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Article

Developing Electronic Student Worksheet (E-Worksheet) Based Project Using *Fliphtml5* to Stimulate Science Process Skills During the Covid-19 Pandemic

Ferdie Febriansyah¹, Kartini Herlina^{2*}, I Dewa Putu Nyeneng³, Abdurrahman⁴^{1,2,3,4} *Department of Physics Education, University of Lampung, Indonesia**Corresponding Address: kartini.herlina@kip.unila.ac.id

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ABSTRACT

This research aims to develop a worthy (in terms of validity and practicality) Electronic Student Worksheets (E-Worksheet) based project using *FlipHTML5* in light interference topic. E-Worksheet developed to stimulate student's science process skills. This research used design and development research (DDR) which consisted of 4 stages, namely analysis, design, development, and evaluation. The results of the product validity were assessed by experts consisting of two high school physics teachers and a lecturer from the physics education department of the University of Lampung who got an average score of 3.56 with the very valid category. The E-Worksheet practicality in terms of the legibility, the student views that was completed by 9 students, and the teacher views that was completed by 5 high school physics teachers got an average percentage of 90% with the very practical category. These results showed that E-Worksheet were valid and very practical to stimulate student's science process skills. Based on teacher views, the E-Worksheet is very possible to be implemented in online and face-to-face learning especially in the covid-19 pandemic era. The E-Worksheet can be used as multimedia to support online learning.

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INTRODUCTION

21st-century skills must be mastered by students to take a role in education as a provision to enter the world of work in the future. There are 18 kinds of 21st-century skills which are divided into three that need to be provided to students, namely learning and innovation skills including critical thinking and problem solving, communication and collaboration, creativity and innovation; digital literacy skills include information literacy,

media literacy, information and communication technology (ICT) literacy; career and life skills: flexibility and adaptability, initiative and self-direction, social and cross-cultural interaction, productivity and accountability. However, among them, the aspects of Learning and Innovation Skills-4Cs, namely critical thinking, communication, collaboration, and creativity, are the most important skill aspects that students must master at the primary to secondary education levels (Roekel, 2002) and it can be trained through science process skills (Turiman et al., 2012). There are several indicators to train students' science process skills at the high school level including defining the problem, hypothesizing, determining the variables, fair testing, collecting data, presenting data, and explaining the results (Aktamis & Ergin, 2008).

Information and communication technology currently plays an important role in education. Effective technology integration in education is a technology tool that can be used and integrated into the teaching and learning process to improve meaningful learning (Keengwe and Georgina, 2012). E-learning has shifted conventional learning in the era of the industrial revolution 4.0 where the IoT (Internet of Things) plays an important role in everything (Pangondian, Santosa, and Nugroho, 2019) and in particular, the lockdown period due to the Covid-19 pandemic (Radha et al., 2020). Many of the benefits obtained include learning that is not constrained by time and space.

Students reveal that they find topics such as optics was difficult to understand for students who have not learned how to apply knowledge in new and real-life situations (Camarao & Nava, 2017). Especially in light interference topic that is difficult for students to found the concept. Many students cannot apply the wave model to explain interference after the teacher explains traditionally (lecture) (Ambrose et al., 1999). Experiment activity can help students learn to do the types of qualitative reasoning that can make physics meaningful to them and build a basic knowledge for quantitative problem solving (Wosilait et al., 1999). Worksheets can be used by teachers to understand students' previous knowledge, learning outcomes, and the learning process; at the same time, they can be used to enable students to monitor the progress of their learning (Lee, 2014).

Project-based learning is complex learning where students are required to exchange ideas, make predictions, make decisions, work in groups, give students the freedom to design a product, and present ideas and findings to others (Blumenfeld *et al.* 1991). Project-based learning builds learner-driven paradigms where the problem can "lead" them to the core concepts of a particular subject. This project should carry out a constructive inquiry of learners whereas this includes the inquisition, decision making, and resolution of the learners. Implementation of project-based learning in the classroom, the teacher acts as a facilitator, not as a subject matter expert. In facilitating students, the continuous discussion between teachers and students plays a major role. Besides, projects are usually complex in nature and tend to have challenging tasks that require learners to solve problems. Therefore, teachers must facilitate students in completing complex tasks (Jumaat *et al.*, 2017). Learning with project work in the form of teaching aids is learning with the limitations of student-centered laboratory equipment. This is important and beneficial for students to develop three realms of learning, namely; cognitive, affective, and psychomotor. Many skills can be obtained from these activities, including the skills of observation, measurement, classification, data recording, making hypotheses, using data, and gaining the ability to create, change and control variables, and conduct scientific experiments (Sumarni, Wardani, & Gupitasari, 2016).

In this era of technological developments, most students are more interested in teaching materials that utilize other media such as computers/laptops, even smartphones compared to teaching materials in the form of printed worksheets (Haryanto *et al.*, 2019). E-Worksheet according to Haryanto, Asrial, & Erawati (2020) can help and facilitate teaching and learning

activities so that effective interactions will be formed between students and teachers so that can increase student activity in improving learning outcomes. Besides, the use of e-worksheets has the potential to change the views of students to read and consume interactively and comfortably, where e-worksheets have pictures, narratives, and graphics. Online flipbook is an interactive online publication with a page-turning effect, converted from PDF via the FlippingBook software. Flipbooks created through FlippingBook are also suitable for education, and especially for distance learning (Makasheva, 2020).

Needs analysis was carried out by distributing online questionnaires and semi-structured interviews. Based on a questionnaire that was shared online to 20 students from 3 different schools, it was found that 59.1% of students had never used light interference worksheet/E-Worksheet, as many as 63.6% of students were taught light interference material by the teacher using textbooks, and as many as 52.4% of students did not understand the light interference material. Then, semi structured interviews were also conducted with several high school physics teachers in Lampung regarding how to deliver light interference topics in schools. Among them, teachers in general still use the lecture method and also do not have an optical KIT (which contains worksheet/E-Worksheet) so experiment activities have not been implemented in delivering interference topics so that students' SPS have not been trained yet. This underlines the importance of stimulating students' SPS through an E-Worksheet-based project using *FlipHTML5*. E-Worksheet was chosen as one of the learning media because of the demands of the Covid-19 pandemic which requires online learning. The Corona Virus Disease (covid-19) outbreak which hit more than 200 countries in the world, has presented challenges for educational institutions to innovate by learning online (in a network) (Jamaluddin *et al.*, 2020).

Overall, the results of needs analysis show that learning about light interference material in several high schools is generally only done by lecturing methods and there is no E-Worksheet available, even though according to Yildirim, Kurt, & Ayas (2011) explain that worksheet causes students to actively participate in learning activities. Besides, in general, some high schools also never carry out light interference practicum activities, so that students' SPS are also not trained yet, even though SPS can be trained with open experiments (Aydogdu, Buldur, & Kartal, 2013). The gaps in problems and expectations were used as the basis for researchers to develop an E-Worksheet-based project using *FlipHTML5* to stimulate students' science process skills that can be used as an alternative online learning media during the Covid-19 pandemic.

Based on needs analysis that has been done known that learning physics on the topic of light interference requires supporting media in the form of worksheet/E-Worksheet to help students find the concept of light interference topic easily and improve science process skills. Then, the current covid-19 pandemic condition requires online learning. Therefore, the researcher developed an electronic student worksheet (E-Worksheet) based project using *FlipHTML5* to stimulate students' science process skills.

METHODS

This study used Design and Development Research (DDR) by Richey & Clients (2007) which consisted of analysis, design, development, and evaluation stages. An analysis is the first stage in development research. The activity carried out was a needs analysis in several schools in Lampung. The needs analysis was carried out by interviewing and filling out a questionnaire to class XI students and teachers. Needs analysis is carried out to determine the potential and problems at the school. The information obtained based on the needs analysis becomes the basis for researchers to conduct research. Needs analysis is carried out to explore information about the learning model used, the use of worksheets in learning, the skills trained, the availability of KIT Optics, the implementation of practicum activities, and

the assessment of student learning outcomes in the skills aspect. Then, the data obtained in this preliminary study were analysed and used as the basis for the research to be carried out.

The second step of this development research designs. At this stage, the e-worksheet framework is designed. Products are made based on the needs analysis that has been carried out and the indicators to be achieved, namely project-based e-worksheet to stimulate science process skills. The e-worksheet developed is for XI grade science semester 2 in light interference topic. At this stage, it is carried out to design Electronic Student Worksheet (E-Worksheet) Based Project Using *FlipHTML5*. The following is the content outline for the e-worksheet and the e-worksheet storyboard.

The development stage is the stage of product development following the designs that have been made at the design stage. The development stage will produce a series of e-worksheet. The product developed was validated by a validator, consisting of 1 physics education lecturer at the University of Lampung and 2 high school physics teachers. The validator performs product validation which consists of material and constructs as well as media and product design. If it has been declared valid or appropriate, the practicality of the e-worksheet can be carried out consisting of legibility, teachers views, and students views. It was carried out to know the level of understanding of students, knowing the teacher's views of whether e-worksheet was possible to be implemented/applied to learning during the Covid-19 pandemic or directly later, and knowing the response of students regarding things obtained after working on e-worksheet.

The last stage is evaluation. Evaluation is carried out at each stage of project-based e-worksheet development to perfect the product by making revisions based on suggestions for improvements or input from experts and students. Evaluation is carried out to identify the success of the product so that it can be said to be valid and practical.

The instruments used in this study were interview guidelines, needs analysis questionnaires, validation questionnaires, practicality questionnaires (that consist of legibility, students' views, and teacher's views), and science process skills assessment sheets. Validation and practicality data were scored using a Likert scale adapted from Ratumanan & Laurent (2011: 131) and the science process skills assessment sheet uses the science process skills rubric adapted from Nur (2011). The interview guide is question and answer activity conducted by researchers to respondents to obtain information about matters related to their research. Researchers conducted interviews with physics teachers and high school students about learning light interference and the availability of media as a support for the learning process. A needs analysis questionnaire in the form of a list of questions given to respondents to get information from respondents about a problem. Filling in a questionnaire was carried out to determine the difficulties of students in learning interference material, the use of e-worksheet in learning, the learning model used by the teacher, and the availability of optical KIT.

The validation questionnaire is used to determine the validity level of a project-based e-worksheet so that it can provide information that it is valid or not used as a teacher companion in learning activities. This questionnaire was given to three experts. The validity questionnaire contains the media and design & the material and construct. The practicality questionnaire consisted of 3 questionnaires, namely a student legibility questionnaire on a project-based e-worksheet, a teacher's views questionnaire, and a students' views questionnaire. Legibility questionnaire is used to determine the level of ease of students to understand the content of the e-worksheet. Teacher's views questionnaires are used to determine the level of product implementation to be implemented during the Covid-19 pandemic and face-to-face. Filling in this questionnaire also aims to determine the level of product implementation so that later it can be used by the teacher as a learning medium.

Student response questionnaires are used to determine students' responses after working on a project-based e-worksheet using FlipHTML5.

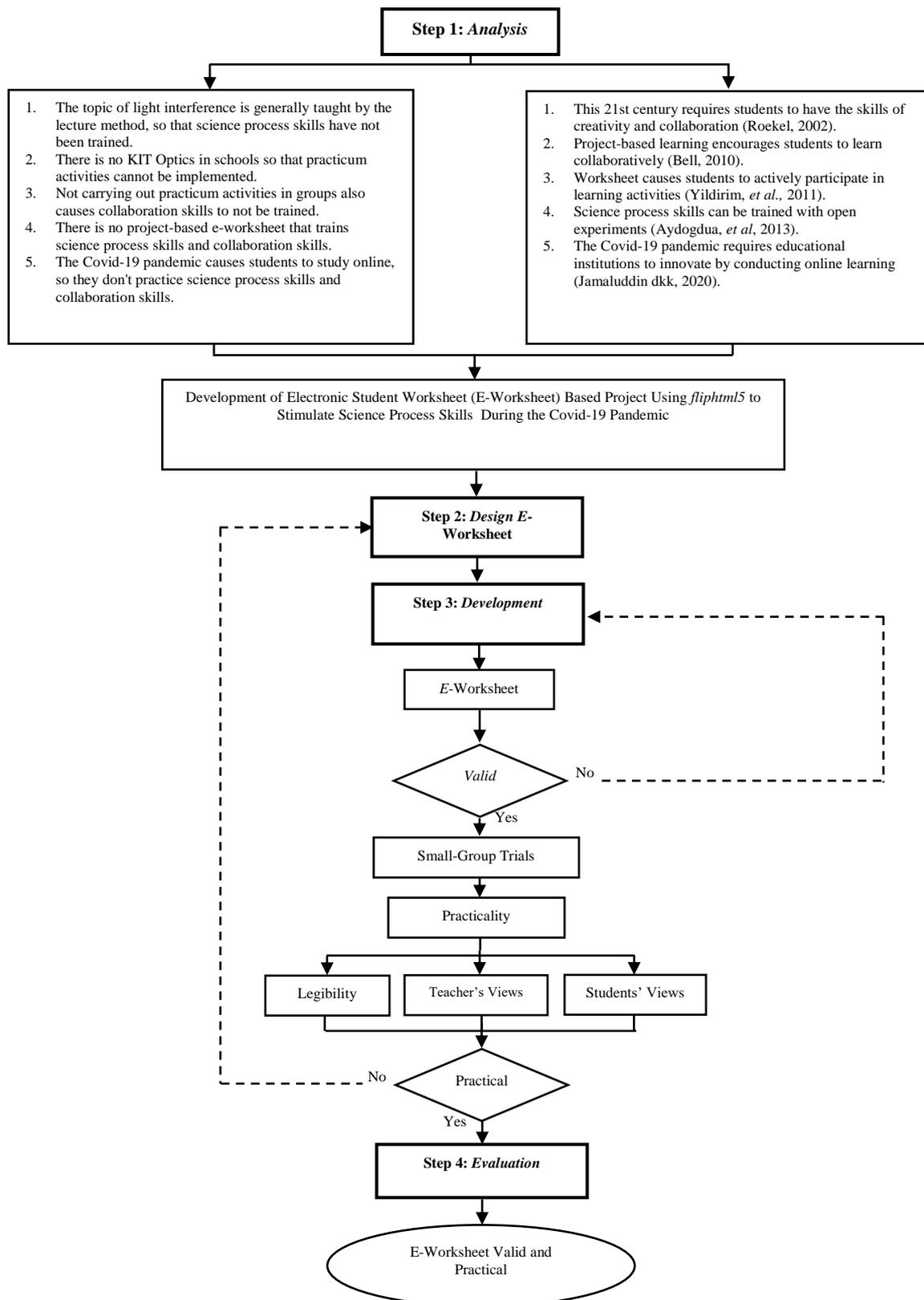


Figure 1. Research Flowchart

Table 1. Likert Scale on the E-Worksheet Validation Questionnaire

Percentage	Criteria
Very valid	4
Valid	3
Less valid	2
Invalid	1

Table 2. Likert Scale on the Practicality Questionnaire

Percentage	Criteria
Very good	4
Good	3
Not good	2
Not good	1

The data analysis of this development research uses mixed methods, namely qualitative and quantitative with the following data analysis techniques.

E-Worksheet validation data were analyzed using percentage with the following equation:

$$p = \frac{\text{average score}}{\Sigma \text{Total}} \quad (1)$$

The result of the score (p) is converted into a category that adapts from Ratumanan & Laurens (2011) as in Table 3.

Table 3. Validation Score Conversion

Interval Score Result of Assessment	Criteria
3.25 <score <4.00	Very Valid
2.50 <score <3.25	Valid
1.75 <score <2.50	Less Valid
1.00 <score <1.75	Invalid

Practicality (that consist legibility, students' views, and teacher's views) data were analyzed using percentage adapted from Sudjana (2005).

$$\%p = \frac{\text{score}}{\Sigma \text{Total}} \times 100\% \quad (2)$$

The result of the score (p) is converted to a category that as in Table 4.

Table 4. Practicality Score Conversion

Interval Score Result of Assessment	Criteria
0.00% -20%	It's not practical
20.1% -40%	Less practical
40.1% -60%	Pretty practical
60.1% -80%	Practical
80.1% -100%	Very practical

The data for the assessment of the stimulus for science process skills (SPS) are processed using the equation adapted from Arikunto (2011: 34) below.

$$NP = \frac{\Sigma}{\text{indicator maximum score}} \times 100\% \quad (3)$$

The result of the score (p) is converted to a category as in Table 5.

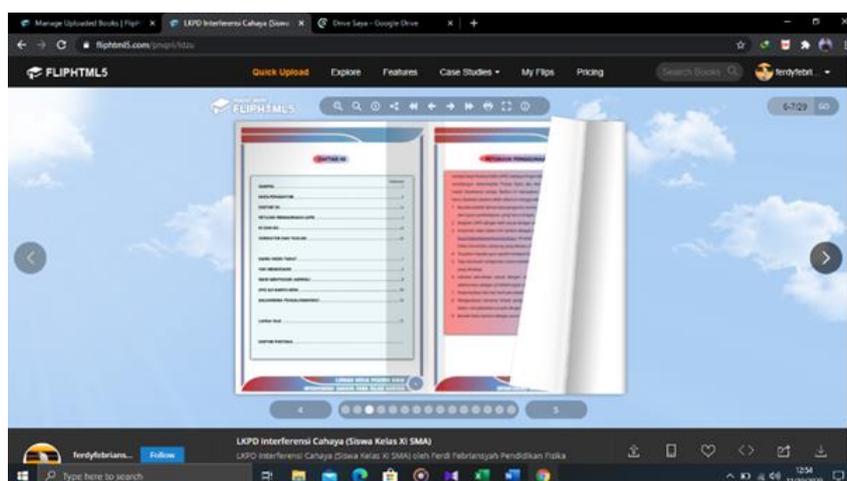
Table 5. Conversion of SPS Stimulus Assessment Score

Interval Score	Result of Assessment	Criteria
0.00% -20%		Not good
20.1% -40%		Not good
40.1% -60%		Pretty good
60.1% -80%		Good
80.1% -100%		Very good

RESULTS AND DISCUSSION

This research presents a solution to stimulate students' science process skills (SPS) during a pandemic *Covid-19* through an E-Worksheet-based project using *FlipHTML5*. Based on the research conducted, the following results were obtained. The first research results are at the needs analysis that has been explained in the introduction. At this stage, problem identification was carried out by distributing online questionnaires and semi-structured interviews. Overall, the results of needs analysis show that learning about light interference material in several high schools is generally only done by lecturing methods and there is no E-Worksheet available, even though according to Yildirim, Kurt, & Ayas (2011) explain that worksheet causes students to actively participate in learning activities. Besides, in general, some high schools also never carry out light interference practicum activities, so that students' SPS are also not trained yet, even though SPS can be trained with open experiments (Aydogdu, Buldur, & Kartal, 2013). The gaps in problems and expectations were used as the basis for researchers to develop an E-Worksheet-based project using *FlipHTML5* to stimulate students' science process skills that can be used as an alternative online learning media during the Covid-19 pandemic.

Next, the design stage. At this stage, the E-Worksheet design is made based on a project which contains several project design activities with an attractive design. The E-Worksheet-based project design was made with help of Microsoft Word and Corel Draw applications to design the cover and layout. Then, the completed E-Worksheet design is uploaded on the *FlipHTML5* web.

**Figure 2.** Display of E-Worksheet using *FlipHTML5*

This E-Worksheet-based project consists of 3 parts, namely the initial part consisting of cover, foreword, table of contents, instructions for use, core competencies, basic competencies, indicators, and learning objectives. Next, the content section contains learning activities which include 5 project design activities. The end (closing) contains practice questions and a bibliography.

Then, the development stage. At this stage, E-Worksheet's validation and practicality were carried out as well as an assessment of the students' SPS stimulus. The results of the validation which consisted of material and construct aspects as well as media and design showed an average of 3.56 which was qualitatively very valid. This shows that the quality of the material, construct, media, and design of the E-Worksheet developed is very good.

Table 6. E-Worksheet Validation Results

No.	Rated aspect	Average Score of Examiners	Category
Material and Construct Aspects			
1.	Suitability of Material Content	3.55	Very Valid
2.	Construction	3.67	Very Valid
Media and Design Aspects			
1.	Cover section	3.52	Very Valid
2.	Contents section	3.50	Very Valid
Average		3.56	Very Valid

Then, the results of practicality which consisted of legibility tests, students' views, and teacher views obtained an average percentage of 88,75% with the very practical category. Legibility questionnaires are given to students in the form of google form which consists of 11 statements and 4 rating scales, namely (1) not good, (2) not good, (3) good, and (4) very good. Students' views questionnaires consist of 5 aspects that must be answered by students via a Google form. Then, there were also 20 student response questionnaire statements with 4 rating scales from bad to very good. Then, the teacher's views questionnaire was given to five high school physics teachers. The teacher's views questionnaire consists of five learning activities in an e-worksheet in which 18 aspects are assessed on a 4 scale from not good to very good.

Tabel 7. Results of Legibility Questionnaires

No.	Statement	Jumlah Skor per pernyataan	Skor Maksimal	Persentase	Category
1.	The e-worksheet structure is arranged in a systematic/sequential manner so that it is easy for me to understand.	33	36	92%	Very Good
2.	The space, type, and font size of the e-worksheet are suitable and comfortable to read.	34	36	94%	Very Good
3.	The layout of the e-worksheet is good and ideal so that I can easily read the content.	35	36	97%	Very Good
4.	The language used in the e-worksheet is generally easy to understand.	33	36	92%	Very Good

No.	Statement	Jumlah Skor per pernyataan	Skor Maksimal	Persentase	Category
5.	The manual guide for the e-worksheet was clear and easy for me to understand.	31	36	86%	Very Good
6.	The commands or questions presented in the e-worksheet are clear so that they are easy for me to understand.	29	36	81%	Very Good
7.	The steps in the e-worksheet are easy to understand.	34	36	94%	Very Good
8.	The e-worksheet presentation is equipped with pictures/illustrations and video links so that it helps me understand the topic.	34	36	94%	Very Good
9.	The phenomena presented in the e-worksheet are easy to understand.	33	36	92%	Very Good
10.	The figure equipped in the e-worksheet can be observed clearly and well.	36	36	100%	Very Good
11.	The exercise questions are equipped with pictures or tables so that they are easy for me to understand.	32	36	89%	Very Good
Total		364	396		
Overall average percentage				92%	Very Good

Tabel 8. Result of students' views

No.	Statement	Total score per statement	Maximum Score	Percentage	Category
1.	I feel comfortable using the computer/smartphone.	31	36	86%	Very Good
2.	I am very skilled at using basic computers/smartphones.	28	36	78%	Good
3.	My internet access skills are sufficient for web-based learning.	30	36	83%	Very Good
4.	I feel comfortable learning via computer/smartphone in online learning.	28	36	78%	Good
5.	I feel comfortable communicating and sharing information with friends and teachers online.	29	36	81%	Very Good
6.	I can search and access information from various sources.	34	36	94%	Very Good
7.	I can develop my problem-solving skills.	29	36	81%	Very Good
8.	Project-based learning can improve my understanding.	29	36	81%	Very Good
9.	My ability to apply what I have learned has increased.	29	36	81%	Very Good

No.	Statement	Total score per statement	Maximum Score	Percentage	Category
10.	My ability to analyze data has improved.	30	36	83%	Very Good
11.	I can share my ideas clearly in the group during the discussion.	30	36	83%	Very Good
12.	I can listen to the different perspectives and points of view of my group members and keep an open mind with their views.	32	36	89%	Very Good
13.	I do my fair share of work in my group.	32	36	89%	Very Good
14.	I can learn new things during problem-solving.	31	36	86%	Very Good
15.	I am actively involved in learning activities with group members.	31	36	86%	Very Good
16.	I am more interested in using simple materials to make simple physics props.	31	36	86%	Very Good
17.	I am more interested in relating phenomena in everyday life with the concept of physics.	31	36	86%	Very Good
18.	Project-based learning using e-worksheet affected my science process skills.	32	36	89%	Very Good
19.	Project-based learning using e-worksheet affects my collaboration skills.	31	36	86%	Very Good
20.	Project-based learning using an e-worksheet is suitable for light interference topics.	34	36	94%	Very Good
Total		612	720		
Overall average percentage				85%	Very Good

Tabel 9. Result of teacher's views

Learning Activity	Total Score per statement	Maximum Score	Percentage	Category
Activity 1 (Defining Questions)	57	60	95%	Very Good
Activity 2 (Project Design)	149	160	93%	Very Good
Activity 3 (Schedule Maintenance)	19	20	95%	Very Good
Activity 4 (Testing Results and Assessment)	107	120	89%	Very Good
Activity 5 (Evaluation and Reflection)	69	80	86%	Very Good
Total Score	401	440		
Overall average percentage			92%	Very Good

Table 10. E-Worksheet Practicality Results

No.	Rated aspect	Average Score of Examiners	Category
1.	Legibility	92%	Very good
2.	Students' views	82,25%	Very good
3.	Teacher's views	92%	Very good
Average		88,75%	Very Practical

The result of the legibility questionnaire is that the average percentage is 88,75% with the very good category. This shows that the E-Worksheet developed can be easily understood by students. Then, based on the students' views, the students as a whole expressed their opinion that the e-worksheet they were working on played a role in making it easier to understand the topic of light interference because there were phenomena and video links in it and there was also guidance to make projects & practical work directly with the group. So it can be said that the average percentage is 100%. Then, 7/9 students were able to improve their science process skills after working on the e-worksheet, although only a few mentioned specifically which indicators had improved the most. Therefore, the average percentage was 78%. Besides, all students also indicated that their collaboration skills were better even though only 3 out of 9 students mentioned specific reasons. So it can be said that the average percentage is 66%. Then, for the response of students to additional aspects regarding things obtained after working on the e-worksheet the average percentage is 85%. Overall, the average percentage of students' responses was 82.25% with the very good category. This shows that the e-worksheet developed is useful for students to make it easier to understand the topic of light interference and can also train science process skills.

Then, the average percentage obtained from filling out the questionnaire by the teacher was 92% with the very good category. Based on the results of teacher perceptions, the e-worksheet developed can be used in learning during the Covid-19 pandemic, as well as face-to-face. Based on the results of the practicality which consisted of 3 aspects, namely legibility of 92%, students' views of 82.25%, and teacher's views of 92%, the overall average percentage was 88.75% with a very good category. This shows that the product being developed is very practical.

After that, the students' SPS assessment was carried out. The students' SPS assessment was carried out by providing an E-Worksheet-based project using *FlipHTML5* access link through the Whatsapp group to do it. Students are asked to do it in groups and ensure that when working on E-Worksheet they must be connected to the internet because participants' answers are submitted via a google form. The achievement of students' SPS indicators was analyzed based on indicators from Aktamis & Ergin (2008). The results of the assessment of students' answers show that the students' science process skills have been stimulated based on the E-Worksheet-based project answers given.

Table 11. Students' SPS Assessment Results

No.	SPS Indicators	Rated Aspect	Total Score	Maximum Score	%	Average %
1.	Formulating Problems	a. Finding Problems	27	27	100%	99%
		b. Make Predictions	27	27	100%	
		c. Formulating Problems	34,5	36	96%	
2.	Making Hypotheses	Making Hypotheses	36	36	100%	100%
3.	Defining Variables	Defining Variables	36	36	100%	100%
4.	Hypotheses test	a. Make a List of Tools and Materials	12	27	44%	69%
		b. Designing Experimental Procedures	42	45	93%	
5.	Presenting Data	a. Presenting Experiment Result Data in Table	45	54	83%	73%
		b. Analyzing Data and Discussion	28,5	45	63%	
6.	Presenting Results	Making Conclusions	27	36	75%	75%
Overall average percentage						86%

Based on the results in Table 11, it is known that the average achievement score of the students' SPS indicator was 86% with the very good category. This shows that the E-Worksheet-based project using *FlipHTML5* developed can be used by teachers or educators to stimulate students' SPS during the Covid-19 pandemic, especially on light interference topics. According to Subali (2011), science process skills are performance skills that contain aspects of cognitive skills, namely intellectual skills that are the background for mastery of science process skills and sensorimotor skills. Thus, the measurement of mastery of science process skills includes cognitive skills that can be measured using written tests. This is also reinforced by the theory of learning by doing which is based on the assumption that students are best at learning when they are personally involved in learning experiences and knowledge must be found by individuals so that learning becomes more meaningful (Smith, 1980: 16). In this study, the students' work on E-Worksheet included a written test, because it contained indicators of science process skills. Therefore, students' science process skills can be measured or stimulated.

The last stage of this development research is evaluation (evaluation). This evaluation is carried out at each stage of the development procedure, namely at the analysis, design, and development stages. Besides, an overall evaluation was also carried out on the E-Worksheet product developed for 5 high school physics teachers. Evaluation at the analysis stage adds a statement aspect to the needs analysis questionnaire. Evaluation at the design stage should use authentic and easy-to-understand library sources as well as an easy-to-use and interactive platform so that E-Worksheet becomes an attractive and effective learning medium to use. Evaluation at the development stage is the E-Worksheet validation. In the validation, the E-Worksheet was corrected based on suggestions for improvement from the expert. Based on the results of the teacher's view of the developed E-Worksheet, 3 out of 5 teachers stated that the E-Worksheet developed was good and could be used in online and offline learning. Meanwhile, 2 other teachers stated that the project in the E-Worksheet was good, but it took time to complete during this pandemic and needed to be adjusted to basic competencies so that the demands of basic competencies could be achieved. Through evaluation and improvements that have been made at each stage, this research has produced a valid and practical product in the form of an E-Worksheet based project using *FlipHTML5* to stimulate

science process skills and collaboration skills to be used during the Covid-19 pandemic and normal teaching and learning activities.

Based on the development stages that have been carried out, E-Worksheet developed plays an important role in online learning in the covid-19 pandemic. Research conducted by Haryanto, Asrial, & Erawati (2020) also developed E-Worksheet. The application used is *Kvisoft Flipbook Maker*. Accessing E-Worksheet by students requires a PC/laptop because the export results of it in the *Kvisoft Flipbook Maker* application do not yet support Android devices. This of course can be an obstacle, because not all students have a PC/laptop. Furthermore, research conducted by Apriyanto, Yusneli, & Asrial (2019) also developed E-Worksheet with the *3D Pageflip Professional* application. Accessing the exported E-Worksheet can use an android device, but requires additional applications to access it. Based on previous studies, the researcher decided to use the *FlipHTML5* web-based platform.

Accessing E-Worksheet through the *FlipHTML5* platform is very easy for students. Students only need to access the link provided by the teacher through a browser on their gadget. Besides, *FlipHTML5* also makes it easier for teachers if they want to create multimedia online due to the demands of online learning during the Covid-19 pandemic. This is because it doesn't take long to create this web-based E-Worksheet. The teacher only needs to prepare a pdf of the worksheet file then upload it on the *FlipHTML5* web, then it can be edited by adding an attractive design and the link can be distributed directly to students to access it. Thus, the E-Worksheet assisted by *FlipHTML5* developed by researchers played an important role in supporting online learning during the Covid-19 pandemic. Other than that, during a pandemic, which requires students to study at home, making projects can use used materials that are around. This is in line with the opinion (Sumarni, Wardani, & Gupitasari, 2016) that practicum with limited laboratory equipment can be done by making other teaching aids made of used materials.

Based on the development research that has been completed, the researcher provides suggestions for doing the effectiveness of subsequent studies. It means that the criteria for good quality products can be fulfilled, namely valid, effective, and practical. Then, the next research is suggested to use the paid *FlipHTML5* platform to get complete editing features, so that e-worksheet becomes more interactive.

CONCLUSION

Based on the results of the research data analysis that has been carried out, it can be concluded that the E-Worksheet based project using *FlipHTML5* is declared very valid with an average score of 3.56 according to the expert's assessment in terms of material, construct, and design. Then, the E-Worksheet-based project using *FlipHTML5* is also very practical to use as teaching material on light interference topics for high school students in grade XI even semester based on assessments obtained from legibility, students' views and teacher's views with an average percentage of 88,75%. Based on the teacher's views the E-Worksheet is very possible to be implemented in online and face-to-face learning, especially in the covid-19 pandemic era the E-Worksheet can be used as multimedia to support online learning. Besides, students' SPS can be stimulated through it.

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