Pengaruh Penggunaan *E-LKPD* Dalam Pembelajaran Matematika Terhadap Kemampuan Penalaran Peserta Didik Kelas VIII SMP

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Abstrak

Penelitian ini bertujuan untuk melihat pengaruh penggunaan *E-LKPD* terhadap kemampuan penalaran siswa kelas VIII SMP saat belajar matematika. Jenis penelitian yang digunakan adalah penelitian kuantitatif dengan metode *Quasi Eksperimen*. Populasi dalam penelitian ini yaitu seluru peserta didik kelas VIII tahun ajaran 2022/2023 dan pengambilan sampel menggunakan teknik *Cluster Random Sampling*. Sampel yang digunakan adalah 2 kelas yang homogen, yaitu kelas VIII-F sebagai kelas eksperimen dan VIII-E sebagai kelas kontrol dengan masing-masing 26 peserta didik. Pengumpulan data menggunakan instrumen tes kemampuan penalaran dalam materi bangun ruang sisi datar sebagai *posttest* dan soal pada instrument berbentuk uraian. Uji prasyarat analisis data yaitu uji normalitas dengan rumus *Product-Moment* pearson dan uji homogenitas dengan rumus *Cronbach Alpha*, uji Hipotesis menggunakan uji-*t* dan dilanjut dengan pengujian pengaruh menggunakan uji *effect size*. Hasil penelitian menunjukan bahwa kemampuan penalaran peserta didik kelas eksperimen lebih tinggi dibandingkan peserta didik pada kelas kontrol. Dampak pemanfaatan *E-LKPD* terhadap kemampuan penalaran peserta didik tergolong sedang pada pembelajaran matematika.

Kata Kunci: kemampuan penalaran matematis, lembar kerja peserta didik elektronik

The Effect of Using Electronic Student Worksheets in Mathematics Learning on the Reasoning Ability of 8th-Grade Junior High School Students

Abstract

This study aims to see the effect of the use of Electronic Student Worksheets on the reasoning ability of 8th-grade junior high school students in mathematics learning. The type of research used is quantitative research with Quasi-Experimental methods. The population in this study is all grade VIII students for the 2022/2023 school year and sampling using the Cluster Random Sampling technique. The samples used were 2 homogeneous classes, namely class VIII-F as an experimental class and VIII-E as a control class with 26 students each. Data collection was conducted using a reasoning ability test instrument in the topic of polyhedra as a posttest, with the questions in the instrument being in the form of essay-type responses. The prerequisite tests for data analysis are normality tests with the Product-Moment pearson formula and homogeneity tests with the Cronbach Alpha formula, hypothesis tests using t-tests and continued with influence testing using effect size tests. The results showed that the reasoning ability of experimental class students was higher than students in the control class. The impact of using Electronic Student Worksheets on students' reasoning ability is moderate in mathematics learning.

Keywords: electronic student worksheets; mathematical reasoning ability

INTRODUCTION

The important role played by mathematics in life is to build knowledge and technology for the future. Mathematics also has relationships with other sciences. This makes mathematics a subject that students must learn, starting from elementary school to college. As education levels increase, the difficulty of mathematics also increases, demanding students to reason. This means that students need reasoning skills to understand mathematics (Gustiadi, Agustyaningrum, & Hanggara, 2021). Mathematics education also has objectives stated by the Ministry of Education and Culture. One of them is for students to possess and enhance their ability to reason about patterns and properties, manipulate mathematics, develop proofs, or articulate mathematical ideas and statements (BSNP, 2006). Additionally, reasoning abilities are also one of the foundations in mathematics learning (Nababan, 2020). This means that a student's way of reasoning is an important and necessary aspect that must be present when learning mathematics.

However, in reality, many students face difficulties in solving mathematical problems, resulting in a lack of interest in mathematics and significantly impacting the level of mathematics learning achievement in Indonesia, which remains very low and far from expected. Looking at the results of PISA 2018, Indonesia ranked 73rd out of 79 countries in mathematics with a score of 379, which is below the OECD average score of 489 (OECD, 2019). The difficulties students face in learning mathematics can be attributed to several factors, including their limited ability to reason, resulting in their inability to connect facts to reach conclusions. This can be said because the PISA competition questions not only measure memory and computational abilities but also assess students' reasoning, problem-solving, and argumentation skills (Asdarina & Ridha, 2020).

Low mathematical reasoning abilities were also found in the research conducted by Asdarina & Ridha (2020), indicating that students' mathematical reasoning skills were still at a low level in solving PISA problems. The same issue was observed in the study by Aziz & Hidayati (2020) which showed that the reasoning abilities of junior high school students were still significantly low. However, these abilities are fundamentally important and necessary in mathematics education, so they need to be trained and developed in every mathematics lesson. In this regard, teachers should be able to improve students' reasoning skills, which means that during the learning process, the chosen methods should be effective, the learning materials and delivery methods should be appropriate, and the use of suitable and functional media is essential.

Educators can involve various media in their teaching to train students' mathematical reasoning abilities, including Student Worksheets (Lembar Kerja Peserta Didik or LKPD). With this learning media, students can develop new data and integrate it with the information they have previously acquired. This can be done throughout the learning process, so that learning is not solely conducted by the teacher, and students become active participants, making the learning process more effective.

However, according to Umaroh, Novaliyosi, & Setiani (2022), currently, Student Worksheets (LKPD) is not fully utilized in mathematics learning. This is because the use of engaging and actively involving student worksheets is still rare (Tariani, Suastra, & Astawan, 2022). In this context, teachers only deliver knowledge directly by writing the material on the board, which makes teachers more involved than the students. This prevents students from having the opportunity to develop their own ideas or thoughts and tends to make them passive during the learning process.

In this era of technological advancement, Student Worksheets can also take the form of digital materials, known as Electronic Student Worksheets (Lembar Kerja Peserta Didik Elektronik or E-LKPD) (Wulansari & Nuryadi, 2022). Teachers often create electronic teaching materials for mathematics learning in PDF and document formats. However, until now, they have not developed interactive electronic teaching materials for learning mathematics. Mathematics learning requires a variety of diverse interactive electronic teaching materials to keep students engaged (Subekti & Prahmana, 2021). Therefore, teachers need to develop interactive electronic teaching materials by utilizing computer assistance to overcome difficulties in mathematics learning. One of the interactive electronic teaching materials that can be developed and used by teachers in mathematics learning is electronic student worksheets (E-LKPD).

Electronic student worksheets (E-LKPD) can be designed to cover various mathematical concepts, allowing students to actively participate in the learning process and enhance their understanding of mathematical concepts. In learning mathematics, electronic student worksheets (E-LKPD) provide interactive exercises, activities, and practice problems that students can engage with using digital devices such as computers or tablets. As we know, the use of electronic devices is popular among teenagers, especially smartphones and laptops. Digital designs of Student Worksheets can be accessed using electronic devices anytime and anywhere, thus stimulating students' interest. Therefore, the use of Electronic Student Worksheets (E-LKPD) as a learning media will be effective in enhancing students' motivation to learning mathematics. Electronic Student Worksheets (E-LKPD) offer opportunities for immediate feedback, self-paced learning, customization based on their specific needs for each mathematics topic, and teachers can reduce excessive paper usage.

The direct use of Electronic Student Worksheets (E-LKPD) will actively involve students in understanding the material, watching instructional videos, conducting experiments, participating in discussions, and solving problems within the worksheets (Tariani et al., 2022). The creation of Electronic Student Worksheets can be done on a free online platform called *Liveworksheets.com*, which assists teachers in making the Electronic Student Worksheets attractive, preventing student boredom, and making the learning process more enjoyable. However, the use Electronic Student Worksheets in teaching activities is still rarely found. In this study, the researcher developed an electronic student worksheet with four characteristics, making it one of the solutions to influence students' reasoning abilities. First, the worksheets are designed according to the students' intellectual level. Second, using digital applications or websites that can make the worksheet layout more attractive and user-friendly. Third, using exercise questions that align with the indicators and fourth, facilitating students' mathematical reasoning abilities.

The use of student worksheets can train students in reasoning, which enhances their reasoning abilities (Afifah, 2017). This is similar to the research conducted by Nurazhaar (2019) which concluded that Student worksheets can improve students' reasoning abilities. This means that the use of digital student worksheets can also develop reasoning skills. Similar findings can be found in previous studies, such as the research conducted by Umaroh et al. (2022) on the development of Electronic Student Worksheets (E-LKPD) based on Problem-Based Learning (PBL) to facilitate students' reasoning abilities in the topic of circles.

After considering all the explanations above, it can be concluded that the use of Electronic Student Worksheets (E-LKPD) has the potential as an effective learning tool to strengthen the mathematics learning process in the classroom. By using Electronic Student Worksheets, students can experience flexibility and interactivity that enhance their active participation, develop ideas, and strengthen their mathematical reasoning abilities. Therefore, research investigating the impact of using Electronic Student Worksheets developed through the liveworksheets.com platform on students' reasoning abilities in 8th-grade mathematics classes is an interesting subject to study. This research can provide scientific evidence and valuable insights regarding the effectiveness of using Electronic Student Worksheets in improving students' reasoning abilities. The findings of this research can also serve as a foundation for the development of more innovative and interactive approaches to mathematics education in the future. Therefore, the aim of this study is to examine the effect of the use of Electronic Student Worksheets on the reasoning ability of 8th-grade in junior high school students during mathematics learning.

METHOD

The study was conducted at SMPN 265 Jakarta during the even semester of the academic year 2022/2023. he entire students in eighth grade, consisting of a total of 8 classes in that academic year, formed the population of the research. The *Cluster Random Sampling method* was used by the researcher to select the research sample. Two classes selected as samples were VIII-E and VIII-F. The Table 1 following is the student data.

Table 1. Student Data

Class	Number of Student
VIII-E	26
VIII-F	26

The sample selection was conducted through a lottery method to ensure that each sample had an equal chance of being selected. Additionally, after discussions with the school, it was decided that class VIII-F would be the experimental group using Electronic Student Worksheets (E-LKPD), while class VIII-E would be the control group using Manual Student Worksheets (LKPD).

This research is a quantitative study that uses the *Quasi-Experimental method*. The objective is to observe the effect of using Electronic Student Worksheets in mathematics learning on the mathematical reasoning abilities of eighth-grade junior high school students. The research design used is *The Nonequivalent Posttest-Only Control Group Design.*

Table 2. The Research Design

Group	Treatment	Posttest
Experiment	X	Y_1
Control	$-$	Y_2

In the experimental class, the learning begins with the introduction of the topic and problems related to polyhedra. Then, electronic student worksheets (E-LKPD) created through the *liveworksheets.com* website are provided to the students, giving them an opportunity to develop relevant information. Afterward, the students engage in discussions with their peers to solve the problems given in the worksheet. The learning process in the control class is similar to the experimental class, with the only difference being that the control class is not provided with electronic student worksheets. Instead, they are given manual or printed student worksheets. After the completion of the polyhedra learning materials, both classes are given the same final test called the "Reasoning Ability Test".

The Electronic Student Worksheets (E-LKPD) provided to the experimental class have four characteristics that is, the worksheets are designed according to the intellectual level of 8th-grade junior high school students, the student worksheets are created using the *Liveworksheets.com* website to make them visually appealing and easy to use, the exercise questions used in the worksheets align with the indicators and are capable of facilitating students' reasoning abilities.

Table 3. Mathematical Reasoning Ability Test details

Indicator of Mathematical Reasoning ability	Question indicator	Number Question
1. Express mathematical information 2. Manipulate mathematics 3. Present mathematical arguments 4. Form conclusions	• Solving problems related to the surface area of a square pyramid based on the similarity of its base with a cube	1
	• Solving problems based on the volume equality between a rectangular prism/cuboid and a right triangular prism	2
	• Solving problems regarding the surface area of a pyramid with a square base that is related to the volume of the pyramid	3
	• Solving problems related to the surface area of a prism with a right triangular base, while considering the lengths of the prism's edges	4
	• Solving problems involving the calculation of the combined surface area of two interconnected of polyhedra	5
	• Solving problems involving the calculation of the combined volume of polyhedra	6

In this study, a reasoning ability evaluation tool is used as the final test. This evaluation tool consists of six questions presented on a paper, and each student will work on it individually. When answering the questions, students are required to solve problems systematically, comprehensively, and clearly, so that they can obtain logical ideas or conclusions. The test questions will include indicators of mathematical reasoning ability. The detailed assessment instrument with the topic of polyhedra or geometrical objects in three-dimensional space that consist of flat faces will be presented in the Table 3.

Validity Test.

Validity is an index that indicates whether an instrument can measure what it is intended to measure accurately (Amanda, Yanuar, & Devianto, 2019). The Product-Moment Pearson formula is used to calculate the correlation coefficient in assessing the validity of an instrument (Sandu Siyoto & Sodik, 2015). The calculated result is then compared to the significance level $\alpha = 0,05$ and the degrees of freedom $(df) = n - 2$. if $r_{value} > r_{table}$, the item is considered valid, while if $r_{value} \leq r_{table}$, the item is considered invalid. The table below presents a summary of the validity of the items in the mathematical reasoning test, along with their interpretations using the classification described by Guilford (1956) in the Table 4.

Table 4. Recapitulation of The Instrument Validity

Item	r_{value}	r_{table}	Keterangan	Interpretasi
1	0,6895		Valid	Moderate
2	0,8485		Valid	High
3	0,8059	0,396	Valid	High
4	0,8865		Valid	High
5	0,8428		Valid	High
6	0,4198		Valid	Moderate

Reliability Test.

Reliability testing can be conducted once the instrument has been established as valid. The reliability of a test is an index that indicates the extent to which the instrument can be relied upon and trusted to demonstrate the consistency of measurement results when performed two or more times under the same conditions and measuring tools. In this study, the instrument's reliability is calculated using the *Cronbach Alpha* formula (Cronbach, 1951). Based on the results of the reliability analysis of the test items, a Cronbach's Alpha value of 0.822 was obtained. With a reliability coefficient value of $\alpha > 0,60$, it can be concluded that the instrument has a high level of reliability.

Data Collection Technique.

In this study, there were three data collection techniques. Initially, two homogeneous classes that had never used Electronic Student Worksheets (E-LKPD) in learning mathematics were selected. Then, these classes were divided into an experimental group and a control group, with each group using Electronic Student Worksheets (E-LKPD) and Manual Student Worksheets (LKPD) respectively. After the learning material is finished, the same reasoning ability test was administered to both groups. The test results were quantitatively analyzed to identify the effect of using Electronic Student Worksheets on students' reasoning abilities during mathematics learning.

Data Analysis Techniques.
Analysis Prerequisite Test.

Before testing the hypothesis, researcher need to fulfill two specific tests. The first test to be conducted is the normality test, which is used to determine whether the collected data comes from a normally distributed sample or not. In this study, the normality test is performed using *the Lilliefors test* at a significance level $\alpha = 0,05$. The result of the Lilliefors test, denoted as L_{value}, is compared with the corresponding L_{table} value at that significance level. If $L_{value} < L_{table}$, it indicates that the

collected data comes from a normally distributed sample. However, if $L_{value} \geq L_{table}$, it means that the collected data does not come from a normally distributed sample.

The second requirement that needs to be fulfilled is the homogeneity test, which is used to examine whether the two groups in the study have equal variances or not. In performing the homogeneity test, researchers use *the Fisher test* at a significance level of $\alpha = 0,05$ and degrees of freedom for the numerator $(df_1) = n_1 - 1$ and for the denominator $(df_2) = n_2 - 1$. The decision is based on comparing F_{value} dan $F_{\alpha(df_1, df_2)}$. if $F_{value} < F_{\alpha(df_1, df_2)}$, it means that the two groups have homogeneous variances, and if $F_{value} \geq F_{\alpha(df_1, df_2)}$, it means that the two groups do not have homogeneous variances.

Hypothesis Test

If the prerequisites for analysis have been met, the next step is to perform a hypothesis test to evaluate whether the use of Electronic Student Worksheets has an effect on students' reasoning abilities. The hypothesis test is conducted using the *t*-test technique at a significance level of $\alpha = 0,05$ and degrees of freedom $(df) = n_1 + n_2 - 2$. The basis for decision-making is as follows: accept H_0 if $t_{value} < t_{(\alpha, df)}$, indicating no significant difference in the average scores of students' reasoning abilities between the two classes; reject H_0 if $t_{value} \geq t_{(\alpha, df)}$, indicating a significant difference in the average scores of students' reasoning abilities between the two classes. The formula for the *t*-test is as follows:

$$t = \frac{\overline{Y_1} - \overline{Y_2}}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \qquad \dots (1)$$

Where $\overline{Y_1}$ and $\overline{Y_2}$ represent the mean values of the experimental and control classes, respectively, while n_1 and n_2 indicate the number of students in the experimental and control classes. The combined standard deviation is represented by s. This study proposes the following statistical hypothesis:

$$H_0 : \mu_1 \leq \mu_2$$
$$H_1 : \mu_1 > \mu_2$$

With μ_1 referring to the mean value of the mathematical reasoning test scores for the experimental class, and μ_2 referring to the mean value of the mathematical reasoning test scores for the control class.

Effect Test.

After determining the difference between the two classes using hypothesis testing, the researcher assesses how big the effect of using Electronic Student Worksheets (E-LKPD) on students' mathematical reasoning abilities using *the Effect Size formula* proposed by Becker & Park (2011), which is as follows:

$$ES = \frac{\overline{Y_E} - \overline{Y_C}}{S_C} \qquad \dots (2)$$

In this case, with $\overline{Y_E}$ and $\overline{Y_C}$ referring to the mean values of the experimental and control classes, and S_C representing the standard deviation of the control class. The decision can be made based on the criteria proposed by Cohen for interpreting how big of the effect (Izzah, Asrizal, & Festiyed, 2021). The criteria are shown by the Table 5.

Table 5. Interpretation Of Effect Size Criteria

ES Value	Interpretation
$ES < 0,2$	Low Effect
$0,2 \leq ES < 0,8$	Moderate Effect
$ES \geq 0,8$	High Effect

RESULTS

Descriptive Analysis.

The researcher used Microsoft Excel as a tool to analyze the data obtained from both classes in this study. In Excel, researchers can perform various necessary statistical calculations. Based on the data processing and descriptive analysis conducted, the results are shown in the Table 6.

Table 6. Description of Research Data

Group	Number of Student	Highest Score	Lowest Score	Average	Variance	Standard Deviation
Experiment	26	99	58	84,115	150,266	12,258
Control	26	99	46	77,308	214,782	14,655

Based on Table 6, it can be described that the experimental group has a mean of 84.115 and a data spread with a variance of 150.266 and a standard deviation of 12.258. On the other hand, the control group has a mean of 77.308, a data spread with a variance of 214.782, and a standard deviation of 14.655. From the available information, it is clear that there is a noticeable difference in the means between the class using Electronic Student Worksheets (E-LKPD) and the class using Manual Student Worksheets (LKPD) as a learning tool. There is a difference of 6.807 in the average scores between the experimental and control groups. In addition, hypothesis testing is necessary to determine the effect of using Electronic Student Worksheets during learning, but two prerequisite tests need to be fulfilled first.

Normality Test.
The researcher used the Lilliefors test to examine the normality of the data obtained from the tests in both classes. Table 7 shows the results of the normality test for both classes.

Table 7. Normality Test Analysis Results

Group	L_{value}	$L_{(0,05;26)}$	Explanation
Experiment	0,1416		normally distributed
Control	0,1226	0,1699	normally distributed

In table 7, the calculation results of the research data show that the experimental group obtained $L_{value} = 0,1416$, while the control group obtained $L_{value} = 0,1226$. The L_{table} value is obtained at a significance level of $\alpha = 0,05$ and with a sample size of $n = 26$, resulting in $L_{table} = 0,1699$. Since $L_{value} < L_{tabel}$, it can be concluded that the collected data comes from a normally distributed sample. As both data groups have been proven to have a normal distribution, the next step is to fulfill the next test.

Homogeneity Test.
The researcher wants to evaluate whether the two groups have similar (homogeneous) variances or not, so a homogeneity test is conducted. This test is carried out using *the Fisher's test* technique. Table 8 shows the results of the homogeneity test for both classes.

Table 8. Homogeneity Test Analysis Results

Group	N	Variances	F_{value}	$F_{0,05(25,25)}$
Experiment	26	150,266		
Control	26	214,7812	1,4293	1,9554

In Table 8, the homogeneity test of the two variances was conducted with a significance level of $\alpha = 0,05$ and degrees of freedom $df_1 = df_2 = 25$, the obtained results is $F_{value} = 1,4293$ dan $F_{table} = 1,9554$. Based on the homogeneity test criteria, the meaning of $F_{value} < F_{tabel}$ is that both classes have homogeneous variances. With the test results indicating homogeneous variances in the test data of students' reasoning abilities in the experimental and control groups, the researcher concludes that both classes have balanced variances. Therefore, the research will proceed to the next test.

Hypothesis Test.
If both classes have normally distributed data and homogeneous variances, then the research data has met the two prerequisite tests. Afterwards, the researcher conducted a hypothesis test using the *t*-test technique. The information used to perform the t-test is presented in the Table 9.

Table 9. The Information Used For t-Test

Group	N	Average	Variances	$S_{combined}$	$t_{(0,05;50)}$
Experiment	26	84,115	150,266	13,5101	1,676
Control	26	77,308	214,782		

The results of the t-test calculation are as follows:

$$t = \frac{\overline{Y_1} - \overline{Y_2}}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$t = \frac{84,115 - 77,308}{13,5101\sqrt{\frac{1}{26} + \frac{1}{26}}}$$

$$t = \frac{6,807}{13,5101 \times 0,2773}$$

$$t = \frac{6,807}{3,7477}$$

$$t = 1,8163$$

Based on the t-test calculation above, the hypothesis test data with $\alpha = 0,05$ and $df = 50$ obtain $t_{value} = 1,8163$ and $t_{table} = 1,676$. Referring to the hypothesis testing criteria, H_0 should be rejected if $t_{value} \geq t_{tabel}$. This indicates that there is a significant difference in the average scores of mathematical reasoning ability between the two groups of students. Therefore, it can be concluded that the mathematical reasoning ability of the experimental group is superior to that of the control group in learning mathematics. Since the researcher wants to assess how big the effect of using Electronic Student Worksheets (E-LKPD), further advanced tests will be conducted.

Effect Test.

The hypothesis testing has been conducted with the conclusion that there is a difference in reasoning ability between the two groups. The difference is observed in the higher mathematical reasoning ability of the experimental group. Therefore, the analysis will proceed by examining how big the effect of using Electronic Student Worksheets through the *Effect Size* formula, which is explained as follows:

$$ES = \frac{\overline{Y_E} - \overline{Y_C}}{S_c}$$

$$ES = \frac{84,115 - 77,308}{14,6554}$$

$$ES = 0,4645$$

Based on the calculations above, it can be interpreted using the criteria proposed by Cohen for interpreting the magnitude of the effect. Since $0,2 \leq ES < 0,8$ or $0,2 \leq 0,4645 < 0,8$, the effect is considered moderate. It can be concluded that the use of Electronic Student Worksheets has a moderate effect on students' mathematical reasoning ability.

DISCUSSION

The research was conducted in classes VIII-E and VIII-F at Public Junior High School 265 jakarta (SMPN 265 Jakarta). The mathematics lessons were carried out for 6 sessions based on the previously designed Lesson Plans (Rencana Pelaksanaan Pembelajaran or RPP), which can be seen in Figure 1. In learning mathematics, the Electronic Student Worksheets (E-LKPD) media created by the researcher through the website *liveworksheets.com* was used for the experimental group, while Manual Student Worksheets (LKPD) was used for the control group. At the beginning of the lessons, students were motivated and introduced to problems related to Polyhedra or geometrical objects in three-dimensional space that consist of flat. The teacher provided the Electronic Student Worksheets (E-LKPD) or Manual Student Worksheets (LKPD), giving students the opportunity to identify information related to the topic and helping them understand and comprehend the given problems. Students discussed with their peers

to find solutions to the problems. They solved the problems presented in the Worksheets using the gathered information and developed them to reach appropriate conclusions. Finally, the teacher facilitated a reflection session where students could share their experiences, new understanding gained, and the difficulties encountered during the lesson.

Figure 1. Mathematics Learning at SMPN 265 Jakarta

Based on the results of the descriptive analysis, there appears to be a difference in reasoning abilities between the two groups. This can be seen from the research findings and the processing of the posttest data, where the average score of the experimental group is higher by 6.807 compared to the control group. The experimental group has an average score of 84.115, while the control group has an average score of 77.308. The test results conducted by both classes indicate a normal distribution and homogeneous variances. Therefore, a hypothesis test was conducted, resulting in $t_{value} = 1,8163$ and $t_{table} = 1,676$. Since $t_{value} \geq t_{table}$, than H_0 is rejected, indicating that the reasoning ability of the group using the Electronic Student Worksheets as a learning media is higher than that of the group using Manual Student Worksheets. The effect of using electronic worksheets in learning mathematics on reasoning abilities is classified as moderate, as proven by the results of the *effect size* test calculation ($ES = 0,4645$), where $0,2 \leq ES < 0,8$.

The transition to electronic student worksheets does not alter the content components of the printed student worksheets. The change that occurs with this development is primarily in the format or medium of presenting the student worksheets. Previously, student worksheets were in paper form, and with this transition, they are now in an electronic format. The content remains the same, but the medium of the student worksheets shifts to electronic platforms (Hayati, Astuti, & Febrian, 2022). In addition, electronic student worksheets have other advantages in terms of space and time efficiency, making learning more effective anywhere and anytime (Indriani & Sakti, 2022; Syafitri & Tressyalina, 2020). With electronic worksheets, there is no need for physical storage space, as they can be easily stored digitally. Other studies have found that Electronic Student Worksheets are highly beneficial and can enhance students' motivation and interest in learning activities. This is primarily because electronic worksheets facilitate students' understanding of the subject matter and problem-solving process (Wijaya & Hidayat, 2022).

After being provided with electronic student worksheets (E-LKPD) that created through *liveworksheets.com* website in mathematics learning, the reasoning abilities of the students improved. Therefore, Electronic Student Worksheets is necessary in every mathematics lesson, because in improving mathematical reasoning abilities it must be done gradually during mathematics learning activities. Mathematical reasoning skills need to be continuously practiced so that a student's reasoning abilities in mathematics can improve. By regularly integrating Electronic Student Worksheets into mathematics lessons, teachers can create an environment that fosters the development of students' mathematical reasoning skills and helps them become proficient problem solvers in the subject.

Several previous studies have stated that the use of electronic student worksheets can also affect other mathematical abilities in students. This can be seen in the research findings of Munika, Marsitin, & Sesanti (2021), which prove that the use of electronic student worksheets with a problem-based learning approach can enhance critical thinking skills, as evidenced by the comparison of pre-test completeness percentage of 81% and post-test completeness percentage of 86%. In another study

conducted by Bombang, Fayeldi, & Pranyata (2022), the use of Electronic Student Worksheets was found to be effective in improving students' mathematical problem-solving abilities. The test results showed a high completeness percentage of 90%, indicating its effectiveness. However, in this study, the interactive nature of electronic student worksheets allows students to actively engage with mathematical concepts and problems, thus promoting the development of students' mathematical reasoning abilities.

Reasoning skills are essential for students to understand mathematical concepts and solve mathematical problems, because reasoning involves logical thinking processes that lead to conclusions (Ayal, Kesuma, Sabandar, & Dahlan, 2016). The immediate feedback provided by electronic worksheets enables students to identify and correct their mistakes, further enhancing their reasoning abilities. Additionally, the flexibility and accessibility of electronic worksheets enable students to practice and reinforce their reasoning skills at their own pace and convenience. Overall, the use of electronic student worksheets in mathematics learning can contribute to the improvement of students' reasoning abilities. Therefore, in this research, using Electric Student Worksheets (E-LKPD) created through the *Liveworksheets.com* website is a suitable choice due to its practicality and ease of use. It can display images or videos that motivate students and prevent them from getting bored during the learning process.

CONCLUSION

Based on the calculations and discussions in this study, it can be concluded that the use of Electronic Student Worksheets created through the *Liveworksheets.com* website during mathematics learning is able to effect students' reasoning abilities. The effect of using Electronic Student Worksheets on mathematics learning is moderate, as the reasoning abilities of students using Electronic Student Worksheets are superior compared to the class using Manual Student Worksheets (LKPD). This is also evident from the average scores of both classes, where the class using Electronic Student Worksheets has a higher average score of 6.807 points.

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