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Analysis of Students' Higher Order Thinking Skills on Science Subject Using Liveworksheet Argumentative Through Discovery Learning

Neni Hasnunidah*, Dhea Olivia Amanda, Nadya Meriza, Dewi Lengkana, & Pramita Sylvia Dewi

Department of Biology Education, University of Lampung, Indonesia

Abstract: Analysis of Students' Higher Order Thinking Skills on Science Subject Using Liveworksheet Argumentative Through Discovery Learning. Objective: This research aims to analyze students HOTS on the Classification of Living Creatures material using Liveworksheet argumentative worksheets through the Discovery Learning model at SMP Negeri 1 Natar. **Methods:** This research is a quasi-experiment with a non-equivalent pretest-posttest control group design. The research subjects were 69 class VII students sampled from a population of 384 people using simple random sampling techniques. Cognitive tests (C4, C5, & C6) were analyzed using the Independent sample t-test. Data on student responses were collected using a questionnaire and analyzed descriptively. **Findings:** The results of the research show that there is a significant difference in the N-gain value ($P<0.05$) between learning using the Discovery Learning model and discovery-model based argumentative liveworksheet. The high scores in the experimental class were the evaluate skills (N-gain 0.63) and analyze skills (N-gain 0.62), while in the control class the three HOTS indicators were low. Based on the results of the student response questionnaire, it was found that almost all students (82.25%) gave very positive responses to the use of argumentative lifeworksheets. **Conclusion:** The liveworksheet effectively improve students' HOTS.

Keywords: HOTS, classification of living things, liveworksheet argumentative worksheet, discovery learning model.

▪ INTRODUCTION

Higher Order Thinking Skills are really needed to support life success in the 21st century. HOTS is a thinking ability that not only requires the ability to remember, but also requires other higher abilities such as the ability to analyze, evaluate and create (Hayon et al., 2017). These skills depend on how far a person isable to analyze every situation logically and solve problems creatively (King et al, 2004). According to Anderson and Krathwohl (2001) in A Revision of Bloom's Taxonomy states that indicators for measuring high-level thinking abilities consist of the ability to analyze, the ability to evaluate, and the ability to create. The main aim of improving HOTS is to have a positive impact on learning. The aim is to help students in processing and improve their higher order thinking skills. This should empower students to gradually generate creative ideas, equipping them with the ability to overcome challenges. The main goal of higher order thinking skills is how to improve critical thinking abilities in receiving various types of information. That students' high-level thinking abilities in learning to help students be more aware of their performance and the growth of cognitive abilities, especially high-level ones, are very important in education both for academic success and as a provision in society (Muti'ah et al., 2023).

Higher Order Thinking Skills of Indonesian students is relatively low. One of them can be identified based on the results of the PISA study in 2018. PISA data shows that in the science category, Indonesian students are ranked 71st out of 79 participating

Neni Hasnunidah
*Email: neni.hasnunidah@fkip.unila.ac.id

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countries, with an average score of 396. This score is classified as low and is below the average score of all Organization for Economic Cooperation and Development (OECD) participating countries, which is 488 (Center for Educational Assessment of Balitbang Ministry of Education and Culture, 2019). PISA data for 2023 shows that in the science category, Indonesia's ranking rose 6 positions compared to before (Kemendikbudristek, 2023), with a score of 383 (OECD, 2023). However, average results in 2022 fell compared to 2018 in mathematics, reading and science (OECD, 2023) The results of the TIMSS study in 2015 also showed similar results, that Indonesian students were ranked 44th out of 47 participating countries in the science category, with an average score of 397. This score is far below the average score of all participating countries. , namely 500 (Martin et al., 2016).

The low HOTS of students is influenced by several factors, namely students, teachers and learning resources. Several factors that influenced the students were student's attitude, thinking ability, teacher's attraction, school facilities, and computer approach (Ibrahim, 2020). According to Singh et al (2020), teachers are one of the factors because teachers do not just understand high-level thinking skills but also train students practically. It is very important for teachers to understand higher order thinking skills so that they can guide students to use the acquired knowledge and skills to be able to find new ways and means to solve everyday problems and make the right decisions. The teacher's inability to plan and implement appropriate techniques, strategies and approaches to teach higher order thinking hinders the application of higher order thinking skills in the classroom context. According to Gopalan & Hashim (2021) teachers who want their learners grow intellectually should thus focus on HOTS. (Brookhart, 2010) stated that teachers should expose the students to HOTS through their lessons. Tajularipin et al. (2017) also propose that teachers need to understand the requirement of teaching higher order thinking skills first. Tan & Halili (2015) revealed that teachers need to teach learners how to think for themselves and how to make their thinking visible rather than just giving them higher order thinking skills questions for them to answer. Tanujaya (2015) also opined that teachers' inability to create creative learning and new techniques in their teaching also influences students' HOTS. Student's worksheet is one of the teaching materials also can influence students' HOTS used by students so that the learning process of students is in accordance with the stages of learning. Teachers can apply HOTS on student worksheets so that they can improve students' science learning abilities (Santoso et al., 2021).

Higher Order Thinking Skills is closely related to argumentation ability. Argumentation has been claimed to be the more general human process of which more specific forms of reasoning are a part (Kuhn et al., 2015). According to Bencze (2020) and Fjelland (2020encze et al., 2020) there is one aspect that is quite important in the process of learning science, namely, communication. One of communication skill is argumentation. Argumentation is defined as a language skill to influence the attitudes and opinions of others to match what the writer or speaker wants. Argumentation skills are needed to respond some scientific issues that occur in today's society, make decisions, assess a claim that arises both through mass media and other media based on valid and reliable evidence. Argumentation skills are critical to be applied in learning to improve the skills demanded in 21st-century (Yulianing et al., 2023). Argumentation is a discursive process for making claims, providing evidence to support claims, and

criticizing. In education, argumentation skills can encourage students to provide facts, data, and theories that are appropriate to support claims against a problem and can be accounted for (Hardini & Alberida, 2022). Argumentation skills correlate with student understanding. Hasnunidah et al (2019) said that the correlation between students' understanding of basic biology concepts and both their argumentation and critical thinking skills is very high (R ADI = 0.886; R Conventional = 0.817).

Argumentation skills can improve students' critical thinking level and logical skills in the thinking process. Everyone has good argumentation skills if has good critical thinking and good logic skills (Yulianing et al., 2023). According to research conducted by Haruna & Nahadi (2021) at SMA Negeri 1 Tellu Siattinge that the level of students' argumentation is closely related to the level of critical thinking. The results of previous research conducted by Cigdemoglu et al. (2017: 9) at Turkish University also stated that argument instruction contributed to HOTS. The variables argumentation skills and understanding of basic biology concepts are interrelated. The higher quality of student arguments was positively related to their level of structural and conceptual understanding. In other words, a new understanding of concepts does not necessarily appear in the argument directly, but arguments support the improvement of student thinking and help them discover aspects that may be new to them (Hasnunidah et al., 2019).

One solution that can be used to empower students HOTS abilities is through argumentation activities in learning. The use of scientific argumentation in teaching is of great importance as it makes the students' engagement more effective in the teaching and learning process, as it helps develop their ideas because they come to know themselves rather than presenting them in ready-made templates. Teaching individuals how to engage in discussions and use scientific evidence in these discussions is essential for future decision-making, especially when students are faced with controversial issues (Yulianing et al., 2023). Teachers must realize that argumentation is an important component in science learning. In addition, a series of pedagogical strategies are needed that will initiate and support argumentation if argumentation is to be adopted and integrated into the classroom. Therefore, developing the ability to evaluate and critique such arguments is a secondary process that builds students' ability to construct coherent relationships between claims, warrants, and data (Simon et al., 2002). Based on the Toulmin Argumentation Pattern (TAP) argumentation model, the quality of the argument consists of six components, including claims, data, warrants, backing, rebuttals, and qualifiers. The argumentation component consisted of claims, evidence, and reasoning. Specifically, argumentation skills are divided into four components, namely (1) compiling claims, (2) showing evidence, (3) compiling reasons, and (4) compiling counterarguments (Chin & Osborne, 2010).

A learner is considered to have good argumentation skills if he can compile claims, show evidence for the claims made, and provide appropriate explanations for the evidence shown (Chin & Osborne, 2010). The explanation built must be per the evidence shown. Evidence can be in the form of phenomena in everyday life, practicum results, and data that support claims (Ginanjar et al., 2015). Evidence is explained by appropriate theories, concepts, and laws so that the arguments presented are accurate, reasonable, and acceptable. Therefore, a student must have good logical skills and conceptual understanding in building compatibility between evidence and explanation.

Argumentation skills are growing slowly, but argumentation skills must be learned carefully. Uncertainty in argument created productive moments for students to collaborate in dialogue and direct their understanding of natural phenomena toward more coherent scientific explanations (Yulianing et al., 2023). It should be remembered that the main objectives of learning science include 3 aspects, namely conceptual, cognitive, epistemic and social. First, a person must use several important conceptual structures (such as scientific theories, models, and laws) as well as cognitive processes in thinking about a particular topic or problem. Second, individuals must recognize and use scientific frameworks to develop and evaluate claims. Lastly individuals involved in scientific argumentation must understand and be able to participate in some of the social processes by which knowledge is communicated, represented, debated and debated within the scope of science (Hasnunidah et al., 2015) That is why learning that is integrated with argumentation activities is important.

One way that can be used to design learning that empowers students' argumentation abilities to improve HOTS is by using interactive student worksheets. One of them is a liveworksheet-based argumentative. According to Ratnawati et al (2023) liveworksheets is a tool that allows teachers to create interactive worksheets for their students. Teachers upload traditional print worksheets in PDF or as Word documents, and can then transform these into interactive exercises using different formats such as multiple choice, drag and drop or join the arrows, which can include audio or videos if necessary. Liveworksheets is a useful tool for creating interactive exercises for students. It is easy for teachers to use and can make learning more fun and enjoyable. Given the many different options available, however, teachers need to carefully select the most appropriate exercise format required for each learning activity. Liveworksheet is one of the teaching materials used to optimize learning activities. Along with the development of technology, liveworksheet is evolving which was a printed teaching material that now can be presented in electronic media. Liveworksheet is one of the electronic media containing text, pictures, video, and animation that is more effective for students not to get bored. Liveworksheet itself is a platform web-based namely liveworksheet.com. The application of liveworksheet is quite easy. Students just open the worksheet, then students do the exercise. After students finish their work, just click finish. Next, the students' works were submitted to teacher's email. Simply, the teacher checks their score automatically.

Through interactive student worksheet, students can interact with each other in it, and teachers can guide, evaluate, and provide suggestions on the arguments that have been submitted by students, thus allowing interaction between students and students, as well as students and teachers. Both teachers and students can benefit from this interactive worksheet as it saves time for teachers and motivates students at the same time (Madden et al., 2023). According to Nurhidayati (2019), technology-based live worksheets aim to provide convenience for teachers and students. This new application also causes students to be more active in their learning and enthusiastic about participating in online activities. These include saving time on assessing or giving feedback, giving teachers insights into students' ongoing formative performance in a timely manner, to include their strengths and weaknesses, which would later inform pedagogical interventions, and reducing teachers' workload. In the context of distance learning, interactive worksheets have helped to lessen teachers' workload by organizing students' learning activities with the assistance of cloud-based services and other online resources, activating acquired

knowledge, framing information processing skills, and increasing motivation to study (Kopniak, 2018). The results of research by Hasnunidah et al., (2022) on class IX students of State Middle Schools in South Lampung Regency also stated that the implementation of argumentative e-student worksheet was able to improve students' argumentation skills, from level 1 to level 3. Using Student Worksheets in learning is a familiar strategy teachers employ to support the learning process in the classroom. However, there are still challenges in developing Student Worksheets that can tap into learners' critical thinking abilities by integrating Higher Order Thinking Skills and a Culturally Responsive Teaching approach (Tressyalina et al., 2023; Zhang et al., 2020). Information and communication technology has significantly changed the education landscape in the current digital era.

One learning model that can be combined with the use of liveworksheets is discovery learning. The advantages of discovery learning are the capital in problem-solving and critical thinking skill. The students can immediately apply the principles and the initial steps in problem-solving. Through this strategy, they have an opportunity to be more intense in solving problems, so it can be useful to face the future life. Discovery learning which focused on the ability to solve something that relevant to the development of the present situation is required to think about a solute issue that occurs in the midst of society. That is why, discovery-learning needs to be actualized in real life, so students are allowed to respond more complex life issues (Nurcahyo et al., 2018). Through discovery learning models, students are expected to be independent, critical, and have creative attitudes. The discovery learning model directs students to be able to find something through the learning process they carry out. They not only act as consumers but are also expected to play an active role, even as actors from the creators of science. The learning discovery model is part of the scientific approach framework (Rahayu et al., 2023). The results of this study are reinforced by (Kunsting et al., 2013); and (Kistner et al., 2016) which stated that the application of learning dominated by the discovery process would further enhance students' understanding of concepts. Other researchers also stated that instructional materials affect significant understanding concept (Gunawan et al., 2020).

▪ METHOD

Participants

The population in this study was all students in class VII of SMP Negeri 1 Natar for the 2023/2024 academic year, totaling 384 students consisting of 12 classes (VII A – VII L). Sampling from this population used simple random sampling techniques. The sample distribution is presented in the following table.

Table 1. Distribution of research samples

No.	Class	Samples
1.	VII E	34
2.	VII H	35
	Totally	69

Research Design and Procedures

This type of research is quasi-experimental. The design used in this research was a pretest-posttest non-equivalent control group design. This research was carried out in the

odd semester of the 2023/2024 academic year, was conducted in September for two weeks or two meetings. The place of this research is SMP Negeri 1 Natar which is located at Jl. Negara Ratu, Merak Batin Village, Natar District, South Lampung Regency, Lampung Province. This research procedure starts from conduct interviews with teachers at SMP Negeri 1 Natar related to students' HOTS in science learning and aslo conduct curriculum studies to understand the breadth and depth of the main material for the classification of living things in class VII. After that, create and compile research instruments, namely RPP, syllabus, pretest-posttest questions, argumentative worksheet liveworksheet based on the discovery learning learning model, and questionnaires student responses.

Then testing the validity of research instruments by the supervisor and analyze the results of validity tests and reliability tests of test questions. During the implementation stage, give a pretest to students first to see students' initial HOTS abilities. Also give a posttest for students to see students' HOTS abilities after learning. Then provide response questionnaires to students for dig up information about the learning experience after learning is carried out. When final stage, processing student HOTS result data and response questionnaires learners to analyzing HOTS results data in the experimental and control classes to find out the HOTS category of students. Analyzing data from student response questionnaires and make conclusions based on the results obtained from data analysis.

Instrument

The instruments used in this research were pretest and posttest, and questionnaire sheet. The test questions aim to measure HOTS and see improvements HOTS for students before and after learning. The HOTS of students in this study was measured using 10 questions in the form of a description that refers to the cognitive ability rubric Anderson and Krathwol (2001). The test was carried out to measure students HOTS before (pretest) and after (posttest) learning. The tests given are HOTS questions with levels C4 (analyzing), C5 (evaluating), and C6 (creating) at the beginning of learning and at the end of learning. The C4 indicator measures the ability to break down/ differentiate/compare material into parts and determine how the parts relate to each other. Indicator C5 measures the ability to make assessments based on criteria and standards. Indicator C6 measures the ability to put elements together to form a coherent and functional whole. The cognitive instrument used consisted of 10 questions. For the cognitive domain C4, it consists of 4 questions with question numbers, namely 1, 4, 6, and 7. Then, questions with the C5 cognitive domain consist of 3 questions with question numbers, namely 2, 3, and 5. Meanwhile, questions with the C5 cognitive domain consist of 3 questions with question numbers 8, 9, and 10.

The questions in the HOTS test focus on KD 3.2 classifying living things and objects based on observed characteristics. An example of question C4 is that news text is presented about robots, students determine robots as non-living objects from the results of comparing the symptoms of life in living things. Then an example of question C5 is that text and pictures of several reptiles are presented, students check whether it is true that these animals are in the same class/group, as well as the characteristics that cause all three to be classified into the same class. Meanwhile an example of question C6 is that pictures of several different animals are presented (cats, chickens, betta fish, and snakes), students arrange the order of key determinations of some of the animals in the picture. The form of the questions given is in the form of descriptive questions.

Then, the questionnaire aims to gather information from students regarding the learning experiences implemented by researchers. The questionnaire that will be given contains 10 statements consisting of 6 positive statements, and 4 negative statements. The questionnaire instrument was developed using the Guttman scale which contains a questionnaire of student responses to the use of argumentative liveworksheets worksheets. The aspects assessed are; (1) participants' interests and attitudes educate against material learning classification of living things use argumentative liveworksheet containing of three statements, with indicators of activeness, enthusiasm, and interactiveness with one statement each other, (2) HOTS containing of three statements, with indicators of understanding, thinking ability and problem solving ability with one statement each other, (3) Argumentation ability containing of one statement, with one indicator, namely the ability to argue, (4) Assessment of quality argumentative liveworksheet material containing of two statements with indicators of worksheet attractiveness and ease of access, with one statement each other. The instruments tested in this research are validity and reability test. Based on the validity tests that have been caried out, the following result were obtained.

Table 2. Validity test results

Number	Correlations Coefficient	Criteria
1	0.685	Valid
2	0.418	Valid
3	0.394	Valid
4	0.699	Valid
5	0.693	Valid
6	0.225	Invalid
7	0.731	Valid
8	0.520	Valid
9	0.332	Invalid
10	0.622	Valid

After that data that valid is then continued with reability testing. Based on the reability tests that have been caried out, the following result were obtained.

Table 3. Reability test results

Reability	Criteria
0.717	Kuat

Data Analysis

To test normality, researchers used the Kolmogorov-Smirnov test. Test the mean using the Independent-Samples T Test. The homogeneity test used is the Levene test. The types of data in this research are quantitative data and qualitative data. Quantitative data is students HOTS scores/values. Meanwhile, qualitative data is students responses to the use of liveworksheet argumentative. Data collection techniques are through tests and giving questionnaires. The test was carried out to measure students HOTS before (pretest) and after (posttest) learning. The tests given are HOTS questions with levels C4 (analyzing), C5 (evaluating), and C6 (creating) at the beginning of learning and at the end of learning.

The quality of students' HOTS improvement is shown using the average N-gain formula. N-gain (normalized gain) is used to measure the increase in students' HOTS between before and after learning. The N-gain value category was determined based on the following N-Gain criteria table:

Table 4. N-Gain criteria

Interpretation Normalized N-Values	Values
$0.70 \leq g \leq 1.00$	High
$0.30 \leq g < 0.70$	Medium
$0.00 < g < 0.30$	Low
$g = 0.00$	There is no increase
$-1.00 \leq g < 0.00$	There is a decrease

In this study, the effect size was used to determine the effectiveness of using liveworksheet argumentative through the discovery learning model on students HOTS. Calculate the effect size using this formula (Yuliati et al., 2023):

$$ES = \frac{M_e - M_c}{SD}$$

Next, to calculate the combined standard deviation, the following formula is used:

$$SD\ pooled = \sqrt{\frac{(N_e - 1)SD_E{}^2 + (N_C - 1)SD_C{}^2}{N_E + N_C - 2}}$$

Then, the values obtained will be categorized as follows:

Table 5. Effect size categories

No.	*Effect Size*/ES	Category
1.	ES < 0.15	Very Low
2.	0.15 < ES ≤ 0.40	Low
3.	0.40 < ES ≤ 0.75	Medium
4	0.75 < ES ≤ 1.10	High
5.	ES > 1.10	Very High

Students HOTS abilities are analyzed based on the ability standards tested in HOTS-based questions. The data was analyzed using percentage descriptions. The values obtained are categorized based on the following Table 6.

Table 6. Category of student ability in solving HOTS questions

Score	Category
81-100	Very High
61-80	High
41-60	Medium
21-40	Low
0-20	Very Low

A questionnaire was given to students to find out students responses to the use of liveworksheet argumentative which were collected at the end of the lesson. This questionnaire uses the Guttman scale, with yes/no answers. If you answer "yes" you will get a score of 1, and if you answer "no" you will get a score of 0. Student questionnaire data was analyzed descriptively qualitatively in the form of percentages. The percentage values that have been obtained are then analyzed in the form of categories. The scale used in this research is the Guttman scale. Using this type of scale will produce a firm answer, namely "yes/no". Alternative scoring categories for answers can be seen in the following table.

Tabel 7. Questionnaire scoring categories

Alternative Answers	Score	
	+	-
Yes	1	0
No	0	1

Next, an interpretation of the answers is given in the following categories.

Table 8. Categories of student responses

Persentase	Category
25% ≤ % NRS < 43%	Negative
44% ≤ % NRS < 62%	Quite Positive
63% ≤ % NRS < 81%	Positive
82% ≤ % NRS ≤ 100%	Very positive

▪ RESULT AND DISSCUSSION

HOTS Result

Students HOTS is seen based on the results of the pretest and posttest. The statistical test results obtained are as follows.

Table 9. Description of HOTS students

Score	Class	$\bar{x}$ ± Sd	Category
Pretest	E	37.84 ± 9.74	Low
	C	28.68 ± 9.30	Low
Posttest	E	62.37 ± 9.75	High
	C	47.44 ± 6.31	Medium
N-gain	E	0.39 ± 0.09	Medium
	C	0.25 ± 0.10	Low

The results of research on using liveworksheet argumentative on HOTS students show that HOTS students in the experimental and control classes show different results. Based on Table 9., it is known that the HOTS of students in the experimental and control classes before learning was classified as low. Then, HOTS students in the experimental and control classes after learning obtained different results. HOTS of students after learning in the experimental class is classified as high, while in the control class is classified as low. The difference in students HOTS can also be seen from the N-gain results. Based on the N-gain results, the HOTS of experimental class students is higher

than that of control class students, namely in the experimental class they are in the medium category, while in the control class they are in the low category. The difference in HOTS between students in the experimental class and the control class occurs because the learning activities in the experimental class are designed to create students who are active in arguing, namely using liveworksheet argumentative through the discovery learning model.

The factor that causes the low result of students in the control class is students who are passive in discussion activities and lack of motivation in learning. The thinking and arguing abilities of control class students were not trained like those of experimental class students. This of course affects HOTS students. So that the majority of control class students have HOTS which is in the very low category. One of the reasons for the low HOTS among control class students is that students do not understand how to argue well, and are not used to solving a problem accompanied by clear and supportive arguments. The learning motivation of students in the control class also tends to be different from the experimental class, thus affecting their activeness in learning. It is because partly of students not able yet to conclude correctly. This result due to student's information processing still uncomplete. Students when conclude is less of concentration so the information their have is discontinue to short term memory. The information that enter short term memory will miss if there is no repeating and concentrating so the information is discontinue to long term memory (Malichah & Yonata, 2023). In line with research conducted by Muspawi et al (2019) another factor that cause low HOTS in the control class include; (1) many students are noisy during group discussions, (2) many students are chat when the teacher explains the lesson material, (3) many students do not understand the steps, (4) many students areless active respond.

This was further emphasized by Putro & Sumardjoko (2023), students found obstacles when answering thinking skills questions because the textbooks they used for the learning process in class mostly 96.35% contained questions that were focused only on C1, C2, and C3, which were in the low level category of Lower Order Thinking Skills (LOTS) so that it had an impact on the low value of students' thinking skills. The low level of students' thinking skills was caused by students still not being used to working on Higher Order Thinking Skills (HOTS) type questions. The results of a further study by Permata et al., (2019) explained that students were not used to answering Higher Order Thinking Skills (HOTS) type questions related to the very limited analysis of students' thinking skills and teachers only accustomed students to working on questions that were focused on levels C1, C2, and C3, which were in the low level category of LOTS.

The increase in HOTS can also be seen from the results of data analysis for each HOTS indicator for experimental class and control class students. The average HOTS of students for each indicator is as follows.

Table 10. Average student HOTS indicator

HOTS Indicator	Class	*Pretest*	Category	*Posttest*	Category
Analytical Skills	E	33.66	Low	75.16	High
	C	28.57	Low	50.79	Medium
Evaluation Skills	E	63.72	High	86.92	Very High

	C	51.74	Medium	63.17	High
Creative Skills	E	5.39	Very Low	8.33	Very Low
	C	1.42	Very Low	1.90	Very Low

Based on Table 10., it is known that in the experimental class, analytical skills and evaluation skills have the highest scores. Meanwhile, in both the experimental and control classes, the create skills was received the lowest score. Analytical skills is a form of reasoning in understanding the relationship between the whole with its component parts and between cause and effect. In Table 10., the average score of each indicator of higher-order thinking shows better results through learning using HOTS worksheet compared with conventional learning. From the data it has been seen that learning using HOTS worksheet can be applied to train higher order thinking skill students. This difference is due to the use of HOTS worksheet, students are accustomed to reasoning in understanding the relationship between the whole with the component parts and between cause and effect. Within this level of reasoning, it includes sorting, categorizing, understanding how to work, understanding causal relationships, and obtaining information from charts, diagrams or maps (Jennifer lyn, 2013). At the evaluations skills, students will be able to express and defend opinions. Assessment assignments require students to consider quality, credibility, pricing and practicality using the established criteria and explain the criteria to be appropriate or not (Moseley, et al., 2005).

Students' in control class are not being able to understand the problem and the difficulty in identifying the problem in analytical skills because the students' lack of reactivity in responding to the problem causes inhibiting factors for students to identify the problems given in HOTS questions. Factors that inhibit students' is when compiling a number of alternative solutions to problems in solving HOTS questions are that students experience difficulties, including students who do not fully understand the problem because students are still struggling with preparing a solution model that will be used to answer each HOTS question, and they also still cannot predict the results of the work accurately.

The obstacle to students' thinking skills in evaluation and create skilss when making conclusions in solving HOTS problems is that students when making conclusions do not match the problems in the HOTS questions given. Most students assume that making conclusions is difficult because it cannot be solved in one step, instead students must go through a number of steps that require a comprehensive understanding of the existing material and the ability to read and understand HOTS questions that function as references for making conclusions. The majority of students' responses to HOTS questions in making conclusions are still lacking. Meanwhile, some students are still unable to conclude the information in the HOTS questions given (Yennita et al., 2018). In line with Fisher's (2008) opinion the obstacles to students' thinking skills when evaluating arguments in solving HOTS problems are that students have difficulty in evaluating valid and invalid arguments and other sources such as textbooks and worksheets, students often feel confused and hesitant in re-evaluating whether a particular source is reliable. In evaluation activities, factors such as supporting evidence, the truth of the source of information, and several others are taken into account in addition to the logic of individual arguments. Students who use critical thinking will reflect and carefully decide whether to accept, reject, or postpone obtaining information. Students have difficulty in

distinguishing relevant information from story problems, organizing, and attributing. While in the realm of "evaluating" and "creating" students have not been able to show it on the answer sheet.

The frequency distribution of students' pretest and posttest in the experimental class can be seen in Figure 1.

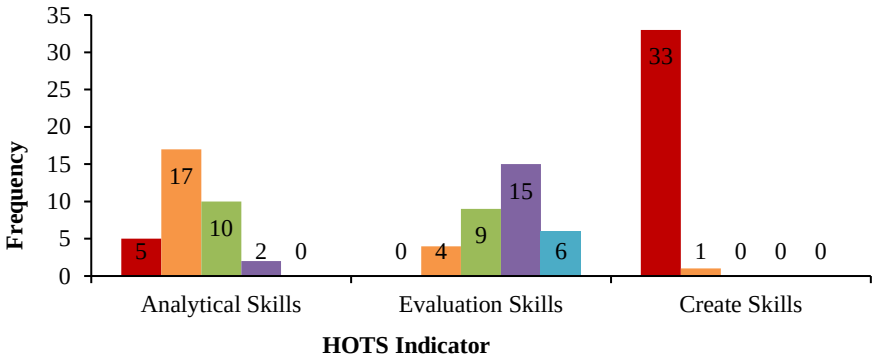


Figure 1. Frequency distribution of student HOTS from pretest results

Based on Figure 1., it can be concluded that before learning, almost all students in the experimental class had create skills that were classified as very low and analytical skills that were classified as low. Meanwhile, the evaluation skills is classified as high. After learning using the liveworksheet argumentative, the frequency distribution of students HOTS indicators obtained from the posttest in the experimental class can be seen can be seen in Figure 2.

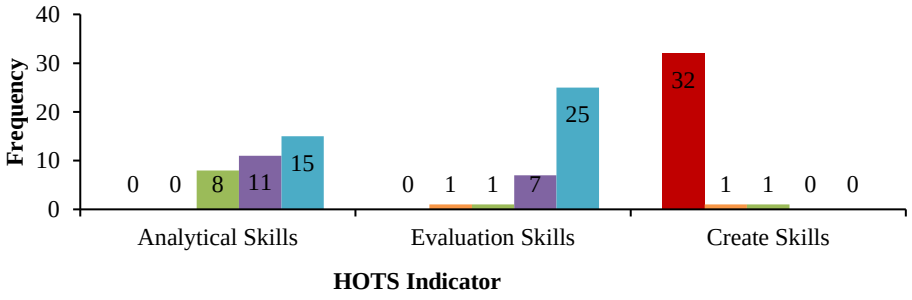
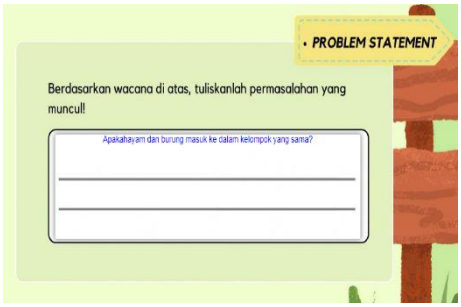


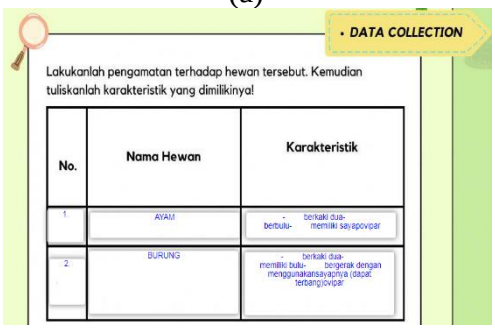
Figure 2. Frequency distribution of student HOTS from postest results

In this research, learning activities are implemented using the discovery learning learning model. Through stimulus syntax, students are faced with several animals or plants which are often considered living creatures in the same group. Then, in the problem statement syntax, students prepare a problem formulation related to the stimulus that has been given as in Figure 3. below.

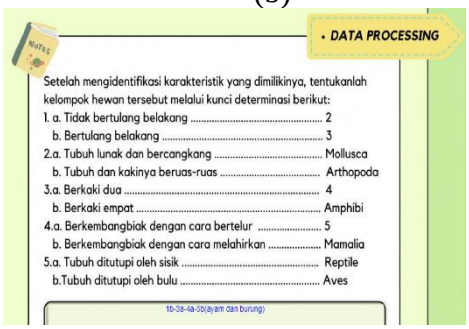
(a)



(b)

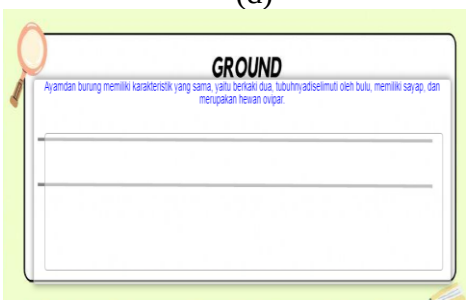


(c)

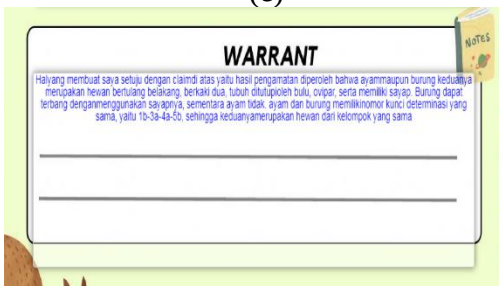


(d)

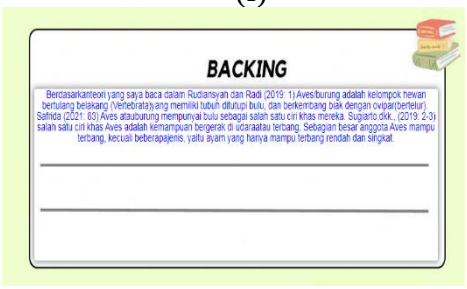
(e)



(f)



(g)



(h)

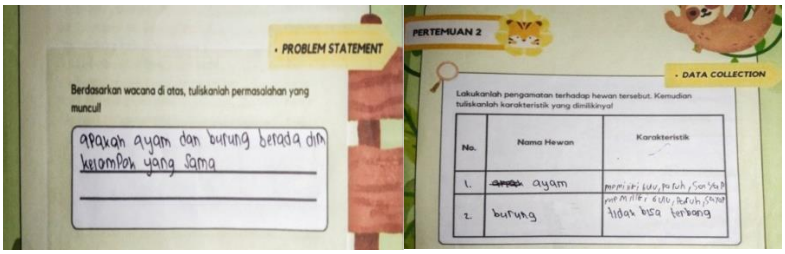
(i)

Figure 3. Experimental class student answer sheet

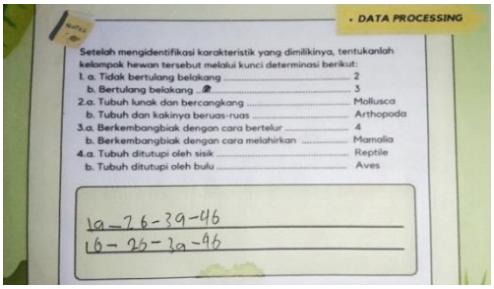
Based on Figure 3a. given a discourse containing two different types of income about chickens and birds. Students in the experimental class have been able to find problems that are gaps between reality and expectations. This can be seen from the problem statement that has been prepared (Figure 3b.). In the data collection syntax (Figure 3c.), students observe the characteristics of animals or plants contained in the stimulus that has been given and collect the data obtained. Then, students in the experimental class are able to make observations and collect data containing the characteristics of the animals being observed. Meanwhile, in data processing syntax (Figure 3d.), students process the data obtained to be able to complete the key determination. Students in the experimental class have been able to process the data they obtained from observations to be able to complete the appropriate determination key. In syntax verification (Figure 3e.), students construct arguments to solve problems. The argumentation pattern used is the Toulmin argumentation pattern which consists of claim, ground, warrant, and backing. According to Erduran et al., (2004) claim is a statement submitted to another person for acceptance. Data or ground are certain facts that are relied upon to support the claims given. Warrant is a guarantee that connects data with a claim. Backing is support for an argument to provide additional support for warrant (Hasnunidah, 2018).

Verification syntax trains students to be able to argue to solve problems and train their thinking skills. In syntax verification, students in the experimental class have been able to formulate arguments to solve and answer problem statements. Students have been able to prepare claims, grounds, warrants and backings based on the data they have obtained and supported by relevant sources. When constructing arguments, students are also able to use linguistic features in each argumentation syntax. Argumentation sheets have an important role in training students' thinking and arguing skills so they are able to solve problems. Then, at the generalization or conclusion stage, students conclude the answers to the problems that have been solved. The following is an example of student answers in the liveworksheet argumentative worksheet which refers to generalization syntax. Based on Figure 6. in the generalization syntax, experimental class students have been able to formulate conclusions that answer problems accompanied by supporting data and evidence.

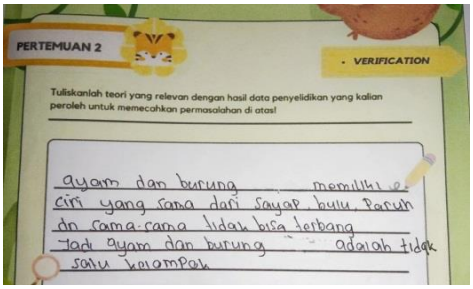
Meanwhile, in the control class, learning activities were designed using the discovery learning model but did not use argumentative worksheets integrated with liveworksheet. In the problem statement syntax, control class students are also instructed to prepare a problem statement related to the stimulus that has been given. Students in the control class have been able to find and formulate problems. Furthermore, in the data collection syntax, students in the control class are also able to collect and describe the data they obtain. The following are answers of students in the control class on Figure 4.



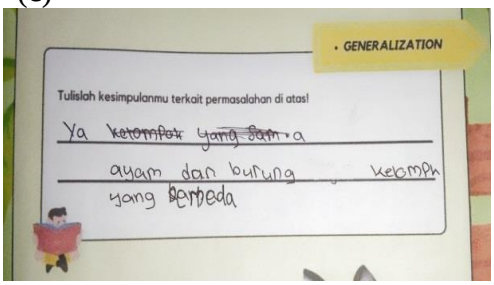
(a) (b)



(c)



(d)



(e)

Figure 4. Control class student answer sheet

Experimental and control class students are classified as having the same abilities only in terms of data processing syntax. In verification and generalization syntax, the abilities of students in the two classes are different, this is because students in the control class have not been able to explain the data they have obtained to find relevant supporting theories to answer the problem. Not only that, not training students' thinking and argumentation skills is very influential in completing syntax verification. So, this has the effect of drawing inappropriate conclusions (generalization) as in Figure 4.

Based on figure 3 to figure 8, it can be seen that the experimental class students were better at answering questions than the students in the control class. One of the causes is the difference in worksheets that used. In experimental class the worksheets used are argumentative in nature where students are given instructions to answer questions according to their linguistic features, so that the answer becomes more focused and better. Whereas the control class does not have linguistic features, so it is not argumentative worksheet. Even though both are designed with similar stages, but it turned out to get very different result because of whether it was argumentative or not. Using the e-students worksheet is very effective in training thinking skills which are implemented in higher order thinking skills questions by providing problems and allowing students to build thoughts and develop reasonable views in the context of problem solving (Khastini et al, 2023). According to Singh et al., (2017) one of the effective ways of teaching higher order thinking skills will be when there's an infusion on critical and creative thinking in the activities prepared. Being able to use higher order thinking skills is very important because without conscious effort a person can build on more of what has been learned previously. Because higher order thinking skills require a person to form connections between what has been learned and what will be learned, it is important to develop skills

to assist this level of thinking. To make connections between what they have learned and the new knowledge needed, they must be able to think critically.

Although thinking is a conscious process and cannot be denied is the core of learning, the ability to use higher order thinking skills such as analyzing, applying, synthesizing and evaluating needs to be emphasized in second language teaching and learning because language learning is similar to skills. Furthermore, teachers will be more aware of the thinking skills that students need to develop. They would be able to modify their activities based on the suggested guide, elevating lower-order thinking skills assessments to higher-order thinking skills to confirm meaningful learning and to attain the learning outcome, which describes the knowledge, skills, and values that students should be able to demonstrate at the end of the course (Aniceto, 2023).

Effect Size Test Results

This research uses an effect size test to determine the effectiveness of using liveworksheet argumentative sheets on students' HOTS, which can be seen in the following Table 11.

Table 11. Effect size test results

Class	Average N- gain	Standard Deviation	*Effect Size*	Category
Experiment	0.39	0.09	1.4	Very High
Control	0.25	0.10		

Based on the test results in Table 11., it is known that the effect size value obtained is 1.4. This value is included in the very high effect category. This shows that the liveworksheet argumentative sheet is effective in increasing the HOTS of students at SMP Negeri 1 Natar on the materia l on the classification of living things.

Student Response Questionnaire on Using Liveworksheet Argumentative Worksheets

Researchers provide a questionnaire at the end of the lesson which is useful for knowing students' responses to the use of live argumentative worksheets during learning activities. The results of the analysis of student response questionnaire data are as follows.

Table 12. Student response questionnaire on using liveworksheet argumentative worksheets

No.	Statement	Type of Statement		Percentage	Category
		+	-		
1.	Liveworksheet argumentative worksheets have an attractive appearance	√		100%	Everyone agrees
2.	Lembar kerja argumentatif liveworksheet mudah untuk diakses	√		100%	Everyone agrees
3.	My learning motivation increased after using liveworksheet argumentative	√		98%	Almost everyone agrees
4.	Using liveworksheet argumentative causes learning activities to become boring		√	79.6%	Almost everyone agrees

5.	Using liveworksheet argumentative makes me passive in arguing		√	18.4%	A small number agree
6.	The use of liveworksheet argumentative causes learning to be non-interactive		√	67.3%	Most agree
7.	Using liveworksheet argumentative makes it easier for me to understand the material on the classification of living things	√		95.9%	Almost everyone agrees
8.	Using liveworksheet argumentative can help me train and improve my thinking skills	√		98%	Almost everyone agrees
9.	Using liveworksheet argumentative makes it difficult for me to solve problems		√	65.3%	Almost everyone agrees
10.	Using liveworksheet argumentative can train my argumentation skills	√		100%	Everyone agrees
Average				82.25%	Almost everyone agrees

The effectiveness of using liveworksheet argumentative can also be seen from the results of student response questionnaires. Based on the results of the analysis in Table 4.6, it is known that the average final score obtained was 82.25%. The average is in the interval 82% ≤ % NRS ≤ 100% which shows that almost all students gave a very positive response to the use of liveworksheet argumentative sheets. In line with research conducted by Kahar et al (2021) the development and application of HOTS-based worksheets can promote various positive impacts, including students' motivation and responses. The significance test on learning outcomes indicating that the developed worksheets significantly influence (maximizes) the students' motivation and response and hence can affect their learning outcomes. According to Hidayah & Kuntjoro (2022) that the use of e-student worksheets is very effective in training thinking skills which are implemented in higher order thinking skill questions by providing problems and allowing students to build thoughts and develop reasonable views in the context of HOTS.

▪ CONCLUSION

Based on the results of data analysis in the discussion, it can be concluded that there is a significant difference for HOTS students between learning using the discovery learning model and the discovery learning model assisted by liveworksheet argumentative on the main material of classification of living things at SMP Negeri 1 Natar. The high HOTS indicators in the experimental class are the ability to analyze and the ability to channel, while in the control class all HOTS indicators are low. Students' responses to the use of liveworksheet argumentative worksheets through the discovery learning model on creature classification material show that the majority of students gave very positive responses.

Students with low HOTS abilities and are having difficulty in the realm of evaluating and creating. It was also found that it was difficult to analyze. Giving open-ended problems can be one solution to improve students' HOTS, giving challenging questions for students to solve in their own way will be able to increase student creativity. The research results prove that the e-student worksheets effectively improve learning outcomes and students' thinking skills. The weakness in this research is the lack of variety in the HOTS questions given, especially for the C6 cognitive level, so it is hoped that in

future research more questions from the C6 cognitive domain will be presented and discussed.

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