E-LKPD Based on Problem Solving as Innovative Teaching Materials to Improve The Ability to Analyze and Data Presentation on Plant Tissue

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Article Info	Abstract

The purpose of this study is to analyze the effectiveness of electronic worksheet (E-LKPD) based on problem solving on plant tissue to improve the ability to analyze and data presentation of high school students'. The research was Pre-Experimental using One Group Pretest Posttest Design. The population of this research is class XI of high school in odd semesters. The method in taking the sample was Purposive Sampling, with a sample size of one class. The result showed that most of the students' scores had completed the KKM, there was a difference in the average score before and after learning using E-LKPD based problem solving, and there was increase in N-gain in the high category for the ability to analyze and an increase in N-gain in medium category for data presentation ability. Based on the results of the study, it can be concluded that E-LKPD based on problem solving in plant tissue learning is effective in improving the ability to analyze and data presentation of high school students'.

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INTRODUCTION

The Ministry of Education and Culture (2020) issued a policy regarding the learning process for students which is carried out through Study from Home (SFH). This is stated in the Ministry of Education and Culture Circular Letter Number 4 of 2020 concerning Implementation of Education Policies in the Emergency of the Spread of *Coronavirus Disease* (Covid-19) which is strengthened by SE Permendikbud Number 15 of 2020 concerning SFH Implementation Guidelines during the Covid-19 emergency.

The implementation of distance learning requires a learning medium to transmit messages from teachers to students. This condition can be an opportunity to integrate learning media with Technology, Information and Communication (ICT). This is as explained by Ristekdikti (2016) that learning resources in distance learning are teaching materials based on Information and Communication Technology (ICT). Lestari (2018) explains that learning media that utilize technology becomes more flexible, students can access the information needed in learning more easily without space and time limits.

Plant tissue is one of the biology learning materials for Class XI Senior High School. In this material the basic competence that must be achieved is KD 3.3 Analyzing the relationship between cell structure in plant tissues and organ functions in plants. Analytical skills are one of the higher-order thinking skills based on logical abilities to use the knowledge they have to be able to differentiate, organize, and make decisions in solving existing problems (Saputra, 2018). Another definition put forward by Hasyim (2018) which explains that analytical ability is the ability to break down something into parts and be able to find linkages between these parts. In addition, there are other basic competencies that must be fulfilled, namely KD 4.3 presenting data from observations of tissue and organ structures in plants. This material examines the cell, structure, tissue, and function of organs in plants. Presentation of data is an activity to compile a set of information so that it makes information more meaningful and well organized (Zayyadi, 2017). Data is presented in various forms, depending on the type of data. In general, data is presented in three forms, which are 1) writing, 2) tables, and 3) images (Rinaldi & Mujianto, 2017). In biology learning, images are used to record observational data such as organism cells, tissues, organs, and organism specimens. Images are also a tool to assess students' understanding of biological concepts (Nugraha, 2018). In biology learning, drawing is one of the basic science process skills for students. Students are asked to draw, provide information, and explain pictures (Wekesa, 2013).

The results of an interview with one of the biology teachers at SMA Negeri 3 Klaten on the material of plant structure and tissue, there is no media available for conducting observation activities, besides that, in this KD, there are still many students' daily test scores that have not completed the KKM. This is because students have difficulty understanding the learning material. One of the reasons for this difficulty is the learning method which is still teacher-centered, so that students are less active in learning activities. This method reduces the opportunity for students to carry out discussion activities to find alternative solutions to problem solving which result in less than the maximum knowledge obtained by students. Therefore it is necessary to apply applied learning by observing in order to increase the learning activities of students. This applied learning requires learning media that can be used for observation activities (Rohmawati, 2018).

One of the biology teaching materials that can be used to facilitate observation activities is LKPD. The definition of LKPD according to Prastowo (2012) is printed teaching material in the form of sheets of paper which contains a summary of the material and instructions for implementing learning tasks that must be completed by students with reference to the basic competencies that must be achieved. Another definition of LKPD was put forward by Choo *et al.*, (2011) which states that

LKPD is an instructional tool consisting of a series of questions, material information, and discussion activities designed to guide students in understanding complex ideas systematically. Along with the times, LKPD is packaged in online or electronic form. The electronic version of LKPD can be opened on a laptop orscreen smartphone and can combine features such as images, video and audio to make it easier for teachers and students to interact (Muhammad & Safitri, 2017).

LKPD electronics can be combined with problem solving methods. Shoimin (2014) explains that problem solving is a learning process that focuses on teaching and problem-solving skills, in this case a problem is defined as a problem where the solution is not yet known, so it is necessary to find or find a solution. Problem solving is briefly explained by Olaniyan *et al.*, (2015) which states that problem solving is a learning process that begins with a problem and ends with an answer equipped with problem-solving information. Problem-solving skills are a part of higher-order thinking. This skill requires proper practice. Problem solving skills consist of three complex combinations of cognitive, behavioral, and attitude factors (Shokoohi-Yekta *et al.*, 2011).

Based on the description above, researchers are interested in examining the effectiveness of E-LKPD based on problem solving to improve the ability to analyze and data presentation skills of high school students' on plant tissue.

RESEARCH METHOD

This research is a type of experimental research. The research design used Pre-Experimental Design with the One Group Pretest Posttest Design model. The population used in this study were students at SMA Negeri 3 Klaten, majoring in Mathematics and Natural Sciences, class XI. The sampling technique in this study using purposive sampling. The sample that will be used in this research is class XI MIPA 7. Data collection techniques were carried out by tests and non-tests. Data were analyzed through non-parametric statistics using the Wilcoxon test.

RESULTS AND DISCUSSION

The results of the study were used to describe the effectiveness of E-LKPD based on problem solving to improve the ability to analyze and data presentation skills of high school students'. The effectiveness of problem solving-based E-LKPD is obtained from the increase in the student' ability to analyze and data presentation which can be seen from the KKM value of 80% of students $\geq$ 75, there is a difference in the average results before and after learning, and there is an increase in N-gain in the moderate category after learning plant tissue.

Minimum Completeness Criteria Value

The results of students 'scores on analytical skills are presented in **Figure 1**.
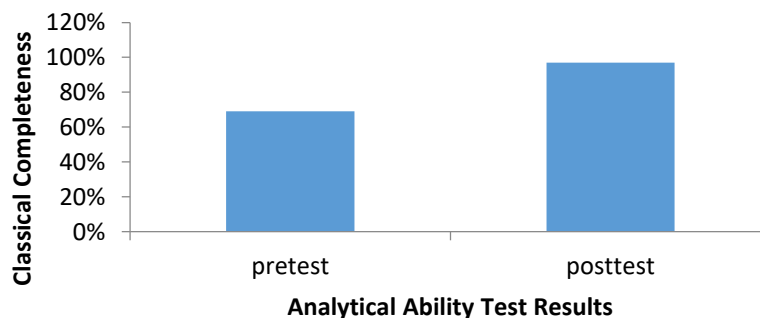

Figure 1. Classical Completeness of Students' Analytical Ability

Based on Figure 1. It can be seen that at the pretest score as many as 25 of the 36 students had reached the KKM score, while at the posttest score as many as 35 students had reached the KKM score. Meanwhile, the results of the data presentation ability value can be seen in Figure 2.
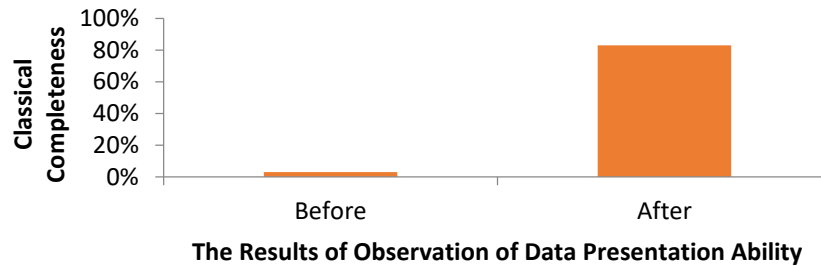

The Results of Observation of Data Presentation Ability

Figure 2. Classical Completeness of Data Presentation Ability

Based on Figure 2. It can be seen that the value of the ability to present data before the learning process as many as 1 in 36 students has reached the KKM value, while after the learning process as many as 30 out of 36 students have reached the KKM value.

Based on minimum completeness criteria value it can be concluded that E-LKPD based on problem solving is able to facilitate students to achieve basic competencies of plant tissues. This result is in accordance with the opinion of Trianto (2010) which states that LKPD is a guide in developing cognitive, psychomotor, and affective aspects in the form of activities that are adjusted to the indicators of learning outcomes that students must achieve. This is also supported by the research of Pramudi *et al.*, (2016) which shows that the use of E-LKPD can improve understanding of plant structure and tissue material as evidenced by the increased completeness of students' classical learning outcomes. Students gain increased understanding through student learning activities during learning activities. In learning using E-LKPD students actively construct their knowledge through activities in E-LKPD. Student learning activities obtained during learning using E-LKPD include 7 out of 8 active learning activities according to Dierich (2011) which include visual activities (viewing pictures and videos), oral activities (discussing expressing opinions and asking questions), listening activities (listening to friends' presentations and videos), writing activities (answering E-LKPD), drawing activities (drawing network structures), mental activities (solving problems), and emotional activities (being brave and confident to present E-LKPD answers).

Difference in average before and after learning plant tissue using electronic worksheets based on problem solving

Table 1. Wilcoxon Test Analysis Results on Analysis Ability

Ranks		N	Mean Rank	Sum of Ranks
Post Test - Pre Test	Negative Ranks	0[a]	.00	.00
	Positive Ranks	36[b]	18.50	666.00
	Ties	0[c]		
	Total	36		

a. Post Test < Pre Test
b. Post Test > Pre Test
c. Post Test = Pre Test

Tes Statistics[a]

	Post Test – Pre Test
Z	-5.248[b]
Asymp. Sig. (2-tailed)	.000

Based on the Wilcoxon Test Ranks analysis, it can be seen that all students experienced an

increase in value from the pretest to posttest results. The increase in the average score of students was 18.50. Based on the statistics test, the *Wilcoxon* test shows that Asymp.Sig (2-tailed) < 0.05, it can be concluded that there is an average difference between the ability to analyze before and after learning using E-LKPD based on problem solving.

The average difference between the pretest and posttest results can be seen through the analysis ability profile in **Figure 3.**
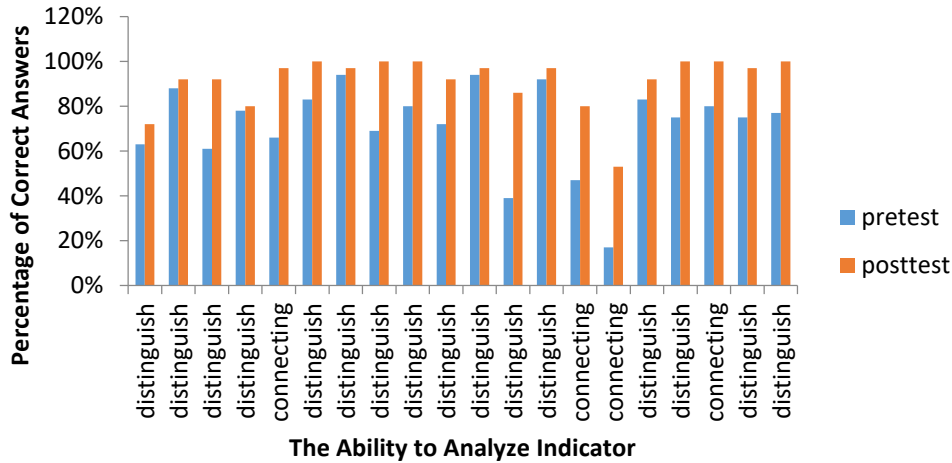

Figure 3. The Analysis Ability Profile of Students

There are differences in students' analytical skills in answering the pretest and posttest questions. The average shows that students who answered the questions correctly experienced an increase when working on the posttest questions. In the pretest and posttest questions there are two indicators. The first indicator is the ability to distinguish various types of plant tissues and the second indicator is the ability to relate the structure and function of plant tissues. In the pretest score, the highest percentage of correct answers was questions number 7 and 11 with differentiating indicators. In the posttest score, the highest percentage of correct answers was in question numbers 6, 8, 9, 17, and 20 which included distinguishing indicators and number 18 which included connecting indicators.

Table 2. Results of the Wilcoxon Test Analysis on the Data Presentation Ability

Ranks

		N	Mean Rank	Sum of Ranks
After – Before	Negative Ranks	0[a]	.00	.00
	Positive Ranks	36[b]	18.50	666.00
	Ties	0[c]		
	Total	36		
	a. After < Before			
	b. After > Before			
	c. After = Before			

Tes Statistics[a]

	Post Test – Pre Test
Z	-5.251[b]
Asymp. Sig. (2-tailed)	.000

35

Based on the Ranks analysis of the Wilcoxon Test, it can be seen that all students experienced an increase in value from the results before to the results after. The increase in the average score of students was 18.50. Based on the statistics test, the Wilcoxon test shows that Asymp.Sig (2-tailed) < 0.05, it can be concluded that there is an average difference between the data presentation ability before and after learning using E-LKPD based on problem solving.

The difference in the average of data presentation ability of students can be seen through the data presentation ability profile. This profile shows the comparison of the ability to present data in each activity in E-LKPD. The profile of the student's data presentation ability is presented in **Figure 4.**
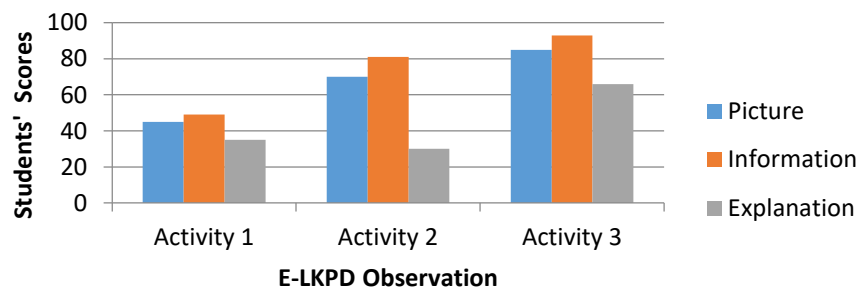

Figure 4. Profile of the Student's Data Presentation Ability

Based on the profile of students' data presentation capabilities, it can be seen that the ability to draw observation results has increased in every activity in the E-LKPD, the ability of students to provide information on pictures shows the highest results in each activity, and the ability to explain pictures shows the lowest results in every activity.

E-LKPD based on problem solving is able to train analytical skills of students. This ability is trained through contextual and factual problems that precede E-LKPD activities. This problem can be solved through observation activities. In the process of solving problems, students experience a thought process and gain higher intellectual abilities. This is in line with the opinion of Yani et al., (2016) which explains that the thinking process of students occurs when students are faced with new knowledge or problems and seek solutions to problems that occur. This is also supported by Supriadi *et al.*, (2015) who say that the thought process is a combination of theory and practice, abstract and concrete, concepts and facts that occur in the brains of students and end when the answer to the problem is found. In problem solving activities, students call back (recall) some of the knowledge they previously had, then accommodate the previous knowledge with the knowledge that has just been obtained. The analytical ability that can be improved after using E-LKPD based on problem solving is the ability to distinguish the various tissues that make up plant organs based on the structure, characteristics, and functions of the tissues that make up the organs of roots, stems, leaves, flowers, and fruits in plants. This is in line with the research results Nur *et al.*, (2017) which explains that with LKPD problem solving can improve analytical skills on differentiating indicators. In E-LKPD activities, students can build an understanding that already existed into a more complex understanding. This is in accordance with constructivism learning theory. Bada & Olesegun (2015) said that in constructivism theory students actively build knowledge and meaning from their experiences. Problem solving-based E-LKPD can also train data presentation skills through drawing observations from each activity in E-LKPD. The ability to present data that can be improved after using E-LKPD based on problem solving is the ability to provide information on parts of the image observed by students. This can happen because most of the problem solving-based E-LKPD activities train the ability to describe the parts in the picture, so that the ability to provide information ranks first

in the indicator of data presentation ability. Drawing activities can make abstract objects more concrete, making it easier for students to understand. This is supported by Nugraha (2018) which explains that drawing activities can help assess students' understanding of biological concepts. In the learning process, the teacher plays a role in helping students to get good and correct results. This assistance is obtained in discussion activities during learning.

Increase in N-Gain

Table 3. Results of N-gain Test The Ability to Analyze

The result	The average value before	The average value after	*Gain score*	Category
The Ability to Analyze	66,39	90,42	0,71	High
The Ability to Data Presentation	42,64	81,03	0,67	Medium

Based on the N-gain test, there was an increase in the value of analytical skills and the value of student data presentation. The increase in these results shows that E-LKPD based on problem solving is effective in improving the ability to analyze and data presentation ability of students. This increase occurred because there was an increase in conceptual understanding of the plant tissues. This is supported by research Zahriah *et al.*, (2016) which explains that learning to problem-solving *(*problem solving*)* can improve the analytical skills of students, because learning problem solving can improve thinking skills to find solutions to any problems. This result is also supported by Adiatmah *et al.*, (2015) who say that in learning biology students are required to be able to develop critical thinking skills to find concepts and solve problems in biological objects in the surrounding environment. Observation activities and presenting data in the form of images help students more easily understand the material structure and plant tissue. This understanding is obtained from E-LKPD activities that facilitate active students to construct their knowledge through observation activities, presenting data in the form of pictures, and the process of answering HOTS questions, as well as the discussion process. This is in line with Sari's (2017) opinion which states that teachers only provide facilities and situations so that students can actively construct knowledge continuously so that there is a change in concept leading to a more detailed and complete concept. Learning using media can make the cognitive dimensions of students run well through: 1) sensory processing through verbal and visual information from the material presented, 2) constructing information obtained with previous knowledge, and 3) integrating information obtained into in the cognitive dimension of learners (Quillin & Thomas, 2015).

CONCLUSION

Based on the results of the study, it can be concluded that E-LKPD based on problem solving is effective in increasing the ability to analyze and data presentations of students on plant tissues learning. The analytical ability that can be improved after the use of E-LKPD based on problem solving is the ability to distinguish the various tissues that make up plant organs based on the structure, characteristics, and functions of the tissues that compose the organs of roots, stems, leaves, flowers, and fruits in plants. The ability to data presentation that can be improved is the ability to provide annotations for parts of the image that are observed by students. This is reinforced by the classical completeness value of the ability to analyze and the ability to data presentation, most of which are above the KKM, there are differences in the average the ability to analyze and data presentation between the values before and after learning, and there is an increase in *N-gain* in the high category for the ability to analyze and medium category for the ability to data presentation.

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