The Use of Flip Chart as a Tool to Strengthen Scientific Literacy at Junior High School Student

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Abstract. This research aims to determine the effect of using a flip chart on students' scientific literacy on environmental pollution material. This development research used the ADDIE model. This research was carried out until the development phase. The flip chart that has been produced was validated by using validation sheets by 4 validators who experts on media and material, then tested on 20 grade VIII junior high school students. The data of Students' responses about flip chart were collected by using a questionnaire and students' science literacy were collected by using the multiple-choice test. The results of the research indicated that there was an increase in the mean score of pre-test and post-test from 62 (low) to 81 (high). It illustrated that there was a strengthening of science literacy on the competence to explain phenomena scientifically from 61.25% (low) to 87.5% (very good), the competence to design and evaluate scientific inquiry from 53.75% (low) to 71.25% (enough), and the competence to interpret data and evidence scientifically from 80% (good) to 87.5% (very good). This result was supported by student questionnaires when using a flip chart, which is 88.1, it shows that flip charts can be used as a means of strengthening student scientific literacy.

Keywords: *flip chart, junior high school, scientific literacy.*

INTRODUCTION

The recent developments and globalization in the 21st-century impact the existence of life's challenges and competition, so that every individual must strive to be a person who is alert to many development and global problems. Some global issues become personal responsibility to solve. These problems include pollution, global warming, wildfire, and many more.

Riau Province is a province with environmental problems due to a lack of sensitivity to nature every year, namely wildfire, illegal gold mining (PETI), and domestic waste. According to BMKG (2019), forest fires happened in four districts, namely in Siak, Rokan Hilir, Pelalawan, and Meranti. The domestic waste problem is a problem that has happened in Pekanbaru since 2016 [#1]. Illegal gold Mining (PETI) is a fundamental problem for people in Riau Province because it has a direct impact on the quality of water and soil.

According to Khaidir et al., (2019) level of high urbanization in Pekanbaru and urban mobility is the cause of garbage in many inappropriate places [#2]. This is what triggers negative impacts that will be very concerning and can lead to complaints and health problems for people in big cities like Pekanbaru. According to Pazli (2020), illegal gold mining has an impact on the availability of natural resources and the environment in a systemic manner. Pining illegal gold has changed the natural order of water resources such as rivers and lakes or swamps in the mining area

[#3]. If these problems are ignored, there will be severe environmental damage in Riau Province in the next few years.

Education has an important role as a means of solving global problems. Permendikbud No. 35 of 2018 stated that the development of the 2013 curriculum was conducted to solve challenges of the 21st century related to global problems. The solution to the global problem can be done by scientific understanding [#4]. The ability to solve problems based on the scientific understanding named scientific literacy or Science Literacy is the ability to apply science in understanding and solving scientific and social problems of life [#5].

The results of the PISA study indicate that the level of scientific literacy among Indonesian students is still low and below the OECD average. The measurement of scientific literacy that was last done in 2018 showed that the average value of science literacy of Indonesian students is 396 which is located at 1a level, which means a degradation compared with 2015 who get a score of 403. The results show that Indonesian students still difficult to have connections between the concepts of science and phenomena in everyday life that require higher-order thinking skills [#6].

The initial survey of 50 secondary school students in Kuantan Singingi shows that only 54% of students know PETI issues. The next 70% of respondents answered that the teacher had never provided information about PETI problems in learning [#7]. The survey which was conducted in 3 secondary schools in Siak towards eighth-grade students showed that the students still lacked knowledge about land and wildfire. The environmental literacy analysis by Wulan Indri Safitri et al., (2020) shows that the environmental literacy of Pekanbaru students was at a medium level [#8]. This shows that most secondary school students have not been able to identify, analyze local environmental problems, and plan actions to solve problems of PETI, KARHUTLA, and domestic waste. To support these students' abilities, adequate learning resources and appropriate strategies are needed.

The results of lesson plan observations in some schools in Pekanbaru show that the learning resources used in learning are limited to books and interactive media. According to Annisa Pusvita Sari (2019), the learning process used by teachers more often uses direct object media (22.3%), pictures (20.6%), power points (18.3%), videos (16.9%), torso (13.2%) and comics (8.7%) [#9]. It can be said that the learning process conducted by teachers in schools is not various and related to relevant environmental conditions. Whereas according to Nizwardi Jalinus and Ambiyar (2016), the use of appropriate learning resources can produce quality, interesting and fun learning for students [#10]. Therefore, the writer research the design media that is memorable, economical, attractive, and contextual to the environmental conditions in Riau and good responses as feedback from students.

One of the simple learning media that is interesting and which is rarely used by teachers is the flip chart. A flip chart is a visual series that is arranged or drawn on large sheets of paper or newsprint which are attached on top (Nizwardi Jalinus and Ambiyar, 2016). This flip chart is a medium that describes the development of an event or object clearly so that students can be more systematic in studying events or science.

The pictures and symbols on the flip chart can improve the student motivation to learn [#10]. According to Desti Ratna Sari (2018), the contents of flip charts can improve student knowledge [#11]. Research by Hardianti M. et al (2019) shows that the score of student learning outcomes taught using flip charts is high with an average score of 81.19 while the scores of student learning outcomes taught without using flip chart learning media are sufficient with an average Average 68.57 [#12]. However, flip charts developed in the science lesson have not integrated the relevant environmental conditions. Even though the integration of images and environmental issues in the flip chart will make students try to solve environmental problems and get moral messages because the images displayed are more relevant to real situations. The problem-solving ability of students will improve students' scientific literacy.

Based on the explanation above, the writer has conducted research namely the development of flip chart media based on Socio-Scientific Issue (SSI) of environmental pollution to strengthen the scientific literacy of secondary school students.

METHOD

The type of research used in this study is Research and Development (R&D) research using the ADDIE model developed by Robert Maribe Branch. According to Sugiyono (2019), the ADDIE model consists of five stages, namely analyze, design, development, implement and evaluate **[#13]**. However, in this study, researchers only did it up to the development stage. The following are the research steps for developing a flip chart media design to produce a product:
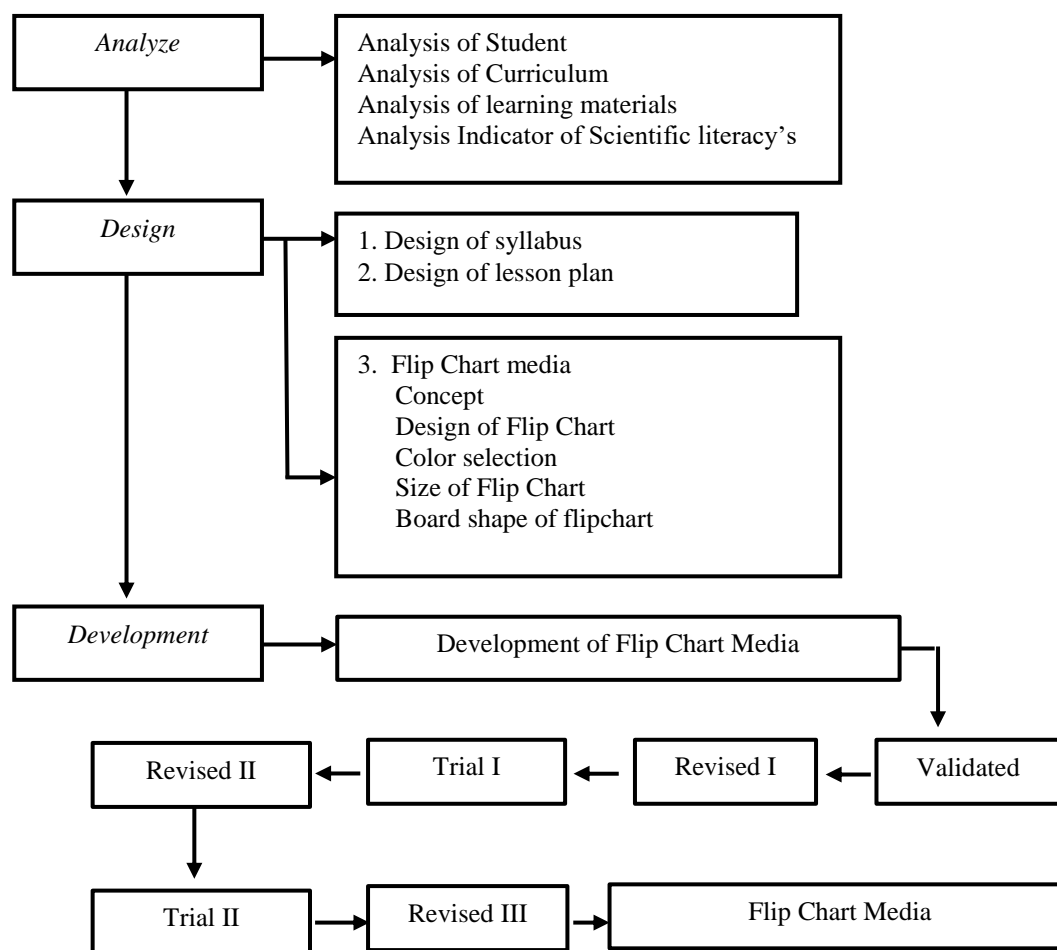
FIGURE 1. The flow of flip chart development as a medium for junior high school science learning

The design, development, and validation stages by lecturers were conducted at the Biology Education Study Program, FKIP, Riau University. The Validation stage by SMP science teachers was conducted at SMPN 4 Pekanbaru and SMP IT FIS Pekanbaru. Phase I trials and trial II were conducted online using the Google Meet and WhatsApp platforms. The instruments used to collect data were validation sheets, questionnaire sheets, and tests. The validation sheet has the objective to determine the validity of the learning media developed. Questionnaire sheets are used to obtain data on the use of flip chart media in science learning. The test determines changes in students' scientific literacy levels before and after using the flip chart media.

The limited trial assessment was conducted using a questionnaire with the Guttman scale. The questionnaire response analysis criteria can be seen in table 1 **[#13]**.

TABEL 1. Criteria of Response Analysis

No	Interval	Category
1	$85 \leq x \leq 100$	Very Good
2	$75 \leq x < 85$	Good
3	$64 \leq x < 75$	Enough
4	< 64	Low

The pretest and posttest data will be analyzed using a formula.

$$\frac{Score}{Maximum\ score} \times 100$$

The Score of pre-test and post-test criteria can be seen in table 2 **[#14]**.

TABEL 2. Score Criteria of Pre-test and Post-test

No	Interval	Category
1	$85 \leq x \leq 100$	Very Good
2	$75 \leq x < 85$	Good
3	$64 \leq x < 75$	Enough
4	< 64	Low

RESULT AND DISCUSSION

The development of the flip chart media has the validation results of the material and media with each percentage of 88.3% and 87.5% invalid categories. The flip chart has been validated then tested on a limited basis for class VIII students of SMPN 4 Pekanbaru. The trial aims to determine the responses or responses of students to the use of the learning media being developed. When collecting student response questionnaire data, each student fills in a questionnaire consisting of 20 statements. The statements in this questionnaire are made to see whether the flip chart made can be used by students. Students are also asked to do a pre-test and post-test to see the strengthening of scientific literacy obtained after reading the flip chart.

Limited trials given to students are conducted online. The trial was conducted online due to the outbreak, which requires all educational institutions to conduct online learning to avoid the impact of this outbreak. The news published by kompas.com (2020) explained that the Minister of Education and Culture (Mendikbud) Nadiem Makarim said, "learning in tertiary institutions in all zones is still required to be conducted online until further policies exist "[#15].

A flip chart is a medium that is used and applied directly by students. The respondents can still assess how to use flip charts although, in outbreak with the online learning system, the writer packages a technique for using flip charts by recording the original form of this media use and sending the design file in pdf format so that the respondent can read it. The trial with students of SMPN 4 Pekanbaru was conducted using the Whatsapp platform because the school uses this platform during online learning.

Respondent questionnaires and pre-test and post-test Sola were created using google form. For pre-test and post-test, the time is limited to 20 minutes so that the answers obtained with the set of time allocation. The limited trial took place in 2 days, 26-27 August 2020. This trial was conducted online by sending usage videos, pdf contents of flip chart material, pre-test links, post-tests, and response questionnaires via the WhatsApp platform. The first day of the phase II trial began with an introduction to all students of grade VIII.3, then continued by explaining the flip chart media. Afterward, through WhatsApp researchers sent a link absent pre-test, the video using a flip chart at once material flipchart 1 meeting, and about post-test stages of the trial day to two at the start by sending video use once the material content flip chart and was accompanied by a link questionnaire responses students.

Based on the results of data analysis, the trial response of SMPN 4 Pekanbaru students to the flip chart was very good with a score of 88.75. The description of the analysis result of student responses to each aspect can be seen in table 3.

TABEL 3. Result student's responses about flip chart

No	Aspect	Score	Category
1	Display	92	Very Good
2	Material	85	Very Good
3	Benefits	94	Very Good
4	Scientific literacy	83,3	Good
	Average	88,75	Very high

Based on table 3, it can be seen that the flip chart media that has been developed is very good with an average score of 88.1. The result of the response analysis with the highest excellent score was the display of 92. The flip chart display aspect is one of the characteristics that distinguish it from the textbooks that are often used in schools. The flip chart is designed with a combination of letters, colors, and relevant images that can support the delivery of

the material. According to Riza Rosita (2018), Flip Chart plays a role in increasing learning participation, because the material presented is more interesting when compared to learning using only textbooks [#16]. This aspect received the highest score because the proportional combination of writing and image colors attracted students to read the material on the flip chart that was developed.

The second rank of highest score is the advantage aspect, with a score of 90. The combination of environmental issues that are relevant with a proportional display design can make learning interesting and fun, thereby improving the willingness of students to know more about the learning material. The flip chart has colors and images to make the learning process in control, interesting, and fun so that motivates students to learn. It is relevant to Hardianty et al., (2018) who state that the use of Flip Chart media makes students focus on the material due to its presentation material along with relevant images that support learning theory [#12]. Pictures that contain environmental issues also make students interested in studying the environment and begin to realize the importance of loving nature. This is following Evi Suryawati et al., (2020) that there is a correlation between increasing student knowledge and student attitudes towards the environment where the attitude of these students will affect personality and responsibility to the environment[#17].

The next high score criteria are the material aspect of 87. This material aspect includes the language, material systematics, current issues, and supporting images of the material. The language used by the flip chart is Indonesian. For scientific language and English, explanations are given so that it is easy for students to understand. The flip chart material is relevant to the learning objectives so that students can easily understand the learning due to some new materials can be achieved if the previous learning goal points have been mastered. The issues that are applied in the flip chart are current issues related to the environment. The supporting pictures on the flip chart are also presented clearly so that they are meaningful and can strengthen the delivery of the material given by the students. This is under the opinion of Riza Rozita (2018) if the material presented is by the learning objectives and the presentation of the material uses simple language, it will be easily understood and understood by students [#12].

The scientific literacy aspect is the next high score category with 83.3. It is due to the material on the flip chart in the form of content knowledge, procedural and epistemic based environmental issues that are relevant to help students understanding the correlation between the concepts of science, developing the competencies of scientific investigation, and associating the material with simple problems in daily life. It is relevant with the statement of Zeidler et al., (2019) about socio-cultural integration, both implicitly and explicitly, in science education will improve scientific literacy [#18].

Strengthening students' scientific literacy is shown by the results of improving the pre-test, post-test scores. The pre-test and post-test questions have the objective to determine students' scientific literacy knowledge. The results of the pre-test and post-test scores show that there is an improvement from an average of 61 as less category to 81 with a good category. Therefore, there is an improvement of scientific literacy before and after using the flip chart media of meeting 1. Descriptions of improving students' scientific literacy in aspects of scientific competence can be seen in Figure 2.
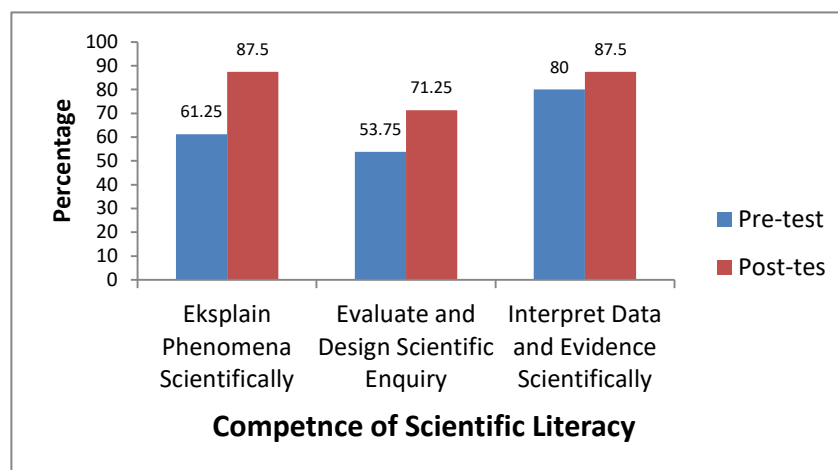
Figure 2. Result science literacy test based on science competencies measured

Figure 2 shows that before the implementation of the flip chart as the learning media with score percentage for each indicator ranged from 53.73 to 80 and after the application of the flip chart becomes71.25 to 87.5. Therefore, it can be said that there is an improvement in students' scientific literacy after using flip charts.

Based on the graph, it can also be seen that the competence to explain phenomena scientifically and interpret data and facts scientifically gets the highest percentage of reinforcement, which is very good. The competence in explaining phenomena scientifically is the ability to provide scientific explanations using explanatory theories, information, and facts as well as an understanding of the correlation among material concepts. The high level of improvement in this competency aspect due to the knowledge of SSI-based content, procedural and epistemic content on the flip chart to develop competence in explaining phenomena scientifically.

The orientation of environmental issues on the flip chart are issues among students and close to their daily life, thus motivating students to interpret the subject matter they are learning. The implications of students' willingness to interpret learning material are: 1) students can remember and apply scientific knowledge, 2) be able to identify, use and provide a representative general explanation of issues related to the material, 3) be able to provide predictions, 4) be able to correlate things between social problems and science. These four abilities describe the competence to explain phenomena scientifically. This statement is supported by Ely Rohmawati et al., (2018) who state that learning is contextual issues that can improve scientific literacy and help students become citizens who are responsible for the learning that prepares students for studying and researching the social problems associated with the material science [#19].

The competence to interpret data and facts scientifically also received the highest reinforcement because flip charts present pictures, graphs, and tables that can develop students' ability to translate data. The ability of students to translate data from one representation to another, for example translating the meaning of a graphic and then relate to the material is one of the characteristics that there is a development of student competence in interpreting data and facts scientifically [#20].

This competence gets a high score because the discussion of questions only tests the basic abilities of students in the competency aspects of data interpretation and scientific facts. The questions presented to test the students' ability to translate data and the ability to interpret data. Meanwhile, the ability to evaluate scientific arguments cannot be explored from the students' abilities in this initial material. According to Yunus Abidin et al., (2018) competence in interpreting scientific data and facts is the ability to create and read data to prove that the research results presented or being conducted are valid and reliable [#21]. This capability will be explored when the material is intermediate. The learning material that is presented will get deeper and deeper so that the longer the scientific competence will be explored deeper.

The competency in designing and evaluating scientific investigations got a score of 71.25 which was categorized as quite good. According to Yunus Abidin et al., (2018) competence in designing and evaluating scientific investigations is the ability to collaborate, communicate, think critically, and evaluate in understanding the objectives of scientific investigation to produce reliable knowledge about the universe [#21]. The flip chart presents the development of issues in the form of journals and charts that can explore students' abilities in developing problem-solving skills through scientific investigations, either in the form of journal studies or in-person research. Based on the results of validation, this competency has the lowest score because flip charts display pictures, charts, and brief explanations that developed the basic skills of designing and evaluating scientific investigations (exploring new topics).

The general impression based on the response questionnaire, the difference in the pre-test and post-test scores of the trial results is that the flip chart can make students interested and focus on the learning material due to attractive design and the material presented shortly, concisely, and clearly. Flip charts with content, procedural and epistemic knowledge also bring the issue of orientation strategies, development, and synthesis related to the environment to improve students' ability to explain phenomena scientifically, design and evaluate scientific investigations and interpret scientific data and facts. This reinforcement is reflected in the difference between the pre-test and post-test values presented. Based on the analysis of the validation results and limited trial data, it can be seen that the developed flip chart media can be used in learning and potentially improve the scientific literacy of secondary school students.

CONCLUSION

There is a strengthening of students' scientific literacy after using the flip chart media. The strengthening showed by increasing the pre-test and post-test scores from 6.2 to 8.1. The Increasing in pre-test and post-test illustrated that

there was a strengthening of science literacy on the competence to explain phenomena scientifically from 61.25% (low) to 87.5% (very good), the competence to design and evaluate scientific inquiry from 53.75% (low) to 71.25% (enough), and the competence to interpret data and evidence scientifically from 80% (good) to 87.5% (very good). The Strengthening supported by student questionnaires when using a flip chart, which is 88.75%   The flip chart about environmental pollution which has been developed in a very good category, can be used as a learning resource in junior high school.

ACKNOWLEDGMENTS

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