



Development of Online Learning Media using Guided Inquiry to Improve Science Process Skills of Elementary School Students Assisted by Microsoft Office 365

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ABSTRACT

The research aims to produce a valid, practical, and effective Microsoft Office 365 guided inquiry learning tool to practice students' science process skills in elementary school. The development of this learning device uses a Four-D model. It is tested on students at Elementary School, in grade IV, class A and B using the design of one Group Pretest-Posttest design. The learning devices developed include syllabus, lesson plans, teaching materials, student worksheets, and science process skills tests with teaching materials themed light properties. Data collection uses validation, observation, and test methods—data analysis techniques using N-Gain, Paired samples t-test, and independent t-test. Science process skill results increased by an average N-Gain of more than 75% or categorized high. The data analysis techniques used to determine the improvement of science process skills are by using Paired samples t-Test that there is an increase in the scientific process skills in the grade IV Elementary School after learning activities. The independent t-test showed that the learning devices used in the sample group had a relatively similar (consistent) influence. Based on data analysis, it can be concluded that the guided inquiry model online science learning device effectively improves the science process skills of elementary school students. This study implies that Microsoft Office 365-assisted online science learning tools have the potential to be a solution and alternative to improve science process skills.

INTRODUCTION

The 2013 curriculum emphasizes student-centered learning. This curriculum aligns with the characteristics of students in the 21st century who must have four competencies, namely critical thinking and problem-solving, creativity, communication skills, and the ability to work collaboratively. Skills century 21 needs to innovate, involve various problems and utilize technology so that the world becomes a place best (Alismail & McGuire, 2015). With these competencies, students are expected to be able to think critically and creatively, solve problems, communicate, and work together with others. Soft skills are the basis for communication (Patacsil & Tablatin, 2017). In other words, communication skills are needed in daily activities. Language is necessary for communication. Language is an effective medium used for touch to interact with each other. Educators are also required to have skills in dealing with the development of science and technology. Educators in the 21st century must be active and creative (Daryanto & Karim, 2017). With these competencies, it is hoped that students can think critically and creatively, overcome problems, and communicate and cooperate with others. Educators are also required to have proficiency in dealing with the development of science and technology. Educators are required to be able to utilize innovative learning media. The importance of media in learning needs educators to be more creative and innovative in using learning resources and media (Rayandra, 2012).

During the pandemic, the learning process in Surabaya was carried out online using Microsoft Office 365 "Form" and "Sway". But the use of Microsoft Form and Sway has not been maximized because, with these applications, students tend to be passive in learning. Students only read and see the material and do the questions. There is no direct involvement in the experiment, so education is monotonous, and students get bored quickly. Therefore, the Microsoft app requires office 365 that can activate students, collaborate online, and conduct experiments. The application is Microsoft Office teams. With Microsoft Office 365 teams, students can do the most online learning. Teams are an application that can be used for collaboration that integrates everyone, content, and tools that teams need to get involved in the same place (TSM lecturer team, 2020).

One of the 21st-century skills is the science process skills students need to acquire through scientific investigation. Scientific research can be done with a guided inquiry learning model (Aktamis et al., 2016). Science process skills (SPS) can actively engage students in inquiry-based assignment activities, and students can learn research methods, providing opportunities for students to conduct experimental activities (Alkan, 2016). That practicum tasks will not be practical without using the skills of science processes. Science Learning should not be separated between knowledge, process, and product (Ningsih et al., 2017). There are several characteristics of guided inquiries, namely 1) students can develop thinking skills through specific observations, 2) to study the process of observing events, 3) each student seeks to build meaningful learning based on observation results, 4) classes are expected as laboratories in learning, 5) teachers motivate students to communicate generalization results (Anam, 2015).

Discusses more advanced integrated science process skills in inquiry learning, including engaging students with scientific questions, designing procedures, emphasizing the importance of providing evidence, formulating explanations, making connections with scientific knowledge, and communicating and justifying descriptions (Mallozzi & Heilbronner, 2013). Process science skills are thinking skills used by scientists to build knowledge to solve problems and formulate conclusions (Ozgelen, 2012). Science process skills are intellectual abilities needed in scientific investigations that students achieve due to learning (Sheeba, 2013). Process skills include developing learners' proficiency in an inquiry, hypothesizing analyses, and understanding. In improving students' process skills, teachers can apply learning according to their experience and scientific competence (Hardianti & Kuswanto, 2017). Process science skills are thinking skills used to process information, solve problems and form conclusions (Ozgelen, 2012). There are two science process skills, namely basic skills and integrated skills. Basic science process skills consist of observing, measuring, predicting, inferring, communicating, and classifying. Integrated science process skills include: defining and controlling variables, formulating and testing hypotheses, operationally defining, experimenting, interpreting data, and developing (Aydinli et al., 2011; Duruk et al., 2017; Aydoğdu et al., 2014; Lestari & Diana, 2018; Mahmudah et al., 2019; Marlina et al., 2019; Ramadhani et al., 2019; Yunita et al., 2017). In learning science, teachers should use inquiry to help students do an experiment (Diawati et al., 2016) and to train process skills (Sulistiyorini et al., 2016).

In learning science subjects in grade IV Elementary School Baratajaya, Indonesia found that student learning outcomes are low, especially stamped. The properties of light so that improvements in learning need to be made so that there is an improvement. The material properties of light allow students to conduct experiments so that learning

is more meaningful. But this has not been done by teachers in online education, so the teaching of science subject material for the properties of light has not been maximized. Supporting learning media and models is needed to activate online science subject learning students. Learning media, supporting media, and learning models are necessary to start students in online science learning. But the situation in the field shows that composing learning tools to practice complex science process skills (Kusumastuti et al., 2016; Ernawati & Safitri, 2017).

Science process skills allow students to understand how science is conducted, conduct scientific investigations, and increase their learning responsibilities (Dementiy & Grogoleva, 2016; Duda et al., 2019). This research aligns with Susanti's et al., study (2016), Development of Guided Inquiry Model in Science Subject Learning Devices to Train Junior High School Students' Science Process Skills. The development of the inquiry learning program is guided by natural resources to practice the scientific process skills in grade IV elementary school. Other relevant research by Johnson et al. (2016) on The Effects of Inquiry Project-Based Learning on Student Reading Motivation and Student Perceptions of Inquiry Learning Processes can be concluded that an inquiry-based learning approach is recommended as an instructional method for students at all levels. As well as research from Akinbobola & Olufuminiyi (2015) shows that the guided discovery model is the most effective in the physics knowledge transfer process. According to a study by Widdina et al. (2018), The Profile of Students' Science Process Skill in Learning Human Muscle Tissue Experiment at Secondary School can be concluded that students' basic science process skills used in learning are categorized in the high category with an index value above 60%. In a study by Schifman et al. (2013), Sleuthing Through the Rock Cycle: An Online Guided Inquiry Tool for Middle and High School Geoscience Education can be concluded that there is a new guided inquiry curricular module which has an online constructivist design with a comprehensive teaching record and has been successful in pilot use in the classroom. Based on this analysis, it is necessary to develop an online learning tool guided inquiry model assisted by Microsoft 365 to train elementary school students' science process skills. This study aims to produce valid, practical, and effective learning tools.

RESEARCH METHOD

General Background

This study used a One Group pre-test post-test design. The development of this learning device uses Thiagarajan's 4-D model with steps: Define, design, development (develop), and deployment (disseminate). The learning devices developed include syllabus, lesson plan, teaching materials, student worksheet, and science process skills tests.

Sample / Participants/ Group

The research was conducted at Elementary School Baratajaya Surabaya in the 2021/2022 academic year in the odd semester, with three meetings and pre-tests and post-tests. The subject of this study is a guided inquiry model learning device assisted by Microsoft Office 365 to practice science process skills. The trial subjects in the study were students of grades IV A and IV B, 25 students each. The researcher acted as a teacher in this study.

Instrument and Procedures

Some of the instruments in this study are learning device validation sheets, observation sheets for the implementation of online science learning guided inquiry models assisted

by Microsoft Office 365, student activity observation sheets and constraint sheets in the learning process, student response questionnaires, and science process skills tests. Two validators validate the developed learning device. The implementation of learning, student activities, and obstacles during education is based on observations made by two observers. Student response is received based on a questionnaire, while student science process skills are obtained based on science process skills tests. SPS test instruments are multiple-choice questions, each with four answer options.

Data Analysis

Learning tools are feasible if they are valid, practical, and effective. Two expert validators carried out an analysis of the device's validity. The analysis of science process skills results was obtained from the pre-test and post-test results. The pre-test and post-test scores obtained by students also indicate the effectiveness of the learning carried out. To determine the enhancement factor using N-Gain Hake classified N-gain into g-high ($g=0.7$), g-medium ($0.7>g>0.3$), and g-low ($g<0.3$). Statistical analysis was done with analysis test precondition and hypothesis testing. The prerequisite test used is the normality test using the Shapiro Wilk test statistic with a significance level of $= 0.05$ and homogeneity with Levene's test with a significance level of $= 0.05$. Test the hypothesis with Independent T-Test with a significance level of 0.05 was used to determine whether there were differences in the learning outcomes of each class from one variable (N-Gain). The results of the science process skills test were analyzed with Normalized-Gain (N-gain) to determine the increase in science process skills, paired t-test to determine the significant increase in science process skills pre-test and post-test with t-test results $\text{sig} < 0.05$, and t-test independent to find out whether the N-gain of both classes is substantial.

RESULTS AND DISCUSSION

1. Validity

Validated data online science learning tools can be seen in Figure 1. The conceptual validity: syllabus 3.58 (89.0%) with a very valid category, lesson plans 3.5 (87.5%) very valid category, assessment sheet 3.45 (86.3%) very valid category, student worksheets 3.5 (87.5%) very valid category and student textbooks 3.56 (89.0%) very valid category, while the readability level: Teaching material 3.56 (87.2%), lesson plan (90.4%) with high category.

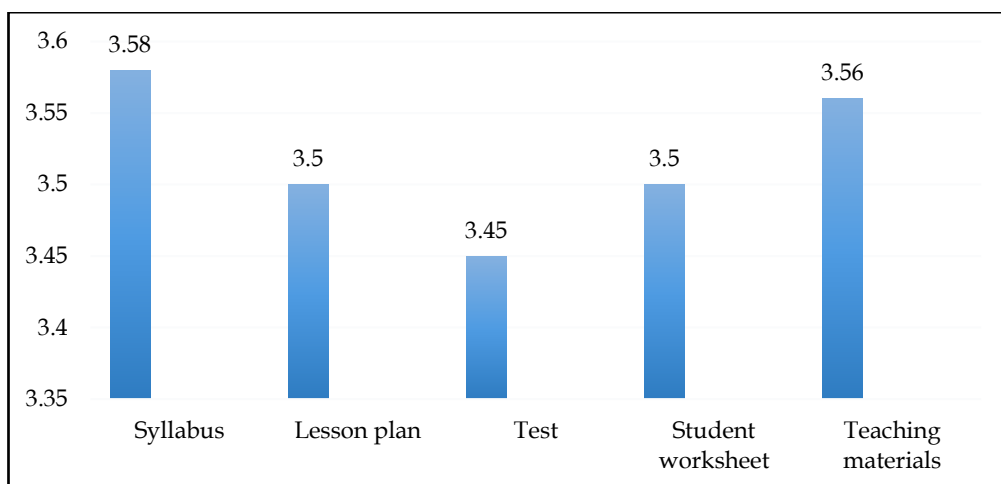


Figure 1. Online science learning media validation results.

2. Practicality

The learning used is online learning assisted by Microsoft Office 365 Teams. The learning process is carried out virtually entirely while still allowing students to interact with each other to communicate directly. This activity requires the internet. The tools used by teachers in the learning process are laptops and internet networks, while students can access using their parents' mobile phones and internet networks. E-learning learning is used using Microsoft Office 365 Teams media. Teams are used to overcome the limitations of space and time in online learning. With Microsoft Teams, students can experiment with teacher guidance, even in virtual education. Pre-test and post-test are given through the Microsoft Office form. The practicality of the implementation of learning devices is reviewed when conducting learning through the implementation of learning, student activities, and obstacles that arise during implementation. Learning devices are said to be practical if 1) the implementation of learning obtains an average observation score of at least 3.00 with the good category; 2) The percentage of student activity observation results is at least 66% with good categories; 3) The obstacles found during learning activities can be overcome. Aspects arranged in the lesson plan are carried out during three meetings. The average assessment of the implementation of the lesson plan is 3.31-3.68 in the excellent category, with a percentage of agreement of 82.81–92.19. The average evaluation of the implementation of the lesson plan is 3.31-3.68 in the superb category with a percentage of understanding of 82.81–92.19, the results of observations of student activities in grades IV A and IV B with an average of 88.82% were categorized as very good, and the obstacles during the study could overcome.

3. Effectiveness

Students' science process skills are assessed with multiple-choice written tests, carried out twice, before and after the online learning of the Microsoft 365 assisted Inquiry model. Pre-tests and post-tests are analyzed using N-gain scores as in Table 1.

Table 1. N-Gain Science process skills.

Class	Pre-test	Post-test	N-Gain
IVA	32.0	86.8	0.81
IV B	25.6	82.8	0.77

Table 1 shows class IV A students get an average N-gain critical thinking score of 0.81 in the high category, while grade IV B students get an N-gain critical thinking score of 0.77 in the high category. The guided inquiry model based on Microsoft Office 365 was declared effective because there was an increase in the science process skills test score. Andriani & Yonata (2018) states that applying the inquiry learning model, if implemented correctly, will help students obtain good results. It is shown in Table 2.

Table 2. Normality test results.

		Test Of Normality					
		Kolmogorov-Smirnov			Shapiro-Wilk		
Class		Statistic	df	Sig.	Statistic	df	Sig.
N-Gain	IV A	.155	25	.123	.933	25	.104
	IV B	.134	25	.200	.955	25	.318

Table 2 shows the normality of the N-gain test for class IV A is 0.104, and class IV A is 0.318. The test results of the two classes obtained probability (sig) > 0.05. As a result, Ho is acceptable, meaning that the data is normally distributed. The data were also analyzed using homogeneity test and shown in Table 3.

Table 3. Homogeneity test results.

Test of Homogeneity of Variances					
Levene Statistic		df1	df2	Sig.	
N-Gain	Based on Mean	.038	1	48	.846
	Based on Median	.052	1	48	.820
	Based on Median and with adjusted df	.052	1	47	.820
	Based on trimmed mean	.044	1	48	.834

Table 3 shows the homogeneity test results are known that a sig value of 0.846>0.05 indicates that the data is homogeneous. The homogeneity test results show the entire homogeneous data so that it meets the prerequisites for the hypothesis test. The data were also analyzed using paired t-test and shown in Table 4.

Table 4. Paired samples test paired differences.

		Paired Samples Test							
		Paired Differences							
		95 % Confidence Interval of the Difference							
		Mean	Std.Deviation	Std. Error Mean	Lower	Upper	t	df.	Sig. (2-tailed)
Pair 1	Pre-test- Post-test	-56.000	10.102	1.429	-58.871	-53.129	-39.200	49	.000

Table 4 shows the paired t-test shows that the sig value in both classes is 0.000. This shows a sig< value of 0.05, and a negative sign that means there is a significant difference between pre-test and post-test results, so there is an influence on the use of online science learning devices guided by Microsoft Office 365 assisted by improving students' science process skills.

Student response

Based on this research data, the average percentage of student responses after participants in the learning of Guided Inquiry assisted by Microsoft Office 365 was 88.89%, with an excellent category. Student response results are positive if the percentage each 61% (Riduwan, 2015).

The effectiveness of learning tools includes 1) Learning tools are said to be effective if the average percentage of student responses is at least 61% with good criteria; 2) Students' learning outcomes are said to increase if the N-gain value is > 0.3 in the medium category. The pre-test scores for class A ranged from 20 – 50, while for class B ranged from 10 – 40. The post-test scores for class A ranged from 70 to 100, while class B ranged from 70 to 100. Based on the post-test scores, the completeness of class A was a participant. Students

are not complete, and 24 students are total. The grade B post-test scores ranged from 70 to 100, with details of 4 students not completing and 21 students completing.

Based on these results, there is a change between pre-test and post-test. With guided inquiry learning, Microsoft Office 365 can practice students' science process skills. This is reinforced by Dementiy & Grogoleva (2016); Duda et al., (2019); science process skills allow students to understand how science is conducted, conduct scientific investigations, and increase their learning responsibilities. This research aligns with Susanti's et al., study (2016), Development of Guided Inquiry Model in Science Subject Learning Devices to Train Junior High School Students' Science Process Skills. And the results of Indah's research (2015), the development of the inquiry learning program is guided by natural resources to practice the scientific process skills in grade IV elementary school. Other relevant research by Johnson et al. (2016) on The Effects of Inquiry Project-Based Learning on Student Reading Motivation and Student Perceptions of Inquiry Learning Processes can be concluded that an inquiry-based learning approach is recommended as an instructional method for students at all levels. As well as research from Akinbobola & Olufuminiyi (2015) shows that the guided discovery model is the most effective in the physics knowledge transfer process. According to a study by Widdina et al. (2018), The Profile of Students' Science Process Skill in Learning Human Muscle Tissue Experiment at Secondary School can be concluded that students' basic science process skills used in learning are categorized in the high category with an index value above 60%. In a study by Schifman et al. (2013), Sleuthing Through the Rock Cycle: An Online Guided Inquiry Tool for Middle and High School Geoscience Education, it can be concluded that there is a new guided inquiry curricular module which has an online constructivist design with a comprehensive teaching record and has been successful in pilot use in the classroom.

CONCLUSION

Based on the study results, it shows that online learning devices in science subjects using the Microsoft Office 365 assisted inquiry learning model are feasible to improve students' science process skills on the materials themed light properties. This is indicated by the average N-gain of both classes in the high category, a statistically significant increase. The N-gain average is no different for both classes. Both classes responded positively, with excellent categories. This research implies that online learning devices using Microsoft Office 365 in science subjects with inquiry learning models can be an innovative solution and alternative to improve science process skills. The limitations of this research are researchers only test it in Elementary school. So, future research can investigate Junior High School or senior high school.

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