

Research Article

HOTS-AEP-COVID-19 and ILMIZI learning model: The 21st-century environmental learning in senior high school

Ilimi Zajuli Ichsan ^{a,b,1,*}, Henita Rahmayanti ^{a,2}, Agung Purwanto ^{a,3}, Diana Vivanti Sigit ^{b,4},
Mieke Miarsyah ^{b,5}, Paulo Weslem Portal Gomes ^{c,6}

^a Department of Population and Environmental Education, Universitas Negeri Jakarta, Rawamangun Muka Street, East Jakarta 13220, Indonesia

^b Department of Biology Education, Universitas Negeri Jakarta, Rawamangun Muka Street, East Jakarta 13220, Indonesia

^c Institute of Biology, University of Campinas, Monteiro Lobato Street, Sao Paulo 13083-862, Brazil

¹ ilmizajuli95@gmail.com*; ² henita.rahmayanti@unj.ac.id; ³ agungpurwanto@unj.ac.id; ⁴ dianav@unj.ac.id; ⁵ mmiarsyah@unj.ac.id;

⁶ p264495@dac.unicamp.br

* Corresponding author

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ABSTRACT

Environmental learning in the Coronavirus Disease 2019 (COVID-19) pandemic requires 21st-century learning innovation which promotes Higher-Order Thinking Skills (HOTS) of which ILMIZI is the potential learning model. The purpose of this study was to measure the students' HOTS using HOTS Assessment based on Environmental Problem of COVID-19 (HOTS-AEP-COVID-19) and describe the syntax of ILMIZI model for the implementation of e-learning during the COVID-19 pandemic. The research subjects used were 172 senior high school students randomly selected from Bekasi City in several schools. The descriptive research used online survey as the data collection technique. The results showed that the students HOTS scores measured using HOTS-AEP-COVID-19 were still in very low category either for all students (22.83) or male students (21.32) and female students (23.82). Hence, the ILMIZI model need further evaluation to be implemented as an alternative for the 21st-Century environmental learning.



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INTRODUCTION

Coronavirus Disease 2019 (COVID-19) a disease from new coronavirus (SARS-Cov-2) causes many changes in the world in various fields of activity. Start from economic activities, government, educational activities, and overall activities in the world received negative impact from COVID-19 (He, 2020; Tian et al., 2020; Zhou et al., 2020). Environmental learning at various levels of education is one of activities that received of COVID-19 impact. Environmental learning when COVID-19 pandemic becomes an interesting issue to solve. Various problems arise due to changes in learning. Physical distancing policy changes learning strategies.

Conventional learning in general of face-to-face learning in class changes to using an e-learning can change the teacher and students learning activities (Mbipom et al., 2018; Mhouthi et al., 2017, 2018; Mirabolghasemi et al., 2019; Nugraini et al., 2013; Radovan & Perdih, 2016).

Environmental learning using e-learning will be slightly different from conventional learning in the classroom. Besides that, student also discuss various concepts of COVID-19 to prevent a wider spread of the COVID-19 pandemic in the environment. COVID-19 was one of environmental problem that must be solved. That resulted in the ability of students in the 21st century is needed, one of which is the ability of Higher Order Thinking Skills (HOTS) to solve a problem. This ability was a important ability that students must have in solving problems (Fitzpatrick & Schulz, 2015; Saido et al., 2015; Vijayaratnam, 2012; Wang & Wang, 2011; Yeung, 2015). When this COVID-19 pandemic occurs it is best to measure students' HOTS from the COVID-19 aspect. HOTS was one ability that suitable to solve COVID-19 problem in the environmental context.

Previous research has carried out the HOTS measurement of students using Higher Order Thinking Skills Assessment based on Environmental Problems (HOTS-AEP) at various levels of education (Ichsan et al., 2019). The instrument developed to measure the ability of HOTS students and university students with a focus on environmental issues. In this study, the instrument can be modified into Higher Order Thinking Skills based on the Environmental Problem of Corona Virus Disease (HOTS-AEP-COVID-19). The use of this instrument was an urgent thing to do and a novelty in this research. That is because previous studies have not been done in measuring HOTS students in COVID-19 situations.

The use of HOTS-AEP-COVID-19 was an urgent thing to do. The urgency is due to the unavailability of HOTS data profiles for students on the COVID-19 topic at the Senior High School level. Besides that, other components in learning must be done, start from use of appropriate learning models to improve the ability. In general, several 21st-century abilities are very commonly known today, such as critical thinking, creative thinking, communication, and collaboration (Barricelli et al., 2016; Grant & Smith, 2018; Heong et al., 2012; Lee, 2016; Nissim et al., 2016; Oncu, 2016; Quieng et al., 2015; Reyna et al., 2019; Zohar & Agmon, 2018). This ability must still be trained when the COVID-19 pandemic. The use of learning models becomes one of the important components, one of the innovations of learning models that can be used is ILMIZI learning model that has a syntax start from identify problems, limitation problems, make mind map, interpret results, analyze results, interaction and evaluate (Ichsan, 2019). This model has previously been implemented on a small scale but has not been implemented further (Ichsan, Sigit, et al., 2020). The ILMIZI model is a potential model to be implemented in e-learning during COVID-19.

Other research that has been done related to COVID-19 has been carried out mainly about finding various drugs that can potentially cure COVID-19 patients (Ahorsu et al., 2020; Bashyam & Feldman, 2020; Georgiev, 2020; Ni et al., 2020). Also, other research showed that learning science during the COVID-19 pandemic has also experienced changes in various countries, strategies and learning media was change to e-learning version (Bakker & Wagner, 2020; Erduran, 2020; Sintema, 2020). That point makes this research follows the world's research trends and becomes a novelty. Based on this, the purpose of this study was to measure students HOTS using HOTS-AEP-COVID-19 and describe ILMIZI syntax for implementation of e-learning during the COVID-19 pandemic.

METHOD

This research was conducted in March 2020 when the World Health Organization raised the state of contamination to the COVID-19 pandemic, a disease caused by the new coronavirus (SARS-Cov-2). The method used descriptive analysis with data collection techniques using a survey via Google form (online media). The sample used in this study were 172 senior high school students randomly selected from Bekasi City in several school. The sample consisted of 66 male students and 106 female students. The instrument used was Higher Order Thinking Skills Assessment based on the Environmental Problem of Corona Virus Diseases (HOTS-AEP-COVID-19). This instrument was a modification of HOTS-AEP that was previously developed (Ichsan et al., 2019). HOTS-AEP-COVID previously have been implemented for junior high school students (Ichsan, Rahmayanti, et al., 2020). The number of items from this instrument is six items. Indicators of this instrument can be more details seen in Table 1.

The instrument developed was tested for validity and reliability. The validity test used is Pearson product-moment and reliability using split-half (Spearman-Brown). The analysis of the data used in this study descriptively is displayed in Table 1. The categorization of student HOTS scores consists of Very high, high, moderate, low, and very low. These categories can be seen further in Table 2.

Table 1. Indicator HOTS-AEP-COVID-19

Aspect	Indicator	Item
Analyze (C4)	Analyzing environmental problems causing the spread of COVID-19	1,2
Evaluate (C5)	Evaluate community behavior for protecting the environment from COVID-19	3,4
Create (C6)	Creating problem solutions of environmental problems to prevent COVID-19	5,6

Table 2. Categories of HOTS scores measured using HOTS-AEP-COVID-19

Category	Interval Score
Very High	$X > 81,28$
High	$70,64 < X \leq 81,28$
Moderate	$49,36 < X \leq 70,64$
Low	$38,72 < X \leq 49,36$
Very Low	$X \leq 38,72$

Source: Category adapted from Ichsan et al. (2019) for scale 0-100

In addition to analyzing students' HOTS descriptively, this study also carried out a description of ILMIZI syntax in the form of teacher and student activity during e-learning. This needed to facilitate teachers in implementing ILMIZI learning models in 21st-century environmental learning. The description of the ILMIZI model also with a duration of usage time for each syntax. In this research, ILMIZI Model not yet implemented for senior high school students. In this research just conduct an analysis for learning stages (syntax) of ILMIZI.

RESULTS AND DISCUSSION

The instrument validity test results showed that the six items HOTS-AEP-COVID-19 had a valid category. This showed that instrument can be used in HOTS measurements. More clearly from the results of the validity test can be seen in [Table 3](#). While the reliability measurement results showed a value of 0.73 which can be used in this study.

Table 3. HOTS-AEP-COVID-19 instrument validity test results

Item	r value	r table	Category
Item 1	0.54	0.24	Valid
Item 2	0.63	0.24	Valid
Item 3	0.65	0.24	Valid
Item 4	0,70	0.24	Valid
Item 5	0.72	0.24	Valid
Item 6	0.72	0.24	Valid

The results showed that HOTS scores of senior high school students measured using HOTS-AEP-COVID-19 showed that the average score were in the very low category. This showed that students' knowledge about COVID-19 in the HOTS still very low and needs to be improved, especially in the second item related to analyzing environmental problems that contribute to the spread of COVID-19. The low score is on all student respondents both male and female students. More details about score can be seen in [Table 4](#).

Table 4. Average HOTS student scores for each item measured by HOTS-AEP-COVID-19

No	Item	All	Male	Female
1	Based on the news about COVID-19, analyze what environmental factors are causing more epidemics of COVID-19?	2.13	2.11	2.15
2	In your opinion, what environmental issues contributed the most to the spread of COVID-19? Explain the results of your analysis	1.95	1.88	2.00
3	Give your opinion and critique about community behavior that not protect the environment from COVID-19	2.49	2.30	2.60
4	What behavior should the community do to minimize the environment from COVID-19? Give your critique and suggestions	2.13	1.95	2.25
5	Create an idea about efforts to reduce the impact of the spread of COVID-19 in the environment around your home	2.17	2.03	2.26
6	Make a short paragraph (consisting of at least 3 sentences) about the relationship between the importance of protecting the environment and the distribution of COVID-19	2.83	2.52	3.03
Raw Score		13.70	12.79	14.29
Average Score (scale 0-100)		22.83	21.32	23.82
Category		Very low	Very low	Very low

The Students HOTS score based on each indicator showed that student scores are still in the very low category. This can be seen in [Table 5](#), mainly related to the ability to analyze environmental problems in the context of COVID-19 prevention. This showed that environmental learning at senior high school is not entirely based on HOTS. Many students answered the question in very short paragraph and not based on their analysis result. Then, many students answered based on textbook and didn't give their own argumentation.

Table 5. Average HOTS student scores for each indicator of HOTS-AEP-COVID-19

Aspect	Indicator	All	Male	Female
C4	Analyzing environmental problems causing the spread of COVID-19	2.04	1.99	2.08
C5	Evaluate community behavior for protecting the environment from COVID-19	2.31	2.13	2.42
C6	Creating problem solutions of environmental problems to prevent COVID-19	2.50	2.27	2.65

Meanwhile, to support environmental learning in the 21st-century, we need a learning model that is compatible with 21st-century learning. One of them is the ILMIZI model that can be applied to e-learning during COVID-19. This model can be adapted for conventional learning and e-learning by modifying teacher activity and also student activity. The duration of the use of the ILMIZI model can also be adjusted for each stage of learning. The following is the syntax or stages of learning from the ILMIZI model along with the activities of the teacher, students, and the duration (total 100 minutes) of learning for each step in [Table 6](#).

Table 6. ILMIZI learning model activity in e-learning during COVID-19 for senior high school students

No	Syntax	Teacher activity	Students activity	Duration
1	Identify problem	The teacher provides a theme of environment and COVID-19 to be discussed by senior high school students in e-learning media such as WhatsApp group	Senior high school students identify environmental problems, especially those related to COVID-19 problems in WhatsApp group	10 min
2	Limitation problem	The teacher asks senior high school students to limit the problem to be solved, especially about COVID-19, then write in WhatsApp group	Senior high school students limit the problem from various problems that have been identified, especially about COVID-19, then write the problem in WhatsApp group	10 min
3	Make mind map	The teacher asks senior high school students to create mind maps with a variety of creative colors	Senior high school students create a mind map about their problems and the solution for this problem, mind map made individually	30 min
4	Interpret result	Senior high school students are asked by the teacher to interpret the mind map results that have been made	Senior high school students interpret the mind map results that have been made in their notes	10 min
5	Analyze Result	The teacher asks senior high school students to analyze the results written before	Senior high school students write the results of the analysis in each note	10 min
6	Interaction and evaluate	The teacher asks senior high school students to upload the mind map in e-learning media that has been created and asks other students to give comments in WhatsApp group	Senior high school students upload mind maps on e-learning learning media and then comments about their classmates mind map in WhatsApp group	30 min

Note: Duration of this ILMIZI learning for 100 minutes, duration can be modified according to the learning topic

The ILMIZI model is one of the models developed to increase HOTS capabilities. Also, this model has compatibility with various competencies needed by students in the 21st-century. Competencies in the 21st-century are critical thinking, creative thinking, communication, and collaboration. This ability can be improved by using the ILMIZI model which can be seen in [Figure 1](#).

Based on [Figure 1](#) it can be seen that each step of learning from ILMIZI trains abilities in the 21st-century. Starting from the first learning stage which is identifying problems, this stage will train the ability of collaboration and communication between students in WhatsApp group. Communication in this context means students must give comments for their classmates works. That was because students must discuss between in group, so that the problems identified are not the same between groups. Then the second syntax was to limited the problem, this ability will practice the ability of critical thinking. That was because the limited problem must be specific, this critical thinking ability was needed to limit the problem. The next step was to made mind map and also interpret the results, the two stages of learning will train students' creative thinking skills. The ability to think creatively is very important in 21st-century learning ([Camacho & Legare, 2015](#); [Miller, 2018](#); [Seechaliao, 2017](#); [Şener et al., 2015](#)).

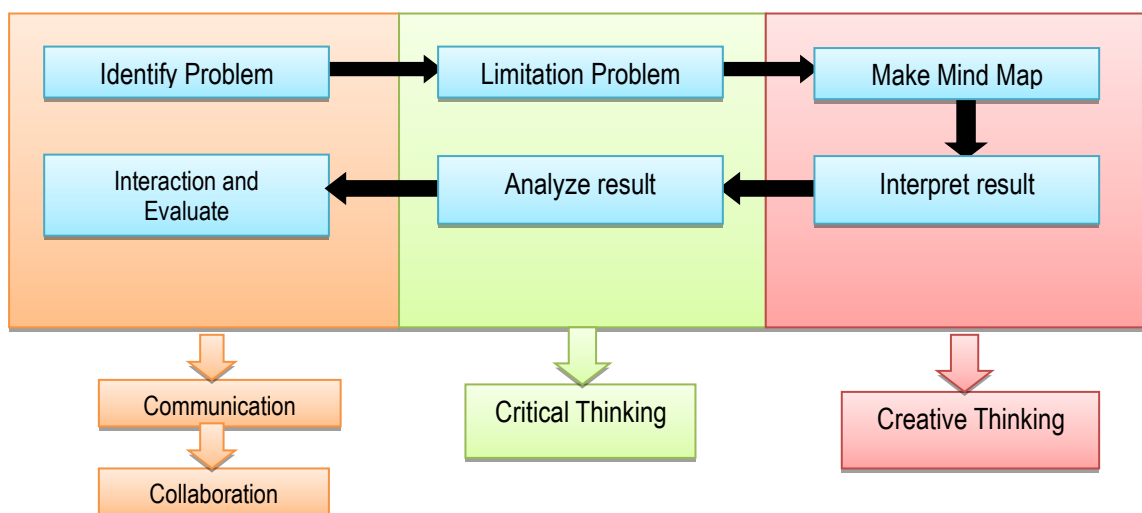


Figure 1. ILMIZI learning model and 21st-century skills Process

After making a mind map individually and interpreting the results, the next step was to analyze the results of the mind map and the interpretation of the previous stages. Analysis on mind map focused on their limitation problem in step 2. This analysis stage will train students' critical thinking skills. That was because students will be able to think critically by analyzing a variety of data and events that occur around their environment. The final stage was interaction and evaluated, it will train the students' collaboration and communication skills. The ability of these students is needed in 21st-century learning.

Based on the results of this study it was found that the ILMIZI learning model has the potential to be implemented using e-learning. In this research, ILMIZI not yet implemented on senior high school students. ILMIZI syntax in this context have an advantages and potentially to improve HOTS in future research. The use of ILMIZI has become a learning innovation when the COVID-19 pandemic. Changes in learning strategies when COVID-19 must be adapted to the use of suitable learning models. The learning model used to increase students' HOTS. That is because the Students HOTS score in COVID-19 was still low. This also makes learning innovation in terms of teaching materials or learning media must be further developed to improve HOTS (Barber et al., 2015; Chin & Chen, 2013; Parkin et al., 2012; Seechaliao, 2017).

Innovations that can be further developed to improve students HOTS about concept of COVID-19 is to develop a worksheet, based on information about COVID-19. This will facilitate students in understanding various things about COVID-19 and prevention efforts in their respective environment. HOTS-AEP-COVID-19 can also be developed further in the form of a learning media integrated with HOTS questions. That will make the developed learning media have the potential to increase students' HOTS and also the 21st-century's ability of students (Deschryver, 2017; Istiyono et al., 2019; Saido et al., 2015; Saputri et al., 2018).

Environmental learning, in this case, was a key role in reducing the impact of the spread of COVID-19 on students. That was because environmental learning discusses highly contextual topics related to COVID-19 prevention in their respective environments. In addition to changing the learning system, the existence of COVID-19 also changes the need for higher knowledge. That is because the ability of HOTS will greatly assist students in efforts to solve environmental problems (Fischer, 2018; Rahman, 2019; Turnip et al., 2016; Winarno et al., 2017). Specifically to prevent the spread of COVID-19 in their environment. The knowledge of students will be able to prevent students from COVID-19 pandemic. Therefore in the short term, it is necessary to develop various environmental learning innovations for various levels about COVID-19, especially in senior high school levels.

CONCLUSION

Based on the results of the study showed that students' HOTS scores measured using HOTS-AEP-COVID-19 were in the very low category. It showed that students' knowledge of COVID-19 in the environment still needs to be improved. The ILMIZI model was the models that can be used in e-learning. That was because the ILMIZI previous develop, this model based on HOTS and each syntax can improve the ability of 21st-century skills. HOTS score of students relative in very low, the suggestion from this research was to develop various

HOTS-based learning media, teaching materials, students worksheet to support HOTS in environmental learning during COVID-19.

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