JPPIPA 9(9) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Implementation of Live Worksheets Assisted Interactive Student Worksheets Based on Discovery Learning

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Received: May 26, 2023
Revised: July 29, 2023
Accepted: September 25, 2023
Published: September 30, 2023

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DOI: 10.29303/jppipa.v9i9.4029

Abstract: This study aims to ascertain the learning outcomes, effectiveness, and significant differences between printed worksheets on electrolytic cell material and interactive student worksheets based on discovery learning. This research is in a quasi-experimental design with a pretest-posttest control group design. The research instrument consisted of multiple-choice test questions with research subjects in classes XII MIPA 6 and XII MIPA 8 at Public High School 1 Kendari. Data analysis techniques consisted of descriptive analysis and inferential analysis. According to the investigation's findings, students who used interactive student worksheets based on discovery learning and supported by Live Worksheets with printed student worksheets experienced increased post-test learning outcomes. Still, the increase in the experimental class was higher than in the control class. As a result, Live Worksheets-assisted interactive student worksheets based on discovery learning on electrolytic cell material are helpful in education because they can enhance student learning outcomes.

Keywords: Discovery learning; Live worksheets; Student worksheet interactive

Introduction

Chemistry is an abstract subject, so students often need help understanding science concepts. The difficulty of studying chemistry is related to the characteristics of most conceptual chemistry (Alam, 2020; Yamtinah et al., 2019). Chemistry is a simplification of the truth; the nature of chemistry is sequential and developing rapidly; chemistry is not just solving problems, and many materials are studied in chemistry (Sudirman, 2021; Fuldiaratman, 2021). The concept of chemistry, in general, is abstract, and students must understand the idea in a relatively limited time (Table, 2021). Chemistry is a hard science for students, causing many to fail to learn chemistry concepts (Timilsen et al., 2022).

Engaging in chemistry learning is needed to support learning. The role of today's unique technology in 21st-century education is very important in helping the learning process. Learning in the 21st century is very important for students to have the skills to learn and innovate using technology and information media (Maryani et al., 2020; Nazifah et al., 2021). Currently, information spreads easily, can be accessed anywhere, and can be communicated anywhere. Therefore, the use of technology is very necessary to meet the needs of modern students in dealing with learning, one of which is interactive student worksheets assisted by online websites such as live worksheets as learning media (Chofifah & Wintarti, 2023).

Learning media is a learning component that plays an essential role in achieving learning objectives, one of which is teaching media (Ariyanto et al., 2018; Fayanto et al., 2021). Learning media can be used to achieve learning objectives, and student activities in teaching and learning activities are student worksheets (Bakri et al., 2020; Marshel et al., 2020). Student worksheets contain instructions and steps to complete a task. Student worksheets (student worksheets) are worksheets that contain information and interaction between the teacher and students so that they can work on a learning activity themselves through practice or

How to Cite:
Maysara, M., Ariana, D., Saefuddin, S., Haetami, A., & Habiddin, H. (2023). Implementation of Live Worksheets Assisted Interactive Student Worksheets Based on Discovery Learning. *Jurnal Penelitian Pendidikan IPA*, *9*(9), 7628–7637. https://doi.org/10.29303/jppipa.v9i9.4029

application of learning outcomes to achieve instructional goals (Celik et al., 2022; Maharani et al., 2022).

Based on interviews conducted at the public high school 1 Kendari, the researchers learned that the student worksheets used were printed and needed to be more interactive. These printed student worksheets are less attractive because they only display pictures and writing, making them monotonous for students, easily damaged, and less practical. This unattractive student worksheet causes learning activities in class to tend to be boring, so students' understanding of concepts still needs to improve. Common conceptual knowledge can be seen from the average learning outcomes of students who have not reached the Minimum Learning Criteria (KBM = 75), namely ≤ 68. The solution to this problem is to apply interactive student worksheets assisted by live worksheets to create more interactive chemistry learning.

Live worksheet is a platform in the form of a website that provides services to educators to use available student worksheets and make their student worksheets interactive online (Prabjandee, 2023; Yusuf & Ali, 2022). Live worksheet interactive student worksheets can provide learning variations for students so that learning is not boring (Fuadi et al., 2022). Interactive student worksheets can make it easier for teachers to direct students to find concepts through experiments or investigations (Yusro et al., 2023; Gurses et al., 2022). Interactive student worksheets overcome the lack of student activity in understanding concepts by providing optimal learning variations that attract students' attention, are recreational and fun, and involve students actively in learning activities (Costadena, 2022; Rahayu et al., 2022). Student worksheets can be used for any subject, including chemistry lessons with abstract concepts, including electrolysis cell material. Electrolytic cell material describes the chemical reactions at the anode and cathode in a solution or liquid with active or inserted electrodes. These abstract chemical reactions require interactive learning media to visualize these things for students in a simple and easy-to-understand form (Ani, 2020; Dewi et al., 2019).

Other advantages of Live worksheet are as follows interactive and engaging. Live Worksheets provides a variety of interactive tools and features that allow teachers to create exciting and challenging worksheets for students (Rumadan et al., 2023). Flexibility in use: LiveWorksheets allows teachers to create, edit, and use flexible worksheets and accessibility and collaboration: Students can access worksheets made with Live Worksheets online from their computers, tablets, or mobile devices. They can incorporate text, images, video, and audio into worksheets to create rich and varied learning materials (Susilawati et al., 2023). It allows students to study anywhere and anytime with an internet connection. In addition, teachers can also provide real-time feedback to students and monitor their progress in real-time (Novikova, 2020). Automatic scoring: Live Worksheets provides an automatic scoring feature for several types of questions, such as multiple-choice questions (Konopliank & Pryshupa, 2023). Integration with other learning platforms: Live Worksheets can be integrated with various other learning platforms, such as Google Classroom and Moodle. To support LiveWorksheets that are interesting and according to needs, they must be supported by learning or learning designs based on students' characteristics (Prabjandee, 2023).

The learning model, following the characteristics of chemistry learning as expected in the 2013 curriculum, is to use the discovery model, namely discovery learning (Fajri, 2019). Combining interactive student worksheets with discovery learning models provides the solution. The discovery learning model excels at helping students understand complex concepts (Nurfadillah et al., 2020). This discovery learning model is designed to increase the activity of process-oriented students through self-directed self-discovery and reflection, which often appear as learning activities (Purkayastha et al., 2019; Vermunt & Verschaffe, 2000). In line with the discovery learning model, interactive student worksheets based on live worksheets also encourage students to be active because they can display material in the form of videos, pictures, and other exciting symbols so that they can add interest and enthusiasm to learning and provide convenience in learning carried out offline or online (Hasanah, 2021).

The results of Arisandi's research (2022) showed that the learning outcomes of students who studied the mole concept material using live worksheets learning media increased from 46.85% in cycle I to 92.86% in cycle II. It shows that using liveworksheets as learning media can improve student learning outcomes because live worksheets can provide learning variations to students so that learning becomes more exciting and interactive (Daryanto et al., 2022; Hurrahma & Sylvia, 2022). Based on the background description, it is necessary to apply interactive student worksheets (student worksheets) based on live worksheet-assisted discovery learning in class XII MIPA at the Public High School 1 Kendari on electrolytic cell material "so that chemistry learning becomes more interactive and can improve learning outcomes and learning activities of class XII MIPA students at the Public High School 1 Kendari. This study provides many benefits that can support learning by increasing student involvement and participation and facilitating better conceptual understanding Liveworksheets provide interactive tools such as games,

multiple choice questions, puzzles, and others, which can help students understand concepts more interestingly and interactively, develop collaboration and communication skills; encourage critical and analytical thinking skills; and facilitate formative assessment. Live worksheets can help teachers conduct formative assessments carried out during the learning process.

Method

The type of research used is a quasi-experimental research design with a pretest-posttest control group design. The sample for this research was class XII MIPA 6 (the control class) and class XII MIPA 8 (the experimental class) at Public High School 1 Kendari. The following are the stages of research implementation.

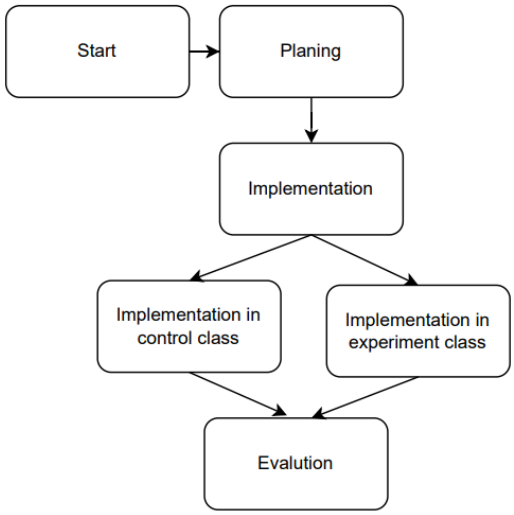

Figure 1. Research schema

Planning

The planning stage of this research includes: requests to schools that will be used as research sites; designing instruments to be used in research; validating the instruments to be used in research; and make a learning implementation plan.

Implementation

Implementation in control class: Step one is carry out an initial test (pretest), and apply learning according to lesson plans and student worksheets that chemistry teachers commonly use at Public High School 1 Kendari. The learning process is carried out in three meetings and the finally Conducting a final test (post-test).

Implementation in experiment class**:** Step one carries out an initial test (pretest); and apply discovery learning models, discovery learning plans, and interactive student worksheets assisted by liveworksheets that have been validated previously. The learning process is carried out in 3 meetings. After that Conduct a final test (post-test).

Evaluation

The evaluation phase of the research was carried out by collecting student competency data in the experimental class and control class using instruments that had been prepared beforehand, then conducting data analysis and compiling the research results. The data collection technique used in this study was giving test questions in the form of a pretest-posttest to students in classes XII MIPA 6 and XII MIPA 8 at Senior High School 1 Kendari with an instrument in the form of multiple-choice tests. Data analysis techniques in this study are presented as follows pretest and posttest scoring using equation 1 with the conditions presented in Table 1.

$$\mathrm{NP} = \frac{\mathrm{R}}{\mathrm{SM}} \times 100 \quad (1)$$

Description: *NP* = sought or expected percent value; *R* = raw score obtained by students; *SM* = ideal maximum score of the test in question

Table 1. Criteria Student Learning Outcomes

Interval	Interpretation
80 – 100	Very good
70 – 79.99	Good
60 – 69.99	Good Enough
40 – 59.99	Not good
0 – 39.99	Very Few

Statistic Parametric test

Test prerequisite analysis

Normality test

Criteria for normality test results for pre-test and post-test values using the Lilliefors (Kolmogorov-Smirnov) test with a significance level of $p > 0.05$; the data is said to be normally distributed

Homogeneity test

The criteria for homogeneity test results are if the data is declared homogeneous ($p > 0.05$), then students in the experimental class and control class are homogeneous Effectiveness Test.

Paired sample t-test

The paired sample t-test was conducted to test whether the treatment had an effect by considering the pretest and posttest averages. Trying the paired sample t-test was carried out with the help of IBM SPSS software version 26.

N-gain test (N-gain score)

$$g = \frac{skor\ posttest\ -\ skor\ pretest}{skor\ maksimal\ -\ skor\ pretest} \quad (2)$$

Table 2. N-Gain Score Criteria

Score	Criteria
$g \geq 0.7$	High
$0.3 \leq g < 0.7$	Medium
$g \leq 0.3$	Low

Hypothesis test

The basis for decision-making is based on the probability value, where if sig. (2-tailed) < 0.05, then H_1 is accepted, but if sig. (2-tailed) > 0.05 then H_1 is rejected.

Result and Discussion

Student Learning Outcomes

The learning process in the experimental class (XII MIPA 8) uses the discovery learning model and interactive student worksheet media assisted by liveworksheets. While in the control class (XII MIPA 6), using the discovery learning model and print student worksheet media commonly used at the Public High School 1 Kendari.

The data in Table 3 shows differences in learning outcomes between the two classes. The learning outcomes of students in the experimental class (XII MIPA 8) and the control class (XII MIPA 6) both increased, but it can be seen from the increase in the average learning outcomes of students in the experimental class, namely 81.93-35.07 = 46.86 higher than the control class, namely 85.27-4.23 = 41.04. It shows that the use of interactive student worksheets assisted by liveworksheets influences improving student learning outcomes because liveworksheets present material in an exciting way and make it easier for students to understand the material presented (Hidayah & Asri, 2022; Fitri et al., 2022). The features in the liveworksheets provide variations in the presentation of problems and their solutions, so students are more interested in solving the issues in student worksheets assisted by liveworksheets. The features of the live student worksheets include) questions with short answers, matchmaking, adding links to other websites, selecting and dragging answers to the appropriate questions, listening activities, adding videos from YouTube, and other features, support this (Rhosyida et al., 2021).

Table 3. Data Student Learning Outcomes

Information	Experiment class		Control class	
	Pretest	Posttest	Pretest	Posttest
Maximum value	60	86	59	93
Minimum value	17	76	27	78
Mean	35.07	81.93	44.23	85.27
Mean ratio		46.86		41.04
Median	34	82	44	86
Modus	28	86	44	90
Std. Dev	12.046	3.095	8.207	4.785

Figure 2. Identification problem & stimulation in Live Worksheets

Figure 3. Student activity in data collection using Live Worksheets

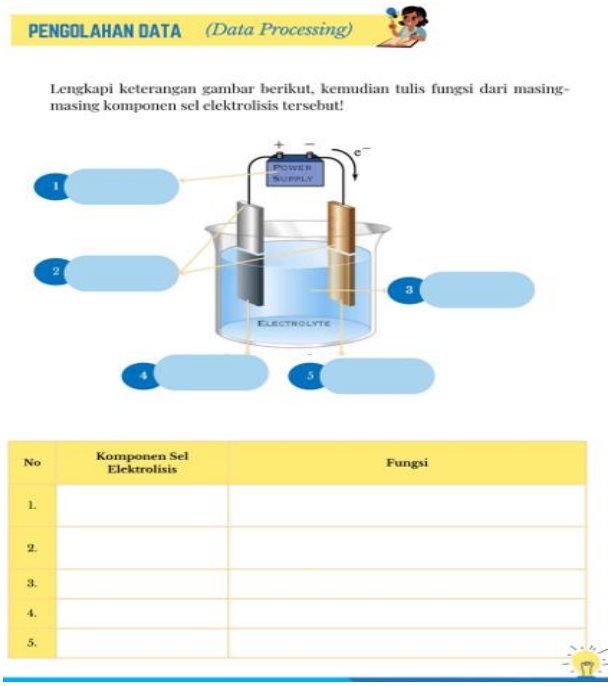

Figure 3. Student activity in data processing using Live Worksheets

These features can improve understanding of concepts and student learning outcomes. Novriani et al. (2021) and Hendrayani et al. (2022) suggest that the ability to understand students' concepts can be increased using liveworksheet-assisted student worksheets during learning. In addition, using interactive student worksheets assisted by liveworksheets based on discovery learning can also increase student motivation because the steps for delivering material in student worksheets are based on the discovery learning model. It was consistent with research conducted by Costadena et al. (2022) that learning activities using live worksheets assisted student worksheets based on discovery; learning has a clear delivery flow, meaningful material explanations, and instructions for using student worksheets. Hurrahma et al. (2022) report that live worksheet-based student worksheets have been tested to be practical, systematically arranged, and structured, equipped with concept maps, material, and self-evaluation questions to attract attention and trigger student motivation to learn to understand the concept.

The learning outcomes of students in the control class who used printed student worksheets also increased, but the difference in the increase in learning outcomes in the control class was lower than that of the experimental class, namely 85.27-44.23 = 41.04. The control class's learning materials still use printed student worksheets that must be interactive, which makes them dull for the students. There is an increase in student learning outcomes in the control class due to the influence of the discovery learning model on the learning process in class. The applied discovery learning model also impacts learning because it becomes more structured and meaningful. This is in line with the research of Sulistiani et al. (2023) state that the learning model influences student learning outcomes. The link between learning models and learning outcomes is also expressed by Dyson et al. (2004) that the use of an effective and good learning model allows students to focus on learning.

Comparison of the average value of the post-test results of students in the control class, which is higher compared to the experimental class because of the cognitive differences of students, where based on interviews that have been conducted, the distribution of students in each class is sorted based on the cognitive level of students, in other words, cognitive students in the control class (XII MIPA 6) were better or higher cognitive than students in the experimental class (XII MIPA 8). It causes a difference in the increase in post-test scores between the control class and the experimental class

The Effectiveness of the Use of Interactive Student Worksheets Based on Discovery Learning Assisted by Liveworksheets on Electrolysis Cell Material

Data normality test

Based on the Kolmogorov-Smirnov normality test (Table 4), it is obtained as a sig value at a significance level of 5% or 0.05. Decisions are accepted based on the provisions of normality hypothesis testing; that is, if sig > 0.05, then the data is stated to be normally distributed, so it can be concluded that the data above is normally distributed and can be continued in further parametric statistical tests.

Table 4. Data Normality Test in Experiment and Control Class

Class	Kolmogorov-Smirnov[a]			Descriptio
	Statistic	df	Sig.	
Pre-test experiment	.159	30	.050	normally distribute
Post-test experiment	.148	30	.093	normally distribute
Pre-test control	.159	30	.050	normally distribute
Post-test control	.149	30	.086	normally distribute

Data homogeneity test

Based on the homogeneity test at a significance level of 5% or 0.05, it is obtained as a sig value. Decisions are accepted based on the provisions of the homogeneity hypothesis test, namely if sig > 0.05, then the data is declared homogeneous, and if sig < 0.05, then the data is stated to be non-homogeneous, so it can be concluded that the data above is not homogeneous. Even though it is not homogeneous, further parametric statistical tests can still be carried out because of the homogeneity test.

Table 5. Result of Homogeneity Test in Experiment and Control Class

Class	Sig.
Pre-test experiment	.003
Post-test experiment	.009
Pre-test control	.010
Post-test control	.003

Result of analysis paired sample t-test

Based on Table 6, it is known that there is a significant difference between pretest and posttest learning outcomes in the experimental class using interactive student worksheet learning media assisted by live worksheets on electrolysis cell material. Likewise, the learning outcomes of the pretest and posttest in the control class are shown in Table 6, where the control class uses learning media for printed student worksheets on electrolysis cell material. As evidenced by the results of the paired sample t-test in both classes of 0.00, which means the sig. (2-tailed) < 0.05, it was concluded: "There are differences in chemistry learning outcomes in electrolytic cell material both in the experimental and control classes." So, it can be said that interactive student worksheets assisted by live worksheets and printed student worksheets on electrolysis cell material are effectively used in improving student learning outcomes for class XII MIPA 8 and XII MIPA 6 at Public High School 1 Kendari.

Table 6. Analysis Paired Sample T-test

Class	Sig. (2-tailed)
Pre and post - test experiment	.000
Pre and post-test control	.000

Interactive student worksheets with live worksheets based on discovery learning can improve student learning outcomes in class XII MIPA 8 because the student worksheets used contain subject matter presented in video form, pictures relevant to the material, various forms of questions such as multiple choice, short entries in the form of essays, and matching according to the concept. The videos and images displayed on the liveworksheet are new information or knowledge that students have just acquired so that they can identify and conclude based on the videos and images shown and relate them to concepts, phenomena, facts, and experiences that already exist in their cognitive structure. Students can also directly work on questions on interactive student worksheets assisted by live worksheets with various forms of questions, such as essay questions related to environmental analysis, thus encouraging students to be able to analyze and describe what they have learned (subject matter such as concepts). Students can also analyze videos by looking at the videos that are displayed. It will attract the attention of students, as stated by Hurrahma et al. (2022) and Yusro et al. (2023) that interactive student worksheets assisted by liveworksheets trigger students to be able to connect facts, phenomena, and experiences into the schemes being studied so that the subject matter can understand concepts well so students can be able to analyze facts or phenomena related to relevant concepts. Thus, interactive student worksheets assisted by liveworksheets can improve student learning outcomes, as seen from the average posttest scores of students in class XII MIPA 8. Prabowo (2021) reports that the use of liveworksheets in learning activities can improve learning outcomes for learners

N-gain score test

Based on the research, the N-Gain Score category data obtained in the experimental and control class are displayed in Table 7.

Table 7. N-gain Score in Experiment and Control Class

Class	Average N-gain	Category	Frequency	Percentage (%)
		High	20	66.67
Eexperiment	0.7	Medium	10	33.33
	(High)	Low	0	0
	Total		30	100
		High	19	63.33
Control	0.7	Medium	11	36.67
	(High)	Low	0	0
	Total		30	100

Table 7 describes the increase in student learning outcomes seen in the N-Gain Score data, which shows an increase in student learning outcomes after learning was carried out in the experimental class, and the control class both had an average N-Gain Score of 0.7. These data show that the n-gain scores in control and experimental classes are in the high category. The effectiveness of using interactive student worksheets assisted by liveworksheets can also be seen from the frequency of n-gain scores, where in the N-Gain Score experimental class in the high category, there were 20 students, while in the control class, there were 19 people. Even though the difference is not too significant, the experimental class has a greater percentage increase in the height category, which is 66.67%, compared to the control class, which is 63.33%.

Significant Differences in the Use of Interactive Student Worksheets Based on Discovery Learning Assisted by Liveworksheets and Printed Student Worksheets on Electrolytic Cell Material

An Independent sample t-test test at a significance level of 5% or 0.05 is obtained as a sig value. (2-tailed) decisions are taken based on the provisions of hypothesis testing, namely if sig. (2-tailed) < 0.05 means H_1 is accepted, and if sig. (2-tailed) > 0.05 means H_1 is rejected. The results of the independent t-test are shown in Table 8.

Table 8.T-test in experiment and control class

T-test	Sig. (2-tailed)
Experiment class Control class	.002

Table 8 obtained sig. (2-tailed) 0.002 < 0.05. That is, H1 is accepted, and H0 is rejected. That is, there is a significant difference in the learning outcomes of students using interactive student worksheets based on discovery learning assisted by liveworksheets and printed student worksheets on electrolysis cell material. The difference in improving student learning outcomes in the experimental class using interactive student worksheets assisted by liveworksheets is more significant than the difference in improving student learning outcomes in the control class using printed student worksheets

Conclusion

Based on the results of the study, it was concluded that the learning outcomes of students using interactive student worksheets based on discovery learning assisted by liveworksheets were better seen from the difference in the mean value of each class, where the control class was 41.06 while the experimental class was 46.86, so the interactive student worksheets based on discovery learning assisted by liveworksheets are more effectively used to improve student learning outcomes. The average n-gain score obtained from interactive student worksheets assisted by LiveWorksheets is 0.7 (high category). It has a higher percentage of increase in the high category than the use of printed student worksheets, namely 66.67%, so the interactive student work based on discovery learning assisted by liveworksheets on electrolytic cell material is effectively used to improve student learning outcomes. The results of the independent sample t-test obtained a sig. (2-tailed) of 0.002 < 0.05. It means that there is a significant difference in student learning outcomes using liveworksheet-assisted interactive student worksheets, liveworksheet-assisted discovery learning-based student worksheets, and printed student worksheets on electrolysis cell material, so it can be concluded that interactive student worksheets based on liveworksheet-assisted discovery learning are better used in education because they can improve student learning outcomes.

Acknowledgments
The author would like thanks to department of chemistry Universitas Halu Oleo for the support in this research

Author Contributions
Maysara: Arranging research instruments and setting research frameworks. Dinny Ariana: Executing research, collecting and processing data, and creating media. Saefuddin: conducting analysis, collecting data, and preparing research instruments. Aceng Haetami: Arranging student worksheet media drafts, creating design frameworks, and creating media. Habiddin: Draft media and develop test instruments.

Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest.

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