JURNAL BIOTERDIDIK: WAHANA EKSPRESI ILMIAH
(*Journal of Bioterdidik: Scientific Expression Media*)
Vol. 11 No. 3, December 2023, page. 297-312
http://jurnal.fkip.unila.ac.id/index.php/JBT/
doi: 10.23960/jbt.v11.i3.29075
e-ISSN: 2621-5594
p-ISSN: 2302-1276

Implementation of Blended Learning Assisted by e-worksheets Focus on Enhancing Students Metacognitive Strategies

Fitriya Lukita Permata Sari[1], Dewi Lengkana[1*], Nadya Meriza[1]
[1]Biology Education, Faculty of Teacher Training and Education, University of Lampung, Prof. Dr. Soemantri Brojonegoro Street No. 1 Bandar Lampung, Indonesia
[*]*Corresponding author*: dewi.lengkana@fkip.unila.ac.id

Received: November 3, 2023 *Accepted: December 1, 2023* *Online Published: December 30, 2023*

Abstract: This research aims to analyze the improvement of metacognitive strategies and students' self-directed learning in the implementation of blended learning assisted by E-LKPD Liveworksheets in 10th-grade classes at SMAN 2 Gedong Tataan during the second semester, focusing on environmental change topics. The research was conducted at SMAN 2 Gedong Tataan using a quasi-experimental method with a Pretest-Posttest Equivalent Control Groups Design. The research sample consisted of 64 students from 10th-grade Science 1 (X MIPA 1) and 10th-grade Science 2 (X MIPA 2) classes, selected through purposive sampling. Data were statistically analyzed using the Independent Samples T-test with a 5% confidence level, utilizing IBM SPSS Statistics 25. The research findings indicated that the implementation of blended learning assisted by E-LKPD Liveworksheets significantly improved students' metacognitive strategies, with a significance value of 0.000 ($p < 0.05$). The highest indicator for metacognitive strategies was procedural knowledge (75.78%) with a very good rating, while the lowest was debugging strategies (71.09%) with a good rating.

Keywords: blended learning, E-LKPD, Liveworksheets, metacognitive strategies

INTRODUCTION

In this digital era, the paradigm of learning has undergone significant changes. Teachers and students are no longer confined to traditional classroom-based learning. Technology-based learning, such as blended learning (a combination of online and face-to-face learning), has become a more relevant and effective alternative to meet the educational needs of today. Although technology-based learning offers the potential to enhance the effectiveness of education, its implementation requires special attention. One of the main challenges is how to improve students' metacognitive strategies and self-directed learning through this approach. Metacognitive strategies (students' ability to organize, monitor, and evaluate their own learning) and self-directed

learning (students' ability to learn independently) are crucial aspects in achieving better learning outcomes. Self-directed learning is an essential aspect of the learning process. It is necessary for every student to take responsibility for organizing and disciplining themselves, as well as developing the ability to learn independently. Self-directed learning can be defined as the understanding of not depending on others and taking responsibility for achieving the expected goals. The independence of learners can be reflected in their willingness to learn without being instructed, solving problems, and taking responsibility for their duties as students (Mufidah & Surjanti, 2021).

Metacognitive strategies help students in their learning, making metacognitive strategies a crucial element in the learning process by stimulating students to enhance their awareness of the thought and learning processes at play (Permata, Suherman, & Rosha, 2012). Metacognitive strategies encompass a series of processes used by an individual to control cognitive activities and ensure that cognitive goals are achieved. These processes involve planning and monitoring cognitive activities and evaluating the outcomes of these activities. The impact of individuals with strong metacognition is their ability to plan, monitor, and self-evaluate effectively, as well as to control ongoing thought processes within themselves. This, in turn, significantly affects students' learning outcomes. The more students are aware of their thought processes during learning, the better they can control their objectives, personalities, and attention, ultimately enhancing their learning outcomes. Additionally, there is a positive relationship between learning performance and metacognition, where students with high metacognitive levels tend to perform better compared to those with lower metacognitive levels (Suliya, Mandra, & Nisa, 2018).

Measuring metacognition is necessary to understand the extent of students' metacognitive abilities. By assessing students' metacognition, we can gauge their metacognitive capabilities, which will guide the extent of their comprehension and thought awareness. This, in turn, can lead to finding appropriate solutions to enhance students' metacognition. Furthermore, through metacognition assessment, we can also understand how a student can address everyday life problems and cope with those challenges. Based on the aforementioned research on metacognition and self-directed learning as the consequences of full online learning, the negative impact is evident in the development of students who tend to become less attentive and appear to underestimate their tasks. Furthermore, students may increasingly rely on others for assistance, making them less self-reliant individuals. Ultimately, the lack of self-reliance in students can pose challenges for parents or guardians when directing students to complete their tasks and responsibilities at school (Khurriyati, Setiawan, & Mirnawati, 2021).

Blended learning has various positive impacts on education in Indonesia in the current era. Among these impacts, both students and teachers can master technology to support online learning. In this increasingly advanced technological age, teachers and students are required to have learning technology skills. The varying levels of mastery of learning technology by students and teachers pose a unique challenge. This necessity forces them to expedite their mastery of digital learning technology. Meeting this requirement

helps them identify online media that can support classroom learning effectively without compromising the quality of instructional materials and learning goals (Siahaan, 2020).

E-LKPD Liveworksheets is one of the digital learning tools that can be used in blended learning. However, there is limited research that specifically examines how the application of E-LKPD Liveworksheets is oriented toward improving students' metacognitive strategies and self-directed learning. Empirical research is required to enhance our understanding of the implementation of Blended Learning aided by E-LKPD Liveworksheets in enhancing students' metacognitive strategies and self-directed learning. The results of this research can make a significant contribution to the development of more effective learning in the digital age. The changing times demand that individuals adapt to technological advancements, particularly in education. Moreover, the prevalence of smartphones among students compared to traditional learning materials like textbooks has a significant impact. This highlights the need for innovative teaching materials like LKPD that simplify the attainment of educational objectives. The innovation of learning materials, particularly in their presentation, includes integrating electronic media or technology, known as E-LKPD. E-LKPD can be accessed easily via PC/laptop or smartphone. The data within E-LKPD is supported by images and videos, and questions can be answered directly by students without the need to access external links, such as Google Forms. Additionally, the results of E-LKPD assignments are automatically sent to the teacher's email (Zahroh, 2021). Hence, there is a need for LKPD that can be used by teachers and students in their learning, such as Liveworksheet, to virtualize learning materials in various engaging formats, motivating students throughout the learning process (Pakpahan & Fitriani, 2020).

Online LKPD using the Liveworksheet website is an electronic media-assisted learning tool that includes text, images, animations, and videos. It is more effective in preventing student boredom. In this research, E-LKPD is defined as an online learning tool designed systematically and attractively to achieve the intended learning objectives. From its benefits, E-LKPD is expected to create a more engaging, enjoyable, interactive, and effective learning environment compared to traditional print-based LKPD (Khikmiyah, 2020: 3). The interactive LKPD based on Liveworksheet has several advantages over printed LKPD, including being (a) freely accessible, (b) more practical without the need for printing, (c) accessible on smartphones or laptops, (d) usable as a learning and assignment tool during online learning, and (e) not taking up storage space (Amalia, Roesminingsih, & Yani, 2022).

The Liveworksheets application allows teachers to create worksheets independently or use the ones provided within the application. When creating a worksheet, teachers upload files in a specific format specified in the application, which are then converted into images. Teachers are required to create drag-and-drop options for correct and incorrect answers if the questions are multiple-choice. The application is easy for students to access, as their answers are

automatically sent to the teacher's notifications, and students can view their scores immediately (Nurbayani et al., 2021).

Based on observations on July 2022, with a biology teacher at SMAN 2 Gedong Tataan, the observation results during face-to-face learning indicate that the learning resources and instructional media commonly used in the teaching process are limited to printed books. Based on the on-site findings, the Student Worksheets (LKPD) used tend to be in the form of sheets of paper containing tasks to be completed by the students. In daily assessments, 70% of students have not reached the Minimum Passing Grade (KKM), which refers to students' metacognitive strategies. Additionally, it was found that 58% of students do not submit their assignments on time, which reflects issues related to students' learning independence, particularly in terms of responsibility. During the learning process, students tend not to ask for clarification or questions regarding the biology lesson material that was previously explained if they don't understand it. Only 9.6% of students inquire about previously explained materials, which again relates to students' learning independence, specifically their sense of responsibility. After the learning sessions, the students do not summarize the material they have learned and always wait for instructions from the teacher before taking any initiative in their learning. This relates to the indicator of learning independence, which is the initiative in learning. Based on the issues observed during face-to-face and online learning, there are indications of low metacognitive strategies and learning independence among the students.

Based on the problems outlined above, the researcher is interested and motivated to conduct a research study titled " The Implementation of *Blended Learning* Assisted by E-LKPD *Liveworksheets* Focus on Enhancing Students Metacognitive Strategies (Experimental Study at SMAN 2 Gedong Tataan)"

METHOD

Research Design

The type of research used in this study is quasi-experimental (quasi-experiment) with a pretest-posttest equivalent control group design. This design consists of experimental and control groups selected using purposive sampling techniques. In this research, the independent variable (X) is the implementation of blended learning with the assistance of E-LKPD *Liveworksheets*, and the dependent variables (Y) are students' metacognitive strategies. The research instrument consists of questionnaire that was validated using SPSS 25.0. The validation process involved statistical tests such as the Product Moment and reliability tests using Cronbach's Alpha. Then, the data were analyzed for normality and homogeneity prerequisites, followed by hypothesis testing using an independent sample t-test for students' metacognitive strategies and self-directed learning.

Population and Sample

The population used in this study comprises all 10th-grade Science students at SMAN 2 Gedong Tataan for the academic year 2022/2023. The sample for this research consists of students from both X MIPA 1 and X MIPA 2 classes, selected using purposive sampling. The purposive sampling technique

is based on factors such as access to facilities, connectivity, and students' flexibility in attending classes. In this research, two classes were used, with X MIPA 1 having 32 students and X MIPA 2 having 32 students, and on average, all the students had smartphones.

Research Instrument

The research instruments used in this study are as follows: Written Test: This test, in the form of essay questions, is designed to collect data about students' metacognitive strategies regarding the environmental change material. The questions are created based on the indicators of the Metacognitive Awareness Inventory (MAI). Metacognitive Awareness Inventory (MAI) Questionnaire: The Metacognitive Awareness Inventory (MAI) questionnaire is administered at the beginning and end of the learning sessions.

RESULT AND DISCUSSION

The results of the research conducted on the implementation of blended learning with the assistance of E-LKPD Liveworksheets for the environmental change material, as indicated by the pretest and posttest (Table 1).

Table 1. The N-Gain Values *Pretest & Posttest* of Metacognitive Strategies.

Class	N	$\bar{X}$		*N-Gain*	Description
		Pretest	***Postest***		
Experimental	32	28,75	25,78	0,487	Moderate
Control	32	62,34	47,03	0,294	Low

Based on Table 1, it can be observed that the calculation of the N-gain for the pretest and posttest metacognitive strategy in this study is 0.487 in the experimental class, with a moderate criterion, and 0.294 in the control class, with a low criterion. Hypothesis testing was performed after conducting prerequisite tests, namely the normality test and homogeneity test. The results of the prerequisite tests are presented in the table below. The results of the prerequisite tests can be seen in Table 2.

Table 2. Statistical Test Results of Metacognitive Strategy *Pretest Posttest* Data.

Mark	Kelompok	$\bar{X} \pm Sd$	Normality Test	Homogeneity Test	*Independent Sampel T-Test [Sig. (2-tailed)]*
Pretest	Experimental	28,75 ± 10,160	Sig. 0,089 > 0,05	Sig. 0,842 > 0,05	
	Control	25,69 ± 9,461	Sig. 0, 080 > 0,05		
Posttest	Experimental	62,34 ± 15,553	Sig. 0,181 > 0,05	Sig. 0, 799 > 0,05	0,000 < 0,05
	Control	47,03 ± 14,417	Sig. 0, 075 > 0,05		

Description: Experiment (n= 32), Control (n = 32), Sd = Standard deviation, X = Mean

Based on Table 2, the data is proven to be normally distributed and homogeneous, so it is continued with hypothesis testing which obtains a Sig

value. (2-tailed) 0.000 < 0.05 indicates an increase in students' metacognitive strategies in implementing blended learning assisted by E-LKPD Liveworksheets at SMAN 2 Gedong Tataan in class X on environmental change material. In this study, researchers also provided a metacognitive strategy questionnaire instrument, namely the metacognition awareness inventory (MAI), related to the learning that had been carried out, namely blended learning assisted by E-LKPD Liveworksheets, to students. Based on the results of the questionnaire that has been given, it is presented in the graph in Figure 1.

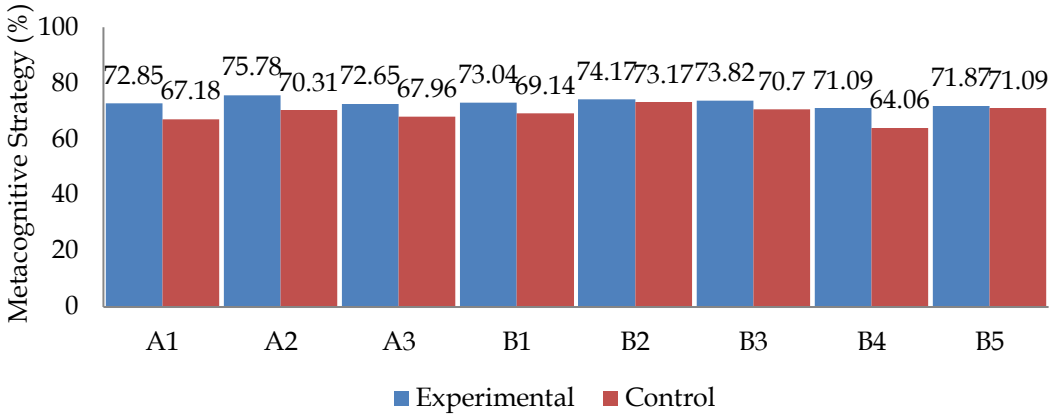

Figure 1. Per-indicator Comparison Graph of Metacognitive Strategy in the Control and Experimental Groups. A: *knowledge about cognition* (A1: *declarative knowledge*, A2: *procedural knowledge*, A3: *conditional knowledge*) B: *regulation of cognition* (B1: *planning*, B2: *information management strategies*, B3: *comprehension monitoring*, B4: *debugging strategies*, B5: *evaluation*).

Based on Figure 1, it can be seen that the results of the student metacognitive strategy questionnaire in the experimental class have a high score compared to the control class in each indicator, namely it is known that the highest metacognitive strategy indicator from the experimental class is A2: procedural knowledge (procedural knowledge) gets an average percentage 75.78% with very good criteria, while the highest metacognitive strategy indicator from the control class is B2: information management strategies which gets an average percentage of 73.17% with good criteria. Then the lowest indicators are found in both classes, namely the experimental class in B4: repair strategies (debugging strategies) getting an average percentage of 71.09% with good criteria, while the lowest metacognitive strategy indicators are in the control class B4: repair strategies (debugging strategies) who got an average percentage of 64.06% with good criteria. Then there was an increase in each indicator between the experimental class and the control class in cognitive knowledge, indicator A1: declarative knowledge increased by 5.67%. A2: Procedural Knowledge increased by 5.47%. A3: conditional knowledge increased by 4.69%. In cognitive regulation there was an increase in indicator B1: planning increased by 3.9%. B2: strategies for managing information increased by .35%. B3: monitoring of understanding increased by 3.73%. B4: improvement strategies increased by 7.03%. B5: evaluation increased by 0.78%.

In the distribution of answers to the experimental class Metacognitive Awareness Inventory (MAI) questionnaire for each indikator (Figure 2).

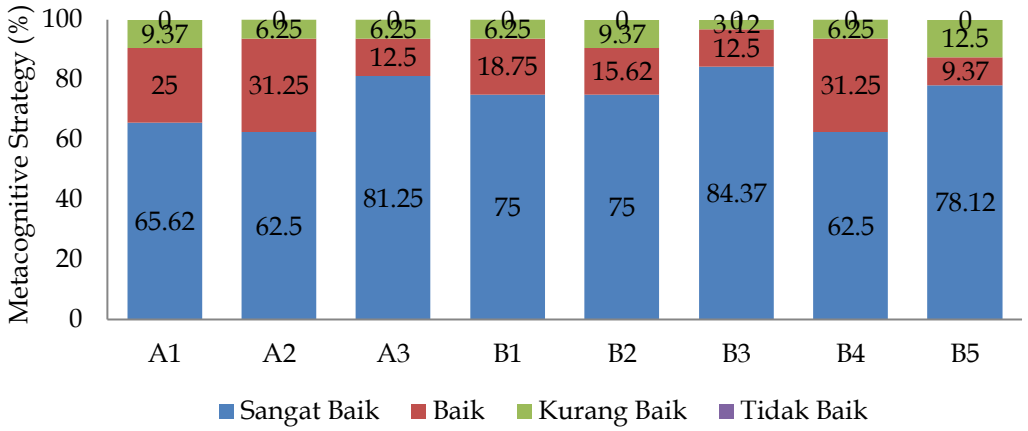

Figure 2. Percentage Distribution of Answers to Experimental Class Metacognitive Strategy Indicators. A: *knowledge about cognition* (A1: *declarative knowledge*, A2: *procedural knowledge*, A3: *conditional knowledge*) B: *regulation of cognition* (B1: *planning*, B2: *information management strategies*, B3: *comprehension monitoring*, B4: *debugging strategies*, B5: *evaluation*).

Based on Figure 2, it can be seen that the results of the distribution of answers to the Metacognitive Awareness Inventory (MAI) questionnaire in the experimental class are highest in indicator B3: monitoring students' understanding, choosing to answer very well, 84.37%, namely 27 students and the lowest indicator A2: Procedural Knowledge and B4: improvement strategy 62.5%, namely 20 students. Choosing a good answer was highest in indicators A2: Procedural Knowledge and B4: improvement strategies 31.25%, namely 10 students and the lowest 12.5% in indicators A3: conditional knowledge and B3: monitoring understanding, namely 4 students. Students chose to answer less well on indicator B5: 12.5% evaluation, namely 4 students. Then for each indicator none of the answers were good 0%.

Discussion

Based on the research results, it is evident that the implementation of blended learning assisted by E-LKPD Liveworksheets enhances the metacognitive strategies of students with a Sig. (2-tailed) value of 0.000, which is less than 0.05, based on the statistical test of N-gain data conducted in the experimental and control classes. The experimental class achieved an N-gain value of 0.487, categorized as moderate, while the control class achieved an N-gain value of 0.294, categorized as low. Referring to Table 2, in the implementation of blended learning assisted by E-LKPD Liveworksheets at SMAN 2 Gedong Tataan in Class X, students improved their metacognitive strategies during the learning process. They planned their studies, controlled themselves to stay focused during learning, reviewed the material taught to better understand it, and sought additional references that could expand their knowledge and were related to the taught material. The use of Liveworksheets

increased students' metacognitive strategies. Metacognitive strategies refer to students' awareness in learning. In the learning context, students know how to learn, are aware of their learning abilities and modalities, and know the best learning strategies for effective learning. Learning that incorporates metacognitive learning strategies, supported by effective and efficient learning media, can raise students' awareness in learning and understanding the studied context (Erlin et al., 2021). Learning with metacognitive strategies instills awareness of how to plan, monitor, and control what they know, what is needed for the task, and how to do it (Namira, Kusumo, & Prasetya, 2014). Metacognition is related to constructivism in building students' knowledge. Metacognitive strategies refer to how to increase awareness of the thinking and learning process so that when this awareness is realized, students can guide their thinking by designing, monitoring, and evaluating what they are about to learn (Khoiriah, 2015).

Metacognitive strategies are regarded as "high order executive skills that make use of knowledge of cognitive processes and constitute an attempt to regulate one's own learning by means of planning, monitoring, and evaluating" (Hartman, 2001b; L. Zhang & Seepho, 2013). Pang (2008) asserts metacognitive strategies as the "monitoring and regulative mechanism that readers consciously use to enhance comprehension." In reading, metacognitive strategies are self-monitoring and self-regulating activities which focus on both the process and the product of reading (L. Zhang & Seepho, 2013). The term metacognition could be defined as the ability of individuals to know their cognitive functions, monitor them while they operate, control and adjust them according to the needs of the learning process. Modern studies divide metacognition into two major and interrelated components: metacognitive knowledge and metacognitive regulation.

The metacognitive knowledge's sub-components consist of declarative knowledge (knowledge about the way we learn), procedural (knowledge about the appropriate learning strategies) and conditional (knowledge about the context in which strategies could be implemented). Metacognitive regulation includes planning, monitoring, and evaluation and could be considered as "self-management" of cognition involving reflective "self-appraisal" which supports awareness and has been labeled executive control. Metacognitive strategies refer to conscious monitoring, sequential processes to control learning, higher order executive skills, decisions learners make before, during and after the learning. It has been proved that the implementation of metacognitive strategies empowers higher-order cognitive abilities, attentional and memory control, self-confidence and leads to independent and meaningful learning. Classification of strategies varies, depending on the definitions adopted and the different associations and connotations within different research domains. Despite significant research efforts on metacognition and its learning strategies, there are still confusion and fundamental questions about their precise structure, their functions in gaining self-knowledge in learning and their conjunction with the notion of consciousness (Mitsea & Drigas, 2019: 4). Based on the above research findings, learners are made to realize about metacognition. Using strategies brings about

favorable result, since learners are knowledgeable about their own thinking. They can make choices and practice their knowledge on metacognition, hence, enabling them to monitor their own performance, make adjustments to some challenges encountered, and make assessments in their own competence. Therefore, it seems imperative that explicit teaching of strategies in metacognition be taught (James & Bulusan, 2020).

The data analysis results of the metacognitive strategy inventory show the trend of metacognitive strategies in the students of the experimental class, where blended learning is implemented with the assistance of E-LKPD Liveworksheets, and the control class for each indicator are as follows:

Based on Figure 1, it is evident that the declarative knowledge indicator has a good percentage in both classes. The experimental class achieved an average percentage of 72.85%, categorized as good, which is higher than the control class, which achieved a percentage of 67.18%. For example, in answering questions 1a and 2b, here are the students' responses. Good students regarding declarative knowledge are those who, during blended learning (Acquisition of information stage) using E-LKPD Liveworksheets, express their knowledge by answering questions within the E-LKPD Liveworksheets. By optimizing the potential of blended learning, students can acquire stronger and more enduring declarative knowledge. Declarative knowledge refers to the type of knowledge related to facts, information, or concepts that can be expressed in words. This aligns with the results of a study conducted by Fitria & Hendriyani (2019: 745) regarding metacognitive knowledge, which includes knowledge used to search for information or information sources needed as part of the tasks assigned, known as declarative knowledge. The complexity of declarative knowledge can train students' thinking skills in organizing their existing knowledge and honing their reasoning abilities. According to Asriningsih, Saepuzaman, & Ferranie (2016: 168), metacognitive knowledge comprises three sub-components, namely declarative knowledge, procedural knowledge, and conditional knowledge. Declarative knowledge refers to one's self-knowledge about a particular subject, such as a student's ability to solve problems by understanding the concepts that will be used to address the problem.

Based on Figure 1, it is evident that for the category of students not doing well regarding procedural knowledge, the experimental class achieved a percentage of 75.78%, while the control class achieved a percentage of 70.31%, both of which are categorized as good. For example, in answering questions 4 and 8, here are the students' responses. Good students regarding procedural knowledge, especially in metacognitive knowledge, understand procedural knowledge. For instance, in the pretest-posttest question number 4, when confronted with a problem and asked to explain the procedure for water purification, procedural knowledge pertains to knowledge related to how to perform specific actions or skills. It involves knowing the steps or procedures necessary to complete a task or achieve a specific goal. In blended learning during the Acquisition of Information stage, students are requested to analyze problems presented in E-LKPD Liveworksheets through group discussions. This aligns with Haryanti's statement within Wardana, Prihatini, & Hidayat (2020),

which emphasizes that students can be said to possess procedural knowledge in learning when they can select and correctly apply appropriate procedures to solve a problem.

Based on Figure 1, it is evident that for the category of students not doing well regarding conditional knowledge, the experimental class achieved an average percentage of 72.65%, categorized as good, while the control class achieved an average percentage of 67.96%. Here's an example of students' responses when answering question number 9a. Students who excel in conditional knowledge benefit from well-designed blended learning that guides them through various learning stages. This means they can begin with foundational online materials and then shift their focus to practical applications in a face-to-face setting. It ensures that foundational knowledge is mastered before attempting to apply it in real-world situations. Conditional knowledge relates to context-specific or situational knowledge, and *blended learning* can enhance the understanding and application of this knowledge in various situations. Therefore, *blended learning* can be an effective approach to improving conditional knowledge because it combines flexibility, structured learning, hands-on experiences, collaboration, ongoing assessment, and access to additional resources to strengthen understanding and application of knowledge across different scenarios. This aligns with what Novita & Widada (2018) mentioned about conditional knowledge: knowledge about when to use a procedure, skill, or strategy and when not to use it, why a procedure can be used under certain conditions, and why one procedure is better than another. Metacognitive strategies can help learners effectively solve problems through thoughtful planning, involving the process of identifying problems, understanding the issues that need resolution, and grasping effective strategies to address them (Anggo, Salam, & Suhar, 2014). Having this ability, students will know what strategies to be best used in certain condition and instruction, when, how and why using those strategies. Students will also have the ability to select the most appropriate reading strategy for different passages and eliminate what are unnecessary. This will save time and students can take the benefit of it for completing another task (Maki & McGuire, 2002).

Based on Figure 1, the graph of planning shows that the experimental class achieved an average percentage of 73.04%, categorized as good, while the control class achieved an average percentage of 69.14%. Here's an example of students' responses when answering question number 6. Students who excel in planning their learning activities have several ways to solve problems and choose the best approaches. They read instructions carefully before starting assignments and can manage their time effectively to achieve learning goals. These students set specific targets for completing tasks, such as finishing an assignment within 15 minutes. Planning activities involve selecting appropriate strategies and allocating necessary learning resources, which can support the success of students in their learning. This aligns with what Sumampouw (2011) stated: planning activities like setting goals and task analysis help activate relevant knowledge, making it easier to organize and understand the learning material. Bjork, Metcalfe, & Shimamura (1994) describe it as the knowledge

about how someone perceive, remember, think, and act upon what he/she knows. Other scholars define it as knowing about knowing. The first knowing represent the awareness of the second knowing, that is, the understanding of different factors to complete certain task, such as the state of one's knowledge and abilities (Kleitman et.al, 2012). So it can be said that having metacognitive ability, one can be said to have awareness, knowledge and control of what he/she has in mind and can regulate it to achieve certain purposes.

Based on Figure 1, the indicator of information management strategies shows that students in the experimental class achieved an average percentage of 74.17%, categorized as good, while students in the control class achieved an average percentage of 73.17%. Here's an example of students' responses when answering questions number 7 and 10. This aligns with the concept of students' strong performance in the "good" category, indicating that they can effectively process information. For instance, in blended learning, during the "seeking of information" stage, the researcher provided a video lesson link on YouTube through a WhatsApp group with the link https://youtu.be/KqHOlwa6jXI, which discussed the causes of environmental changes and their impact on life. In the previous session, three groups were each assigned to study and summarize the provided video lesson. Students were also given interactive worksheets and shared a liveworksheets link https://www.liveworksheets.com/w/id/biologi/7119464. This was done because blended learning with the assistance of E-LKPD liveworksheets was conducted online, necessitating an information-sharing process during learning. The information management strategies indicator is a cognitive regulation phase that plays a role in direct activities within the learning process of the students (Dwi et al., 2021: 89). Effective planning is a supportive factor in developing information management strategies. These strategies are essential in the learning process between the researcher and students. The application of blended learning with E-LKPD liveworksheets significantly influences the outcomes of this indicator. This learning process strongly supports students in actively analyzing acquired information to help solve problems. Cognitive management can enhance students' metacognitive abilities and, in turn, improve their performance (Panggayuh, 2017). In Organizational Planning, there are three activities which spent quite long time, they are: coming up with a list of reading strategies which would probably be used, scanning the text first and concentrate on what would be read, and reading the text before reading the task. These activities were very advantageous to help the students comprehend the text. They could prepare some reading strategies which had been learned before then chose the most appropriate ones based on what was demanded by the task. The students could do these activities when they did not have to rush with the time. However, in certain situation, for example in an exam or a test, they probably choose to avoid doing these activities. Since the students had got the training of metacognitive strategies for reading, they could equip themselves with strategies that supported the success of their reading (Muhid et.al, 2020).

Based on Figure 1, the indicator of comprehension monitoring shows that students in the experimental class achieved an average percentage of 73.82%,

categorized as good, while students in the control class achieved an average percentage of 70.70%. Here are examples of students' responses when answering questions number 2a, 5, and 9b. This demonstrates excellent results, meaning that the students, as a whole, can analyze their understanding gained during the learning process. Monitoring comprehension is a cognitive strategy used by learners to ensure they understand the material being studied. It involves self-awareness of understanding and the ability to identify when comprehension is disrupted or lacking. Another way to monitor understanding is through participating in classroom or group discussions. Students can listen to others' opinions, ask questions, and explain their understanding to others. In blended learning (Acquisition of Information phase), students are asked to discuss problems presented in E-LKPD liveworksheets as a group. During the Synthesizing of Knowledge phase, students join pre-assigned groups, with one group presenting their findings while the others listen and provide feedback. In this phase, students have the opportunity to ask questions about unclear material. This aligns with Wardana, Prihatini, & Hidayat (2021), where monitoring activities include paying attention when reading and creating self-questions or self-testing. These activities help students understand the material and integrate it with their prior knowledge.

Based on Figure 1, the debugging strategies indicator shows that the experimental class achieved an average percentage of 71.09%, categorized as good, while the control class achieved an average percentage of 64.06%. Here are examples of students' responses when answering question number 3. The need for and use of debugging strategies in solving problems during the learning process are evident. This means that almost all students can apply debugging strategies effectively when facing difficulties in the learning process (Setyadi, 2018). During learning, students may seek help from others when they don't understand the material they are studying, such as asking the teacher or a classmate for assistance. Additionally, when they fail to comprehend a topic, they adapt their learning strategies. For example, students may reread a passage when they are confused and don't understand its meaning. These activities help students overcome difficulties and support their learning success. This aligns with Sumampouw's view as mentioned in Wardana, Prihatini, & Hidayat (2021), that "regulation activities include adjusting and improving students' cognitive activities. These activities help improve performance by monitoring and correcting behavior while completing tasks." In relation to reading comprehension, Forrest-Pressley & Waller (2013) mention metacognitive aspects of comprehension which involve knowing when one has understood a text he/she has read, knowing what one does not understand, and being able to use this knowledge to monitor comprehension. That the ability to monitor comprehension depends on what a reader knows about his/her own comprehension processes. Thus it can be said that metacognition is the trigger for other processes that are necessary for understanding.

Based on Figure 1, the evaluation indicator shows that the experimental class achieved an average percentage of 71.87%, categorized as good, while the control class achieved an average percentage of 71.09%. Here are examples of

students' responses when answering question 1b. These results show that students are proficient in learning and understand how to evaluate their own learning outcomes. They achieve this by evaluating the learning goals they set for themselves, which involve comprehending the material and applying it to solve problems. These students use various learning strategies depending on the situation. For example, when studying specific materials, they may take notes to facilitate their understanding, and when they grasp a concept, they read carefully. This aligns with Nulhakim's view as mentioned in Wardana, Prihatini, & Hidayat (2021). In this process, students reflect on how well they have mastered a particular skill, value, or knowledge. They analyze why it was easy or challenging for them to master it and identify actions or improvements needed. Evaluating learning strategies in students significantly impacts their future learning processes (Barida, 2017). Metacognitive process involves cognitive effort which consists of knowledge about and regulation of cognitive processing (Cubukcu, 2008). It affects the success of comprehension. Pang (2008) mentions about metacognitive strategic competence which reflects readers' monitoring and control of reading strategies. (Hartman, 2001a) asserts that students who are aware and in control of their metacognitive reading behaviour can take advantage because they can monitor their comprehension, clarify difficulties and restore the process when it fails.

CONCLUSION

Based on the results of the research and discussion that have been described, the conclusion that can be drawn from this research is that the application of blended learning assisted by E-LKPD Liveworksheets improves students' metacognitive strategies regarding environmental change material in class X at SMAN 2 Gedong Tataan, Pesawaran Regency.

REFERENCES

Aini, P. N., & Taman, A. (2012). Pengaruh Kemandirian Belajar dan Lingkungan Belajar Siswa Terhadap Prestasi Belajar Akuntansi Siswa Kelas XI IPS SMA Negeri 1 Sewon Bantul Tahun Ajaran 2010/2011. *Jurnal Pendidikan Akuntansi Indonesia*, *10*(1), 48-65.

Amalia, I.N.F., Roesminingsih M.V., & Yani, M.T,. (2022). Pengembangan LKPD Interaktif Berbasis Liveworksheet untuk Meningkatkan Hasil Belajar IPS Sekolah Dasar. *Jurnal Basicedu Vol.6 No.5* (8154 – 8162)

Anggo, M., Salam M., & Suhar. (2014). Strategi Metakognisi untuk Meningkatkan Hasil Belajar Matematika Siswa. *Jurnal Pendidikan Matematika*. 5(1). Hal 84-91

Anggreini, R., & Mariyanti, S. (2014). Hubungan Antara Kontrol Diri Dan Perilaku Konsumtif Mahasiswi Universitas Esa Unggul. *Jurnal Psikologi*. Vol.12(1)

Aslamiyah, T., Setyosari, & P. Praherdhiono, H., (2019). *Blended Learning* dan Kemandirian Belajar Mahasiswa Teknologi Pendidikan. *Jurnal Kajian Teknologi Pendidikan*, pp.109-114.

Barida, M. (2017). Keterampilan Metakognisi Mahasiswa Program Studi Bimbingan Dan Konseling Terhadap Mata Kuliah Statistik. *Jurnal Psikologi Pendidikan & Konseling*, *3*(2), 46–54.

Bjork, R. A., Metcalfe, J., & Shimamura, A. P. (1994). *Metacognition: Knowing about knowing*. Boston: MIT Press.

Cubukcu, F. (2008). Enhancing vocabulary development and reading comprehension through metacognitive strategies. *Issues in Educational Research*, 18(1), 1–11.

Darma, Y., Firdaus, M., & Haryadi, R. (2016). Hubungan Kemandirian Belajar Terhadap Kemampuan Pemecahan Masalah Matematis Mahasiswa Calon Guru Matematika. *Jurnal Edukasi,* Vol. 14, No. 1

Dwi, O., Rendy, B., Putera, A., Hidayah, R., Suarningtyas, S., & Mitasari, R. A. (2021). *Jurnal Penelitian Pendidikan Matematika dan Sains*. In *JPPMS* (Vol. 5, Issue 2). http://journal.unesa.ac.id/index.php/jppms/

Erlin, E., Rahmat, A., Redjeki, S., & Purwianingsih, W. (2021). Analisis Berbagai Strategi Dan Model Pembelajaran Yang Dapat Memberdayakan Kemampuan Metakognitif Pada Pembelajaran Biologi. *Jurnal Pendidikan Biologi*, *9*(2), 30–40.

Farida, A., & Indah, P.R. (2018). Penerapan *Blended Learning* Untuk Peningkatan Kemandirian Belajar Dan Critical Thinking Mahasiswa. *Jurnal Derivat.* 5(2).

Fitria, N., & Hendriyani, M. E. (2019). Analisis Pengetahuan Deklaratif Siswa Melalui Tes Berpikir Tingkat Tinggi Pada Konsep Sistem Sirkulasi Di Kelas Xi Man 2 Kota Serang. *Jurnal FKIP Universitas Sultan Ageng Tirtayasa* Vol. 2, No. 1, 2019, hal. 744-749.

Forrest-Pressley, D.-L., & Waller, T. G. (2013). *Cognition, metacognition, and reading* (Vol. 18). Springer Science & Business Media.

Hartman, H. J. (2001b). *Metacognition in learning and instruction: Theory, researchand practice* (Vol. 19). Springer Science & Business Media.

Hartman, H. J. (2001b). *Metacognition in learning and instruction: Theory, research and practice* (Vol. 19). Springer Science & Business Media.

Hidayat, D. R., Rohaya, A., Nadine, F., & Ramadhan, H. (2020). Kemandirian Belajar peserta DIDIK Dalam Pembelajaran daring Pada Masa PANDEMI covid -19. *Perspektif Ilmu Pendidikan*, *34*(2), 147–154.

James, H. D., & Bulusan F. (2020). Metacognitive Strategies on Reading English Texts of ESL Freshmen: A Sequential Explanatory Mixed Design. *ESOL International Journal.* Vol. 15 Issue 1

Khikmiyah, F. (2021). Implementasi Web Live Worksheet Berbasis Problem Based Learning dalam Pembelajaran Matematika. *Pedagogy: Jurnal Pendidikan Matematika*, *6*(1), 1-12.

Khoiriah, T. (2015). Strategi Pembelajaran Metakognitif Terhadap Hasil Belajar Siswa Pada Konsep Sistem Pencernaan Pada Manusia. *Jurnal Pengajaran Matematika Dan Ilmu Pengetahuan Alam*, *6*(1), 177. https://doi.org/10.18269/jpmipa.v20i2.581

Khurriyati, Y., Setiawan, F. & Mirnawati, L.B. (2021). Dampak Pembelajaran Daring Terhadap Hasil belajar Siswa Mi Muhammadiyah 5 Surabaya. *Jurnal Ilmiah Pendidikan Dasar*, 8(1), p. 91.

Kleitman, S., Stankov, L., Allwood, C. M., Young, S., & Mak, K. K. L. (2012). Metacognitive self-confidence in school-aged children. In M. M. C. Mok (Ed.), *Selfdirected learning oriented assessments in the Asia-Pacific* (pp.139–153). Springer.

Lathifah, M. F., Hidayati, B. N., & Zulandri. (2021). Efektifitas LKPD Elektronik sebagai Media Pembelajaran pada Masa Pandemi Covid-19 untuk Guru di YPI Bidayatul Hidayah Ampenan. *Jurnal Pengabdian Magister Pendidikan IPA*, 4(1) 25-30

Lestaria, N.Y., Misdalina, & Marhamah. (2017). Peningkatan Hasil Belajar dan Kemandirian Belajar Metode Statistika Melalui Pembelajaran Blended Learning. *Jurnal Pendidikan Matematika* (Vol. 8, Issue 2).

Maki, R. H., & McGuire, M. J. (2002). Metacognition for text: Findings and implications for education. *Applied Metacognition*, 39–67.

Mitsea, E., & Drigas A. (2019). A Journey into the Metacognitive Learning Strategies. *Internasional Journal of Online and Biomedical Engineering*(IJOE). Vol.15, No.14

Marito, W., & Riani, N. (2022). Efektifitas Model Pembelajaran Blended Learning dalam Meningkatkan Kemampuan Berpikir Kritis dan Kemandirian Belajar Mahasiswa UPMI pada Mata Kuliah Statistik. *Jurnal Cendekia: Jurnal Pendidikan Matematika* , *06*(01), 223–233.

Mufidah, N.L., & Surjanti J., (2021). Efektivitas Model Pembelajaran Blended Learning dalam Meningkatkan Kemandirian dan Hasil Belajar Peserta Didik pada Masa Pandemi Covid-19. *Ekuitas: Jurnal Pendidikan Ekonomi, 9(1)*. 187-198

Muhid, A., Amalia E.R., Hilaliyah H., Budiana N., Wajdi M.B.N., (2020). The Effect of Metacognitive Strategies Implementation on Students' Reading Comprehension Achievement. *International Journal of Instruction.* Vol.13, No.2.

Namira, Z.B., Kusumo E., & Prasetya A.T., (2014). Keefektifan Strategi Metakognitif Berbantu Advance Organizer Untuk Meningkatkan Hasil Belajar Kimia Siswa. *Jurnal Inovasi Pendidikan Kimia*, 8(1). 1271–1280

Novita, T., & Widada, W. 2018. Metakognisi siswa dalam pemecahan masalah matematika siswa sma dalam pembelajaran matematika berorientasi etnomatematika Rejang Lebong. *Jurnal Pendidikan Matematika Raflesia*, *3*(2). https://ejournal.unib.ac.id/index.php/jpmr

Nurbayani, A., Rahmawati, E., Inayah Nurfaujiah, I., Dinda Putriyanti, N., Fitria Fajriati, afni, Safira, Y., & Ruswan, A. (2021). Sosialisasi Penggunaan Aplikasi Liveworksheets sebagai LKPD Interaktif Bagi Guru-guru SD Negeri 1 Tegalmunjul Purwakarta. *Indonesian Journal of Community Services in Engineering & Education (IJOCSEE)* 1(2). 126-133

Nurhayati, E. (2017). Penerapan *Scaffolding* untuk Pencapaian Kemandirian Belajar Siswa. *Jurnal Penelitian Pendidikan dan Pengajaran Matematika*, *3*(1), 21–26.

Pakpahan, R., & Fitriani, Y. (2020). Analisa Pemanfaatan Teknologi Informasi dalam Pembelajaran Jarak Jauh di Tengah Pandemi Virus Corona Covid-19.

JISAMAR (Journal of Information System, Applied, Management, Accounting and Researh) Vol.4 No.2.

Pang, J. (2008). Research on good and poor reader characteristics: Implications for L2 reading research in China. *Reading in a Foreign Language*, 20(1), 1–18.

Panggayuh, V. (2017). Pengaruh Kemampuan Metakognitif Terhadap Prestasi Akademik Mahasiswa Pada Mata Kuliah Pemrograman Dasar. *JIPI (Jurnal Ilmiah Penelitian dan Pembelajaran Informatika)*. Vol.02, No.01

Pawestri, E. & Zulfiati, H.M. (2020). Pengembangan Lembar Kerja Peserta Didik (LKPD) Untuk Mengakomodari Keberagaman Peserta didik Pada Pembelajaran Tematik Kelas II di SD Muhammadiyah Danunegaran. *Trihayu : Jurnal Pendidikan Ke-SD-an*. 6(3) : 904-905

Permata, S.P., Suherman., & Rosha. M. (2012). Penerapan Strategi Metakognitif dalam Pembelajaran Matematika Siswa Kelas X SMA Negeri 2 Padang. *Jurnal Pendidikan Matematika*. Vol 1 (1). 8-13.

Sari, A. R. (2013). Strategi *Blended Learning* untuk Peningkatan Kemandirian Belajar dan Kemampuan Critical Thinking Mahasiswa di Era Digital. *Jurnal Pendidikan Akuntansi Indonesia,* XI (2): 32-43.

Siahaan, M. (2020). Dampak Pandemi covid-19 Terhadap Dunia pendidikan. *Jurnal Kajian Ilmiah*, 1(1), pp. 73–80.

Suliya, A., Mandra K. H., & Nisa, K. (2018). Hubungan Keterampilan Metakognitif Dengan Hasil Belajar Mahasiswa S1 PGSD Universitas Mataram Pada Pembelajaran Menggunakan Pendekatan Konstruktivisme. *Jurnal Ilmiah Profesi Pendidikan*, *3*(2), 140–145.

Sumampouw, H. M. (2011). Keterampilan Metakognitif Dan Berpikir Tingkat Tinggi Dalam Pembelajaran Genetika (Artikulasi Konsep Dan Verifikasi Empiris). *Bioedukasi: Jurnal Pendidikan Biologi*, 4(2), 23-39.

Sutisna, A. (2016). Pengembangan Model Pembelajaran Blended Learning pada Pendidikan Kesetaraan Program Paket C dalam Meningkatkaan Kemandirian Belajar. *Jurnal Teknologi Pendidikan*, 18(3): 156-168.

Tresnaningsih, F., Pratiwi D. S. D., & Suminarsih, E. (2019). Kemandirian Belajar Siswa Kelas III SDN Karang Jalak I dalam Pembelajaran Tematik. *Pedagogi: Jurnal Penelitian Pendidikan* , *6*(2), 51–59.

Uz, R., & Uzun, A. (2018). The influence of blended learning environment on self-regulated and self-directed learning skills of learners. *European Journal of Educational Research*, *7*(4), 877–886. https://doi.org/10.12973/eu-jer.7.4.877

Wardana, R. W., Prihatini, A., & Hidayat, M. (2020). Identifikasi Kesadaran Metakognitif Peserta Didik dalam Pembelajaran Fisika. *PENDIPA Journal of Science Education*, *5*(1), 1–9.

Zahroh, D. A. (2021). Pengembangan E-LKPD Berbasis Literasi Sains untuk Melatihkan Keterampilan Berpikir Kritis Peserta Didik Pada Materi Pertumbuhan dan Perkembangan. *Jurnal BIOEDU : Berkala Ilmiah Pendidikan Biologi.* Vol. 10 No. 3.

Zhang, L., & Seepho, S. (2013). Metacognitive strategy use and academic reading achievement: Insights from a Chinese context. *Electronic Journal of Foreign Language Teaching*, 10(1), 54-69.