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THE DEVELOPMENT OF E-WORKSHEET TO TRAIN SCIENTIFIC LITERACY ON MEMBRANE TRANSPORT MATERIAL FOR 11TH-GRADE HIGH SCHOOL STUDENTS

Pengembangan E-LKPD untuk Melatihkan Literasi Sains pada Materi Transpor Membran Siswa Kelas XI SMA

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Abstract

Scientific literacy is the ability of a person to apply his knowledge to identify questions, construct new knowledge, provide scientific explanations, and develop a reflective mindset so that he can participate in overcoming science-related issues and ideas. Biological material that has the learning potential to train science literacy is membrane transport. The objective of this study is to create a membrane transport E-worksheet that is reliable, useful, and efficient for teaching scientific literacy and enhancing classroom instruction. A 4-D model research design was used to create the e-worksheet (Define, Design, Develop, Disseminate) without the Disseminate stage. A total of 30 students from class XI of science 3 took part in the trial. The parameters of this study are the validity of expert validation results, the applicability of student replies, and the efficacy of learning outcomes and scientific literacy abilities. The results showed that the validity of the developed E-worksheet received a percentage score of 97% and was included in the very decent category. The practicality of E-worksheet based on student responses obtained results of 96.65% included in the very practical category. The effectiveness reviewed based on the completeness of learning outcomes obtained results of 100% included in the very effective category and the achievement of science literacy indicators of 88.64%. These findings allow for the declaration that the E-worksheet is valid, practical, and effective.
Keywords: E-worksheet, scientific literacy, membrane transport.

Abstrak

Literasi sains merupakan kemampuan seseorang menerapkan pengetahuannya untuk mengidentifikasi pertanyaan, mengkonstruksi pengetahuan baru, memberikan penjelasan secara ilmiah, dan kemampuan mengembangkan pola pikir reflektif sehingga mampu berpartisipasi dalam mengatasi isu-isu dan gagasan-gagasan terkait sains. Materi biologi yang berpotensi sebagai pembelajaran untuk melatihkan literasi sains adalah transpor membran. Tujuan dari penelitian ini adalah untuk menciptakan E-LKPD transpor membran yang valid, praktis, dan efektif untuk pengajaran literasi sains dan meningkatkan pembelajaran di dalam kelas. Desain penelitian model 4-D digunakan untuk membuat E-LKPD (Define, Design, Develop, Disseminate) tanpa tahap Disseminate. Sebanyak 30 siswa dari kelas XI IPA 3 mengikuti uji coba. Parameter penelitian ini adalah validitas hasil validasi ahli, respon siswa, dan ketuntasan hasil belajar dan kemampuan literasi ilmiah. Hasil penelitian menunjukkan validitas E-LKPD yang dikembangkan mendapatkan persentase skor 97% dan termasuk dalam kategori sangat layak. Kepraktisan E-LKPD berdasarkan respon peserta didik mendapatkan hasil sebesar 96,65% termasuk dalam kategori sangat praktis. Keefektifan yang ditinjau berdasarkan ketuntasan hasil belajar mendapatkan hasil sebesar 100% termasuk dalam kategori sangat efektif, dan ketercapaian indikator literasi sains sebesar 88,64%. Temuan ini mengindikasikan bahwa E-LKPD valid, praktis, dan efektif.
Kata kunci: *E-LKPD, literasi sains, transpor membran.*

INTRODUCTION

The fourth industrial revolution has brought forth several good developments in all facets of society, including education. Information and Communication Technologies (ICT) are incorporated into educational activities in the twenty-first century. ICT-based learning can be done as access to the main or supporting means in the learning process. Computer devices and the internet are facilities that facilitate the teaching and learning process in the implementation of learning. Therefore, it is necessary to be able to use technology in a suitable manner (Nastiti and Abdu, 2020).

Various research studies state that education is an indicator of the nation's strength (Al-Aslamiyah et al, 2019). Education is the main base to contribute to all sectors by providing what is necessary both skills and knowledge (Anil, 2019). Skills in the 21st century are the main focus of education today, especially in science education (Nisrina et al, 2020). This skill is one of the basic needs of science learning, which is currently not appropriate to be learned in schools (Astuti et al, 2012). One skill that is very important to pay attention to so that students are able to apply science appropriately is science literacy (Suryani et al, 2017). Deming et al (2007) stated that science literacy skills are one of the main needs of students in this 21st century.

Science literacy is divided into four dimensions, namely science competence/process, science knowledge/content, science application context, and science attitude. Science competence consists of three aspects, namely explaining scientific phenomena, evaluating and designing scientific investigations, and interpreting scientific data and evidence. Science knowledge consists of content knowledge, procedural knowledge, and epistemic knowledge. Science literacy is important for students so that they not only understand science as a concept but also can apply science in everyday life (Sutrisna, 2021). Therefore, science literacy is one of the important pillars in improving the quality of human resources, especially the world of education so that students are expected to have higher competitiveness in competing in the era of globalization and modern times today (Wahyudi et al, 2015)

Science literacy is the capacity of an individual to use his or her knowledge to identify questions, create new knowledge, offer scientific explanations, draw conclusions based on scientific evidence, and have the capacity to cultivate a reflective mindset so that he or she can take part in overcoming science-related problems and ideas. (OECD, 2019). Provisions based on PISA shows that the average score of science literacy skills is 500. Based on 2018 achievement data with participants from 78 countries, Science literacy levels among Indonesian pupils fall below the established average. The average score for Indonesian students' science literacy was 396. The research demonstrates Indonesian pupils' poor science literacy abilities (OECD, 2019). This is a challenge that students will face now and in the future.

To overcome these problems, a teacher must use learning media. Based on the findings of interviews with SMAN 1 Dawarblandong biology instructors, the development of media conducted by teachers is still very lacking. Because instructors often only utilize conventional media like textbooks and Microsoft PowerPoint. And in the absence of the use of interactive media based on science literacy, students are only asked to read the material provided by the teacher. More creative use of media still does not exist. This is a result of the teacher's still limited capacity to employ media. Additionally, there is not enough media available in schools for educational purposes.

And this underlies that currently there is a need for learning media that can teach science literacy and can also take the positive side of ICT advance. Khikmah (2019) stated that E-worksheet can train science literacy skills. According to Junita and Yuliani research (2022), using an E-worksheet was able to boost students' enthusiasm in learning and their knowledge of cognitive science. Judging from the validity test results which got a score of 98.37%, which means it is very valid because the E-worksheet is packed with neat, attractive, and concise systematic language. E-worksheet which is presented in non-print form, aims at the utilization of (ICT) as an electronic learning medium that can help learning effectiveness. This E-worksheet must take the basis of science literacy.

One of the subjects that can be related to technology and can teach students science literacy is Biology in High School. In this subject, there is membrane transport material that is suitable for scientific literacy, namely in basic competence 3.2 Analyzing various bioprocesses in cells which include membrane transport mechanisms, reproduction, and protein synthesis. And in basic competence 4.2 Making models of bioprocesses that occur in cells based on literature studies and experiments (Permendikbud, 2016). Based on the results of a pre-research questionnaire of SMAN 1 Dawarblandong students, 63,3% of students stated that Membrane Transport material was difficult. This is supported by data from the Ministry of Education and Culture (2019) that the distribution of UN (Ujian Nasional) for the

2018/2019 academic year the average score achieved is 39.72 included in the low category. Membrane transport material is difficult to observe directly because it is abstract, so it requires more understanding to master the concept. Setiawati et al (2017) argue that microscopic material requires understanding concepts as the main capital in learning. This is in line with Juhji and Mansur (2020) research, which finds that students' science literacy abilities affect their ability to grasp fundamental biological ideas.

The researcher's goal is to create a valid, practical, and efficient E-worksheet to teach scientific literacy about membrane transport materials based on the challenges that have been stated. Students are anticipated to exhibit strong teaching motivation, engage in active learning, and possess appropriate science literacy skills in light of this growth.

METHOD

This study is an example of a specific type of development research used to produce educational resources in the form of electronic worksheets (E-worksheets) using the 4-D models development approach, (define, design, develop, and disseminate). However, the dissemination step is not carried out.

The purpose of this study is to create an E-worksheet to teach scientific literacy on membrane transport materials. This E-worksheet was created and tested on 30 randomly chosen grade XI Science 3 SMA Negeri 1 Dawarblandong students.

Research design

The define stage describes the learning needs. The goal at this stage is to define the learning requirements. At this stage, it is necessary to analyze the goals and limitations of E-worksheet membrane transport material using scientific methods. Curriculum analysis, learner analysis, task analysis, and idea analysis are all included in this level. The design stage aims to design the prototype of an E-worksheet. The stages of the design stage include preparation of evaluation questions, media selection, format selection, determination of time allocation, and E-worksheet product design. The design was carried out with the guidance of lecturers and produced draft I.

The development stage aims to produce research products, namely in the form of E-worksheet membrane transport material that has been revised based on expert input and tested by students. The stages of the development stage include: review, validation, practicality test, and effectiveness test.

Variable

The variables observed in this study include the validity, practicality, and effectiveness of E-worksheet. Validity of the electronic worksheet in the form of a validation evaluation that considers the viability of the presentation, the viability of the information, and the viability of the language. E-worksheet practicality, including study utilizing student response surveys. The effectiveness of the electronic worksheet, includes the accuracy of the science literacy abilities.

Data collection techniques

The methods used to acquire the study's data include tests, questionnaires, and validation techniques. Three validators - an education specialist, a material specialist, and a high school biology teacher - are given E-worksheet validity sheets to complete as part of the validation process. E-worksheet validation is carried out before being tested for media use by students. Response questionnaires are used to obtain data related to student responses to learning activities for membrane transport material. The questionnaire is in the form of questions related to aspects of E-worksheet and aspects of achieving science literacy indicators given and filled in by students after learning by using the developed E-worksheet. Filling out the questionnaire is done by selecting the option "Yes" if you agree or "No" if you do not agree to answer the questions provided based on student experience. The test uses multiple-choice questions and essays which are questions in the E-worksheet feature. The question is used as a measurement tool for the achievement of students' science literacy skill indicators.

Data analysis techniques

In this work, descriptive statistical analysis was used to analyze the data. Validation used a validity sheet with a Likert scale and the aspects assessed are aspects of presentation, content, and language. The score obtained is then calculated on average and calculated using the following formula:

$$validity\ (\%) = \frac{\sum score}{\sum maximum\ score}\ x\ 100\% \ldots\ldots\ldots\ldots (1)$$

In order to examine the validity of the E-worksheet, the validation findings from experts were utilized in conjunction with Riduwan's (2013) assessment criteria for score interpretation:

Table 1. Score interpretation criteria

Percentage Range (%)	Category
0-20	Not worth it
21-40	Less viable
41-60	Pretty decent
61-80	Proper
81-100	Very decent

Surveys of students' opinions were utilized to gauge how useful the E-worksheet was. Student response questionnaires given after learning using E-worksheet contain choices of "Yes" and "No" answer options, then calculated using Guttman scale guidelines.

Table 2. Guttman Scale

Answer	Score	
	Positive statement	Negative statement
Yes	1	0
No	0	1

Based on response questionnaire data, it can be known the percentage of practicality of E-worksheet, from the responses of students calculated using the following formula:

$$percentage\ (\%) = \frac{\sum\ score}{\sum\ maximum\ score}\ x\ 100\% \text{.....(2)}$$

Then the percentage data of the response questionnaire was analyzed using score interpretation with assessment criteria adopted from Riduwan (2013):

Table 3. Score interpretation criteria

Percentage Range (%)	Category
0-20	Impractical
21-40	Less practical
41-60	Quite practical
61-80	Practical
81-100	Very practical

If the average percentage achieved is more than 61%, the created E-worksheet is deemed practical and usable based on the proportion of response surveys.

Students' responses to assessment questions on an electronic worksheet are used to determine whether learning objectives are comprehensive. If the results of the cognitive learning tests meet the minimal completeness standard (KKM), which is ≥ 66, established by SMA Negeri 1 Dawarblandong, the analysis of the completeness of the student learning outcomes is said to be finished. The following formula is then used to determine the learning outcome:

$$grades = \frac{score}{maximum\ score}\ x\ 100\% \text{.....(3)}$$

Then the data on the completeness of learning outcomes were analyzed using score interpretation with assessment criteria adopted from Riduwan (2013):

Table 4. Score interpretation criteria

Percentage Range (%)	Category
0-20	Ineffective
21-40	Less effective
41-60	Quite effective
61-80	effective
81-100	Highly effective

The increase between the results before and after using E-worksheet is analyzed by the gain score method using the following formula:

$$N - Gain = \frac{before - after}{maximum - before}\ x\ 100\% \text{.....(4)}$$

This study was conducted to evaluate the improvement in science literacy as evidenced by improved learning outcomes both before and after the usage of the E-worksheet. The following score interpretation was used to examine the learning outcome improvement data:

Table 5. Gain Index Interpretation

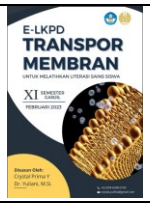
N-Gain score	Interpretation
-1,00 < g < 0,0	Decrease
g = 0,0	No increase
0,00 < g < 0,30	Low
0,30 < g < 0,70	Mid
0,70 < g < 1,00	High

RESULTS AND DISCUSSION

The development research that has been carried out is E-worksheet to train scientific literacy on valid, practical, and effective membrane transport materials. This E-worksheet is presented in the form of a digital flipbook in HTML format, designed in A4 paper size, uses Times New Roman font, and has detailed displays ranging from covers, introductions, features, and indicators, instructions for use, competency mapping, material concept maps, activities, summaries, and tasks. The stage of making an E-worksheet is carried out in Canva, then converted into PDF format, which is then converted into a flipbook with the Professional Flip PDF application.

The flipbook, which can finally be accessed via smartphone or PC / laptop online E-worksheet, has several features, namely Bio-Observe, Bio-Analyze, Bio-Info, Bio-Project, Bio-Report, and Evaluation. E-worksheet in its development is adapted to several skills and indicators of science literacy, including explaining phenomena scientifically, with indicators identifying phenomena and making and explaining hypotheses; evaluating and designing scientific investigations, with indicators of formulating questions and designing problem solution; and interpreting data and facts scientifically, with indicators analyzing data and drawing conclusions. The cover, features, and competencies of science literacy training are presented in Table 6.

Table 6. Display of Cover, Features, and Competencies of Science Literacy on E-worksheet

Number	Display	Description
Cover		
1		The cover of the E-worksheet is made with a simple display design. Dominated by colors indicating the name of the author, the material taught, and for what class E-worksheet is intended.
Features		
2	Bio-Observe	Presented as a means for students to identify phenomena for achieve skills in Explaining the phenomenon Scientific problems
3	Bio-Analyze	Presented literature study as a means for students to formulating questions for achieve skills of evaluating and designing scientific discoveries
4	Bio-Info	Presented material deepening the concept of membrane transport as a means for students to create and explain hypotheses to achieve skills in explaining scientific problem phenomena.
5	Bio-Project	Practicum activities are presented as a means for students to designing problem solution to achieve skills in evaluating and designing scientific discoveries
6	Bio-Report	Presented assignments as a means for students to analyze data and conclude to achieve skills in interpret data and evidence scientifically
7	Evaluasi	Evaluation is presented after the learning process by doing evaluation questions on the entire material

The validity of E-worksheet

The validity of E-worksheet was obtained from the results of E-worksheet validation carried out by 3 validators, namely two lecturers of Biology FMIPA Unesa who acted as educational expert lecturers and material expert lecturers, and one grade XI biology teacher SMAN 1 Dawarblandong. The validated components in E-worksheet include presentation feasibility, content feasibility, and language feasibility. The validation results obtained against the developed E-worksheet are presented in Table 7.

Table 7. The Result of E-worksheet Validation

No	Criteria	V1	V2	V3	Average (%)
1.	**Presentation**				
	Display quality	4	4	4	4
	E-worksheet page layout	4	4	4	4
	Suitability of fonts used in E-worksheet	4	3,75	4	3,91
	Color quality	3,75	3,75	4	3,83
Average		3,93			
Score interpretation (%)		98,25%			
Category		Very decent			
2.	Content				
	Breadth and correctness of the concept	3,75	4	4	3,91
	Learning aspects	3,75	4	4	3,91
	Task/practice aspect	3,75	4	4	3,91
	Aspects of Indicators of science literacy skills				
	a. Identifying phenomena	4	4	4	4
	b. Formulate questions	4	4	4	4
	c. Create and explain hypotheses	4	4	4	4
	d. Design / evaluate problem-solving	4	4	4	4
	e. Analyze data and draw conclusions	4	4	4	4
Average from the aspect of indicators of science literacy skills		4			
	Achievement of science literacy skills in each feature				
	a. Bio-Observe trains indicators identifying phenomena	4	4	4	4
	b. Bio-Analyze trains indicators to formulate questions	4	4	4	4
	c. Bio-Info trains indicators to create and explain hypotheses	3	4	3	3,33
	d. Bio-Project trains problem-solving design skills	4	3	3	3,33
	e. Bio-Report trains indicators, analyzes data, and draws conclusions	4	3	3	3,33
	f. Evaluation as a means of evaluation after the learning process	4	4	4	4
Average achievement of science literacy skills		3,66			

No	Criteria	V1	V2	V3	Average (%)
in each feature					
Average		3,87			
Score interpretation (%)		96,95%			
Category		Very decent			
3. Bahasa					
	Language use	4	4	4	4
	Language structure	3,75	3,5	3,75	3,67
	Use of terms	4	4	4	4
	Motivating and interactive skills	3,5	4	3,5	3,67
Average		**3,84**			
Score interpretation (%)		95,87%			
Category		Very decent			
Average of the overall aspect		3,88			
Score interpretation (%)		97%			
Category		Very decent			

Based on the results of E-worksheet validation in Table 7, an overall score of 3.88 was obtained which included aspects of the feasibility components of presentation, content, and language. The interpretation of the score obtained is 97% with a very decent category. The score obtained is an indication of an E-worksheet that has met the elements and requirements of a good E-worksheet. The elements of worksheet based on its technicality are composed of 6 elements, including the title on the cover, instructions for use, basic competence or material coverage, additional information to support the concept of the material, and tasks, questions, or work steps (Asmaranti, 2018). The validation stage needs to be carried out to determine whether E-worksheet is feasible or not to be used as a learning support because E-worksheet is a learning tool that has an important function in achieving a learning objective (Prastowo, 2015). In addition, the E-worksheet developed is also following scientific literacy competencies including explaining phenomena scientifically, evaluating and designing scientific investigations, and interpreting data and facts scientifically. Based on suggestions from the three validators on E-worksheet which were developed including improving writing following PUEBI, removing images that were considered less practical on E-LKPD, and changing the name of one of the features in E-LKPD.

The E-worksheet validation criteria itself are in accordance with the National Education Standards Agency (2017). The feasibility of teaching materials can be assessed from the feasibility of presentation, content, and language. The presentation aspect gets an average score of 3.93 with an interpretation score of 98.25% classified as very decent. The average did not reach a perfect or maximum score because there were still sub-aspects of color quality that are considered by validators to be lacking. This is because the color selection and color composition are considered less suitable and not contrasting, making the writing in the E-worksheet a little difficult to read. In order for students to grasp the tasks included in the E-worksheet, it is imperative that the layout and design be accurate while creating the E-worksheet. (Kurnia, 2019).

The content aspect obtained an overall rating of 3.87 and a very decent interpretation score of 96.95%. The feasibility of the content has 5 sub-aspects that are assessed, namely the breadth and correctness of concepts, learning aspects, aspects of tasks / exercises, aspects of indicators of science literacy skills, and the achievement of science literacy skills in each feature. All sub-aspects assessed by the three validators obtained very decent categories. This shows that the entire E-worksheet is in accordance with the concept of material applicable in the curriculum. This is in line with the Ministry of National Education (2008) which states that the teaching materials developed must adjust to the demands of the applicable curriculum. Based on the results of the content eligibility criteria, it can be stated that E-worksheet is in accordance with the concept of membrane transport material and can train science literacy with features that can support the training of science literacy skills. E-worksheet can be declared valid if it is following the truth of the concept, the material taught is following the goals to be achieved, and the activities in E-worksheet have been adjusted to the characteristics of the learning base used (Sari, 2018).

The linguistic aspect gets an average score of 3.84 with an interpretation score of 95.87% classified as very decent. Language feasibility has 4 sub-aspects assessed, namely language use, language structure, use of terms, and motivating and interactive abilities. The linguistic aspect did not get the maximum score, this is due to the low score obtained by E-worksheet in the sub-aspects of language structure and motivating and interactive skills due to the rudimentary use of PUEBI. This is following the statement that the language on the E-worksheet must be presented according to PUEBI and the sentence writing must be good and correct (Ahmadi et al, 2018).

The practicality of E-worksheet

Students' responses to surveys at SMAN 1 Dawarblandong reveal the usefulness or the effectiveness of the produced E-worksheet for teaching science literacy about membrane transport. Following the use of an electronic worksheet for learning, pupils are provided

with response surveys. Table 8 displays the findings of the data from the student response questionnaire.

Table 8. The Result of Student Response

No.	Aspects rated	Average	Category
1.	Presentation		
	The presentation of E-worksheet is interesting		
	Attractive cover design	100	Very practical
	The presentation of information in E-worksheet is interesting	100	Very practical
	Attractive E-worksheet layout	100	Very practical
	The color combination of the entire E-worksheet is not appropriate	100	Very practical
	The writing in E-worksheet is not clearly legible	100	Very practical
Average		100	Very practical
	The use of E-worksheet is easy		
	E-worksheet is easy to operate	96,67	Very practical
	Font style and size in E-worksheet are indistinguishable	100	Very practical
	The picture presented is not visible and illustrates the content of the material	100	Very practical
	The video presented is clearly visible and illustrates the content of the material	100	Very practical
	E-worksheet can be flipped back and forth easily	96,67	Very practical
	Video content can be clicked directly to youtube as a referral source	100	Very practical
	There are external links that connect directly to the internet	100	Very practical
	The use of bilingual (English) in E-worksheet is required	83,3	Very practical
Average		97,08	Very practical
Average (%) from the aspect of the presentation		98,54	Very practical
2.	Content		
	Ease to understand the material		
	The contents of E-worksheet are following the learning objectives	100	Very practical
	E-worksheet can increase knowledge about membrane transport material	96,67	Very practical
	The features in E-worksheet help in making it easier to understand the material	100	Very practical
Average		98,89	Very practical
	Conformity of indicators of science literacy		
	E-worksheet has activities to identify phenomena	100	Very practical
	This E-worksheet has activities to formulate questions	100	Very practical
	E-worksheet has activities to make and explain hypotheses	100	Very practical
	E-worksheet has activities to design problem-solving	100	Very practical
	E-worksheet has activities to analyze data and draw conclusions	100	Very practical
Average		100	Very practical
Average (%) from the aspect of the content		99,44	Very practical
Average (%) for overall		98,99	Very practical

Based on the findings of the student response surveys given out following the learning process utilizing the E-worksheet at SMAN 1 Dawarblandong, the viability of the E-worksheet to educate science literacy on membrane transport material for grade XI high school students was evaluated. There are 20 statements on the questionnaire that students must either answer "Yes" or "No." 30 students from class XI MIPA 3 SMAN 1 Dawarblandong responded to the survey.

Student response questionnaire data contains aspects of presentation and content with sub-aspects of presenting an interesting E-worksheet, easy use of E-worksheet, ease of understanding the material, and suitability of science literacy indicators. The sub-aspect of the E-worksheet presentation is interesting, getting an average percentage score of 100%. These results state that the E-worksheet has an attractive presentation with appropriate color combinations and legible writing. Good letter selection must pay attention to the level of readability, the more complicated the letters used, the more difficult it is to read and understand by students. If the readability of teaching material is not following the student's level of understanding, learning will be hampered (Susanti et al, 2021). Graphic design from cover to presentation and attractive worksheet layout can stimulate student motivation (Adi et al, 2021). This result is also supported by several indicators in the sub-aspect of using E-worksheet easily.

The sub-aspect of using E-worksheet easily gets an average percentage score of 97.08%. This sub-aspect gets the lowest percentage compared to other sub-aspects, this is because many respondents expressed disagreement with the indicator of English use because it was considered difficult to understand. Afridayanti and Azizah (2020) noted that imprecise words or

explanations can make it difficult for teachers to teach the content and for students to fully understand the concepts they have learnt. The presenting aspect receives an average rating of 95% with a highly practical category based on these two sub-aspects. While the average score for the content component is 98.3%. E-worksheet has a 96.65% average, which is regarded as being very practical.

The effectiveness of E-worksheet

Based on the accuracy of the learning outcomes of SMAN 1 Dawarblandong students as determined by the comparison between odd semester grades and evaluation test result scores, the efficacy of the created E-worksheet is evaluated. The test is given once after the E-worksheet trial. The increase between the results of the value before and after using E-worksheet was then analyzed using the gain score method. Six multiple-choice questions and an essay make up a test used to gauge students' science literacy. Figure 1 below contains the completeness value of student learning outcomes before the E-worksheet trial and after the E-worksheet trial.

Table 9. Learning Outcomes Completeness Value Data

Respond e-nts	Before		After		N-Gain	Cate-gory
	Sco-re	Criteria	Sco-re	Criteria		
01	70	P	88	P	0,6	Mid
02	70	P	100	P	1	High
03	60	F	88	P	0,7	High
04	60	F	76	P	0,4	Mid
05	50	F	76	P	0,52	Mid
06	70	P	100	P	1	High
07	80	P	88	P	0,4	Mid
08	80	P	88	P	0,4	Mid
09	80	P	100	P	1	High
10	60	F	88	P	0,7	High
11	70	P	100	P	1	High
12	80	P	88	P	0,4	Mid
13	60	F	76	P	0,4	Mid
14	60	F	100	P	1	High
15	70	P	100	P	1	High
16	80	P	100	P	1	High
17	60	F	76	P	0,4	Mid
18	70	P	100	P	1	High
19	80	P	88	P	0,4	Mid
20	70	P	100	P	1	High
21	80	P	100	P	1	High
22	60	P	88	P	0,7	High
23	60	F	76	P	0,4	Mid
24	60	F	72	P	0,3	Mid
25	80	P	100	P	1	High
26	70	P	88	P	0,6	Mid
27	60	F	100	P	1	High
28	80	P	100	P	1	High
29	60	F	88	P	0,7	High
30	70	P	76	P	0,2	Low
Average	68,6		90,2		0,7	
Complete-ness (%)	60%		100%			
Interpreta-tion	Quite effective		Highly effective		High	

Note:

P : Passed
F : Failed

The data on the completeness of learning outcomes presented in Table 6 shows that the completeness of learning outcomes before using E-worksheet in 30 grade XI students of SMAN 1 Dawarblandong received a percentage of class completeness of 60% with the interpretation category being quite effective. The percentage of class completion for the learning outcomes after utilizing the E-worksheet was 100%, with the category for extremely successful interpretation. The attainment of the science literacy indicators in the E-worksheet shown in Figure 1 below is another way to evaluate a student's proficiency in science.

Fig 2. Recapitulation of the Results of the Achievement of Science Literacy Indicators before and after using E-worksheet

Note:

A : Identifying phenomena
B : Formulate questions
C : Create and explain hypotheses
D : Design problem solving
E : Analyze data and draw conclusions

The effectiveness of E-worksheet to train science literacy on membrane transport material for grade XI high school students is seen from the completeness of student learning outcomes as measured by evaluation questions in E-worksheet. The evaluation questions consist of 6 multiple-choice questions and essays containing science literacy components according to PISA 2015. Data on the completeness of learning outcomes is obtained after the learning process using E-worksheet. Students are declared passed if they get a score of ≥ 66. Before using E-worksheet, out of 30 students, 18 students were declared passed, while 12 students were declared failed. The failure of the 11 students was due to several reasons, including students who did not listen to the teacher's explanation, and also students who did not understand the concept of the material. During learning, of course, teachers are still very necessary in interacting with students where teachers are facilitators and evaluators of student understanding so that teacher functions remain influential in learning outcomes (Muzenda, 2013).

According to the information in Table 4.5 on the completeness of learning outcomes, students typically scored 68.6 out of a possible 100 before utilizing an E-worksheet, representing a student completion rate of 60%, placing them in the category of highly successful. This demonstrates the low-level of student learning outcomes. Because students lack appropriate background knowledge of membrane transport material, the issue of diffusion, and osmosis, there are still misconceptions about the subject matter, which is the reason of the low percentage of student completion. According to the claim that a concept error is one of the errors students make (Suroso, 2016). With a student completion rate of 100% and an average score of 90.2, E-worksheets fall into the category of being extremely effective with students.

Judging from the results of the gain score, the average gain score of students is 0.7 which is classified as high. This shows that E-worksheet is effectively used in learning to train science literacy. This can happen because the evaluation questions used, in addition to being adjusted to basic competencies, are also adjusted to scientific literacy indicators, in addition to evaluation questions are also in the form of equivalent questions and have cognitive levels C4 – C6 which are included in the HOTS (high order thinking skills) category. The evaluation questions have also been validated by three expert validators before being used in limited trials.

The results of the attainment of science literacy indicators demonstrate improvement, as shown in Figure 4.1. Before using E-worksheet, the indicators of learners' science literacy skills varied from low to quite high. Low science literacy of students can be caused by a learning system that does not support training in science literacy, concepts that have not been obtained, and students tend to do problems in rote form. Students' inadequate science literacy can be attributed to a learning system that does not promote science literacy training, ideas that have not been attained, and students' propensity to perform questions by heart. (Arief, 2015). In addition, learning Biology rarely invites students to analyze concepts based on scientific data (Nofiana and Julianto, 2017).

The achievement of students' science literacy indicators increased after learning using E-worksheet. The achievement of students' science literacy indicators increased after learning using E-worksheet. The indicator formulates questions with competency indicators analyzing the difference between passive transport and active transport getting the lowest score, both before and after using E-worksheet. This is due to the lack of practicum activities for students. Experimentation activities, scientific skills training, and scientific use of science facts are still rarely carried out at the core of learning (Setiadi, 2014). Indicators identify phenomena; indicators analyze data and draw conclusions, get the highest score. Competency indicators for both indicators of science literacy are linking membrane transport with daily life and compiling reports on practicum results and conclusions. The high score is obtained because students already can identify and analyze which is quite high before using E-worksheet. However, overall, the achievement of science literacy indicators increased dramatically after using E-worksheet. Thus, it is clear that E-worksheets can help students develop their science literacy abilities. This is consistent with Kusuma's (2015) assertion that students' scientific literacy skills increase in direct proportion to the quality of their academic performance. And it may be inferred from study findings that using an electronic worksheet is valid, useful, and successful for teaching.

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CLOSURE

Conclusion

Based on the findings of the research, it has been determined that the E-worksheet is legitimate, useful, and efficient for teaching scientific literacy about membrane transport materials. The validity of the E-worksheet of 97% is classified as very feasible. The practicality of the E-worksheet of 98.99% is classified as very practical. Effectiveness based on the results of the science literacy skills test of students who have increased with an N-gain score range of 0.70 (high) and student learning completeness results of 100% is classified as very effective.

Suggestion

The development of an E-worksheet to train science literacy can be implemented in other biological topics in order to effectively train students' science literacy, according to the researchers' recommendations based on the analysis of the data and conclusions.

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