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Development of Students' Science Worksheets Based on *Liveworksheet* as Alternative Learning Resources for Junior High School Students

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Abstract

Liveworksheet-based science student worksheets (LKPD) on the topic of substance pressure are a development of students' worksheets to provide a learning experience that is by the characteristics of students. This study aims to develop live worksheets-based science worksheets on the substances' pressure topic as an alternative learning resource for junior high school students. This development research uses the type of R&D research with the ADDIE development model, which is modified according to the needs of researchers, namely analysis, design, and development. Data collection techniques used were observation, in-depth interviews, and profiling of students at State Junior High School 13 Madiun. The instruments used were observation sheets, interview instruments, and LKPD validation sheets. At the analysis stage, an analysis of the problems faced by the teacher was carried out so that solutions to these problems could be formulated. A live worksheet-based (IPA LKPD) was designed on the substance pressure material in the design phase. The development stage obtained validation results from the validator, who received a percentage of 91.39% in the valid category. This development research concludes that the developed live worksheet-based science worksheet on substance stress material is suitable for the science learning process.

Keywords Science Worksheets; Liveworksheet; ADDIE Model

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1. INTRODUCTION

Education is interpreted as one of the efforts to improve the quality of and the potential possessed by individuals. In other words, enhancing individual abilities is very important, especially in today's 21st-century learning. Science learning is a process of helping students understand all science concepts (Safitri et al., 2022). Science learning necessitates that students understand the fundamental concepts of science so that they can apply them in their daily lives. Science learning can also be defined as memorizing and comprehending concepts and facts discovered in nature. With science learning, the teacher can provide direct experience by assisting students in directly finding ideas (Sutarto et al., 2021).

Science learning has an important role in the current educational process. Science learning can generate interest in efforts to develop science. Science learning can teach students to be actively involved in finding concepts, principles, and theories to be developed sustainably (Indrawati et al., 2021).

Science lessons in junior high school contain many concepts that are quite difficult for students to understand because many of them involve abstract concepts. Referring to the theory of age-appropriate child development, junior high school students enter phase D, where children can think abstractly and develop hypotheses logically. Aside from that, one of the goals of 21st-century education is for students to master various core skills, including digital literacy.

Based on this explanation, the teacher can make an effort to link science learning with technology as an alternative to help students master both abstract concepts and core skills. The use of technology in science education greatly assists teachers in optimizing the learning process (Suharyat et al., 2022). Science information or material can be easily conveyed to students using technology in science learning (Yusro & Sasono, 2016).

According to the findings during the data collection, students at state junior high school 13 Madiun preferred using mobile phones during the science learning process. Students believe that using mobile phones makes learning more exciting and enjoyable. Learning science on a mobile phone offers an alternative way to make learning more exciting enjand oyable (Solviana, 2020). State Junior High School 13 Madiun students like science learning with practicum activities, discussions, and presentations. This learning activity is interpreted as student-centered learning. Practicum activities and presentation methods make it easy for students to understand science material. Learning with practicum activities makes it easier for students to construct their knowledge to understand the subject matter (Ulfa & Rozalina, 2019). The presentation-discussion method aims to build students' cognitive abilities, namely learning to discover, psychomotor abilities in improving hard skills, and affective abilities, which are carried out by working with teams in discussion groups (Dianawati, 2019)

Based on the findings of in-depth interviews with several students at State Junior High School 13 Madiun, some teachers still need to implement practical activities and presentation methods into the science learning process. This is due to the need for a laboratory at State Junior High School 13 Madiun. Furthermore, according to the interview, the teacher needed help facilitating practicum activities during the science learning process. Based on the observations, it was found that during science lessons, the teacher utilized technology by asking students to use their cell phones to find information. However, students still need to make the most of their cell phones; some still use them to play games. Even when the learning took place, some students were still engrossed in their cell phones. This causes science learning activities not to be carried out optimally.

In addition to the poor condition of laboratory facilities, students stated that science was difficult when asked about it. The subject is dominated by material that requires memorization and calculation; as a result, students frequently memorize and cannot build their understanding. Independent learning can increase curiosity, decision-making ability, critical thinking skills, innovation, and confidence (Oishi, 2020). Natural science material was included in the subject of material pressure on objects at the

beginning of the second semester. Students needed help understanding the concept of pressure and the calculations in determining the magnitude of the pressure score on an object.

Because the role of the teacher in guiding, educating, nurturing, and directing students to improve the quality of education is entirely in the hands of the teacher in the science learning process, a teacher has an important role in managing science learning activities both inside and outside the classroom, especially now that teachers are required to be able to provide freedom for students to study independently as well as skilled in building the concept of student. One of the learning tools that teachers in teaching science can use is using student worksheets. Student worksheets are interpreted as teaching materials that students can use and contain learning activities that must be carried out by students, usually in the form of practical or experimental instructions, discussion material, portfolio assignments, and various practice questions. Using student worksheets in science learning can involve actively finding information (Hamidah et al., 2018).

Interactive student worksheets, or E-LKPD, can be used based on the characteristics of students who have followed information and communication technology developments to maximize technology-based science learning. Students' insights can grow with E-LKPD and learn science concepts independently (Prianoto et al., 2017). E-LKPD can be developed using the website live worksheet. According to Andriyani et al. (2020), the live worksheet is a website provided free of charge by the Google search engine. This website enables teachers to convert traditional printable worksheets (doc, pdf, jpg, or PNG) into E-LKPD. The live worksheet-based E-LKPD contains videos, images, audio, and automatic corrections. Students can work on worksheets online and then send their answers to teachers directly (Widiyani & Pramudiani, 2021).

Based on the above description, this study aims to create a live worksheet-based Science E-LKPD on substance pressure as an alternative learning resource for junior high school students. This research is also expected to broaden knowledge about the importance of learning innovation in dealing with technological progress.

2. METHODS

This research uses the research and development (R&D) method. According to (Sugiyono, 2015), research and development (R&D) is research that produces and tests product effectiveness. The product developed in this development research is E-LKPD IPA, based on a live worksheet on substance pressure material. The E-LKPD IPA can be used in science learning based on a live worksheet on the substance pressure material developed and meets valid criteria.

The development design uses the ADDIE development model. The ADDIE development model consists of phases: (1) analysis, (2) design, (3) development, (4) implementation, and (4) evaluation. The choice of this model is because this model has stages in a logical sequence for developing a product. According to (Branch, 2009), the ADDIE model is an instructional process consisting of five stages: analysis, design, development, implementation, and evaluation. The ADDIE development model is shown in Figure 1.

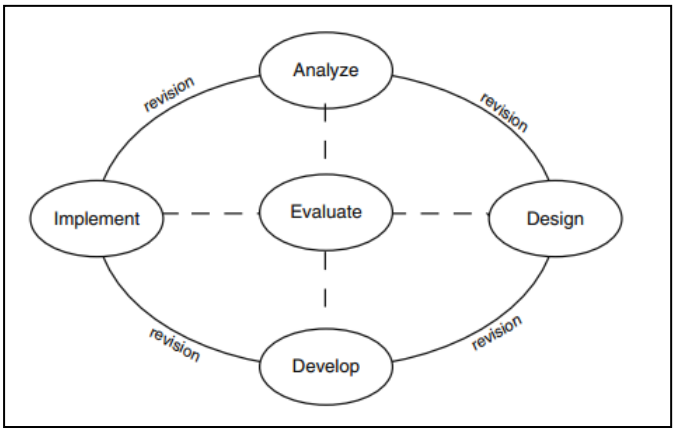

Figure 1. ADDIE development model stage

According to (Cahyadi, 2019), the output of each stage of the ADDIE development model can be used as input for the next stage. However, in this study, the researchers limited the steps of the ADDIE development model to the development stage. The implementation and evaluation stages were not carried out because they adapted to the researcher's needs. This is consistent with the statement of Syahputri & Dafit (2021), who carry out product development by dividing the stages of the ADDIE model into three stages: analysis, design, and development.

The first stage of this research began with examining the problems encountered by teachers and students at State Junior High School 13 Madiun, followed by an examination of learning materials to develop a live worksheet-based science E-LKPD on substance pressure with the ADDIE model. The second stage is the creation of a live worksheet-based IPA E-LKPD on substance pressure, which includes covers, learning activities, and E-LKPD complements. The final stage is to validate the product to determine the applicability of the live worksheet-based IPA E-LKPD on the substance pressure material under development.

Five education experts and natural science teachers carried out the validity test. Data collection techniques used were observation, interviews (in-depth interviews), and student profiling. This stage was carried out in October–November 2022.

In this study, the analysis stage of the ADDIE model examined the significance of developing a live worksheet-based science worksheet on the substance pressure material. Performance analysis, student analysis, and material analysis can all be used to carry out this analysis (Cahyadi, 2019). Performance analysis is carried out by determining the learning needs. Students' characteristics and learning needs were determined through student analysis. Analysis of learning materials in terms of facts, concepts, principles, and procedures Furthermore, it relates to learning objectives and can be used as a foundation for developing E-LKPD.

Validation data analysis techniques are used to assess the LKPD's level of validity. This validation occurs during the development stage. According to (Prilianti et al., 2018), validity is by the provisions and should be evaluated in three areas: language, content, and product. The validator performs product validation during the process, with the results used to improve the product being developed.

The instruments used in this development research were observation sheets, interview instruments, and E-LKPD validation sheets. The validation sheet used includes format, language, and content assessments. The validator evaluated the validation sheet in January 2023 using a Likert scale of 1-4, valid score 4, valid enough score 3, less valid score 2, and invalid score 1. Then, using the following calculation formula, technique, and analysis of the validity of the LKPD IPA based on live worksheets on the substance's material pressure:

$$V = \frac{\Sigma X}{\Sigma Xi} x100\%$$

Explanation:

V : validity percentage
ΣX : total score achieved
ΣXi : maximum total score

Furthermore, the conclusions drawn are seen from the criteria in Table 1.

Table 1. Validity criteria

Percentage (%)	Criteria
76 - 100	Valid
51 - 75	Valid enough
26 - 50	Less valid
0 - 25	Invalid

(Haking & Soepriyanto, 2019)

3. FINDING AND DISCUSSION

The ADDIE development model, namely analysis, design, and development is used in this study's development of live worksheet-based science E-LKPD on substance pressure. This is done according to the research needs of the researchers. The description of the research data is explained as follows:

Analysis

This stage involves gathering information about the problems encountered while science learning activities at State Junior High School 13 Madiun. This was accomplished by observing and conducting in-depth interviews with a science teacher and several State Junior High School 13 Madiun students. The researchers then identified these issues to develop worksheets on substance-pressure material in the form of live worksheet-based IPA worksheets. The following is an explanation of the analysis phase:

Science Teacher Analysis

An analysis of science teachers was conducted to determine what problems teachers faced when teaching science in class. Based on the results of the observations, it was found that in carrying out science learning, the teacher had yet to use the student worksheet to support the learning process. Science textbooks are the only learning resources used by teachers. Furthermore, teachers have taken advantage of technology by instructing students to use their cell phones to search for information on the internet. However, the teacher has yet to condition students to use their cell phones, owing to some students who play games, using social media, and listening to music in class, making science learning less effective.

According to the findings of an in-depth interview with a science teacher at State Junior High School 13, Madiun stated that teachers felt they needed to be able to facilitate practicum activities to support the science learning process. This is because State Junior High School 13 Madiun lacks a science laboratory. Furthermore, the teacher believes that students at State Junior High School 13 Madiun have a variety of characteristics, so the teacher has been unable to implement science learning based on these students' characteristics.

Student Analysis

Student analysis aims to discover the problems students face in learning science. Based on the results of in-depth interviews conducted with several students at State Junior High School 13 Madiun, students like using technology in the form of mobile phones for science learning. Using mobile phones makes students feel they are following the current trend, namely using advanced technology in science

learning. State Junior High School 13 Madiun students enjoy science learning through practicum activities, discussion, and presentation methods. Students, in this case, prefer student-centered learning (SCL). Students currently believe that the science learning process in class is quite dull. This is because teachers frequently use the lecture method and only have discussions. Students at State Junior High School 13 Madiun also need help grasping scientific concepts, particularly calculations.

Data from student profiling revealed that students at State Junior High School 13 Madiun had a variety of learning styles, including auditory, visual, and kinesthetic. The conclusion drawn from the problems encountered by teachers and students at State Junior High School 13 Madiun is the need to develop a live worksheet-based science E-LKPD on substance pressure. This student worksheet makes use of student cell phones. So that when implementing science learning, students' cell phones can be used to their full potential. This is consistent with the statement of (Fuadi et al., 2021), who states that students' cellphones and laptops can be used to access digital LKPD so that students can study independently. Learning is no longer teacher-centered but student-centered.

Liveworksheet-based science E-LKPD on substance pressure topics is also tailored to student learning styles. This E-LKPD has several features, such as teaching materials, figures, learning videos, and practical activities, to facilitate the student's learning style. Qomari et al. (2022) state that student worksheets adapted to visual learning styles contain pictures of stories and discourses that students can read. Student worksheets adapted to auditory learning styles can be supplemented with learning videos that students can watch. Student worksheets adapted to kinesthetic learning styles can be complemented with practicum activities involving students' physical activity.

Furthermore, the live worksheet-based science E-LKPD on substance pressure contains student-centered learning activities. The E-LKPD learning activities are organized by the steps in the problem-based learning (PBL) model. The PBL model is used in E-LKPD learning activities because it aligns with 21st-century learning and can help students improve their higher-order thinking skills (HOTS), particularly their problem-solving abilities. Masjid (2022) states that with the steps of the PBL model, students can improve their higher-order thinking skills and problem-solving abilities. As a result of this LKPD, students can discover their knowledge and better understand the science concepts being taught.

Analysis of Learning Materials

This analysis was conducted to determine the scope of the material and learning objectives. This is used to develop live worksheet-based science worksheets on substance pressure material. This analysis was carried out by analyzing the core competencies (KD) and indicators of competence achievement (IPK) in the substance pressure material presented in Table 2.

Table 2. KD and IPK of substance pressure

Core Competencies (KD)	Indicators of Competence Achievement (IPK)	
3.8 Explain the pressure of matter and its applications in everyday life, including blood pressure, osmosis, and capillary transport tissue in plants.	3.8.1	Understand the concept of hydrostatic pressure **(C2)**
	3.8.2	Applying the hydrostatic pressure calculation formula (**C3**)
	3.8.3	Applying hydrostatic pressure in everyday life (**C3**)
	3.8.4	Analyze the factors that affect hydrostatic pressure **(C4)**
4.8 Presenting experimental data to investigate liquid pressure at a specific depth, buoyancy, and capillarity in plant stems, for example	4.8.1	Conducting experiments to determine the factors that affect hydrostatic pressure **(P2)**
	4.8.2	Presenting the results of hydrostatic pressure experiments **(P3)**

Design

The science E-LKPD on the topic of substance pressure is divided into two sub-materials: solid substance pressure and hydrostatic pressure. This E-LKPD was developed to assist teachers in carrying out science learning activities in the classroom through technology. Furthermore, teachers can use this E-LKPD to facilitate student-centered learning, allowing students to understand better the science material.

Liveworksheet-based science E-LKPD on substance pressure material is made in the Microsoft Word program, then exported in PDF form. Then, the E-LKPD is uploaded to the live worksheet website.

The following is the content of the live worksheet-based science E-LKPD on substance pressure:

Liveworksheet-based science E-LKPD covers substance pressure topic

The cover of the E-LKPD contains titles, pictures, and student identities on the sub-material pressure of solids and hydrostatic pressure. The E-LKPD surface can be seen in Figures 2 and 3.

Figure 2. E-LKPD Cover for solid matter pressure

Figure 3. E-LKPD cover for hydrostatic pressure

Instructions for Using E-LKPD

The presence of instructions for using this LKPD is intended to ensure that students have no difficulty working on and completing the E-LKPD. Figure 3 shows the instructions for this use.

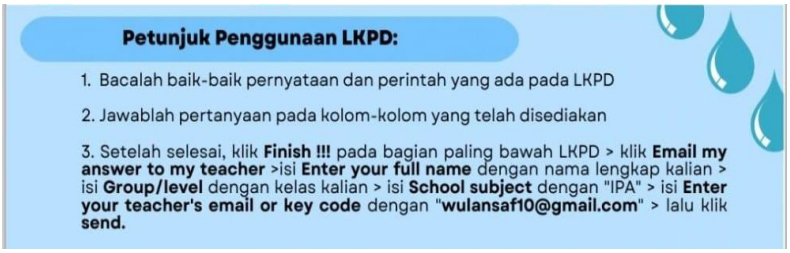

Figure 4. Instruction for Using E-LKPD

Teaching materials

The teaching material is in digital text, entered into Google Drive, and then embedded in the live worksheet-based IPA E-LKPD on substance pressure material. The display of teaching materials on the E-LKPD can be seen in Figure 5.

Figure 5. Teaching material

Learning Videos

The learning video is taken from YouTube and then embedded in the science E-LKPD on substance-pressure material. The display of learning videos on E-LKPD can be seen in Figure 6.

Figure 6. Learning video
(Sources: https://youtu.be/7fc1_kBc30E)

Learning Activity

Learning activities are an essential component of the E-LKPD. This activity can help students learn more effectively. Figures 7, 8, and 9 show how learning activities are tailored to the phases of the problem-based learning (PBL) model.

Figure 7. Learning activities in phase 1

Figure 8. Learning activities in phases 2 and 3

Figure 9. Learning activities in phases 4 and 5

Develop

The development stage aims to validate the live worksheet-based science E-LKPD on substance pressure material. The level of product validity is used to determine whether the live worksheet-based Science E-LKPD on substance pressure material is appropriate for use in science learning. Five (5) education experts carried out live worksheet-based IPA E-LKPD validation on substance pressure materials. Table 3 shows the results of the validator's assessment of the live worksheet-based E-LKPD on substance pressure material.

Table 3. Liveworksheet-based science worksheet validation results on substance pressure material

No.	Assessment Aspects	Interval Score (%)					Average (%)	Criteria
		V1	V2	V3	V4	V5		
1.	Format	91,67	95,83	87,5	91,67	91,67	91,67	Valid
2.	Language	91,67	83,33	91,67	91,67	91,67	90	Valid
3.	Content	93,75	87,5	87,5	93,75	100	92,5	Valid
Average Validation Score		**92,36**	**88,89**	**88,89**	**92,36**	**94,44**	**91,39**	**Valid**

A result of 91.39% was obtained, which was included in the valid criteria. The validation instrument used in this study was adapted from the previous research validation sheet for science worksheets. According to Safitri et al., (2022), a valid category for a science worksheet is one that meets the criteria for format, content, and language.

The explanation of the format, content, and language validation results in this study is shown in Tables 4, 5, and 6.

Table 4. format aspect validation results

No.	Indicator	Interval scores (%)	Criteria
1.	The suitability of the cover with the title of the live worksheet-based science E-LKPD on substance pressure materials.	100	Valid
2.	Clarity of instructions for using live worksheet-based science E-LKPD on substance pressure material	100	Valid
3.	Conformity of writing and letters on science live worksheet -based E-LKPD on substance pressure material	90	Valid
4.	Appropriateness of the layout and content of live worksheet-based science E-LKPD on substance pressure material	85	Valid
5.	Display of live worksheet-based science E-LKPD on substance pressure material	90	Valid
6.	Clarity of images, videos, and hyperlinks	85	Valid
	Average Validation Score	**91,67**	**Valid**

According to table 4, the overall average E-LKPD validation value on the format aspect is 91.67% with valid criteria. This means that the live worksheet-based science E-LKPD format aspect of the developed substance pressure material adheres to the E-LKPD preparation format.

Table 5. Language aspect validation results

No.	Indicator	Interval scores (%)	Criteria
1.	The sentences used in the live worksheet-based science E-LKPD on substance pressure topic are clear, operational, and do not cause double meanings	100	Valid
2.	The language used in the live worksheet-based science E-LKPD on substance pressure topic is easy for students to understand	85	Valid
3.	The language used in the live worksheet-based science E-LKPD on substance pressure material invites students to be interactive	85	Valid
	Average Validation Score	**90**	**Valid**

According to Table 5, the average E-LKPD validation value on the language aspect is 90% with valid criteria. This means that the language aspects of the developed live worksheet-based IPA LKPD on substance stress material are clear and operational and do not result in double meanings in every sentence. Furthermore, the language used is easily understood by students, and it encourages them to participate.

Table 6. Content aspect validation results

No.	Indicator	Interval scores (%)	Criteria
1.	The suitability of the material with the learning objectives	95	Valid
2.	The suitability of the material in the live worksheet-based science E-LKPD on substance pressure material with the concept	85	Valid
3.	Conformity of questions/questions with learning material	90	Valid
4.	The contents of the E-LKPD motivate students to solve problems	100	Valid
	Average Validation Score	**92,50**	**Valid**

According to table 6, the overall average LKPD validation value for the content aspect is 92.50% with valid criteria. This means that the content aspects of the developed live worksheet-based science worksheets on substance pressure are consistent with the learning material.

The E-LKPD developed by the researcher in this study has a novelty value in that it uses contextual learning to state problems that students face in their daily lives. Furthermore, the learning model used in this E-LKPD is problem-based learning (PBL), consistent with the previous goal of creating a student-centered learning activity in the classroom. The problem taken on by researchers is related to news about the KRI Nanggala 402 submarine, which sank at a depth of 830–850 meters. The problems have been adjusted to the material pressure. The news is loaded as a hyperlink in the E-LKPD so that students can immediately press the hyperlink button to be able to read the news. Furthermore, the live worksheet-based science E-LKPD on substance stress material has been updated, namely the presence of teaching materials in LKPD. The researcher's teaching materials include complete substance-pressure material. The teaching materials were previously uploaded to Google Drive and then linked to the LKPD.

4. CONCLUSION

The following issues have been identified as a result of observations and interviews with both science teachers and students at State Junior Highschool 13 Madiun

a. Teachers have not used LKPD to help students learn science.
b. Students have not made the best use of their mobile phones for science learning.
c. Students want student-centered science learning, which includes practical activities.

The live worksheet-based scientific E-LKPD validation on substance stress material yielded a percentage result of 91.39% with valid criteria. This means that the science E-LKPD on substance stress material created with live worksheets is appropriate for use in the science learning process. The live worksheet-based science E-LKPD can overcome these issues above because it uses technology, specifically student cell phones. Students can access LKPD on the live worksheet website using their cell phones. Furthermore, because it includes practicum activities and learning activities tailored to the PBL model phase, this LKPD promotes student-centered learning. Teachers can maximize learning activities with this LKPD, and students can better understand the learning material taught by the teacher.

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