J. Pijar MIPA, Vol. 17 No.3, May 2022: 394-399 ISSN 1907-1744 (Print)
DOI: 10.29303/jpm.v17i3.3498 ISSN 2460-1500 (Online)

AN ACTION RESEARCH FOR ENHANCING STUDENT UNDERSTANDING OF SCIENCE LITERACY IN STOICHIOMETRY BY USING FLASH-BASED LEARNING MEDIA

Raditya Wisnu Saputra and Mitarlis*
Chemistry Education Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya, Surabaya, Indonesia

*Email: mitarlis@unesa.ac.id

Received: April 11, 2022. Accepted: May 24, 2022. Published: May 31, 2022

Abstract: The research aims to determine the influence of flash media on students' understanding of scientific literacy in stoichiometry. The research method used one group pretest-posttest design. The research was conducted in the tenth grade in one of the State Senior High schools in Gresik, East Java, Indonesia. The three meetings in action research were running well. However, there are obstacles where the device used is very limited, so teachers need to find the solution. Student activity during learning gets a percentage average of 87.67%. It means students were very active. Student learning outcomes show that 97% of students complete the standard minimum of completeness, 34 students complete, and one student does not complete. The Wilcoxon test shows a significantly average student learning outcomes, and the n-gain value for all students of 0.72 is relatively high. The results of the percentage of students' positive responses of 87% are classified as very good. In conclusion, learning by using flash media can be accepted by students and increase their understanding of scientific literacy on stoichiometry.

Keywords: *Flash Learning Media, Learning Outcomes, Learning Process, Stoichiometry, Student Activities*

INTRODUCTION

In the new education era, individuals are demanded to think innovatively based on scientific thinking and discoveries. Education is expected to produce generations that can bring up innovative thinking so that Indonesia can compete in the scope of the world. In the 21st century, education is crucial to have learning and innovation skills, the ability to use technology, and life skills[1]. Science literacy is the key to answering the challenges of the global society. Science literacy can prepare responsible and sensitive residents for problems around. According to Rodger W. Bybee [2], science literacy is a continuum where individuals can develop greater and more sophisticated scientific understanding. To PISA 2006, science literacy refers to the knowledge owned by individuals and the application of knowledge by the individual to identify the scientific, explain scientific phenomena, and draw conclusions based on data related to problems in the science world.

Program for International Student Assessment (PISA) researches measuring the quality of students in science literacy in a country carried out once every three years. It is known in the study that the quality of students in science literacy in Indonesia is very low [3]. The low literacy can be caused by the process of science in schools still lacking practicing student science literacy skills. The factors that cause the low literacy of student science, namely, curriculum and education system, selection of teaching methods and models by teachers, media or learning tools, and teaching materials that do not meet the learning objectives of the 21st century [4]. In general, schools use lectures so that students still have difficulty understanding the material. The media used usually use PowerPoint and learning videos but still needs innovation so that students do not feel bored when learning. The development of learning media is very necessary to develop so that students can easily understand learning and teachers can be easier to explain the material to students. In addition, the learning carried out can follow the development of increasingly advanced age.

Many learning multimedia can be used, such as flash media. Most students and teachers still don't know about Flash. Flash can be used for combining images, text, sound, animation, and videos as learning media. Flash use can make students active in learning [5]. It can make students increasingly interested so they can pay attention during learning. Flash is the right software to make visual presentations that can interpret various media, such as videos, animations, pictures, and sounds. This software is quite reliable in making various kinds of interactive and interesting tutorial applications [6]. Using animation can provide an appropriate picture to students repeatedly [7]. Students will generally be more interested in describing with images or animations because the animation and images presented can make students easily understand the material delivered. It is necessary for students considering that some students feel chemicals are difficult to understand.

One of the sub-topics of chemistry that was still difficult to learn by students was stoichiometry [8]. Stoichiometry is the most important and interrelated basis for other concepts in chemistry. The factors that cause difficulties in stoichiometry are due to lack of understanding of the concept of mole, inability to equalize chemical equations, use of inconsistent stoichiometry relationships, identifying limiting reagents, determining theoretical results, and excessive identification of substances [9]. In addition, the impression about chemistry lesson that

is difficult to understand make students not motivated to learn. Supposedly, the teacher must give an interesting impression to students, so they like chemistry lessons.

Based on the background, this research aims to determine the implementation of learning and the influence of flash media on students' understanding of scientific literacy in stoichiometry lessons. This research is expected to be more learning methods to make students interested because if learning is too monotonous can make students Bored. So, therefore innovation is needed in learning.

METHODS

The method of this research uses One Group Pretest-Posttest Design. The research was conducted on implementing the learning process using Flash learning media to increase scientific literacy understanding of the tenth-grade stoichiometry material in one of the State Senior High schools in Gresik, East of Java, Indonesia. This research can be drawn as follows:

$$O_1 \; X \; O_2$$

Description: O_1= pretest; X = treatment; O_2 = posttest [10]

The data acquirement that will be used in research is quantitative data in the form of numbers. Furthermore, the data will be analyzed descriptively and qualitatively. Data can be obtained from 1) Validation Sheet, 2) Learning Observation Sheet, 3) Student Activity Observation Sheet, 4) Pretest and Posttest, and 5) Student response questionnaires. The learning device used is 1) Syllabus, 2) Lesson plan, 3) student worksheets Assisted by Flash, and 4) Flash Media.

The Implementation of Learning Using Flash Media in increasing Scientific Literacy Understanding

Observation Sheet of Learning Implementation will be given to 3 observers to observe the implementation of learning. Observers give positive and negative statements to determine the implementation of each learning phase. Observers also provide descriptions to describe learning activities. Assessment on the observation sheet has a score (1) if it answers "yes" while getting a score (0) if it answers "no". After the observer gives a score, then the results of the instrument of the learning observation sheet are calculated.

After that, the percentage of each step in the phase is averaged to produce a percentage of each phase.

Student Activities During Learning

The student activity observation sheet will be given to 3 observers to observe student activities during learning. Student activities are divided into several aspects, namely a) activity, b) interest in the media, c) discussion, d) discipline and e) completeness in a discussion. After the observer gives a score, then the results of the instrument observation sheet of student activity.

The percentage results are then interpreted into the criteria score on the Likert scale [11] as follows:

Table 2. Criteria for Observation of Student Activity

Percentage (%)	Criteria
0 – 25	Less Active
26 – 50	Pretty Active
51 – 75	Active
76 – 100	Very Active

Student activity is said to be good if the observation results obtain a percentage of achievement ≥ 51%, so flash learning media with science literacy orientation is declared good for use in the learning process.

Student Learning Outcomes

The results of student tests are both pretest and posttest are said to be complete and have mastered stoichiometry lessons if individuals get a score ≥75.

Student literacy capabilities are measured by the learning outcomes obtained and then analyzed using normality testing as a prerequisite for the t-test. If the data is normally distributed, it will use the t-test. But if the data is not normally distributed, it will use the Wilcoxon test [12]. The hypothesis applied to this test is "H0," which means that there is no difference in the average score of the pretest and posttest, while "H1" means there is a difference in the average pretest and posttest scores. To find out the increase in student science literacy skills on stoichiometry material, so the results of the pretest and posttest are tested using the n-gain test.

Then the N-gain score of each student is on average. After that, the average N-Gain score will be converted into the criteria and can be seen in Table 1.

Table 1. N-Gain Criteria

N-Gain	Criteria
$g \geq 0.7$	High
$0.3 \leq g < 0.7$	Medium
$g < 0.3$	Low

Student Response

After learning using flash media with a science literacy orientation, a student response questionnaire is given to students. This sheet contains a statement about students' ease and impacts after learning. In the questionnaire of students, the students there are positive and negative statements. The assessment given a score for a positive statement can be a high-value point (1) when answering "yes"

ISSN 1907-1744 (Print)
ISSN 2460-1500 (Online)

and (0) if it gives a "no" answer. The results of the student response questionnaire are then calculated.

The percentage results are then interpreted into the criteria score on the Likert scale as follows:

Table 2. Criteria For Student Response Questionnaires

Percentage (%)	Criteria
0 – 20	Very Bad
21 – 40	Not Well
41 – 60	Pretty Well
61 – 80	Well
81 – 100	Very Well

Based on the interpretation of the score, the learning process using Flash-based learning media is said to be either used as a learning media with a percentage of achievement ≥ 61%.

RESULTS AND DISCUSSION

The Implementation of Learning Using Flash Media in increasing Scientific Literacy Understanding

The implementation of learning using Flash learning media in increasing scientific literacy understanding is observed by three observers. One person is a chemistry teacher, and the remaining two are students majoring in Chemistry. This learning uses the Discovery Learning method that has six syntaxes, namely 1) Giving stimulus, 2) Problem Identification, 3) Data Collection, 4) Data Processing, 5) Verification, and 6) Generalization [13]. The advantage of the Discovery Learning learning model is making abstract lessons meaningful and realistic because there are real examples in life [14]. The results of the observation of the implementation of learning using Flash media in increasing scientific literacy understanding can be seen in Figure 1

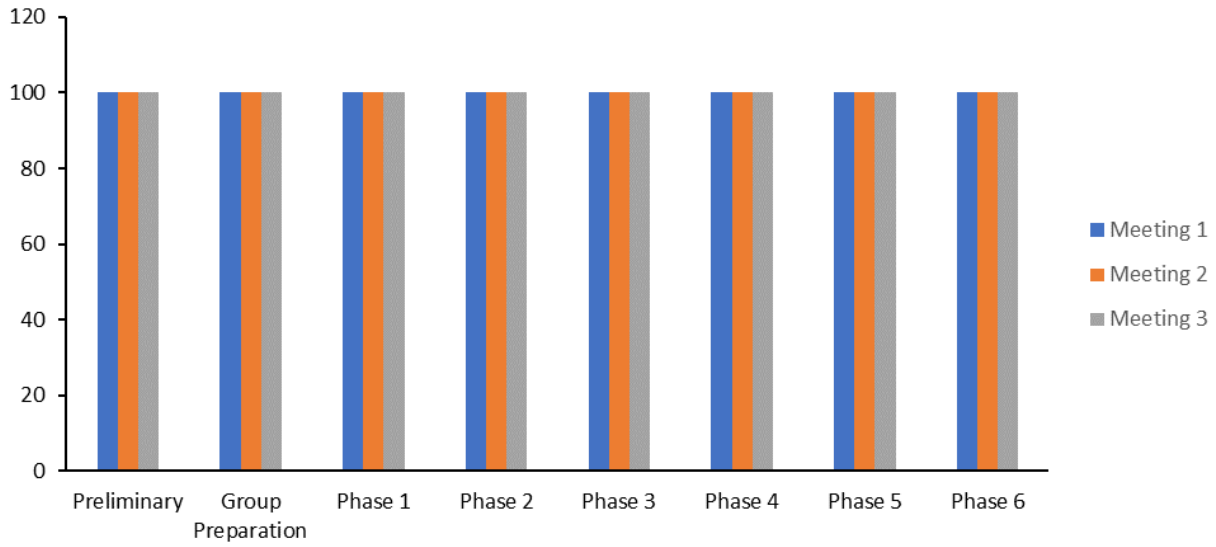

Figure 1. Chart Percentage of Learning Implementation

The implementation of the entire learning stage carried out for three meetings received a 100% percentage. It means that all the learning stages can be carried out. To carry out good learning, teacher competency factors that are following the curriculum that is carried out need to be considered. The readiness of the teacher to understand the learning process and the readiness in the learning tools that will be used as a support in learning [15]. But learning using flash media gets constraints where students do not have devices used in learning then teachers must find a solution so that the learning is not hampered. It can be concluded that learning using Flash media to increase scientific literacy understanding can be carried out properly. However, there is still an obstacle because the device is used in a limited number. One of the obstacles to learning using technology in Indonesia is inadequate devices, especially for students from the lower middle class [16].

Student Activities During Learning

Student activities are measured using student activity sheet instruments with several aspects: a) activity, b) interest in the media, c) discussions, d) discipline and e) completeness in a discussion. The purpose of student activity can be observed to support teaching activities in improving learning outcomes. The results of student activities during learning for three meetings can be seen in Table 2.

In Table 2, it can be seen that as a whole aspect of obtaining a percentage average of 87.67%. So students' activities during learning in three meetings can be said to be very active. The strength of the activity students can make students more likely to be interested and enthusiastic when

participating in learning, so it determines the success of the learning process [17].

Table 2. The Percentage of Student Activities

Aspect	Criteria
Activity	75.00% (Active)
Interest in The Media	98.81% (Very Active)
Discussions	94.52% (Very Active)
Discipline	92.38% (Very Active)
Completeness in a Discussion	75.00% (Active)

Student Learning Outcomes

This test measures scientific literacy understanding within the limits of 3 competencies: the ability to explain the scientific phenomenon, evaluate and model the scientific investigation, interpret data, and prove scientifically. Students are declared completed if the value obtained is ≥ 75%. The results of student completeness from the acquisition of pretest scores and posttest students can be seen in Figure 2.

Based on the graphics in figure 2, when the pretest is carried out, obtained results were students who did not complete as many as 35 students while those who complete are non-existent. For the posttest results, 34 students were said to have been completed, while the remaining students were said to be not completed. These results show that after learning treatment, using flash media can increase the number of students who complete learning. From there, it can be seen that there is a learning process that occurs in students. It follows the definition of learning, namely assistance provided by educators/teachers, so there is a process of obtaining science and knowledge, mastery of proficiency and character, and forming attitudes and trust in students [18].

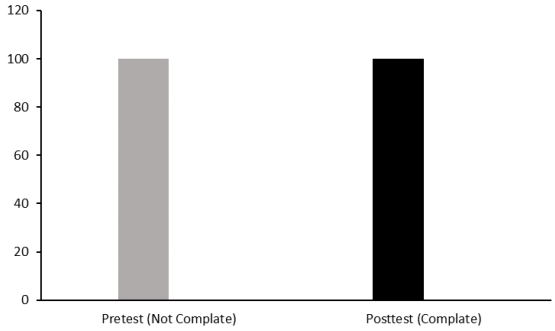

Figure 2. Chart Percentage Completion of Student Learning Outcomes

The data will be tested for normality using the Kolmogorov-Smirnov test. The results of the normality of the data obtained can be seen in Table 3.

Table 3. The Results of Kolmogorov-Smirnov Test

		Unstandardized Residual
N		35
Normal Parameters	Mean	.0000000
	Std. Deviation	6.65227164
Most Extreme Differences	Absolute	.244
	Positive	.244
	Negative	-.224
Kolmogorov-Smirnov Z		1.442
Asymp. Sig. (2-tailed)		.031

Table 3 shows a 2-tailed sig value of 0.031. It shows the significance level < 0.05, meaning that data is not normally distributed, so the data includes non-parametric. Therefore to test the hypothesis will use the Wilcoxon test. The results of the Wilcoxon test can be seen in Table 4.

In Table 4, we can see that the 2-tailed sig value obtained is 0.00. It showed significance < 0.05, so H0 was rejected while H1 was accepted. So it can be concluded that there are significant differences in the average pretest and post-test scores. It indicates that learning using flash media can affect students' scientific literacy abilities in stoichiometry lessons.

Table 4. Wilcoxon Test Results

	Post Test - Pre Test
Z	-5.171[a]
Asymp. Sig. (2-tailed)	.000

To find out how much increased understanding of science literacy, then the results of the pretest and post-test will be tested with N-gain tests. Increased N-gain score for each student has a different score. The increase in the N-gain score is good if included in high or medium criteria. Students got high criteria, with the percentage obtained being 45.71%. 19 students met the criteria with a

percentage obtained of 54.29%. No students get low criteria, so the percentage obtained is 0%. The average percentage of N-gain score of all students was obtained by 0.72. Increasing scientific literacy understanding in stoichiometry lessons is a high criterion.

Increasing scientific literacy understanding in students due to the presentation of the flash media can encourage students to be actively involved during the learning process. In addition, students are easier to understand stoichiometry lessons with the presentation of phenomena that are associated with everyday life. The existence of problems presented in Flash media following the competence of the literacy literature is the ability to explain the phenomenon scientifically. Implementing learning with a model that presents the problem can improve student learning outcomes because students must think to solve the problem [19].

In addition, the flash media presents a practicum simulation so that students can observe practicum steps without having to practicum in the laboratory. The existence of this practicum simulation is in accordance with students' competence, namely the evaluation and model of the scientific investigation. The presentation of practicum simulations on flash media can be seen in Figure 3.

Figure 3. Practicum Simulation on Flash Media

In the practicum simulation, there are both qualitative and quantitative data where students will interpret the data. It is in accordance with the competence of science literacy, namely interpreting data and proves scientifically. In this competency, students are required to interpret scientific data and scientific evidence based on the theory that will later be obtained a conclusion so that students can have more divergent thinking skills [20].

But there is still one student who is not complete after being given learning using Flash media to increase scientific literacy understanding. Students have not been actively involved in learning, and the slowness of students' understanding of stoichiometry lessons.

Student Response

After learning was held for three meetings, the response questionnaire was given to 35 respondents who were class 10 students of one of the State Senior High schools in Gresik, East of Java, Indonesia. The purpose of this respondent is to find out how student opinions during the learning process use flash media learning to increase scientific literacy. The student's response to learning using flash media learning to increase scientific literacy can be seen in Figure 6.

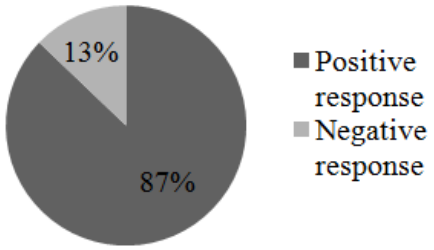

Figure 4. Percentage of Student Response Questionnaire Results

Figure 4 shows that students' percentage of positive responses is more than negative responses. In addition, the results of a positive response of 87% are included in the criteria very well. It shows that using flash media learning to increase scientific literacy understanding can be well received by students.

CONCLUSION

Implementing the learning process on stoichiometry using Flash for three meetings can be very well. Learning by using flash media can be accepted by students and make students more active. Using flash media in learning can help students increase their understanding of literacy science in stoichiometry. However, there are a few obstacles where the device used is very limited, so the teacher needs to find the problem solution.

REFERENCES

[1] McFarlane, D. A. (2013). Understanding the challenges of science education in the 21st century: New opportunities for scientific literacy. International Letters of Social and Humanistic Sciences, (04), 35-44.

[2] Bybee, R. W. (2010). The Teaching of Science: 21st Century Perspectives. Virginia: NSTA Press

[3] OECD. (2019). Programme for International Students Assessment (PISA) Results from PISA 2018, Country Note: Indonesia. https://www.oecd.org/pisa/publications/PISA2018_CN_IDN.pdf diunduh pada Maret 2022.

[4] Juniati, N., dkk. (2020). Penggunaan Multimedia Pembelajaran Untuk Meningkatkan Literasi Sains Siswa. *Jurnal Pijar MIPA*, 15(4), 315-319

[5] Sukariasih, L., Erniwati, E., & Salim, A. (2019). Development of interactive multimedia on science learning based adobe flash CS6.

International Journal for Educational and Vocational Studies, 1(4), 322-329.
[6] Umbara, U., & Nuraeni, Z. (2019). Implementation of realistic mathematics education based on adobe flash professional CS6 to improve mathematical literacy. Infinity Journal, 8(2), 167-178.
[7] Ihsan, M. S., & Jannah, S. W. (2021). Development of interactive multimedia based on blended learning to improve student science literacy during the covid-19 pandemic. Jurnal Pijar Mipa, 16(4), 438-441.
[8] Davidowitz, B., Chittleborough, G., & Murray, E. (2010). Student-generated submicro diagrams: A useful tool for teaching and learning chemical equations and stoichiometry. Chemistry Education Research and Practice, 11(3), 154-164.
[9] Fach, M., De Boer, T., & Parchmann, I. (2007). Results of an interview study as basis for the development of stepped supporting tools for stoichiometric problems. Chemistry Education Research and Practice, 8(1), 13-31.
[10] Gall, M. D., Borg, W. R., & Gall, J. P. (1996). Educational research: An introduction. Longman Publishing.
[11] Riduwan. (2016). *Skala Pengukuran Variabel-variabel Penelitian*. Bandung: Alfabeta.
[12] Sudjana. (2002). *Metoda Statistika*. Bandung: Tarsito
[13] Nurrohmi, Y., dkk. (2017). Pengaruh Model Pembelajaran Discovery Learning Terhadap Kemampuan Berpikir Kritis Mahasiswa. *Jurnal Pendidikan*, 10(2), 1308-1314
[14] Pramestika, N. P. D., Wulandari, I. G. A. A., & Sujana, I. W. (2020). Enhancement of Mathematics Critical Thinking Skills through Problem Based Learning Assisted with Concrete Media. Journal of Education Technology, 4(3), 254-263.
[15] Yustiqvar, M., Hadisaputra, S., & Gunawan, G. (2019). Analisis penguasaan konsep siswa yang belajar kimia menggunakan multimedia interaktif berbasis green chemistry. Jurnal Pijar Mipa, 14(3), 135-140.
[16] Albab, S. U. (2020). Analisis Kendala Pembelajarane-Learningpada Era Disrupsi Di Smk Terpadu Al-Islahiyah Singosari Malang. Jurnal Manajemen Pendidikan, 2(1), 37-46
[17] Naziah, S. T., dkk. (2020). Analisis Keaktifan Belajar Siswa Selama Pembelajaran Daring pada Masa Covid-19 di Sekolah Dasar. *Jurnal JPSD*, 7(2), 109-120
[18] Suardi, Moh. (2018). *Belajar dan Pembelajaran*. Yogyakarta: Deepublish
[19] Islamiati, N, dkk. (2020). Pengaruh Model Pembelajaran Berbasis Masalah Terhadap Hasil Belajar Kimia Siswa Kelas X Ms Sman 1 Kediri Pada Materi Reaksi Reduksi Dan Oksidasi. *Chemistry Education Practice*, 3(2), 112-115
[20] Haerani, S. A. S., dkk. Pengaruh Model Inkuiri Bebas Terhadap Kemampuan Literasi Sains. *Jurnal Pijar MIPA*, 15(2), 140-144