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Implementation of Web-Assisted Project Based Learning Model Learning to Improve Critical Thinking Skills and Science Process Skills

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Abstract: The purpose of this study was to describe and analyze the effectiveness of the website-based Project Based Learning approach to improving students' critical thinking skills and science process skills. The design of this study was a quasi-experimental with a non-equivalent control group design in which the experimental and control groups were selected randomly. The instruments used to measure critical thinking skills are test questions while the instruments used to measure science process skills are test questions and observation sheets. The results of the study show that learning before and after Project Based e-Learning has increased by 9.8%. The increase in students' critical thinking skills is caused by the use of Project Based Learning where this model can make students play an active role in solving problems, making decisions, researching, presenting and creating documents. The application of Project Based e-Learning to class V science material has experienced a significant increase. This is shown by the results of hypothesis testing where the sig (2-tailed) value is 0.00 ($p < 0.05$). The increase in science process skills occurs because Project-Based learning can support participants in developing their creativity in designing and creating projects that can be used to solve problems.

Keywords: project based learning, critical thinking skills, science process skills.

Abstrak: *Tujuan penelitian ini adalah mendeskripsikan dan menganalisis efektivitas pendekatan Project Based Learning berbantuan WEB terhadap peningkatan keterampilan berpikir kritis dan keterampilan proses sains peserta didik. Desain penelitian ini adalah kuasi experiment dengan tipe Non-Equivalent Control Group Design dimana kelompok eksperimen maupun kelompok kontrol dipilih secara random. Instrumen yang digunakan untuk mengukur keterampilan berpikir kritis adalah soal tes sedangkan instrumen yang digunakan dalam mengukur keterampilan proses sains adalah soal tes dan lembar observasi. Hasil penelitian menunjukan bahwa pembelajaran sebelum dan sesudah Project Based Learning berbantuan WEB mengalami peningkatan sebesar 9,8 %. Peningkatan keterampilan berpikir kritis peserta didik disebabkan oleh penggunaan Project Based Learning dimana model ini dapat membuat peserta didik berperan aktif dalam memecahkan masalah, mengambil keputusan, meneliti, mempresentasikan dan membuat dokumen. Penerapan Project Based Learning berbantuan WEB pada materi IPA kelas V mengalami peningkatan yang signifikan. Hal ini ditunjukan dengan hasil uji hipotesis dimana nilai sig (2-tailed) adalah 0.00 ($p < 0.05$). Peningkatan keterampilan proses sains terjadi karena pembelajaran Berbasis Proyek dapat mendukung peserta dalam mengembangkan kreativitasnya dalam merancang dan membuat proyek yang dapat digunakan untuk memecahkan masalah.*

Kata kunci: *pembelajaran berbasis proyek, keterampilan berpikir kritis, keterampilan proses sains.*

▪ INTRODUCTION

Education can provide maturity in thinking and developing the potential that exists in a person, and can provide learning experiences so that a person has the skills to solve the problems they face (Putri et al., 2021: 3). Learning in elementary schools

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provides an opportunity for students to spend half their day at school and make the school environment a strategic place in acquiring knowledge (Wong et al., 2021: 836). One of the lessons that can facilitate students to find their own knowledge in the surrounding environment is learning science. Natural science learning in elementary schools provides opportunities for students to develop their curiosity through scientific thinking about natural phenomena that occur, so that students are able to solve problems around them (Hafidz, 2021: 549). Science process skills and critical thinking skills are two skills that students need to develop in science learning because these skills are able to train students in solving problems based on scientific thinking. The teacher's approach in making classroom learning into student-centred learning, capitalizing on the strengths of students, demonstrating an experiential teaching orientation, using collaborative techniques, engaging external experts and continuously reflecting and planning lessons so as to develop critical thinking skills and science process skills students (Sukma et al., 2020: 2).

Philosophical Association defines critical thinking skills as a self-regulatory assessment process that generates interpretation, analysis, evaluation, and inference, as well as explanations of evidence, conceptual, methodological, logical, and contextual criteria on which judgments are based (Tseng, 2020). Critical thinking skills are related to the quality of thinking, independence and making appropriate thinking decisions according to existing standards (Gojkov et al., 2015: 592). Critical thinking skills according to Hacioğlu & gülhan (2021: 140) are skills in evaluating all solution ideas from real life and making decisions to solve problems. Florea & Hurjui, (2015: 556) critical thinking skills are active, coordinated, complex processes, such as reading and writing, speaking and listening, which involve thinking processes that begin with the active accumulation of information that ends with reasoned decisions. Critical thinking skills play a major role in the success of students in learning, and enable students to develop the ability to generate ideas and solve problems in learning (Halpern, Millis, Graesser, & Butler, 2012). Students who have critical thinking skills will solve problems more effectively than other students. In class learning there are still students who are passive in doing group assignments, students are still not active in raising problems in learning, and there are some students who are actively involved during the learning process (Ramdani et al., 2021: 188).

Research conducted by Wicaksono et al., (2022) showed low critical thinking skills due to a lack of variety of learning materials used by classroom teachers during the pandemic and a lack of learning media. Students only work on LKPD without any explanation in learning, this results in low students' critical thinking skills. In line with that, previous research conducted by Kristiawan et al., (2022) showed that the thinking skills of fifth grade students were still very low. Critical thinking skills in the observation results are still relatively low, this is because the value obtained is below the minimum completeness criteria (KKM), namely 70. Critical thinking skills are very important for students because they play a role in the development of students' thinking. Critical thinking skills are one of the basic and intellectual needs that must be met by each individual (Aizikovitsh-Udi & Cheng, 2015). Critical thinking is not only able to improve students' academic abilities but can also prepare students to become professionals in the world of work.

In addition, in learning science students can develop science process skills. Science process skills can help students to improve their mindset to be more critical through experimental activities. Science process skills are abilities that are used to

acquire, develop, and apply concepts, principles, laws and theories as well as mental abilities, physical abilities and social abilities (Yuliati, 2016: 74). Science process skills can be used to find a solution to a problem so that students are able to develop their scientific skills (Aras et al., 202: 944). The learning process in KPS classes is not only related to students' cognitive abilities, but attitudes such as responsibility, discipline, and effort also exist in KPS. Attitudes like this are the concern of the teacher in learning in the classroom. In line with Rahman, (2018: 130), the flow of behaviorism views that learning is a change in observable behavior caused by external stimuli. Tinapay et al., (2021: 16) students' science process skills can be improved by applying science skills to real-world problems, so that students' abilities in science will increase. Teachers play an important role in educating individuals with these skills to contribute significantly to societal change. Science process skills are grouped into two types, namely basic science process skills and integrated science process skills. Basic process skills include observing, classifying, communicating, measuring, using images, inferring and predicting whereas integrated science process skills include making hypotheses, controlling variables, interpreting data, conducting experiments, operational definitions (Kalemkuş et al., 2021: 115).

Research conducted by Putra et al., (2022) shows low science process skills because teachers as educators must be able to create and create innovative learning, besides that in schools learning is still conventional and teachers mostly use the lecture method without looking ahead. process. Directly students do not communicate learning with the teacher, that is, many students are embarrassed to ask questions during learning. In line with that, research conducted by Safitri et al., (2022) showed low science process skills caused by the use of worksheets that did not support learning. This statement is reinforced by Sari et al., (2020) which states that the LKPD used in schools has not prepared student KPS because it only contains a few questions that students work on. Science process skills are used by scientists to construct knowledge to solve problems and formulate results. One of the goals of science education is to teach effective thinking as defined by SPS (Özgelen, 2012:283).

Heat anditstransfer is one of the natural science materials that can support the development of students' critical thinking skills and science process skills. Through simple experiments students can investigate various kinds of heat transfer that exist in the environment around them. The learning model that can be used to engage students in learning is the Project Based Learning model. Project based Learning is a student-oriented learning model and the teacher acts as a facilitator and motivator where students can produce a project or work (Suryaningsih & Koeswanti, 2021: 41). Learning uses Project Based Learning can focus student activities so that they can interpret a concept or principle by conducting detailed investigations of problems and finding solutions to these problems and applying them in working on projects. learning model Project Based Learning focuses on contextual learning through complex activities based on questions and problems that are very challenging and guides students to design, solve problems, make decisions, carry out investigative activities, and provide opportunities for students to work independently (Ika, 2021: 1162).

Chen & Lin (2019) explain that the use of Project-Based Learning can improve students' scientific knowledge and ensure higher passing in national exams. When students understand science, students are able to apply or practice the knowledge they get at school in everyday life. The results of the study show that teachers have changed their teaching from teacher-centered to learner-centered. in line with research conducted

by Sasson, et al (2018) explaining its use Project-Based Learning provides opportunities for students to actively design and solve problems (scientific investigations) through realistic and engaging real-world projects. This model exposes students to make decisions, solve problems and various other types of investigative activities. Project Based Learning can develop thinking skills, social skills and the ability to collaborate effectively. Critical thinking skills can. make students be thorough, focused, in focusing on the problems faced. Critical thinking skills need to be developed so that they can be used in everyday life. Critical thinking can involve skills such as analysis, evaluation and synthesis.

The development of technology and information in utilizing the internet is currently growing very rapidly, one of which is in the field of education. The impact of this development is changing the traditional learning approach towards future learning which is referred to as the learning age of knowledge, that is, people can learn anytime and anywhere (Zulfarina al., 2021: 364) et .based Website is defined as learning that is displayed using an electronic device in the form of a website. Favale, et al (2020) shows where E-Learning is one of the solutions in overcoming distance learning policies during the Covid-19 pandemic. Research conducted by Lee & Yeung (2021) explains that using Google Drive To make it easier for students to collect, analyze, and manipulate real time data loggers in freeware cloud storage Google Drive used in remote experiments. Google Drive is a free file storage and synchronization service which can support students to store experiment data, such as log files in cloud servers google. Research by Wahyuningsih, et al (2021) explains that in the era of the industrial revolution 4.0, integrating web applications is very much needed in the problem solving learning process. One learning model that can be integrated with web applications is Project Based Learning. Project Based Learning can help students think creatively, hone problem solving skills, practice interacting, and assist investigations that lead to real problem solving. .Website Project -based the creative construction of multimedia skills and cooperative learning skills, and is used as a tool to promote learning, interaction and cooperation while working, to enhance the creative construction of multimedia skills and cooperative learning skills (Chatwattana & Nilsook, 2017: 6).

Based on the results of interviews with the fifth grade teacher at SD Inpres Oebesa, learning during the pandemic was still not effective. Teaching and learning activities (KBM) during the pandemic were limited to giving assignments to students and then returning them to the teacher concerned. The use of creative and innovative learning models during a pandemic is still not effective, this results in low critical thinking skills and science process skills. Other obstacles faced are: (1) teachers still have difficulties in utilizing technology in education, (2) the availability of learning resources is still lacking, (3) problems sending and receiving information and (4) access to tutoring is not yet available. anytime and anywhere. This resulted in ineffective teaching and learning activities during the Covid-19 pandemic at SD Inpres Oebesa. Based on the problems that have been described, the effort to improve critical thinking skills and science process skills is to use Web-Assisted Project Based Learning becomes learning. Implementation of learning with Web-Assisted Project Based Learning designed to improve critical thinking skills and science process skills during the Covid-19 pandemic. Through the website it is hoped that it can support the implementation of learning and learning, because teachers and students can carry out tutoring activities easily and are able to attract students' interest.

▪ METHOD

This study uses quantitative research with an experimental research design. An experimental model whose purpose is to investigate the causal relationship between the conditions being manipulated and the output being measured. The research method used is the quasi-Experimental Design method, the research design used is the Nonequivalent Control Group Design.

Table 1. Research design

E	O_1	X_1	O_2
K	O_3		O_4

This study uses two classes consisting of a control class and an experimental class. The experimental class will be given a pre-test, treatment and also a post-test. The treatment in question is the provision of learning with a website-based Project Based Learning approach. While the control class will be given a pre-test and post-test. According to Ennis in Firdaus (2020: 682), there are twelve indicators of critical thinking skills, namely: (1) Focusing or formulating questions; (2) Analyze arguments; (3) Clarifying and asking and answering questions; (4) Considering the truth of the source; (5) Make observations and evaluate reports on the results of observations; (6) Make deductions and consider the results; (7) Make an induction and consider the results; (8) Creating and weighing values; (9) Define and consider it; (10) Identify assumptions; (11) Considering reasons; (12) Combine information and integrate in decision making. Of the twelve indicators of critical thinking skills above, in this study only six indicators were used, namely: (1) Focusing or formulating questions; (2) Analyze arguments; (3) Make observations and evaluate reports on the results of observations; (4) Make deductions and consider the results; (5) Make an induction and consider the results; (6) Integrating in decision making. Meanwhile Nuryani, (2007:9) defines 10 indicators of critical thinking skills, namely (1) Observation/Observation, (2) Interpretation, (3) Classification, (4) Prediction, (5) Communicate, (6) Hypothesize, (7) Planning an experiment or investigation, (8) Implementing an experiment or investigation, (9) Asking questions, (10) Concluding. In this study there are six indicators that will be used, namely: (1) Observation/Observation; (2) Communicating; (3) Hypothesize; (4) Planning an experiment or investigation; (5) Implementing experiments or investigations; (6) concluded.

The population is a generalization area consisting of objects or subjects that have certain qualities and characteristics determined by researchers to be studied and then conclusions drawn (Sugiyono, 2017: 117). The population in this study were all 5th grade students at SD Inpres Oebesa, totaling 87 people. While the sample is part of the number and characteristics possessed by the population. Determination of the sample in this study using nonprobability sampling with purposive sampling type. Nonprobability sampling is a sampling technique that does not provide equal opportunities or opportunities for each element or member of the population to be selected as a sample (Sugiyono, 2017: 122). The sample selection in this study did not represent the entire population because the sampling was not random, but was determined directly according to the terms and objectives of the study. The criteria determined to get the sample in this study were: (1) Students who were in two classes, namely class VA and class VB, had almost the same level of knowledge; (2) the class is more active and responsive in learning.

Data collection is a way of obtaining data regarding the variables in the study (Arikunto, 2013: 265). With regard to the methods taken in order to obtain the necessary data and information, several data collection methods are used, namely: (1) Interviews, interviews are used in collecting data if someone wants to conduct a preliminary study to find problems that must be studied, and wants to know things from respondents (Sugiyono, 2017: 194). The purpose of the interview method used is to gather initial data in research; (2) Test questions, Test questions are tools or procedures used to find out or measure something in an atmosphere, in ways and rules that have been determined (Arikunto, 2013: 226). The test questions used are descriptions. The essay test is used to measure students' critical thinking skills. This description test requires students to be able to describe, explain, discuss, compare, give reasons using their own words and language; (3) Observation. Observation is a complex process, one which is composed of various biological and psychological processes. Two of the most important are the processes of observation and memory (Sugiyono, 2017:203). The observation sheet is used to measure students' science skills. The collection of research data using observation sheets was carried out when students carried out experiments. The observation used in this study is structured observation where observations have been systematically designed, about what will be observed, when and where it is.

The data analysis techniques used are: (1) Normality test, the Normality Test is used to determine whether the data is normally distributed or not; (2) Homogeneity test, Homogeneity test is carried out to check whether the scores in the research conducted have homogeneous variance or not for the significance level α. Testing the data collection instruments in this study includes: (1) Test the validity of the questions; item validation shows the levels of validity of the instrument's ability to measure the content that should be. That is, a test is said to be valid if it is able to measure what it wants to measure (Sudjana, 2011); (2) Test Reliability of Items, Reliability of questions is the level of consistency of questions so that they can be trusted; (3) t test, the data are normally distributed, then proceed with the t-test of two independent samples (independent-samples t test); (4) ANOVA test, one-way ANOVA test. The data analysis test used in this study was a one-way ANOVA test. It is called one-way analysis of variance, because the analysis uses variance and the observed data is the influence of one factor. One-way analysis of variance is a parametric statistical technique used to test differences in several groups of means, where there is only one independent or independent variable divided into several groups and one dependent or dependent variable; (5) N-Gain The N-Gain test is the difference between the pretest and posttest values. To show the quality of improving students' science process skills, the normalized average gain formula is used.

▪ RESULT AND DISSCUSSION

Critical thinking skills

The ability of students' critical thinking skills is obtained by using test questions. Data on the results of critical thinking skills in this study were obtained from *the pretest-posttest* given to two classes as samples. *Pretest* is a test given to students to determine students' initial abilities before being given treatment or *treatment.* While *posttest* is a test given to students to determine the final ability of students after being given treatment or *treatment.* The results of the six indicators of critical thinking skills are shown in graph 1 below:

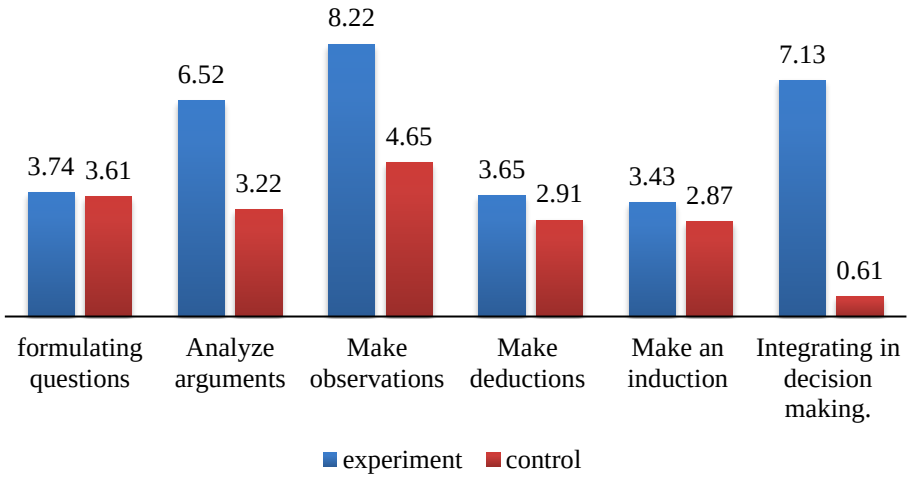

Figure 1. Critical thinking skills

Figure 1 Shows an analysis of critical thinking skills from the six indicators which show an increase in each indicator of critical thinking skills. While the average results of students' critical thinking skills taught using the Project Based Learning show that learning before and after using the Project Based Learning has increased by 9.8%. The results of the analysis of the application of the WEB-based Project Based Learning approach to class V science material experienced a significant increase. This is shown by the results of hypothesis testing where the sig (2-tailed) value is 0.00 while the α value is 0.05. This means that the value of sig (2-tailed) < α is 0.05, thus the hypothesis H_01 is rejected and H_a1 is accepted. This means that there is an influence of the critical thinking skills of students using learning with a WEB-based Project Based Learning approach to students of SD Inpres Oebesa. In line with previous research conducted by Siska et al. (2015) showed that the use of Project Based Learning can improve students' critical thinking process skills. Project-based learning can train critical thinking skills on contextual problems through complex activities. Students can be involved in various activities in the form of projects as a whole, can choose topics, decide on approaches, conduct experiments, draw conclusions and communicate the results of the projects they are working on.

Hartini (2017) explains that critical thinking skills are skills that must be developed and trained in students, through teaching and learning activities, so that critical thinking skills can develop and grow. The use of Project Based Learning can support students with regard to focusing on meaningful questions and problems, problem solving, decision making, the process of finding various sources, providing opportunities for members to work collaboratively, and closing with presentations of real products. Increasing students' critical thinking skills is due to the use of Project Based Learning where this model can create innovative learning and emphasize contextual learning through complex activities (Hartini, 2017: 2). The use of Project Based Learning shows that learning is more effective, improves critical thinking skills and increases students' understanding in understanding lessons. In line with research conducted by Daniel, (2017) explaining that the use of Project Based Learning can improve critical thinking skills. This is because Project Based Learning is a learning model that uses contextual learning, where students will play an active role in solving

problems, making decisions, researching, presenting and creating documents. Project Based Learning is designed so that it can develop critical thinking skills so that it can be used in solving complex problems.

Furthermore, research conducted by Ida (2019) shows that the use of WEB media can influence the development of students' critical thinking skills. WEB learning media allows many links between learning materials so that they can make learning media more varied. In line with the research conducted by Januarisman & Ghufron, (2016: 169) website-based learning provides advantages in delivering material that can be accessed anytime and anywhere. Website-based learning can provide the widest possible access and opportunity for students to build their own knowledge by accessing existing learning resources through learning media so that learning objectives will be easily achieved. In this study, researchers designed learning media using Google Drive. The following is a display of WEB learning media shown in Figure 2 below:

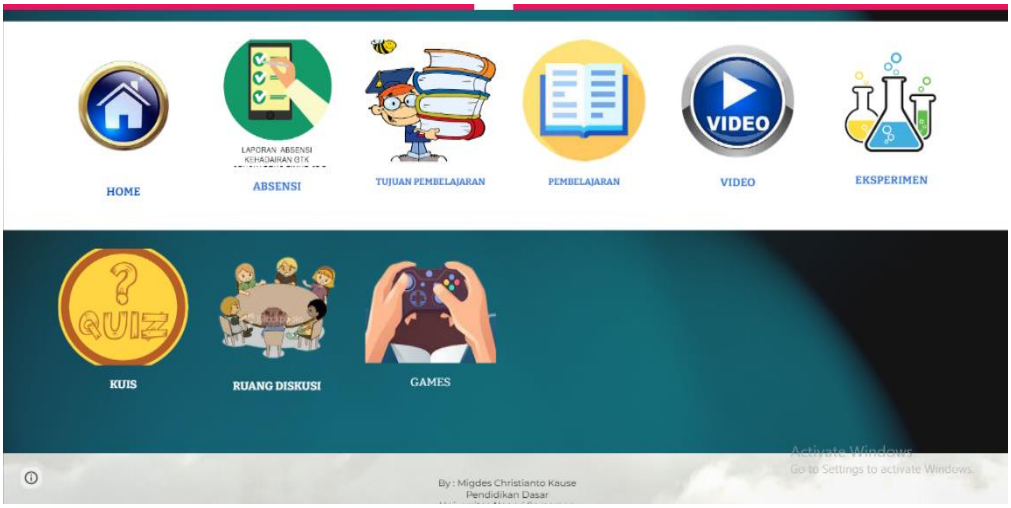

Figure 2. WEB learning media

Science process skills

The results of the analysis of the application of the Project Based Learning to class V science material experienced a significant increase. This is shown by the results of hypothesis testing where the sig (2-tailed) value is 0.00 while the α value is 0.05. This means that the sig (2-tailed) <α is 0.05, thus the hypothesis is rejected and accepted. This means that there is an influence of the science process skills of students using learning with a Project Based Learning to students of SD Inpres Oebesa.

Research conducted by Chasanah et al. (2016) Project Based Learning can effectively improve science process skills. Project Based Learning can support students in developing their creativity in designing and creating projects that can be used to solve problems. Learning using Project Based Learning takes place systematically so as to create new learning that reflects the place where students learn. Research conducted by Wijanarko et al., (2017) shows that the Project Based Learning effective for improving science process skills. The Project Based Learning model is a learning model that can develop the characteristics of students and includes four main elements, namely attitudes, processes, products and applications.

In line with research conducted by Firdaus et al., (2020) explains that the use of the Project Based Learning can improve students' science process skills, this is because

the Project Based Learning applies principles to the learning process, namely: (1) oriented to students; (2) can develop students' creativity; (3) creating fun learning; (4) contains values, ethics, aesthetics, logic, and kinesthetics; (5) provide varied learning experiences. The Project Based Learning has the advantage of being able to increase student motivation, improve student skills in utilizing existing learning resources, increase collaboration between students in working on projects that have been designed and can solve complex problems while working on projects.

This research shows that the use of the Project Based Learning in the learning process can make students more active, this is because students can find creative and innovative ideas in their own way and complete projects using their knowledge, skills, knowledge and learning experience. In addition, learning using the Project Based Learning can provide solutions and be able to solve problems that occur by creating ideas or producing products by utilizing the surrounding environment. as long as students carry out experimental activities. Experimental activities in this study can be accessed on the experimental menu presented in Figure 3

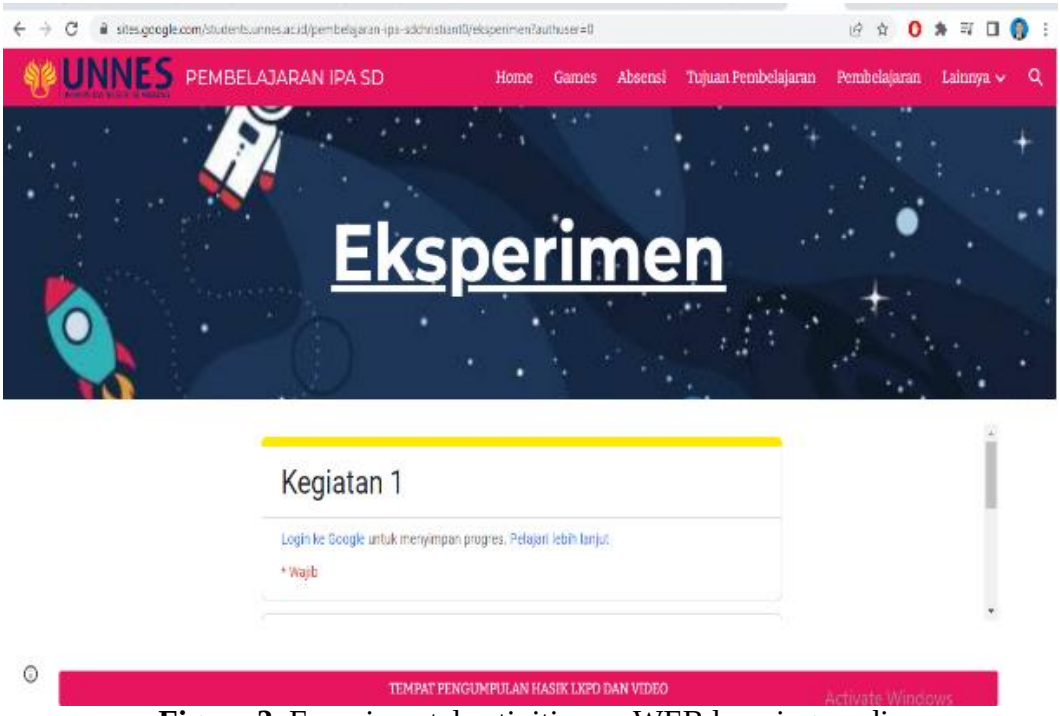

Figure 3. Experimental activities on WEB learning media

Abriyanto et al., (2022) shows that web-based media can improve students' science process skills. The use of WEB-based media in learning can be accessed using the internet network. Teachers can implement learning by utilizing computers. In addition, students can operate computers/smartphones properly in order to get the right information. In line with research conducted by Kurniawan, (2014) that web-based learning media can improve science process skills. The use of websites hardware portable (personal computer hardware movable (laptops or cellphones), and can be done anywhere, anytime, and by anyone. The rapid development of information technology and knowledge can be informed to students easily and quickly compared to other learning media.

▪ CONCLUSION

Use of Web-Assisted Project Based Learning has a significant effect on improving students' critical thinking skills. The test results show a sig (2-tailed) value of 0.00 while the α value is 0.05 according to the basis for decision making if the sig (2-tailed) value < 0.05 then there is a significant influence on students' critical thinking skills using learning with a Project Based Learning for Inpres Oebesa Elementary School students. Use of Web-Assisted Project Based Learning has a significant effect on improving students' science process skills. The test results show a sig (2-tailed) value of 0.00 while the α value is 0.05 according to the basis for decision making if the sig (2-tailed) value is <0.05 then there is a significant influence on students' science process skills using learning with a Project Based Learning for Inpres Oebesa Elementary School students.

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