Triggering Students’ Scientific Literacy through Static Fluid Scrapbook

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Abstract. The research was purposed to describe science literacy after the implementation of the scrapbook as a media in a static fluid. The research utilised pre experimental design with one-group pre-test and post-test design. A group of 36 students of public high school in East Java Indonesia was invited as the research participants. The instrument consisted of literacy test and documentation guidance was used in data collection. Pre-test and post-test scores were analysed with paired \( t \)-test in describing science literacy improvement, n-gain analyses was aimed at describing science literacy improvement category. The averaged of pre-test score was 35 and the post-test score was 71. The \( t \)-test result was \( t = 34.63 \), with \( t_{table} = 2.03 \) (\( t > t_{table} \)). Meanwhile, the result of gain score analysis was 0.55. Based on that result, it showed that the implementation of the scrapbook as a media could improve students’ scientific literacy especially in static fluid concept. The researchers also predict that it enhance students’ scientific literacy in another physics concept.

1. Introduction

Originally, scrap means leftover goods and book is a collection of paper or other material that is bound together at one end and contains writing, pictures, or stickers [1]. Basically, the definition of scrapbook is the art of sticking photos or pictures on paper media, and decorating it to become a creative work. Scrapbooking activities became a lifestyle in America around 20 years ago. However, it still becomes an artistic work that is popular. The implementation of scrapbook in school is targeted to trigger students’ scientific literacy [1]. Scientific literacy is the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen. The competencies of scientific literacy are explaining phenomena scientifically, evaluate and design scientific inquiry, interpret data and evidence scientifically [2]. The OECD (Organization for Economic Cooperation and Development) through PISA (Programme for International Student Assessment) indicated that “Indonesia received 382 points (2012), 403 points in 2015” [2-3]. As we know, it was classified that the points lower than the international points (500 points) [3]. The points also indicated that Indonesian students achieved a low level of their literacy especially in all domain of science.

In fact, scientific literacy can be trained in students’ learning activities. It can be included in learning activities, especially in the physical sciences. Through scrapbook activities, the problem is targeted to solve? “Scrapbooks encourage students to see the science all around them and to realize that is truly relevant in their lives”. Previous studies also indicated that “scrapbooks increase students’
understanding of the scientific concepts by relating them to their interests and experiences, resulting in a greater desire and excitement to learn” [4].

The most important media in Scrapbook art is the album itself. Now many scrapbook albums are sold in various sizes. There are albums that have been permanently bound, there are also albums whose pages can be installed and removed. Many scrapbook albums sold now have transparent plastic as protection. Scrapbook is usually used for a memory album that contains not only photos, but clippings or important notes related to a moment. The procedure taken in making this Scrapbook learning media product is to look at the existing forms of Scrapbook and how to make them. Then sort through images about certain physics concept to be pasted in the media. The next step is seeing how to form a Scrapbook from YouTube and other crafts media that helped a lot to make this learning media.

The specific topic of physics as the content of scrapbook in this study is static fluid. This concept is one of the subject content knowledge of physics class in senior high school. Meanwhile, previous studies signalled that guided discovery and problem-based learning models can improve students’ science literacy [5-7]. In addition, learning media via scrapbook were required to support the teaching and learning processes. Learning media aids in the learning process teaching. Anything that stimulates the mind, attention, and ability (skills) that can be encouraged the activities of learning [8]. Thus, this study is focused in triggering students’ scientific literacy in physics class through scrapbook.

2. Method
The research used a common experimental research in Indonesia. Specifically, the research utilized pre-experimental design with one-group pre-test-post-test design. The participants of the research were 36 students of public high school in Mojokerto, East Java Indonesia. The simple procedure of the research as follows:

✓ Before scrapbook was implemented, the validation process of the quality of scrapbook media by expert lecturers was conducted.
✓ Before the scrapbook media were implemented, the students’ were given pre-test of physics literacy
✓ After teaching and learning process of static fluid concept and utilising scrapbook, then the researchers gave post-test to the students.

The following is the representation of the scrapbook of Archimedes topic as part of static fluid as figured out in Figure 1.

![Figure 1. The cover of scrapbook as a learning media.](image-url)
In general, scrapbook shows the principle of Archimedes (embossed book). The cover scrapbook of learning media was featured a character (Archimedes) as well as one of the application of Archimedes’ principle. Meanwhile, an overview of the contents can be seen in Figure 2.

Figure 2. An overview of the scrapbooks content.

Figure 2 shows the scrapbook media that was implemented. From Figure 2A, it is shown the history of Archimedes’ principle by using dialogue and Figure 2B shows the concept and application about viscosity and Stoke law. Meanwhile, Figure 2C and 2D show one of the applications of Archimedes’ principle in daily activity. In addition to that, the key concepts of other static fluids concept follow these similar paths.

Data was obtained from the scientific literacy test instrument. It is only one scientific literacy competencies, which is explaining phenomena scientifically. In learning activities, problem-based learning models were used [6-7]. Before the results of the pre-test and post-test data were analysed, a prerequisite test, which is the normality test was conducted to find out whether the data could be tested hypothetically. Based on the data obtained, an analysis of the data to determine the increase of students’ physics literacy after the implementation of scrapbook media by using paired t-test and the normalized gain [9] with the equation 1.

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g = \frac{Post\text{test score} - Pre\text{test score}}{Maximum\text{ score} - Pre\text{test score}}
\]
The criteria of scientific literacy are shown as follows:

| Standard Gain Score (g) | Criteria       |
|-------------------------|----------------|
| 0.70 < (g)              | High           |
| 0.30 ≤ g ≤ 0.70         | Medium         |
| (g) < 0.30              | Low            |

### 3. Discussion

In the teaching and learning process, the problem-based learning model was implemented [6-7]. The process of developing and implementing scrapbook is shown as in Figure 3.

**Figure 3.** The process of developing and implementing scrapbook.

Based on Figure 3, first, the teacher used scrapbook as a model, and then teacher guided students to create artefacts and exhibitions. Then, students conduct literature studies from various sources such as book and internet (literacy process). Then, students choose the material to be used; they made the contents for scrapbook in the end students’ present the scrapbook that has been made [1].

The pre-test and post test data were tested using the paired *t*-test and n gain analysis which aims to determine the improvement of students’ scientific literacy. Table 2 illustrates the results of this test.

**Table 2.** The result of paired *t* test.

| *t*<sub>count</sub> | *t*<sub>table</sub> | Information          |
|---------------------|---------------------|----------------------|
| 34.63               | 2.0322              | *H*<sub>0</sub> rejected |

Based on Table 2, it shows that *t*<sub>count</sub> is more than *t*<sub>table</sub>, then *H*<sub>0</sub> is rejected and *H*<sub>1</sub> is accepted, so it gives an implication that there is a difference of science literacy between before and after the implemented scrapbook as a media in physics learning of static fluid. In other words, the existence of scrapbook as a physics learning media of static fluid can trigger students’ physics literacy [1, 4, 5]. The level of the students’ literacy increases from un-literacy to moderate literacy. Meanwhile, Table 3 informs the result of normalized gain analysis.

**Table 3.** Summary of normalized gain analysis

| N-Gain | Category |
|--------|----------|
| 0.55   | Medium   |
Based on Table 3, N-gain score shows the average value is 0.55. It means that the scientific literacy of students is categorized as medium. In relation to problem-based learning that was implemented in scrapbook as a media, it can improve scientific literacy with the gain 0.41 is categorized as medium in another study [5]. Therefore, the finding of this study is improvement from the achievement of the previous study, such as study by [5] and by [9]. So, the problems related to low literacy scores in international studies such as PISA can be reduced in the future through scrapbook. If the scrapbook is applied in learning physics, interest in reading will be higher because they will be curious about the physics material that is applied when using the media [13]. The scrapbook can attract learning interests from reading to understanding the contents of physics subject matter. This is the essence of literacy. The benefits of scrapbooks for schools are to support learning media in the classroom to be more interesting and innovative and to make the media as a delivery tool of the limitations of existing books in schools.

Further study is also recommended to implement physics’ scrapbook in digital learning as well as e-book [10,14,15], or announced via massive open online courses (MOOCS) [11] and integrating with augmented reality, or the combination among them with certain software such as software of concept map [12] integrating in scrapbook to organize the outline. The researchers also predict that it enhance students’ scientific literacy in another physics concept. To sum up, there are many opportunities to integrate scrapbook in physics learning.

4. Conclusion
Regarding the results of the paired t-test and N-gain score, this study concluded “the existence of scrapbook as a physics learning media of static fluid concept can trigger students’ physics literacy”. Scrapbooks are a great opportunity for students to apply their own interests and abilities to their learning processes. The researchers also recommended that the physics scrapbook enhance students’ scientific literacy in another physics concept.

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