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Higher-Order Thinking Skills (HOTS) in Environmental Learning at Indonesian High School

[1]Heria Budi Handayani, [2]Sajidan, [3]Rini Soemarwoto, [4]Sunardi

[1] [3] [4] Universitas Padjadjaran, Bandung, Indonesia
[2] Universitas Sebelas Maret, Surakarta, Indonesia

Email: [1]heriapsdil17@gmail.com

Abstract: This study aims to determine teachers' competence in implementing HOTS in environmental learning in SMA/SMK with environmental care status (adiwiyata). This study will emphasize the teachers' competencies in implementing HOTS in classroom learning**.** This research uses a combination method. The quantitative method used a questionnaire to collect data on the extent to which teachers have understood and implemented HOTS in learning. The qualitative method was conducted by interviewing to obtain more detailed information about the phenomena behind the quantitative data and the obstacles encountered by teachers in implementing HOTS. The sample in this study was taken with purposive sampling to obtain 120 teachers spread over ten high and vocational high schools in Metro. The study results indicate that some teachers implement HOTS in environmental learning. At the planning, implementation, and evaluation stages of learning, several obstacles related to teacher competence, including the teacher's ability to integrate environmental education into the subjects taught, the ability to manage to learn, and the strategies applied in learning. The government can use the results of this study to map teacher competencies and determine the best strategies to improve the quality of learning in terms of HOTS and Environmental Education.
Keywords: Higher-Order Thinking Skills; Environmental Education; Teachers' Competency.

1. Introduction

Environmental education is one of the success factors in environmental management and is also an essential tool in producing human resources who can implement the principles of sustainable development (Widianingsih et al., 2017). This education is a learning carried out to assist students in understanding the environment with the ultimate goal of increased protection and a responsible attitude towards the environment. Environmental education must be understood as an effort to lead individuals towards changes in lifestyle and behavior that are environmentally friendly.

Environmental education materials are delivered through various teaching methods that require teachers to think critically, imagine scenarios, and make choices to empower students to take action to address various environmental problems. These abilities are related to thinking critically, reflectively, metacognitively, and creatively. It is in line with the demands of the globalization era, where every student must improve their scientific nature, values, attitudes, and higher-order thinking skills to think critically and creatively in making decisions for problem-solving.

Higher-order thinking skills (HOTS) are essential in applying, connecting, and using prior knowledge to solve problems effectively. HOTS is very important in environmental learning because environmental problems are complex problems, so students must be able to analyze, evaluate, and find something new (Lee & Lai, 2017; Tajudin & Chinnappan, 2016). Through HOTS, students are expected to be able to learn things they do not know and then successfully apply them to new situations.

Research in various countries shows that HOTS is one of the skills needed in 21st-century learning (Husamah et al., 2018; Ichsan & Rahmayanti, 2020; Quieng et al., 2015; Saputri, 2019; Urbani et al., 2017). Several studies have shown that HOTS in students positively correlates with student achievement (Tanujaya et al., 2017). HOTS is very important in solving various environmental problems, including flood problems, requiring HOTS to provide the best solution (Ichsan et al., 2019).

Variations in learning are carried out to increase the HOTS of students. The improvement and use of various learning models, learning materials, learning resources, student assignments, and learning media are expected to increase students' HOTS. Teachers' understanding of learning and HOTS assessment is critical to supporting and improving students' thinking ability at higher levels (Retnawati et al., 2018). Here, the teacher plays a role in being able to carry out HOTS-based learning so that it can provoke students to think more critically. Several previous studies have shown that the teacher's ability to manage to learn is essential in increasing students' HOTS (Ichsan, Sigit, et al., 2019). At the same time, other research shows that physical factors such as classroom climate will also affect the increase in HOTS in students (Tajudin & Chinnappan, 2016).

However, practice in the field, learning, and HOTS assessment are some that teachers need help implementing. Teachers must have the competence to master the concepts and learning strategies. The current research focuses on learning strategies that support HOTS learning and focus on students as learning objects. Therefore, research that focuses on teachers as educators is also needed. In addition, several studies on PLH and HOTS are currently being conducted separately. Environmental Education research that has been done previously primarily discusses the implementation of PLH and the implementation of PLH policies in schools. The researchers tried to collaborate between HOTS and environmental education. This study aimed to determine the teacher's perspective on implementing HOTS in the learning environment. This research is essential to map teachers' competence in implementing HOTS in the learning environment, so this is a differentiator from previous research. The impact of this research is expected to assist teachers in improving competence and effective learning strategies for defenders to prepare students who can compete in the world of work in solving problems with a critical and broad perspective.

2. Method

The research method used is mixed methods, combining quantitative and qualitative methods. The use of this combination method aims that qualitative methods can complement the shortcomings of quantitative methods and vice versa so that a good understanding can be obtained in answering research problems. In determining the population and sample, pass through several stages, including 1) determining high school and vocational high school with adiwiyata status in Metro City, Lampung Province, Indonesia. Furthermore, ten Senior and Vocational High Schools (SMA & SMK) received the Adiwiyata title in the 2017-2019 range.

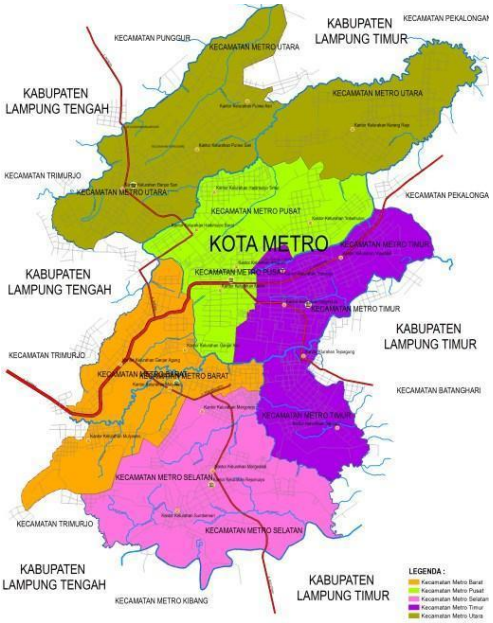

Fig 1: Metro City Administrative Map

The choice of Metro City as a research area is according to the vision and mission where Metro City is also determined to become an educational city in Lampung Province. In addition, the Human Development Index

also supports it, which is higher than other regencies/cities in the province of Lampung. The detailed list of schools is described in Table 1.

Table 1: List of High Schools and Vocational High Schools with Adiwiyata Status in Metro City 2017-2019

No	Senior High Schools (SMA & MA)	Vocational High Schools (SMK)
1	SMA Negeri 1 Metro	SMK Negeri 1 Metro
2	SMA Negeri 2 Metro	SMK Negeri 2 Metro
3	SMA Negeri 3 Metro	SMK Negeri 3 Metro
4	MAN 1 Metro	SMK Muhammadiyah 1 Metro
5	SMA Kristen 1 Metro	SMK Muhammadiyah 2 Metro

2) After obtaining ten schools with Adiwiyata predicate, the researcher conducts initial interviews with the Deputy Principal for the Curriculum Sector and observes curriculum documents to determine subjects and areas of expertise closely related to environmental education materials. The subjects closely related to the environment include Biology, Chemistry, Geography, and Entrepreneurship in Senior High Schools. While Vocational Schools are integrated science subjects, chemistry, entrepreneurship, and productive subjects in Agribusiness and Agrotechnology, Business and Management, Tourism, Technology and Engineering, Information and Communication Technology, and Arts and Creative Industries, 3) the next step is to determine the sample. The sample selection was determined using a purposive sampling technique, namely a sampling technique with specific considerations (Sugiyono, 2017). The sample is the teacher who teaches selected subjects at the schools that have been determined. The sample in this study includes 120 teachers. The distribution of the sample is described in the following table.

Table 2: Distribution of Samples in Senior and Vocational High Schools

No	Participant Expertise	n
	Senior High School	
1	Biology	13
2	Chemistry	12
3	Geography	13
4	Entrepreneurship	9
	Vocational High School	
5	Agribusiness and Agrotechnology Expertise	23
6	Business and Management Expertise	21
7	Tourism Expertise	9
8	Technology and Engineering Expertise	11
9	Information and Communication Technology Expertise	9
10	Arts and Creative Industries Expertise	2
	Total	120

The data were analyzed using descriptive analysis of percentages. Categorizing the respondent's response scores is done to make it easier to interpret the studied variables. The principle of categorization of the number of respondents' response scores in this study uses the calculated average value as a reference for determining the classification of assessment categories. The average calculation is used to see the tendency of the statement items' answers to describe the conditions of each variable studied. The assessment categories in this study are determined based on the number of measurement scales used, which are five classifications. The following is an equation for calculating the class length at each interval (Supangat, 2017):

$$P = \frac{X_{max} - X_{min}}{b} = \frac{R}{b}$$

Description:

P = Class Length per Interval
X_{max} = Maximum Score
X_{min} = Minimum Score
R = Range
b = Number of Classes

In this research, the maximum value of the assessment is five, and the minimum value of the research is one so that if the value is substituted into the previous equation, the following results are obtained:

$$P = \frac{5-1}{5} = 0 \qquad (1)$$

Based on the results of the calculation of the class length for each interval, the classification of the assessment categories for the average value is presented as follows:

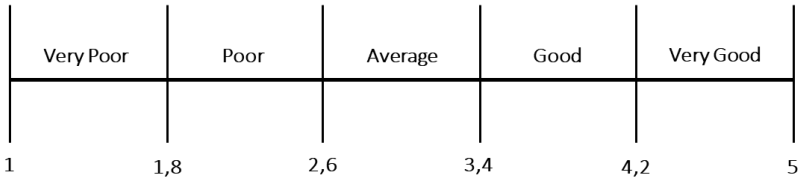

Fig 2: Continuum Line

Table 3: Criteria for Assessment of Indicators on Research Variables

No	Percentage	Criteria
1	1,00 – 1,79	Very Poor
2	1,80 – 2,59	Poor
3	2,60 – 3,39	Average
4	3,40 – 4,19	Good
5	4,20 – 5,00	Very Good

Meanwhile, the qualitative data was collected from interviews with ten teachers or vice principals for the curriculum at SMA/SMK. The results of this interview were analyzed using data analysis proposed by Miles et al. (Miles et al., 2014). In qualitative analysis, researchers build words from the results of observations or observations of the data needed to be described and summarized. The results of this qualitative data will later strengthen and complete the results of quantitative data processing.

The quantitative data was collected using a questionnaire to 103 teachers in 10 SMA/SMK. The research measurement instrument is in the form of a HOTS implementation questionnaire in environmental learning. The questionnaire is used to see the teacher's understanding of applying higher-order thinking skills in schools in environmental learning. This questionnaire is adapted from a study entitled Teachers' Levels of Knowledge and Interest on Higher Order Thinking Skills (HOTS), the Field Taught and Category of Schools by Ramasamy et al. (2016). It also refers to the Regulation of the Minister of Education National Republic of Indonesia Number 16 of 2007 concerning Standards of Academic Qualification and Teacher Competence. It is tested on 45 teachers with the same characteristics as the sample. The questionnaire consists of 3 parts: the learning planning stage, learning implementation, and learning evaluation. The Likert scale is used to rank respondents' answers, which consist of 4 answer choices, including Very Understand (SP) 4, Understand (P) 3, Not Really Understand (KP) 2, and Not Understand (TP) 1.

3. Results And Discussion

Three focus studies were conducted in this study, including lesson planning, learning implementation, and evaluation. The findings of the research results on each aspect of the study can be seen in the following elaboration.

Lesson Planning

The details of the planning are presented in the following table.

Table 4: Lesson Planning

No	Indicators		Score				Total Score	Mean
			Very Understand (4)	Understand (3)	Not Really Understand (2)	Not Understand (1)		
1	Teachers design the syllabus and lesson plans by integrating environmental awareness into materials related to the environment.	F	17	47	23	16	271	2,63
		%	16,50%	45,63%	22,33%	15,53%		
2	Teachers develop environmental learning plans based on core competencies and essential competencies contained in the curriculum.	F	40	34	22	7	313	3,04
		%	38,83%	33,01%	21,36%	6,80%		
3	Teachers design environmental learning according to the environmental issues that are trending at that time.	F	16	46	27	14	270	2,62
		%	15,53%	44,66%	26,21%	13,59%		
4	Teachers make learning objectives on material related to the environment in the lesson plan and syllabus.	F	30	36	24	13	289	2,81
		%	29,13%	34,95%	23,30%	12,62%		
5	Teachers design syllabi and lesson plans by applying active verbs in higher-order thinking skills.	F	15	48	28	12	272	2,64
		%	14,56%	46,60%	27,18%	11,65%		
6	Teachers make indicators according to the learning objectives to be achieved.	F	63	28	1	11	349	3,39
		%	61,17%	27,18%	0,97%	10,68%		
7	Teachers make indicators of knowledge and skills in pairs	F	43	45	15	0	337	3,27
		%	41,75%	43,69%	14,56%	0,00%		
8	Teachers must pay attention to active verbs in basic	F	46	39	7	11	326	3,17
		%	44,66%	37,86%	6,80%	10,68%		

No	Indicators		Score				Total Score	Mean
			Very Understand (4)	Understand (3)	Not Really Understand (2)	Not Understand (1)		
	competencies to make learning indicators on basic competencies related to the environment.							
9	Teachers develop syllabuses and lesson plans for environmental education that are integrated into subjects.	F	21	43	26	13	278	2,70
		%	20,39%	41,75%	25,24%	12,62%		
10	Teachers develop the syllabus and lesson plans for environmental learning and relate them to everyday life.	F	22	52	16	13	289	2,81
		%	21,36%	50,49%	15,53%	12,62%		
11	Teachers design student-centered learning	F	38	52	13	0	334	3,24
		%	36,89%	50,49%	12,62%	0,00%		
12	Teachers design learning according to the learning objectives	F	65	27	11	0	363	3,52
		%	63,11%	26,21%	10,68%	0,00%		
13	Teachers design varied learning so that students do not get bored	F	35	54	14	0	330	3,20
		%	33,98%	52,43%	13,59%	0,00%		
14	Teachers design learning by paying attention to the characteristics of students.	F	33	53	6	11	314	3,05
		%	32,04%	51,46%	5,83%	10,68%		
15	Teachers prepare several learning resources to increase students' knowledge.	F	24	66	13	0	320	3,11
		%	23,30%	64,08%	12,62%	0,00%		
16	Teachers design learning in the classroom and the environment around the school.	F	13	65	14	11	286	2,78
		%	12,62%	63,11%	13,59%	10,68%		
Total Score and Average							**4941**	**3,00**

Table 4 shows that the average respondent's response to the planning dimension has a total score of 4941. The average respondent's response to the planning dimension is 3.00, included in the reasonably good category. The score interpretation criteria on the Planning dimension can be seen on the continuum line (Figure 3).

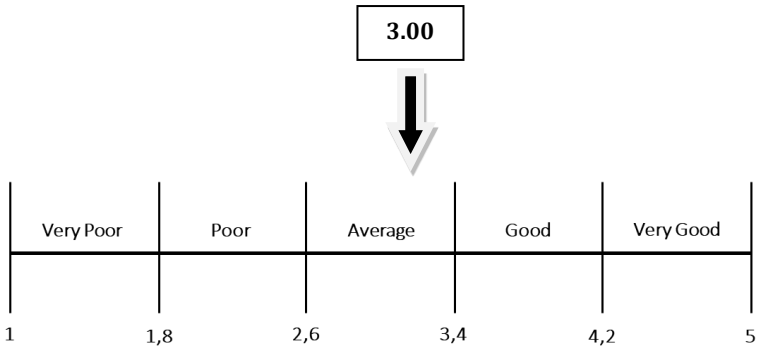

Fig 3: Continuum Line of Planning Dimensions

Based on the continuum line (Figure 3), the Planning stage shows that the respondents' responses fall into the reasonably good category with an average value of 3.00 in the 2.6 – 3.99. Based on these results, it can be concluded that respondents' responses regarding the Planning stage were included in the reasonably good category.

Learning Implementation

The results of the implementation phase are presented in the following table.

Table 5: Implementation Stage

No	Indicators		Respondents Answer Score				Total Score	Mean
			4	3	2	1		
1	According to the syllabus and lesson plans, teachers convey material to students in learning.	F	44	47	12	0	341	3,31
		%	42,72%	45,63 %	11,65 %	0,00%		
2	Teachers use learning media that has been adapted to the material	F	35	57	4	7	326	3,17
		%	33,98%	55,34 %	3,88%	6,80%		
3	Teachers only use one type of learning media (LCD/video/photo/environment) so that students focus on the material being taught.	F	47	46	0	10	336	3,26
		%	45,63%	44,66 %	0,00%	9,71%		
4	Teachers use appropriate learning strategies and models to help students more easily achieve learning goals.	F	40	51	12	0	337	3,27
		%	38,83%	49,51 %	11,65 %	0,00%		
5	Student-centered learning will help students more easily analyze material related to the environment in learning.	F	33	56	14	0	328	3,18
		%	32,04%	54,37 %	13,59 %	0,00%		
6	Teachers apply a problem-based learning model in learning related to environmental management issues.	F	30	63	0	10	319	3,10
		%	29,13%	61,17 %	0,00%	9,71%		

No	Indicators		Respondents Answer Score				Total Score	Mean
			4	3	2	1		
7	The teacher gives assignments related to the environment	F	10	49	31	13	262	2,54
		%	9,71%	47,57 %	30,10 %	12,62 %		
8	The teacher invites students to look for learning references in environmental learning.	F	20	49	22	12	283	2,75
		%	19,42%	47,57 %	21,36 %	11,65 %		
9	In learning, teachers invite students to go to the environment around the school to see the environmental problems around us.	F	10	49	30	14	261	2,53
		%	9,71%	47,57 %	29,13 %	13,59 %		
10	Teachers give independent assignments (PR) at the end of the lesson.	F	37	52	4	10	322	3,13
		%	35,92%	50,49 %	3,88%	9,71%		
11	Teachers give questions that can foster students' analytical and critical power.	F	30	62	5	6	322	3,13
		%	29,13%	60,19 %	4,85%	5,83%		
Total Score and Average							**3437**	**3,03**

Table 5 shows that the average respondent's response regarding the Implementation dimension (realization of planning) has a total score of 3,437, and overall, the average respondent's response regarding the Implementation dimension (realization of planning) is 3.03, included in the average category. The score interpretation criteria on the Implementation dimension (realization of planning) can be seen below in the continuum line (Figure 4).

Fig 4: Continuum Line Implementation Dimension (realization of planning)

Based on the continuum line above, the Implementation dimension (realization of planning) is included in the reasonably good category with an average value of 3.03 in the 2.6 – 3.99. Based on these results, it can be concluded that the respondent's response regarding the implementation dimension (realization of planning) is included in the average category.

Learning Implementation

The results of the evaluation stages are presented in the following table.

Table 6: Evaluation of Learning Implementation

No	Indicators		Respondents Answer Score				Total Score	Mean
			4	3	2	1		
1	Teachers use multiple-choice questions to make it easier for students to work on the questions.	F	52	36	8	7		
		%	50,49%	34,95%	7,77%	6,80%	339	3,29
2	Preparing the assessment includes the domains of attitude, knowledge, social, and skills.	F	48	40	5	10		
		%	46,60%	38,83%	4,85%	9,71%	332	3,22
3	The assessment was prepared based on the curriculum that was in effect at that time.	F	60	32	1	10		
		%	58,25%	31,07%	0,97%	9,71%	348	3,38
4	The teacher sets the Minimum Mastery Criteria (KKM) score according to that set by the school.	F	62	24	6	11		
		%	60,19%	23,30%	5,83%	10,68%	343	3,33
Total Score and Average							**1362**	**3,31**

Based on Table 6, the average respondent's response regarding the Evaluation dimension is 3.31, which is included in the average category. The score interpretation criteria on the Evaluation dimension can be seen on the continuum line (Figure 5).

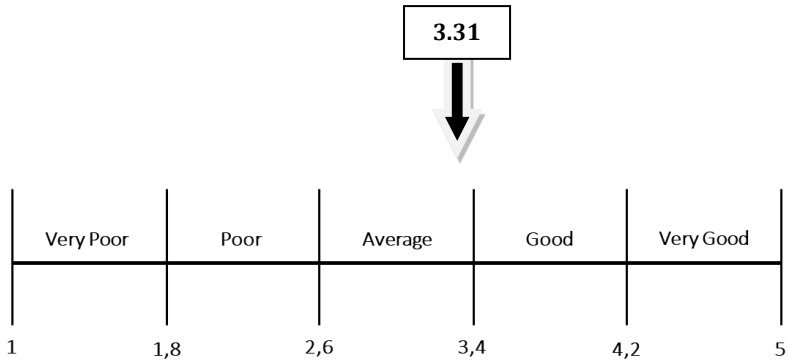

Fig 5: Evaluation Dimension Continuum Line

Based on the continuum line above, it is included in the reasonably good category, indicated by the average value of 3.31 in the 2.6 – 3.99. Based on these results, it can be concluded that the respondents' responses regarding the evaluation dimension are included in the average category.

The planning stage is the first in the HOTS-based environmental learning implementation process. The planning stage, in general, consists of making environmental learning plans based on the appropriate curriculum, applying active verbs in lesson plans, making learning indicators in lesson plans, integrating environmental issues into lesson plans, using learning methods that follow HOTS, and using learning references. The indicators at the planning stage with the highest scores are indicated by statements regarding the design of learning according to learning objectives, making indicators according to learning objectives, and making indicators of knowledge and skills in pairs. The indicators with the lowest scores in the planning stage are shown by statements regarding the design of environmental learning following existing environmental issues, the design of learning by integrating environmental education, and the application of active verbs in learning design plans (RPP). The planning stage

on the study results shows that the scores are included in the reasonably good category. Teachers can design learning according to learning objectives and make indicators in pairs between the realm of knowledge and skills according to learning objectives. However, some teachers must integrate environmental education materials into their planning documents. Environmental Education is a subject that uses an integrative approach. This integrative approach combines or integrates environmental learning (PLH) into specific subjects.

The second stage in implementing the HOTS-based learning environment is the implementation stage, which is the realization of the planning stage. The general implementation consists of the suitability of the material with the lesson plans, the learning tools (media), the applied learning strategies and models, and the use of reference materials that support HOTS in learning. In more detail, the indicator in the implementation with the highest score is the delivery of material to students following the syllabus and lesson plans. Then, it is followed by learning media adapted to the material, questions that can foster students' analytical and critical abilities, and one type of learning media (LCD/video/photo/environment). So that students focus on the material being taught and provide independent assignments (Homework) at the end of learning. The indicator with the lowest score is the statement that invites students to go to the environment around the school to see environmental problems that are around us, giving assignments in the form of projects to make something on materials related to the environment and the teacher's ability to invite students to look for learning references in environmental learning.

The final stage in the implementation of this learning is the evaluation stage. The Evaluation Stage consists of several indicators, which generally relate to the types of questions given, the preparation of assessments, and the determination of KKM. In more detail, the statement item with the highest score is the process of compiling an assessment made based on the current curriculum, then setting the KKM value following that set by the school, the process of compiling an assessment that includes the domains of attitudes, knowledge, social, and skills and items. The lowest uses multiple choice questions to make it easier for students to work on the questions.

The teacher of the relevant subject carries out the integration technique. Integration is done by analyzing any material closely related to the environment. The expected integration is conceptual integration designed and systematically implemented based on the curriculum. Conceptual integration can be realized if the subject matter of Environmental Education and related subjects can be integrated, complement each other, and enrich students' knowledge and understanding (Basri, 2013). HOTS globally emphasizes skills that have become the core focus of teaching at every level of education. HOTS is a fundamental skill teachers must master to grow students' thinking and improve learning in the classroom through its application in the teaching and learning process (Hamzah et al., 2022).

According to the findings of this study, some teachers need help applying HOTS in environmental learning. The teacher's reason for not integrating is that the teacher needs clarification about environmental issues. In addition, teachers need more hours of learning if they have to apply HOTS. Teachers only focus on their lesson plans to get an excellent final score for each student. Because the teacher's ability to understand HOTS still needs to improve, students have yet to demonstrate the ability to think critically in solving problems, especially in PLH. It is in line with Ichsan and Rahmayanti, whose research shows that the HOTS of students at all levels of education still needs to be considered higher (Ichsan and Rahmayanti, 2020).

Furthermore, the results of research in South Africa show similarities with the results of this study that teachers need more competence and ability to integrate Environmental Education. Some of them have less basic skills about the environment, so they still need clarification about how to apply Environmental Education in learning. During the interview, they revealed that they needed help understanding and that teachers needed to be given complete information about the curriculum. Therefore, teachers need the ability to define EE and how they can apply learning methodologies to implement EE (Damoah, 2019).

The results of another study state that teachers in South Africa did not implement environmental education because it required additional time in subjects. According to EAI, learning time is essential in considering students' learning opportunities, although many factors affect the education system's effectiveness. Moreover, the South African curriculum (CAPS document) must clearly describe integrating environmental education into subjects (Shabalala & Msezane, 2020).

This study's results sharpen the need for teacher competence regarding time management and integrating environmental materials due to the need for more learning resources and references about environmental

education. According to research, some teachers say that the need for supporting books, especially environmental education guidebooks, is essential in providing environmental knowledge to students. It arises because some teachers still interpret learning resources in a narrow sense, limited to books (Rivai & Sudjana, 2009)

The second stage in implementing the HOTS-based learning environment is the implementation stage, which is the realization of the planning stage. The general implementation consists of the suitability of the material with the lesson plans, the learning tools (media), the applied learning strategies and models, and the use of reference materials that support HOTS in learning.

In more detail, the indicator in the implementation with the highest score is the delivery of material to students following the syllabus and lesson plans. Then, it is followed by learning media adapted to the material, questions that can foster students' analytical and critical abilities, and one type of learning media (LCD/video/photo/environment). So that students focus on the material being taught and provide independent assignments (Homework) at the end of learning.

The indicator with the lowest score is the statement that invites students to go to the environment around the school to see environmental problems that are around us, giving assignments in the form of projects to make something on materials related to the environment and the teacher's ability to invite students to look for learning references in environmental learning.

Effective learning can use various resources (Basri, 2013). Learning resources can use everything around the learning activity environment, which functionally helps optimize learning outcomes (Sanjaya, 2016). Students understand science more easily if students interact directly or are associated with the surrounding environment, where these activities are more integrated with students. Learning styles and understanding of concepts will be significantly better when learning about using the environment around the school as a learning resource compared to students who take conventional learning (Bintarini et al., 2013).

Even though many other sources or references can be used as learning resources, an effective learning process uses various learning resources (Basri, 2013). Learning resources are everything around the learning environment that can functionally be used to help optimize learning outcomes (Sanjaya, 2016). Furthermore, students find it easier to understand science if students interact directly or are associated with the surrounding environment, where these activities are more integrated with students. Learning styles and understanding of concepts will be significantly better for those who take part in learning the use of the environment around the school as a learning resource compared to students who take part in conventional learning (Bintarini et al., 2013).

The learning method is project-based, and students look enthusiastic about carrying out their projects. It is evident in the respondents who are teachers of geography subjects who say that there are several materials related to the environment, for example, global warming, in learning about the earth's atmosphere. Meanwhile, the Biology subject teacher said that Biology has a close relationship with the environment, so environmental education has automatically been integrated into the Biology subject. Students are more enthusiastic when carrying out environmental-related practices, and it is easier to understand the concept of knowledge than just through conventional learning resources. However, the difficulty encountered is when it comes to applying HOTS in implementing learning. The teacher said that they needed more time to apply HOTS in learning. Therefore, a teacher should not be fixated on using various methods so that the learning process is not dull but on how the teacher can attract students' attention (Puspitarini & Hanif, 2019).

One of the learning methods that can train students to think in higher order (HOTS) is to apply a problem-based learning model. The problem-based learning model uses students' various thinking abilities individually, in groups, and in natural environments to overcome problems so that they are meaningful, relevant, and contextual (Tan, 2003). This learning model aims to improve the ability to apply concepts to new/real problems, integrate higher-order thinking skills (HOTS) concepts, desire to learn, self-directed learning, and skills. Various varied and creative learning methods can provoke students to think in HOTS ways.

In addition to problem-based learning models, project-based learning models can also support students to think at a high level. This project-based learning model is a learning model that involves the activeness of students in solving problems carried out in groups or independently through scientific stages with a specific time limit that is outlined in a product and presented to other people. This learning model trains students to think creatively, part of HOTS learning. In addition, the project-based learning model will change the learning paradigm from teacher-centered to student-centered.

Based on the final report from the UN Decade of Education for Sustainable Development with the title "Shaping the Future We Want" shows that teachers have a role in the environmental learning process in schools. Teachers have an essential role in the success of environmental learning by building habits, instilling sustainability principles, and applying environmental ethics. Teachers have an essential role in the success of environmental education programs and achieve environmental education goals by presenting environmental problems encountered in everyday life and displaying the principles of sustainability and environmental ethics through active discussions (Adisendjaja & Romlah, 2008).

The paradigm shift in the learning process that was previously centered on educators to become student-centered learning is expected to encourage students to be actively involved in building knowledge, attitudes, and behavior (Basri, 2013). In a student-centered learning process, students get the opportunity and facilitation to build their knowledge to gain a deep understanding (deep learning), ultimately improving the student quality. Learner-centered learning methods are now considered more in line with today's external conditions, which challenge students to decide effectively on their problems.

The challenge for educators (teachers) to implement learner-centered learning is understanding concepts, thinking patterns, philosophies, methods, and learning strategies. Through this learning, students are required to participate actively, have critical power, and be able to analyze and solve their problems. A study found that HOTS is needed to determine the quality of one's thinking in fostering a positive attitude in developing skills (Heong et al., 2016). HOTS is a person's skills in conveying ideas and making problem-solving decisions. HOTS plays a role in helping students build the knowledge and information they learn, which can ultimately improve their learning achievement.

The teacher-centered learning approach causes a lack of stimulation of HOTS abilities in students (Gündüz et al., 2016; Mahoney & Harris-Reeves, 2019; Tyabaev et al., 2015; Xia, 2017; Yee et al., 2015). Therefore, teachers should be willing to change their habits in learning using a student approach. It will be effectively done if their learning planning uses a more constructive approach (Ichsan, Hasanah, et al., 2019). These various strategies are only partially practiced in senior high schools in Indonesia, even though this would be fascinating if applied in the Indonesian education system. Several techniques in the learning model, such as asking questions, formulating hypotheses, designing experiments, and determining conclusions, are part of HOTS learning (Zohar & Dori, 2003). Another example of stimulating students to apply HOTS is giving arguments against differences of opinion, solving problems, giving opinions, and making choices (Zohar & Nemet, 2002). Teachers can start applying these techniques in learning to train students' HOTS.

4. Conclusion

The study above concludes that some teachers have implemented HOTS in environmental learning. HOTS is very much needed to support an effective and comprehensive learning environment. At the planning, implementation, and evaluation stages of learning, several obstacles related to teacher competence, including the teacher's ability to integrate environmental education into the subjects taught, the ability to manage to learn, and the strategies applied in HOTS-based environmental learning. Teachers also still need to understand how to apply HOTS in learning. The government can use the results of this study to map teacher competencies and determine the best strategy to improve the quality of learning in terms of higher-order thinking Skills and Environmental Education. Furthermore, teachers can also reflect on themselves to see the challenges and obstacles they experience. Knowing the obstacles faced, it is hoped that the teacher can also determine what steps must be taken to overcome them.

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