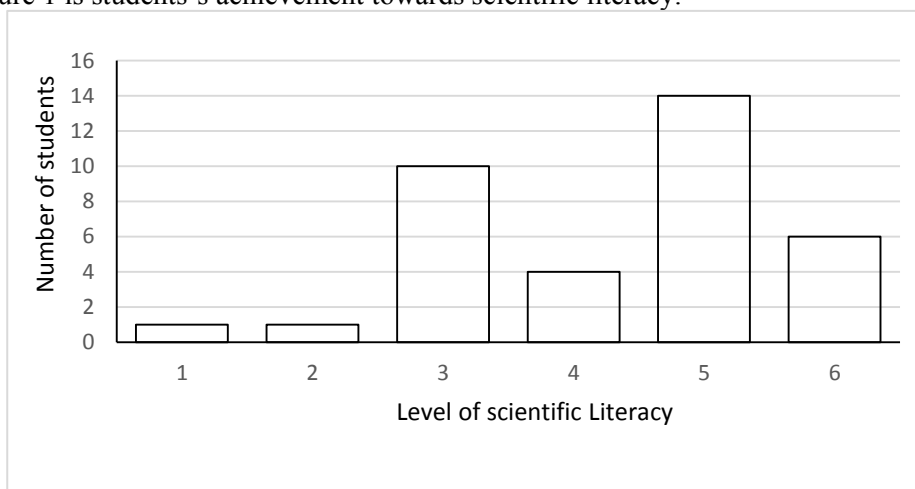


Figure 1. Achievement of Scientific Literacy Level

The data of scientific literacy score is also used to analyse students' ability to answer questions in every aspect of scientific literacy. There are three aspects of scientific literacy, namely aspects of context, knowledge and competence, with results as shown in figure 2.

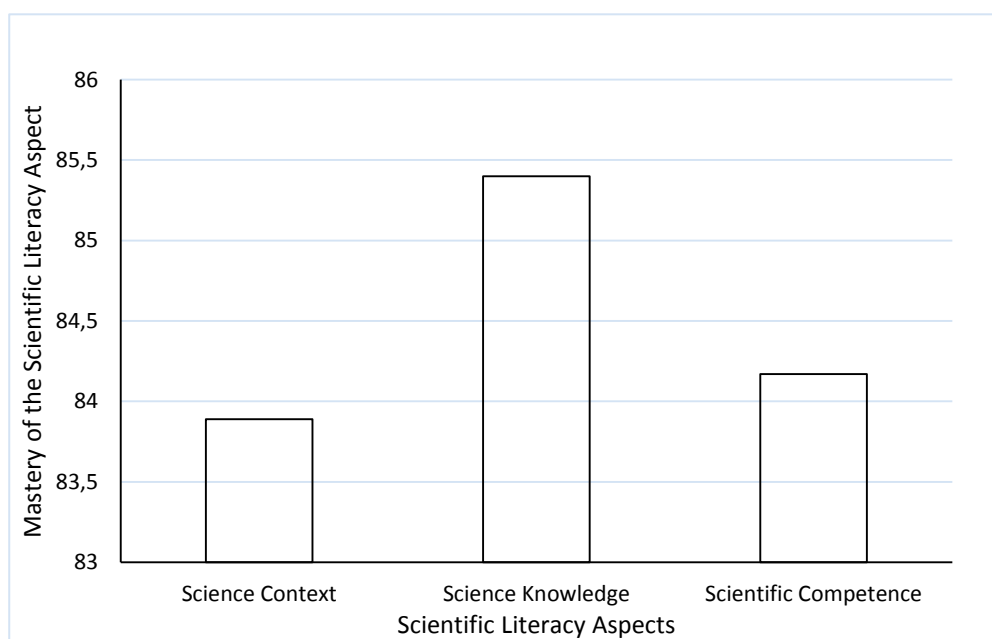


Figure 2. Achievement of Scientific Literacy Level

The scientific literacy test consists of 15 items covering the context of science, scientific knowledge and scientific competence. Description of the achievement of aspects of scientific literacy are shown in table 1.

Table 1. Achievement of the Scientific Literacy Aspect

Scientific Literacy Aspects	Component	Percentage of Knowledge Mastery	Avarage of Knowledge Mastery
Contexts	Global	79.57	83.89
	Personal	89.70	
	Social	82.23	
Knowledge	Knowledge of science	89.68	85.40
	Knowledge about science	81.12	
Competencies	Evaluate and design scientific enquiry	88.12	84.17
	Explain phenomena scientifically	72.49	
	Interpret data and evidence scientifically	91.83	

The data in figure 2 shows that students have mastered 83.89% aspects of the science context, which means that students are able to deal with scientific problems in a personal, social and global context well. The knowledge aspect of science is dominated by 85.40% of students, which means that students are able to conduct scientific investigations and scientific exposures. This is in accordance with the results of observations that show students able to investigate the scientific process and the components contained in the science process when conducting acid-base practicum. During the discussion, it was seen that most of the students were able to explain the results of the science process that had been carried out in the practicum. Thus, students have mastered aspects of science knowledge well.

While the aspect of scientific competence has been mastered by students as much as 84.17%. The scientific literacy description mastered by students in this aspect shows that, students can answer questions about identifying scientific problems, be able to recognize problems, be able to identify keywords to search for science information and students are able to investigate science. In addition, students are also able to answer questions about explanation and predict phenomena scientifically, able to apply scientific knowledge in given situations. Learners are also able to describe and interpret phenomena scientifically and predict their changes, be able to interpret scientific facts, make and communicate the conclusions.

3.2. Activeness of Students in Contextual-Flipped Classroom Learning Model

A contextual-flipped classroom learning model that presents independent learning by watching videos at home, making students actively learn independently at home. When the discussion in class also adds to the activeness of students. Here are some reflective data of student journals.

"This learning makes the classroom atmosphere not rigid, pleasant and warm. Using videos and giving quizzes make learning not boring"

(Student 5, 30 January 2018)

"In learning there is a lot of discussion, so the class atmosphere becomes more alive and active"

(Student 9, 30 January 2018)

Students also argue that this learning model makes students who have introvert characters become extrovert, because this model make all students play a role in the learning process to express their thoughts. This learning model makes it easy for students to get information through discussion. Students who are ashamed to ask the teacher, can ask friends through discussion. The teacher acts as a facilitator

who facilitates group learning, answers questions and is ready to provide information when students have not gotten information maximally with a group of friends.

3.3. *The Difficulty Level of the Contextual-Flipped Classroom Learning model*

Based on data obtained from reflective journals and interviews, it was found that some students did not recognize the flipped classroom contextual learning model, so that students needed time to get used to this learning model. However, some students experienced ease in learning with the contextual-flipped classroom learning model. Learners feel that the learning presented through video learning before learning in class makes students' understanding better and supports the readiness of students in learning material in class. Here are some examples of student reflective journal data.

"This method is fun, because we learn through video and when in class we also form groups for discussion. It also makes us easier to understand because the learning is not only from printed books or with teachers writing on the board"

(Student 15, 30 January 2018)

"Because the video uses audio and visual facilities so that it helps students more easily understand the lesson"

(Student 21, 30 January 2018)

According to students, this learning model is interesting because it is not as usual, which only focuses on delivering the teacher through verbal and writing on the board. This learning model supports students who have an audio-visual learning style, so that they are more motivated to understand the material. This learning model also supports students who are accustomed to independent learning at home. Through this learning model, students are trained to discuss and collaborate, thus helping students to understand the material more deeply.

3.4. *The Advantages of the Contextual-Flipped Classroom Learning Model*

Some students are motivated in this learning model, because the discussion models conducted in class make students understand better to the topic, can share knowledge with friends who do not understand and they can ask to their friends who already understand the topic. In this learning model there is interaction between students, exchanging ideas and opinions. When students face difficulties, they can ask the teacher directly so that there is also interaction between students and teachers.

According to students, this learning model provides another environment in the learning process, which usually students just listening to the teacher convey the topic, now they can play an active role directly in the learning process. The advantage of this contextual-inverse classroom learning model is in accordance with Love's research in which learning models make students have basic knowledge to discuss in class and the teacher can maximize the time to examine and pay attention to students' understanding [10].

3.5. *Weaknesses of Contextual-Flipped Classroom Learning Models*

The contextual-flipped classroom learning model requires students to access and learn the subject matter independently outside the classroom. Students who are used to learn with being guided directly will face difficulties. The use of learning video that can be accessed online through YouTube makes students have to buy enough internet quota, because many students do not have Wi-Fi at home. When learning in class, discussion cannot effectively if not all students watch the video given. This result is in accordance with Brown's research which states that the independent learning at home makes students have more burden than normal learning [11].

4. Conclusion

Based on the results and discussion in this study, it can be concluded that students have achieved scientific literacy from level 1 to level 6. The most scientific literacy mastery is at level 5, which means students can identify scientific components in complex situations, applying both concepts science knowledge and knowledge about science and can compare, choose, and evaluate scientific evidence that appropriate to respond to life situations. Thus, it can be concluded that contextual-flipped classroom Learning model can be used to improve students' scientific literacy.

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Acknowledgments

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