

## PENGEMBANGAN E-LKPD TERINTEGRASI LABORATORIUM VIRTUAL UNTUK MELATIHKAN KETERAMPILAN LITERASI SAINS SISWA MATERI SISTEM PEREDARAN DARAH

### *The Development of E-Worksheet Integrated With Virtual Laboratory to Train Student's Scientific Literacy Skills on Blood Circulatory System Topic*

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#### Abstract

*The use of technology in online learning during the covid-19 pandemic is needed due to provide facilities for students in learning activities. Scientific literacy skills is included in higher-order thinking skills by the demands of the implementation curriculum 2013. Data in the field showed that the majority of students in Indonesia have a low level of scientific literacy. The purpose of this research was to make an e-worksheet integrated with Virtual Laboratory to train Scientific Literacy Skills on Circulatory System Materials that feasible, practical, and effective. The research model was 4D (Define, Design, Develop, Disseminate). The research trial was conducted on 18 students of SMAN 1 Pasuruan. The validity of the e-worksheet has been known from the results of the validation by the validators, the practicality of the e-worksheet has been known from the results of student response questionnaires, and the effectiveness has been known from the learning outcomes refers to scientific literacy indicators.. Data analysis was carried out with a quantitative description. The results of e-worksheet validation were 94.62% which is a very valid category. The results of the practicality were 95.1% in the very practical category, and the effectiveness results were 88% which is in the very effective category. Based on the results obtained, e-worksheet integrated with virtual laboratory to train scientific literacy on circulatory system was valid, practical, and effective.*

**Keywords:** Scientific literacy, E-worksheet, Virtual laboratory

#### Abstrak

Penggunaan teknologi pada pembelajaran jarak jauh pada pandemi covid-19 dibutuhkan untuk memfasilitasi siswa dalam pembelajaran. Keterampilan literasi sains termasuk dalam keterampilan berpikir tingkat tinggi sesuai dengan kurikulum 13. Data di lapangan menunjukkan bahwa mayoritas siswa di Indonesia memiliki tingkat literasi sains yang rendah. Tujuan penelitian ini yaitu untuk menghasilkan E-LKPD Terintegrasi dengan Virtual Laboratory untuk Melatihkan Keterampilan Literasi Sains Pada Materi Sistem Peredaran Darah yang valid, praktis, dan efektif. Model penelitian yang digunakan yaitu 4D (*Define, Design, Develop, dan Disseminate*). Uji coba dilakukan pada 18 orang siswa SMAN 1 Pasuruan. Validitas e-LKPD diketahui dari hasil validasi oleh validator. Kepraktisan e-LKPD diketahui dari hasil angket respon siswa, dan keefektifan diketahui dari hasil belajar mengacu pada indikator literasi sains. Analisis data dilakukan secara deskriptif kuantitatif. Hasil validasi e-LKPD sebesar 94,62% termasuk kategori sangat valid. Hasil kepraktisan e-LKPD sebesar 95,1% termasuk kategori sangat praktis, dan hasil keefektifan sebesar 88% termasuk kategori sangat efektif. Berdasarkan hasil yang diperoleh, e-LKPD Terintegrasi Virtual Laboratory dinyatakan layak, praktis, dan efektif.

**Kata Kunci:** Literasi sains, E-LKPD, Virtual Laboratory

## INTRODUCTION

The covid-19 pandemic that occurred had a significant impact on mobility of all sectors throughout the world, including the education sector. To adapt learning activities due to restrictions on mobilization during a pandemic, the Ministry of Education and Culture implemented a regulation that learning activities were carried out using a hybrid learning model or limited face-to-face learning. This happened about the government's efforts to prevent the spread of COVID-19. Thus, innovation and school transformation are needed in conducting distance learning activities (Nadeak, 2020).

The use of technology needed to facilitate learning activities. With that, it can increase student's interactivity and interest in learning, so that transfer of knowledge activities becomes easy, comfortable, and effective (Raja and Nagasubramani, 2018). The use of technology in learning is in line with the demands of the curriculum 2013 as stipulated in the Regulation of the Minister of Education and Culture No.69 of 2013b. Implementation of the 2013 curriculum in learning is expected to produce graduates who have 21<sup>st</sup>-century skills. These skills consist of critical thinking skills, creative thinking skills, communication skills, and collaboration skills (BSNP, 2010). Curriculum 2013 focuses more on mastering higher-order thinking skills (Mulani and Subali, 2019). Scientific literacy skills are one of the skills included in the HOTS category (Rahayuni, 2016).

Scientific literacy is an ability that includes scientific knowledge, identifying problems, and being able to make conclusions based on facts and data that are useful for understanding the universe and being able to make decisions based on changes that occur due to human activities (OECD, 2016). The concept of scientific literacy is to expect students to have a high concern for themselves and their environment related to everyday problems and make decisions based on scientific knowledge (Indana, S et al., 2018). The Program for International Student Assessment (PISA) results showed that in 2012 Indonesian students were ranked 64th out of 65 countries in scientific literacy. In 2015 it was ranked 62 out of 70 countries, and in 2018 it was ranked 72 out of 79 countries (Setiawan, 2020). The factors that affected the low level of scientific literacy in students are that students are easy to memorize but less skilled in applying science to solve problems. many methods in the learning process are lacking in directing students to read, and limited facilities

in the learning process that are useful for providing support during learning activities (Indana, S et al., 2018).

Low scientific literacy skills can make it difficult for students to respond to and make decisions related to scientific problems in everyday life (Indana, S et al., 2018). Teachers can train students in scientific literacy skills by carrying out learning activities that apply scientific literacy indicators such as identifying phenomena, predicting a phenomena, determining hypotheses, formulating questions, designing problems solving, evaluating problem solving, processing data, and analyzing data (OECD, 2015 ). In addition, the learning process that can increase student's curiosity about material topics can encourage students to solve problems given by the teacher and can build science process skills which are part of the aspect of scientific literacy competence (Indana, S et al., 2018).

Student worksheet is one of the instrument that can support the implementation of curriculum 2013 (Amani and Hadi, 2021). Electronic Students Worksheet (E-Worksheet) is an innovation in the development of electronic teaching materials in which there are various multimedia to meet the achievement of student competency indicators in the learning process which is presented with a more attractive appearance and a more practical form (Sriwahyuni, 2019). Applying digital Worksheet in the learning process, can facilitate students in the process of understanding the concept of the material because it refers to the role of media in learning that can deliver messages to students (Julian and Suparman 2019).

A virtual laboratory is interactive multimedia-based software that contains simulations of activities in a laboratory equipped with a series of tools and materials (Manirudin and Madlazim, 2017). Virtual laboratories can be used as an innovative learning strategy that is easier, cheaper, and increases motivation of students in the learning process (Špernjak & Šorgo, 2010). Kurnia et al (2017) mention that virtual laboratories can be used to teach conceptual and procedural knowledge. In the learning process using a virtual laboratory, it is necessary to be equipped with worksheets that serve as guidelines for students so that practicum activities can run correctly (Kurnia, et al., 2017). Research conducted by Humairah et al (2021) showed that the e-worksheet virtual lab-based got a percentage of 80% for the effectiveness and students gave a positive response.

Circulatory system is one of the materials that is closely related to the daily lives of students

(Kemendikbud, 2017). The competence of the High School National Examination in 2019 on biology material showed that the circulatory system material got a 46% which is in a low category. Based on the observations at SMAN 1 Pasuruan, it showed that biology learning only used the zoom meeting platform at the beginning of the meeting, then at the next meeting, the teacher asked students to work on the Independent Learning Activity Unit and teaching materials in the form of biology textbooks.

Based on the explanation above, it is necessary to research the development of e-worksheet integrated with virtual laboratories to train students' scientific literacy in circulatory system material that is categorized as valid, practical, and effective.

## METHOD

The type of research that is carried out as research and development (R&D) used a 4D model which is Define, Design, Develop, and Disseminate stages. The research was conducted from November 2021-March 2022. The product development process was carried out at the Department of Biology, FMIPA, Unesa. Then, the product would be tested on 18 students of XI-Science-2 in SMAN 1 Pasuruan.

The definition stage objectives to determine and describe the needs in the learning process. This stage consists of 4 steps: Curriculum analysis, Student analysis, Task analysis, and Concept analysis.

The design stage determines basic competencies, learning indicators, time allocation, aspects of scientific literacy, and supported features that will be carried out in the E-Worksheet. The aspects of scientific literacy that were selected were content aspects, process aspects, and science context aspects. Then, the features developed are Go-Tube, Who's This, Tech corner, and Fun games.

The development stage results in two product drafts that have been validated and revised and then will be tested on students. The revised E-Worksheet product is based on suggestions from supervisors and validators. The dissemination stage is carried out by publishing scientific articles resulting from research that has been carried out.

The data collection method used in this research is a questionnaire and test method. The questionnaire method was carried out to determine the validity and practicality of the product, while the test method was carried out to

determine the effectiveness of the product used. Data analysis was carried out in a quantitative descriptive.

The validity of the E-worksheet was reviewed based on the results of the assessment of three validators consisting of media expert lecturers, material expert lecturers, and biology teachers at SMAN 1 Pasuruan. The instrument used is a validation sheet that contained aspects of validity of presentation, content, language, and conformity of E-worksheet to train students science literacy. The Likert scale with a rating scale of 1-4 was used on the validation sheet. Results of validation are then analyzed using the following formula:

$$\text{Percentage}(\%) = \frac{\text{Total Score obtained}}{\text{maximum score}} \times 100\%$$

Then, from the results of the percentage calculation, an interpretation was made with the score criteria adapted from Riduwan (2016).

**Table 1.** Validation Interpretation Criteria

Average Score	Criteria
1,00-1,75	Less valid
1,76-2,50	Valid enough
2,51-3,25	Valid
3,26-4,00	Very valid

The completion of the scientific literacy skills of students is carried out to find out how good the level of scientific literacy of students is. Can be calculated using the following formula:

$$\text{Percentage}(\%) = \frac{\text{Total score obtained}}{\text{maximum score}} \times 100\%$$

Then, the calculation results can be interpreted based on the criteria adapted by Riduwan (2012).

**Table 2.** Scientific Literacy Skills Interpretation Criteria

Score (%)	Criteria
25-39,9	Not good
40-54,9	Less good
55-69,9	Good enough
70-84,9	Good
85-100	Very good

The practicality of E-worksheet was reviewed based on the results of student response questionnaires. The response questionnaire sheet used the Guttman scale with a score 1 for the "YES" response and a score 0 for

the "NO" response. The percentage of results from student responses was calculated using the following formula:

$$\text{Percentage (\%)} = \frac{\text{Total students who answered yes}}{\text{maximum score}} \times 100\%$$

Then, the results of the percentage calculation, can be interpreted based on the criteria adopted by Riduwan (2013).

**Table 3.** Practicality Interpretation Criteria

Score (%)	Criteria
0-48	Very not practical
49-61	Not practical
62-74	Fair Practical
75-87	Practical
88-100	Very practical

## RESULTS AND DISCUSSION

The research resulted in a teaching material product called e-worksheet integrated with a virtual laboratory to train scientific literacy skills on the circulatory system material. The developed e-worksheet contained two sub-materials, namely sub-material 1 regarding blood components and blood circulation mechanisms equipped with two virtual laboratories, while sub-material 2 contains material on blood types and blood transfusions equipped with one virtual laboratory. The scientific literacy skills was presented coherently in 3 aspects, which are content aspects, process aspects, and context aspects.

In the scientific content aspect, students were asked to understand the concepts of material that are equipped with audiovisuals. In the scientific process aspect, students were asked to do practical activities used virtual laboratory, then from those activities, students answered questions to measure the achievement of students scientific literacy indicators such as identifying scientific questions, using scientific evidence, and explaining scientific phenomena. In the scientific context aspect, an article related to the concept of the material is presented, then students were asked to answer questions according to the concepts they have been done in previous learning activities.

Design of e-worksheet was made attractive and easy to use because to increase student interest in learning and motivation. These are the layout of the developed e-worksheet :



a)

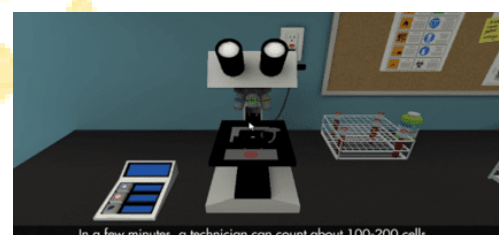


b)

**Figure 1.** (a) e-worksheet 1 cover, (b) e-worksheet 2 cover

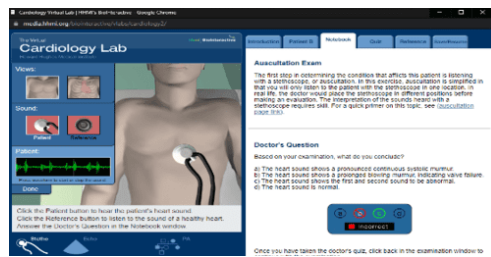


**Figure 2.** E-worksheet layout



a)



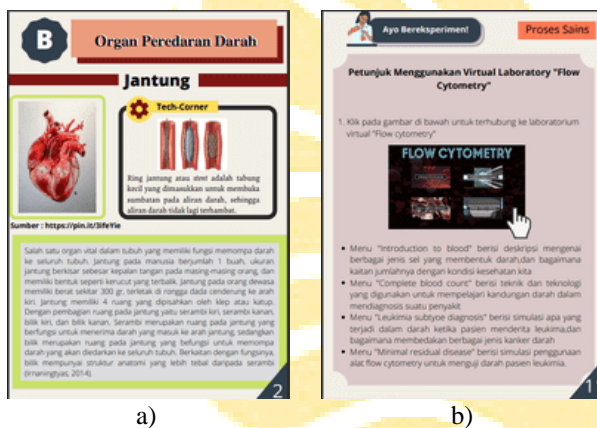


b)



c)

**Figure 3.** (a) Flow Cytometry Virtual lab, (b) Cardiology lab, (c) Blood Group Test Virtual lab



**Figure 4.** Scientific Literacy Aspect; (a) Content aspect, (b) Process aspect, (c) Context aspect

The components of e-worksheet are learning objectives, material content, exercise questions, and student activities equipped with these features such as go-tube, tech corner, fun games, and who is this. These are explanations of the features in e-worksheet:

**Table 4.** Features of e-worksheet

No	Features	Descriptions
1.	Go-Tube	Show videos from youtube platform to visualize circulatory system material
2.	Tech-Corner	Contains technological discoveries related to the circulatory system
3.	Fun games	Contains games or quizzes that related to the circulatory system
4.	Who is This	Contains scientists or experts who play a role in the discovery process related to the circulatory system
5.	Ayo Bereksperimen	Contains practicum activities and answering questions based on scientific literacy indicators
6.	Ayo Memahami	Read and understand the article related to the material. Then answer the questions based on scientific literacy indicators

E-worksheet was developed in pdf file form with hyperlinks and audiovisuals attached to several contents. E-worksheet can be accessed using a laptop/pc and also a smartphone with an internet network so that it is easy to use. This is in line with Sriwahyuni's statement (2019) that the E-worksheet is an innovation in developing electronic teaching materials in which there are various multimedia to meet the achievement of student competency indicators in the learning process which is presented with a more attractive display and more practical form. Also, by using smartphones wisely in the implementation of digital learning, it can increase students learning motivation (Rahma and Sandika, 2022).

E-worksheet integrated with a virtual laboratory can be used as an alternative to online learning. In the e-

worksheet, there are student practicum activities that aim to understand and apply concepts as well as scientific literacy skills, especially in process aspects. This is in accordance with research conducted by Ritmayanti and Supardi (2017) showed that students science process skills have increased after using virtual lab-based e-worksheets. E-worksheet is equipped with indicators that can train scientific literacy skills to overcome the low level of scientific literacy of students in Indonesia.

In this study, three assessments were carried out, which are validation, effectiveness, and practicality to determine the feasibility of e-worksheet integrated with virtual labs to train students' scientific literacy skills that can be used in learning. These are in line with the statement of Wisanti et al (2020) that before being used in classroom, it is necessary to select and evaluate learning resources whether they have qualified the criteria or not.

## 1. Validation of e-worksheet

E-worksheet that has been developed was validated to 3 validators consist of one education expert lecturer, one material expert lecturer, and one high school biology teacher using a validation sheet instrument. The criteria for the components assessed are the appropriateness of presentation, content, language, and the conformity of the e-worksheet in training scientific literacy. Table 5 shows a recapitulation of e-worksheet validation integrated with the virtual lab.

**Table 5.** Validation Recapitulation Results

No	Aspects	Score			Average
		V1	V2	V3	
Presentation Validity					
1.	Cover	3	4	4	3,67
2.	Title of e-worksheet accords with learning objectives	4	4	4	4
3.	Time allocation	3	4	3	3,33
4.	Learning objective	4	4	3	3,67
5.	Guidance of e-worksheet	4	4	4	4
6.	Overall e-worksheet display	4	4	4	4
Average				3,78	
Score interpretation (%)				94,5%	
Category				Very valid	
Content Validity					

1.	Materials conformity with learning objectives	4	4	3	3,67
2.	Concepts	4	4	3	3,67
3.	The use of <i>Virtual laboratory</i>	4	4	4	4
4.	Features	4	4	4	4
5.	Overall e-worksheet content	4	4	4	4
<b>Average</b>				3,87	
<b>Score Interpretation (%)</b>				96,7%	
<b>Category</b>				Very valid	
<b>Language Validity</b>					
1.	Language conformity with PUEBI	3	3	4	3,33
2.	Use of terms	4	4	4	4
3.	Sentences that used is clear and easy to understand	4	4	4	4
4.	Sentences that used do not contain multiple interpretations	4	4	4	4
<b>Average</b>				3,83	
<b>Score interpretation (%)</b>				95,8%	
<b>Category</b>				Very valid	
<b>Conformity of E-worksheet to Train Scientific Literacy</b>					
1.	Science content aspect	4	4	4	4
2.	Science context aspect	4	4	4	4
3.	Science process aspect	3	3	3	3
<b>Average</b>				3,66	
<b>Score interpretation (%)</b>				91,66%	
<b>Category</b>				Very valid	
Total average				3,78	
Score Interpretation (%)				94,62%	
Category				Very valid	

**Notes :** V1 = Education expert lecturer, V2 = Material expert lecturer, V3 = High school biology teacher

Based on the validation's results by three validators, it showed that the average percentage of e-worksheet validity was 94.62% with a very valid category. There were 4 aspects of the assessment, which consist of aspects of presentation validity, content validity, language validity, and conformity with scientific literacy indicators. This is in accordance with e-worksheet validity indicators based on the textbook of the National Education Standards (2012) which consists of content aspects, language aspects, presentation aspects, and graphic aspects. Dinantia et al (2017) stated that the achievement of didactic requirements could have viewed from the validity of the content aspect, while the achievement of construction requirements could have viewed from the validity of the language aspect, and the achievement of technical requirements could have viewed from the presentation and graphic aspects.

E-worksheet in presentation aspect obtained a percentage of 94.4% with a very valid category. There were six assessments criteria with the lowest score on the time allocation criteria with a total score of 10. This was because in the e-worksheet 1 and 2 before the revision, the assignment has not been adjusted to the time allocation during the hybrid learning with details of 1 lessons hour is 30 minutes. so that the time allocation for activities with e-worksheet is not appropriate. One of criteria for a good e-worksheet is completion of time allocation (Putri, 2016). With a clear completion of time allocation, it can be used as a guide for teachers and students in carrying out practicum activities effectively (Kurniasih et al., 2020).

Based on the aspect of content validity, e-worksheet contained material on the circulatory system in 11<sup>th</sup> class with the coverage of the concept of blood components, blood circulation mechanisms, blood transfusions, physiological disorders, and technology used. This is in accordance with KD 3.6 which stated Analyzed the relationship between the structure of the tissue that make up organs in the circulatory system in relation to bioprocesses and functional disturbances that can occur in the human circulatory system. The results of the validator's assessment on the content feasibility aspect obtained an average of 96.6% with a very valid category. There were five assessments criteria with the lowest score on the conformity of the material with the learning objectives and the concepts presented refer to a valid theory with a score of 10. It was because there were several assessment instruments that were not suitable. Then, on the concept criteria presented, there were errors in e-worksheet regarded the blood transfusion compatibility table. Scores on three others criteria, which is the used of a virtual laboratory, features, and overall

content could have helped students understand the material and practiced scientific literacy skills, obtained a maximum score of 12. This was because the preparation of the e-worksheet was integrated with the use of a virtual laboratory and various attractive features that could increased students interest and learning outcomes. Those results were in line with Humairah et al (2021) that e-worksheet based on virtual laboratory was effective in learning activities.

The language aspect obtained an average percentage 95.83%. There were four assessments criteria with the lowest total score on the language criteria used in accordance with PUEBI with a score of 10. This was because there were punctuation errors such as the used of dots and commas without spaces. Aspects of conformity with scientific literacy indicators got an average percentage of 91.66% with three assessments criteria, There were aspects of science content, aspects of science context, and aspects of science processes with the lowest score on the criteria of scientific process aspects with a total of 9. This was because of virtual laboratories that used, two of them can be accessed using hyperlinks, and not in software form.

## 2. Practicality of e-worksheet

The practicality of e-worksheet can be seen from the students response questionnaires after the learning activities. The instrument used was a response questionnaire sheet that used Guttman scale. The results of students response to the e-worksheet were presented in Table 6 below.

**Table 6.** Students Response Recapitulation

No	Aspects	Average (%)	Category
<b>Presentation Aspect</b>			
1.	Display of e-worksheet	95,8	Very Practical
2.	Time Allocation	83%	Practical
3.	Learning Objectives	94,4%	Very Practical
4.	The Use of e-worksheet	94,4%	Very Practical
5.	Facilitate to understand the concepts	100%	Very Practical
<b>Presentation Aspect Average (%)</b>		<b>93,52%</b>	<b>Very Practical</b>

Content Aspect			
1.	Conformity with material	100%	Very Practical
2.	Features that can help to understand the concepts	100%	Very Practical
3.	Help to train scientific literacy	98%	Very Practical
<b>Content Aspect Average (%)</b>		<b>99,3%</b>	<b>Very Practical</b>
Language Aspect			
1.	The use of terms	88,8%	Very Practical
2.	The use of sentences	94,4%	Very Practical
3.	The use of language is easy to understand	88,8%	Very Practical
<b>Language Aspect Average (%)</b>		<b>90,67%</b>	<b>Very Practical</b>
<b>Total Average</b>		<b>95%</b>	<b>Very Practical</b>

Based on the results of Table 6, it can be seen that recapitulation of the average percentage of student responses is 95%. The practicality of the e-worksheet can be seen in the student response questionnaires after the learning activities. The learning was carried out for 2 meetings, with details one time with offline class, and one meeting being conducted independently with online class. Learning activities are quite smooth. However, there were some obstacles such as limited signal in the classroom.

The results of student responses, obtained an average of 95% with a very practical category. In the presentation aspect, the average score is 93.52%, which indicated that the overall appearance of the e-worksheet integrated with the virtual laboratory is attractive. The lowest score is in the time allocation, this is due to signal problems when accessed and downloaded the e-worksheet and virtual laboratory so that it takes time to do the tasks that have been provided.

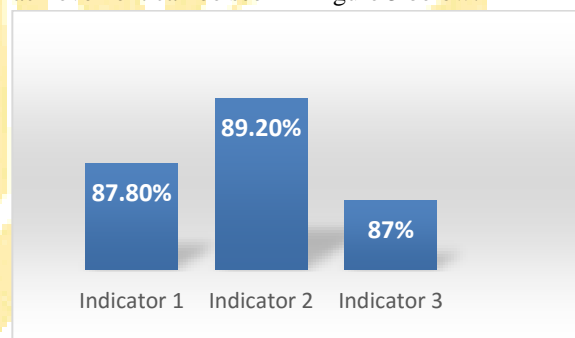
In the aspect of content obtained an average of 99%. This shows that overall students can understand and participate in learning activities using e-worksheet

integrated with virtual laboratories. This is in line with Tatli and Ayas (2012) that virtual laboratories can be used as a supporting factor to increase experience and increase student motivation in conducting interactive experiments and developing experimenting skill activities. In addition, virtual laboratories could have simulated a complex experiment, can simulate expensive experimental devices, or replace experiments in hazardous environments (Mahanta and Sarma, 2012).

In the language aspect, it obtained an average of 91.6% with the highest score on the criteria of legibility of writing clearly at 100%. Then three other criteria consisting of terms, language, and sentences that are easy to understand and in accordance with PUEBI got the same score of 88.8%. This was because e-worksheet 1 used English in virtual laboratory. So that some students feel unable to understand or take a long time to understand well.

### 3. The effectiveness of e-worksheet

The effectiveness of the e-worksheet can be seen based on student learning outcomes regarding the results of the tasks provided in the e-worksheet. The tasks in the e-worksheet were prepared based on three scientific literacy indicators. The results of the scientific literacy indicators achievement can be seen in Figure 5 below:



**Figure 5.** Recapitulation of Scientific Literacy Indicators

Based on the results of Figure 5, it can be seen that the average percentage of achievement of scientific literacy skills is 88% in the very good category. Explaining scientific phenomena indicator got the lowest percentage of 87%. Explaining scientific phenomena indicator required students to recall appropriate knowledge or material content in certain situations (PISA, 2018). The concepts of material and knowledge possessed by students affect the ability to describe or explain phenomena scientifically (Susanti and Muchtar, 2012).

At the time of learning, most students could explained a phenomenon scientifically well, this was



because during learning activities, students carried out scientific literacy-based practicum activities, Interesting material contents, and phenomena presented in everyday life that are related to blood components, technology to treat heart disease, and blood transfusions. Thus, practicum-based learning can be used to train students' scientific literacy skills. This was in line with Wulandari and Solihin (2016) that students scientific literacy skills in the aspects of science knowledge and competence can be improved through practicum activity-based learning. However, there are some students who have not been able to achieve the indicators of explaining scientific phenomena well because in some practical activities used a virtual laboratory that used English, students cannot understand the material optimally. So, there were some students who have not been able to explain phenomena scientifically well.

In identifying scientific questions indicator, students could understand the purpose of scientific investigations in order to produce reliable knowledge (PISA, 2018). When learning and answered the questions provided on the e-worksheet, overall, students could answered the research objectives, made hypotheses correctly, and explained the experimental procedures that will be carried out using the virtual lab properly. However, there were some students who have not been able to make research variables correctly.

The last indicator is used scientific evidences got the highest percentage. It was 89.2%. Used scientific evidence, which is students could interpret data scientifically and made statements or conclusions from understanding the form of data and evidence (PISA, 2018). This was because students could interpret scientific evidences that has been obtained in the practicum process used virtual laboratory properly.

This was in accordance with the statement of Kurnia et al (2017) that virtual laboratories can be used to gain conceptual and procedural knowledge. In addition, learning used virtual laboratories could improved the affective aspects of students who describe feelings, attitudes, and interests in the learning process (Yuliani et al., 2013). Students achievement would have an impact on performance, the better student's perception of learning, the better the performance (Daesang et al., 2013). By choosing the right learning media, it can increase students perceptions so that they can increase learning motivation (Swandi et al., 2014). The results of Ritmayanti and Supardi's research (2017) showed that students science

process skills after carrying out learning activities using virtual labs-based worksheets has increased.

## CLOSING

### Conclusion

E-worksheet integrated with a virtual laboratory to train scientific literacy on the material circulatory system was declared valid, practical, and effective. The validity of obtaining a percentage in all aspects of 94.62%. Practicality gets an average percentage of 95.1%, and Effectiveness gets an average percentage of 88%.

### Suggestion

Based on research that has been done, researcher can suggest for other researchers who take the same topic to develop an e-worksheet virtual-lab based on other biological materials and also try it on full online learning or full offline learning.

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