

## About the Journal

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This journal publishes research articles multidisciplinary sciences, which includes: Humanities and social sciences, contemporary political science, Educational sciences, religious sciences and philosophy, economics, Engineering sciences, Health sciences, medical sciences, design arts sciences and media. Published articles are from critical and comprehensive research, studies or scientific studies on important and current issues or reviews of scientific books.



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## THE FEASIBILITY OF WEB-BASED VIRTUAL STUDENT WORKSHEETS ON DISASTER MITIGATION MATERIALS TO IMPROVE CRITICAL THINKING SKILLS AND LEARNING OUTCOMES

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### ABSTRACT

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*The Covid-19 pandemic that hit Indonesia caused panic in the education sector so that the Education office took representative actions to prevent the spread of Covid-19 by carrying out learning activities from home. Learning from home activities need to be supported by the existence of teaching materials that can be used by students, so researchers provide solutions by making the right teaching materials to use. This study aims to obtain web-based virtual worksheets on valid disaster mitigation materials to improve critical thinking skills and learning outcomes. The research includes research and development (RnD) using Thiagarajan's 4D research model consisting of define, design, development and disseminate stages. The research data were obtained from the results of validation carried out by three validators consisting of two expert validators and one user validator. The first expert validator scored 85.48%, the second expert validator scored 97.58% and the user validator scored 95.16%. The average result of the final validation is 92.74% and the criteria are very valid (> 85.01%) so that web-based virtual worksheets are feasible to use or apply.*

### KEYWORDS

Web-Based Virtual, Student Worksheets, Disaster Mitigation, Critical Thinking Skills, Learning Outcomes

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## INTRODUCTION

Indonesia is geologically located at the confluence of three giant plates, namely the Eurasian plate, the Indo-Australian plate and the Pacific plate which move at different speeds and can cause faults, local faults and folds (Lubis, 2020). Indonesia's geographical conditions have the potential to cause disasters that can result in loss of property, life and psychological impact (Setyowati, Hardati, Benardi, Hamid, & Anugrahanto, 2021). Types of disasters are divided into three, namely natural disasters such as earthquakes and tsunamis, non-natural disasters such as technological failures and pandemics and social disasters such as conflicts between communities. The non-natural disaster that is currently hitting Indonesia and even the world is the Covid-19 pandemic which was confirmed on March 2, 2020 in Indonesia (Yuliarti, 2020).

The emergence of confirmed cases of Covid-19 made the government panic, especially in the field of education so that the Education office took representative actions to prevent the transmission of Covid-19 in the education environment by carrying out learning activities from home known as BDR. The implementation of learning activities from home encourages teachers innovate in learning systems that are carried out online (on a network). Distance learning takes advantage of information and communication technology (ICT) systems, students can access all the information they need from various sources without any limitations on time, place and territorial area. The use of ICT will certainly have an impact on all subjects in school, one of which is science.

Science is one of the subjects that must be taken by vocational secondary level students (SMK) in the field of expertise and management. IPA is a science that studies natural events and their symptoms through a scientific process that is built with a scientific attitude so as to produce scientific products (Sari & Faizah, 2018). Science teachers must be able to carry out teaching and learning activities even with a remote system, one strategy that can be done by teachers is to provide teaching materials that can attract students' attention to learning and can improve skills needed in the 21st century, including critical thinking skills.

Based on the results of field observations conducted by researchers at vocational schools in Lumajang Regency in the 2020-2021 school year, for instance, 66.7% of 21 students stated that the teaching materials they received were not interesting, while 33.3% stated that their teaching materials are just normal. The display of unattractive teaching materials make students are lazy to read or study them so that the learning outcomes obtained are less than optimal because learning activities do not go well. Teaching and learning activities ideally can encourage students' creativity as a whole, encourage active students so that learning objectives are achieved effectively and learning is fun because it can attract students' interest (Nasrah & Elihami, 2021)

One of the teaching materials that can foster students' interest in learning is student worksheets that are arranged in an interesting way (Asrial & Ernawati, 2020). Latifah explained that the use of student worksheets can emphasize activities on students' activities where students can learn actively, creatively and independently in finding and developing concepts of knowledge so that it is easier to understand the material well (Pikasari, Fitriyana, & Purwasi, 2018). Seeing the learning conditions that occur in the field that are not in accordance with ideal conditions, one of the solutions proposed by researchers in dealing with these problems is to develop web-based virtual student worksheets to improve critical thinking skills and learning outcomes.

Student Worksheets (LKS) by their nature include printed teaching materials that contain guidelines for carrying out learning activities that are used by students to gain knowledge, skills and develop their abilities (Heleri, Situmorang, & Dewi, 2019). LKS has four functions in teaching and learning activities, since it can increase the active role of students so that the teacher is not dominant in the learning process, make it easier for students to understand the material being studied, as one of the teaching materials that is concise and equipped with tasks to practice, and facilitate the implementation of teaching to students because they were already designed and programmed well (Syamsul et al., 2020). A good LKS does not only meet the components that have been regulated by the Ministry of National Education in 2008, but also meet the eligibility criteria based on the National Professional Certificate Agency (BSNP) in 2014 which include content feasibility, presentation feasibility, language feasibility and graphic feasibility (Pratiwi, Padmadewi, & Paramartha, 2019)

The LKS compiled by the writer is a virtual LKS, the fifth edition of the Big Indonesian Language Dictionary (KBBI/Kamus Besar Bahasa Indonesia) describes several virtual meanings, namely real, similar or very similar to something described and/or appearing/present using computer software such as the internet. Learning materials that are abstract and must be practiced will make it difficult for students, so students need virtual media that can be an alternative to real practicum implementation, one of which is by using a virtual laboratory (Masril, Hidayati, & Darvina, 2018) A virtual laboratory is a series of laboratory tools that can simulate a real environment

The virtual worksheets designed by the next researchers will be will be included on the web page to make it easy for students to access. The web is one of the information and communication technologies that is connected by the internet, the web is an application using hypertext technology that contains multimedia documents such as text, images, sound, animation and video which are accessed with the help of software which is often called a browser (Fajriya, Supriyana, Bahiyatun, & Widyawati, 2017). The website used in this research is the type of Wordpress.com. Wordpress is an opensource application that is very popular in the world, even there are 42.6 million new posts every month (Ratnasari, Siregar, & Maulana, 2021). WordPress is made with open source software or known as open source software which consists of a programming language and a database. The advantage of using wordpress is that it is easy to use both by lay people or beginners and also experts because of the easy programming language, wordpress has a large community because more than 30% of websites in the world use it so that wordpress users can have discussions both online and offline, many tutorials available that make it easy for users to learn independently, the plugins are provided by wordpress to make it easier for users to manage and add features on the web are numerous and even thousands, many developers are releasing wordpress themes for free or paid so that users can choose the theme they want (Mubarok, 2018)

Worksheets that are developed and packaged in virtual form can help students apply and integrate the concepts and theories that have been found, because these worksheets are able to present concrete and simple phenomena related to the concepts of the material students are learning. The virtual concept presented on the web page is in the form of two dimensions where students can carry out disaster mitigation simulation activities in the form of preventive actions. LKS is able to guide student learning activities because it contains instructions for activities that will be carried out by students such as doing, observing and designing and contains questions whose answers can be sought independently or in groups (Kumala, Susilo, & Susanto, 2018).



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Web-based virtual worksheets are designed with the aim of improving critical thinking skills and student learning outcomes. Critical thinking is a skill that a person has and is used to solve problems logically (Gotoh, 2016). Michael argues that critical thinking is the ability to think, interpret and evaluate skillfully and actively from the observations, information and arguments he gets (Bustami, Riyati, & Julung, 2019). Facione developed six indicators of critical thinking skills consisting of interpretation, analysis, inference, evaluation, explanation, and self-regulation (Facione, 2011)

Six reasons why do students have critical thinking skills, the first reason is the rapid development of science and technology so that information circulating from thousands of information sources needs to be evaluated, and students need to think critically to choose and sort out which information is truly valid and can be accounted for. The second reason is because students have high compressive strength so that this strength needs to be directed at the right things with the provision of critical thinking, the third reason is because students will live complex lives in the future and they are required to be able to solve the problems they will face critically. in order to produce good and wise decisions, the fourth reason is because critical thinking skills are the key to developing creativity that arises because of the desire to solve problems after seeing natural and social phenomena that occur in a creative way, the fifth reason is because many jobs require critical thinking skills in solving existing problems. The last reason is because in everyday life everyone will be faced with problems that arise in their lives and decision making as a good solution requires critical thinking skills (Sudrajat, 2021)

Learning outcomes are defined as changes in individuals who carry out the learning process, these changes include changes in knowledge, ability to form and develop skills, changes in attitudes, self-control and self-esteem in individuals who learn (Surdin, 2017), while Gagne states that learning outcomes are the whole process that occurs through teaching and learning activities in schools which can be expressed by numbers and measured by learning outcomes tests (Gagne & Briggs, 1974). Learning outcomes can be used as a benchmark for the level of success of teaching and learning activities that have been carried out by teachers and students as well as everything related in it such as the learning model and the media used (Kpolovie, Joe, & Okoto, 2014). Howard Kingsley divides learning outcomes into three types, the first is skills and habits, the second includes knowledge and understanding, and the third is attitudes and ideals . Gagne divides learning outcomes into five types, namely intellectual skills, cognitive strategies, verbal information, motor skills and attitudes

## RESEARCH METHOD

The type of research used is Research and Development (R&D). Research and Development (R&D) is a type of research that combines qualitative and quantitative research, to determine the product to be produced, a needs survey is needed (qualitative), while the effectiveness test needs to use experiments and then the data is analyzed (quantitatively) (Haryati, 2012).

Web-based virtual worksheet validation aims to determine the feasibility of the product to be tested in the learning process. The web-based virtual worksheet validation instrument consists of content and construction feasibility components. Feasibility of content includes the need, currentness and substance of the material. Construction feasibility includes visual communication display, learning design, web display and computer simulation. The validity of the web-based virtual student worksheet was obtained from the results of logical validation test analysis by expert validators. Web-based virtual worksheets are said to be valid if the results of the validation carried out by three validators

consisting of two expert validators and one user validator meet the minimum criteria of 70.01% or valid category.

Data analysis techniques on web-based virtual LKS validation use percentage data analysis techniques with the formula:

$$V = \frac{TSE}{TSM} \times 100$$

Information:

V = Percentage of validation

TSE = Total empirical score (sum of validator assessment scores)

TSM = Maximum Total Score (Akbar, 2013)

The data is then analyzed and converted with the following criteria:

Table 1. Criteria for Validation of web-based virtual student worksheets

No	Validation criteria	Validity level
1	85,01 % - 100 %	Very valid, can be used without revision
2	70,01 % - 85,00 %	Quite valid, but needs a little revision
3	50,01 % - 70,00 %	Not valid
4	01,00 % - 50, 00 %	Invalid or cannot be used

(Akbar, 2013)

## RESULT AND DISCUSSION

The validation of the development product, namely web-based virtual worksheets, was carried out by three validators, namely two expert validators who were lecturers at FKIP Jember University and one user validator was a teacher at SMK YP 2 Lumajang. The product validation instrument is first validated to find out whether the product validation instrument is suitable to be used to assess or validate web-based virtual worksheets. The results of the product validation instrument validation can be seen in the table 2.

Table 2. Validation of web-based virtual LKS validation instruments

No.	Item	Expert validator	Expert validator	User validator
1	Instructions for using the instrument are clearly stated	4	4	4
2	Based on the content aspect, the instrument can reveal the needs, up-to-date and substance of the material in the developed web-based virtual worksheets	3	4	4
3	Based on the construction aspect, the instrument can reveal the construction structure of the developed web-based virtual LKS	3	4	4
4	Based on the language aspect, the instrument uses clear and unambiguous language (double meaning)	3	4	4
5	The instrument sheet provides space for validators to provide input or revision	4	4	4
Validation Results		85%	100%	100%
Average Validation Results		95%		

Table 2 shows the results of the validation carried out by the first expert validator by 85%, while the validation results by the second expert validator and user validator get a perfect score of 100%. The final validation results obtained from the average of the three

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validators are 95%, this shows that the web-based virtual LKS validation instrument is very feasible to use without revision because the validation value is  $> 85.01\%$ .

The web-based virtual LKS validation instrument is then used to validate the product with the validation results which can be seen in the table 3.

Table 3. Web-based virtual worksheet validation results

No	Rated aspect	Expert validator	Expert validator	User validator
I	Content Eligibility			
A	Need			
1	Conformity with the demands of the 2013 curriculum	4	4	4
2	Conformity to the demands of critical thinking skills	3	4	3
B	Update			
1	Conformity with the development of science	4	3	4
2	Up-to-date knowledge	3	3	3
3	Concrete examples from the environment	3	4	4
C	Substance of matter			
1	The truth of the substance of the material is in accordance with scientific rules	4	4	4
2	The scope of the substance of the material is complete	3	4	4
3	virtual worksheets contain actual material	2	3	3
4	The language used is standard and easy to understand	4	4	4
5	Steps of work containing a scientific approach	3	4	3
6	Material according to skill competency	4	4	4
7	Questions in the virtual worksheet can increase student understanding	4	4	4

II Construction Eligibility				
<b>A Visual communication display</b>				
1	The web uses navigation and hyperlinks that work well	3	4	4
2	Proportionate and attractive virtual worksheet layout	3	4	4
3	The display of letters is legible	4	4	4
4	Colors of attractive virtual worksheets	4	4	4
5	Virtual Media can work properly	3	4	4
6	Animations used according to context	4	4	4
<b>B Learning design</b>				
1	Title of virtual worksheet according to the content	3	4	4
2	virtual worksheets according to KI and KD	4	4	4
3	The material is in accordance with the learning objectives	4	4	4
4	Questions according to learning objectives	3	4	4
5	Questions can stimulate students to develop knowledge	3	4	4
6	Simulations allow to increase students' knowledge	3	4	4
<b>C Web View</b>				
1	Web is easy to access	4	4	4
2	There is interactivity	3	4	3
3	Web can increase student motivation	3	4	3
<b>D Computer simulation</b>				
1	The simulation used is in accordance with KD 4	4	4	4
2	The data obtained is logical	3	4	4
3	Simulations can display abstract material	3	4	4
4	Simulations provide a more concrete learning experience	4	4	4
Validation Results		85.48%	97.58%	95.16%
Average Validation Results		92.74%		

Table 3 shows that there are two aspects of web-based virtual LKS validation assessment, namely content feasibility and construction feasibility. The results of the validation carried out by the first expert validator got a score of 85.48% and the second expert validator got a score of 97.58%, while the validation carried out by the user validator got a score of 95.16%. The final validation results from the average of the three validations were 92.74% and entered the very valid criteria. There are several improvements that

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researchers need to make to improve the development of web-based Virtual LKS, these improvements include adding content and content that is designed to be more attractive, revamping the concept of disaster risk, types of disasters need to be detailed regarding definitions, examples, and locations of disasters, adding mechanisms the occurrence of a disaster, the signs of an earthquake described are more measurable and access the BMKG website in real time. Web-based virtual worksheets that have been revised then re-validated and the results were better because they were very in line with the demands of the 2013 curriculum, this can be seen in the validation scores that get perfect scores from the validators. The assessment of the substance of the material gets a perfect score on the aspect of the truth of the substance of the material that is in accordance with scientific rules, the language used is standard and easy to understand, the material is in accordance with the competence of skills and questions in the virtual worksheet can increase students' understanding.

Web-based virtual worksheets are very interesting for students to learn, this is based on the perfect eligibility scores from the validators, namely the aspect of the appearance of letters, attractive colors of virtual worksheets, and animations used according to the context. The use of virtual worksheets will facilitate teaching and learning activities because virtual worksheets are in accordance with KI and KD, the material described is in accordance with learning objectives, the web is easily accessible and simulations provide a more concrete learning experience for students.

Validation was done by means of researchers sending validation instruments and products in the form of web-based virtual worksheets on disaster mitigation materials and then the validator validates. Validation was carried out twice because from the results of the first validation there were several suggestions from the validators who made the product to be revised to be perfected. From the results of the second validation, the product in the form of a web-based virtual worksheet on disaster mitigation materials can be used without any revision and is in the very valid category.

The product display of the web-based virtual LKS can be seen in figure 1.

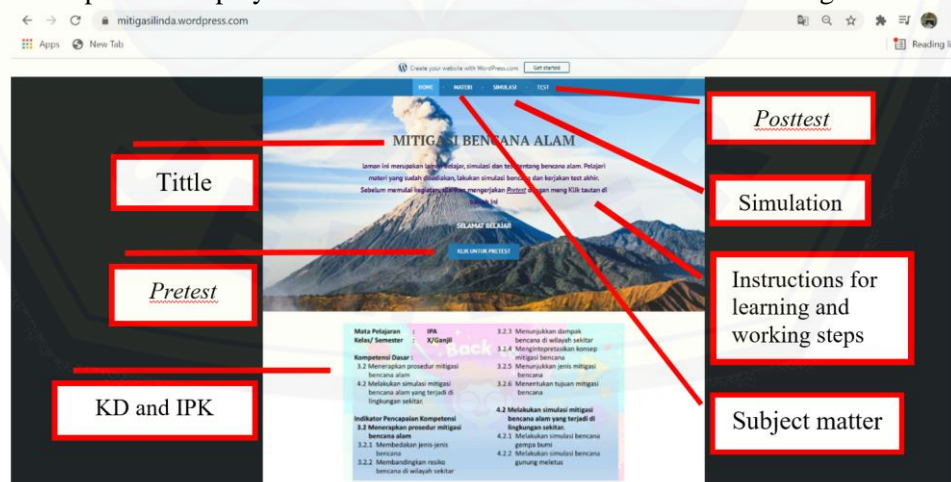


Figure 1. Web-based virtual worksheet design

Figure 1 is a web-based virtual worksheet design, consisting of title, study instructions, competencies to be achieved, work steps and assessments, main material containing descriptions of materials and pictures and videos as supporting information, tasks in the form of working on volcanic eruption disaster mitigation simulations and

earthquake disaster. The main material described in web-based virtual worksheets can be seen in figure 2:

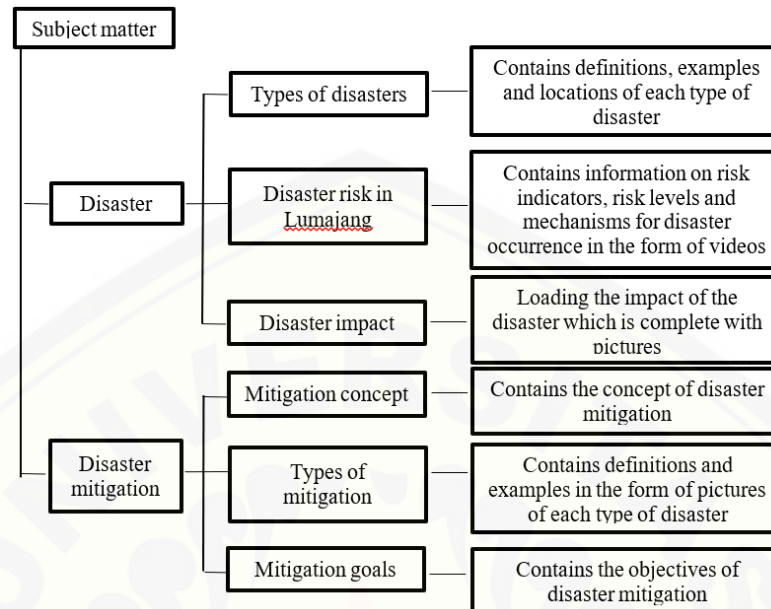


Figure 2. Concept map of material description

Figure 2 shows the description of the material on disaster and disaster mitigation, the disaster material explains the types of disasters, disaster risk in Lumajang and the impact of disasters, while disaster mitigation explains the concept of mitigation, types of mitigation and the objectives of disaster mitigation. Presentation of material in web-based virtual worksheets is equipped with pictures and videos.

The task given in the web-based virtual worksheet is in the form of a simulation of volcanic eruption and earthquake disaster mitigation, in which students can perform appropriate disaster mitigation simulations when disaster comes. The presentation of the disaster mitigation simulation can be seen in the figure 3.



Figure 3. Display of the volcanic eruption disaster mitigation simulation page

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Figure 3 shows volcanic eruption disaster mitigation which consists of 14 actions including making lava flow paths, constructing fire and volcanic dust resistant structures, conducting socialization to the community, recognizing quick and precise evacuation routes to the gathering point, preparing a standby bag containing equipment what is urgently needed, monitoring mountain activities, making the village Tangguh a disaster, not within the radius set by the BMKG, coordinating with the three pillars namely the government, DUDI and the community, not being in the area of the lava flow, using a mask/wet cloth and wearing covered clothes and make disaster-prone maps and recognize signs of earthquakes and monitor information from BMKG in real time.



Figure 4. Display of the earthquake disaster mitigation simulation page

Figure 4 shows earthquake disaster mitigation which consists of 12 actions including activities to make buildings earthquake resistant, placing cabinets near walls, hanging frames and mirrors in a safe place, placing glassware in closed places, placing heavy and large items in the wardrobe. downstairs, identify safe places indoors and outdoors and determine meeting points, prepare a standby bag containing much-needed equipment, stay calm and not panic during an earthquake, create evacuation routes and avoid elevators in the event of an earthquake, socialize earthquake songs, and recognize signs of a volcanic eruption and monitor information from the BMKG in real time.

## CONCLUSION

Based on the results of the research conducted, it was concluded that the results of developing web-based virtual LKS on disaster mitigation materials reached a value of 92.74% and were categorized as very feasible and could be used without revision with evidence of the fulfillment of all validation aspects by the validators.

Web-based virtual worksheet products can be used as additional references and can be applied in everyday life. Researchers suggest for teachers to access, study and try first before being used in learning

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