



HOTS about Environment and Designing Science Serial Books for Digital Learning in Elementary School

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Abstract: Environmental education is one of the important aspects of Higher Order Thinking Skills (HOTS)-based elementary school learning. The use of learning media for e-learning implementation requires HOTS-based evaluation. This study aims to perform analysis related to HOTS and the utilization of e-learning in elementary school (SD). The method used in the research is the descriptive method with a survey as the data collection technique. The research instrument is in the form of a test question to measure HOTS based on Anderson's taxonomy and Ichsan's taxonomy. The second instrument employed is a questionnaire containing questions related to learning and various obstacles in e-learning. The research finds that the average HOTS score of elementary school students measured using Anderson's taxonomy is 2.58; whereas, those measured with Ichsan's taxonomy is 2.27 for all items. The HOTS measurement results using both taxonomies have some differences and one of them is in the C6 realm (create versus develop). The measurement results using the questionnaire suggest that WhatsApp is the frequently-used learning media (65.97%). Moreover, the most ideal learning duration according to the students is less than 3 hours (67.36%). The utilization of learning media become an important matter in the implementation of e-learning to enhance elementary school students' HOTS. Serial books are an alternative solution so that students can understand environmental material well. The research concludes that differences in HOTS scores occurred between those measured with Anderson's taxonomy and Ichsan's taxonomy. Learning media to be further developed should be HOTS-based.

Keywords: e-learning, Higher Order Thinking Skills, Taxonomy

Introduction

Environmental education is an intriguing topic to be presented to elementary school (SD) students. The implementation of environmental education in SD is usually integrated with thematic learning with certain themes discussed in a classroom. One of the themes is related to school and house environment cleanliness, which are important concepts to be understood by elementary school students. Environmental education is crucial since the impacts of environmental damage have occurred in numerous places (Ashraf et al., 2012; Shabani et al., 2013). Prevention should be taken so that the destruction and impacts of various non-environmentally friendly activities will not continue. One of them is by developing a Higher Order Thinking

Skills (HOTS)-based education. HOTS can be learned and trained so it will contribute to solving environmental issues.

HOTS contributes to providing concrete solutions to solve complicated issues. Students must possess HOTS since they play a role in providing an example to other younger kids to understand daily environmental problems. HOTS are part of 21st-century education that emphasizes 4C skills, namely critical thinking, creative thinking, communication, and collaboration (Ait et al., 2015; Lee, 2016; Urbani et al., 2017). HOTS in the development of 21st-century education is often identified with critical and creative thinking that must be developed in learning in SD.

In its development, HOTS experienced various changes. A taxonomy stated by Anderson (2001) tends

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to explain the differences between skills of create (C6) and evaluate (C5). Changes in the Anderson’s taxonomy cause the C6 (create) thinking level ranks up to the highest level. In the next development of taxonomy in education, however, the order of the thinking level in Anderson et al. (2001) taxonomy requires a revision. Taxonomy from Ichsan et al. (2021) updates the order and naming of Anderson’s taxonomy. The new thinking levels according to Ichsan’s taxonomy are Identify, Compare, Implement, Criticize, Solve Problem, and Develop Innovation (Ichsan et al., 2021). The change in the thinking level order makes Ichsan’s taxonomy should be considered to be a new instrument to measure HOTS.

Various studies in HOTS have been conducted, from the development of the OIIDE learning model to the development of RMS. The application of the OIIDE learning model is specifically developed to enhance HOTS in science learning. The OIIDE learning model accentuates the implementation of science learning that is more contextual to problems existing in the surrounding environment (Husamah et al., 2018). The advantage of the learning model includes its sufficient effectiveness in developing HOTS. The RMS model, on the other hand, highlights the implementation of science literacy-based learning through techniques of reading, problem mapping, and sharing experiences with fellow friends (Muhlisin et al., 2016).

HOTS and literacy skills are part of 21st-century required by students in daily life (Dani, 2011; Paristiowati et al., 2019). The 21st-century skills consist of four competencies, namely critical thinking, creative thinking, communication, and collaboration. These skills must be trained from an early age and by mastering the skills, students could contribute to solving problems. Critical and creative thinking skills are very useful skills to solve environmental problems. Students who possess the skills could easily look for solutions to the problems. Solutions offered can be more creative if students acquire creative thinking skills. Once the solutions are obtained, they will be communicated and collaboration could take place so that problems can be solved immediately. The 21st-century skills can be summarized in the form of HOTS.

Besides HOTS research, numerous research has been conducted regarding learning media. Latest studies indicate that learning media used in learning is pivotal to be developed in medium-term education programs. Learning media become one of the key components of e-learning application in various levels of education (Dumitrica, 2017; Yusuf et al., 2017), from primary to higher education. All levels of education employ learning media as a means to convey information related to current discussions and topics in the learning themes. One of the learning media that can be used is in the form of serial books in digital form so

that students can use them when learning in class or at home when learning online using laptops. Learning media play a significant role in e-learning implementation. Therefore, it is necessary to perform an analysis related to obstacles in elementary school education.

Method

The research employed a descriptive method. The data collection technique used was a survey technique to respondents. The research was carried out in 2022 with respondents from various elementary schools in Bekasi and Bogor. Samples for the research consisted of elementary school students randomly selected using a simple random sampling. The instrument used in the research included test questions that contained questions on the level of Higher Order Thinking Skills (HOTS). Moreover, other data collected were related to the implementation of e-learning that required an instrument of a list of questions on online learning. The number of question items of the HOTS test was 6 questions developed according to the taxonomy levels of Anderson et al. (2001). The second version of the test question consisted of 6 questions developed by referring to the taxonomy levels of Ichsan et al. (2021). The grids of the research instruments for the HOTS category are presented in Table 1.

Table 1. Grids of HOTS instrument according to the Taxonomy Type

Thinking Levels	Type of Taxonomy	Item
C4 Analyze	Anderson et al (2001)	1 and 2
C5 Evaluate	Anderson et al (2001)	3 and 4
C6 Create	Anderson et al (2001)	5 and 6
C4 Criticize Problem	Ichsan et al (2021)	1 and 2
C5 Solve Problem	Ichsan et al (2021)	3 and 4
C6 Develop Innovation	Ichsan et al (2021)	5 and 6

Next, the e-learning measurement comprised 6 questions associated with the implementation of online learning. The question items prepared were consistent with the needs of the classroom learning. The question items can be seen in Table 2. The questionnaires that were developed according to Table 2 were then disseminated to the elementary school students to be filled out online. The indicator developed had various question options. Indicators 1 and 5 had 6 options, whereas indicators 2, 3, and 4 had 4 options. Moreover, the 6th item had 7 question options. These answers would be recorded in the form of percentages and presented in the form of a table to facilitate data reading.

Table 2. Grids of e-learning instrument

No	Indicators	Number of option
1	Learning media used	6
2	Duration of online learning	4
3	Difficulties in working on the independent assignment	4
4	Obstacles in online learning	4
5	Teaching media in natural science learning	6
6	The most interesting natural science topic	7

Result and Discussion

The research found that the average scores of the elementary school students' HOTS measured using instruments developed using Anderson's taxonomy indicate that the lowest item was item number 5 (see Table 3).

Table 3. Results of measurement using Anderson's Taxonomy

No	Item	Score
1	Give your opinion regarding the deforestation phenomenon, what are the impacts? Explain!	2.52
2	State your opinion on hydroponic cultivation at home, does it have a positive impact? Explain!	2.75
3	What is your suggestion for school in establishing an environmentally-friendly school?	2.68
4	What do you think are the differences between ornamental plants (example: rose and orchid) and cultivated plants (example: corn, rice)? Which one is suitable to be planted in urban areas? Explain!	2.69
5	Please write a creative idea to invite your friends to grow plants in their respective home pots, what will you do to invite them?	2.42
6	Of all existing plants, what plants will you grow in your house? And why?	2.46
Average score		2.58

The measurement results of the HOTS of the elementary school students using Ichsan's taxonomy (new version) suggest that the highest score was in the third item. The result indicates that measurement using Ichsan's taxonomy can be done in various learning themes. The research result can be seen in Table 4.

The research results indicate that the learning medium mostly used in online learning was WhatsApp. Whereas, the least used medium was YouTube. This illustrates that very few teachers use YouTube as a learning medium. Data on the utilization of media can be seen in Table 5.

Table 4. Results of Measurement using Ichsan's Taxonomy

No	Item	Score
1	Give criticism related to the habits of people who like to smoke!	2.29
2	Is the policy to increase cigarette prices effective in preventing people to smoke? Explain!	2.23
3	The heart is the most important organ for humans. However, people often can't live a healthy lifestyle. Please explain the solutions and how to maintain heart health.	2.47
4	Consumption of high-fat foods will have a bad impact, what solutions could you provide so that consumption of fat-containing foods can be adjusted according to their portion	2.24
5	As a student, what innovative ideas could you give to maintain the cleanliness of your environment from bacteria and viruses?	2.34
6	Please write an innovative idea that you could do to be able to exercise amid busy daily activities!	2.10
Average score		2.27

Table 5. The utilization of online learning media

Option	Number of respondents	Percentage
WhatsApp	190	65.97
Zoom	22	7.64
Google Classroom	46	15.97
Google Meet	20	6.94
YouTube	3	1.04
Other	7	2.43

The ideal duration for online learning according to the students was <3 hours. This is an input for teachers in terms of ideal online learning. A duration of >8 hours was the least stated by the students. Thus, the duration of online learning must be adjusted (Table 8).

Table 6. Ideal duration for online learning according to students

Option	Number of respondents	Percentage
< 3 hours	194	67.36
3-5 hours	77	26.74
6-8 hours	12	4.17
> 8 hours	5	1.74

The research results also suggest that the majority of the elementary school students (54.51%) felt difficult to perform independent learning. Natural Science and environmental learning should prioritize how to facilitate students to understand various occurring phenomena.

Table 7. Respondents' opinion regarding independent learning

Option	Number of respondents	Percentage
Very easy	10	3.47
Easy	72	25.00
Difficult	157	54.51
Very difficult	49	17.01

The elementary school students encountered diverse obstacles including internet connection, difficulty in understanding concepts, and too much schoolwork. These obstacles must be anticipated to expedite lectures (see Table 8).

Table 8. Obstacles encountered by students in online learning

Option	Number of respondents	Percentage
Internet problem	87	30.21
Difficulty in understanding concepts	170	59.03
Too much schoolwork	22	7.64
Other	9	3.13

The research results also imply that video was considered more ideal by the students in natural science learning (see Table 9). This was inversely proportional to the results in Table 5 which indicates the use of the YouTube platform as a video medium that is still rarely used. The complete results can be seen in Table 9.

Table 9. Effective teaching media in natural science learning

Option	Number of respondents	Percentage
A. PowerPoint	39	13.54
B. Video	114	39.58
C. Pdf	50	17.36
D. Android application	28	9.72
E. E-book	21	7.29
F. Other	36	12.50

The interesting learning topics according to the respondents were those related to public health, environmental damage, distance learning, diversity, energy, and natural resources. Whereas, topics with the least interest were those related to marine and maritime. The results are presented in Table 10.

Table 10. Interesting topics to learn according to respondents

Option	Number of respondents	Percentage
A. Public health	92	31.94
B. Environmental damages	17	5.90
C. Diversity	36	12.50
D. Energy and natural resources	37	12.85
E. Marine and maritime	1	0.35
F. Distance learning	86	29.86
G. Other	19	6.60

The research results suggest that the average scores of the HOTS of the elementary school students were low and it needs improvement. The results of the HOTS measurements used Anderson’s taxonomy and the new

version of taxonomy (Ichsan’ taxonomy). The skills of elementary school students in solving environmental problems are necessary to be developed. Environmental awareness attitudes and behaviors must be instilled in elementary school students every day. In its development, the students’ HOTS will vary from level 4, level 5, and level 6. The thinking levels could solve various environmental problems. The research results can be a consideration for teachers in developing HOTS-oriented learning media and worksheets.

Consequently, the development of HOTS-based learning media by elementary school teachers becomes crucial. Assignments and learning flow must be oriented to HOTS development (Acharya, 2016; Aisyah et al., 2018; Istiyono et al., 2020). The trained HOTS, such as analytical skills, needs a learning type that sharpens the skills. Other skills, for example, skills to evaluate and create programs, must be accustomed so that students start to think critically from an early age. HOTS-based learning needs to be applied at various levels, from primary education to higher education. Learning of current environmental topics at elementary schools should prioritize current issues, such as global warming and climate change.

One of the media that can be made is to develop a series of learning books with the theme of maintaining personal and environmental hygiene. The results of this study also recommend the development of an integrated serial book in science learning at the elementary school level. The books developed can vary according to the needs of students at school. Serial books are one type of book that can be used in online and offline learning directly in the classroom. The contents of the book series that can be developed are related to the habit of washing hands for students, then continued with the topic of keeping the house clean. The specifications of the book design that can be made are as follows.

Table 11. Design of serial books for environmental learning in elementary school

No	Topic Section	HOTS aspect
1	Introduction	Analyze concept
2	Washing Hand	Evaluate the activity
3	Planting a tree	Create problem solution
4	Conclusion	Create conclusion

HOTS with orientation to innovation enhancement is based on Ichsan’s taxonomy. Skills to develop innovation is a continuation of the skills of create in Anderson’s taxonomy. Elementary school students should make a breakthrough to participate in the development of science, knowledge, and technology-based innovations in their surrounding environment (Jiang et al., 2017; Parkin et al., 2012). This innovation skill development should be followed by learning media that are contextual to problems occurred in the daily environment. One of them is self-cleanliness and

environmental cleanliness. Topics of self- and environmental cleanliness are contextual topics since they discuss daily events experienced by students. Upon studying the topics, students are expected to have more understanding of the essences in maintaining cleanliness.

Based on the research results, the implementation of e-learning that used several learning media had been going well. Whereas, the obstacles experienced by students include limited access to the internet and a long duration of learning. These obstacles can be an input for schools and primary education administrators to facilitate the limited access to the internet. Another obstacle is related to the students' understanding skills when they learn independently. Students must be capable of understanding complex concepts independently so their comprehension could increase. Comprehension of environmental concepts is a necessity to be able to solve environmental problems. Difficulties in understanding the concepts can be assisted via the utilization of technology-based learning media (McDougall et al., 2018; Yousefi, 2014).

The research results recommend students participation in solving environmental problems. Learning media must assist efforts in enhancing HOTS. The existing online learning is relatively good and run according to its purposes. Substantially, learning media must be oriented to materials that are contextual to current problems. Materials developed must be conveyed to students so they will have more understanding contextually regarding various problems that occurred in their surrounding environment (Bustami et al., 2018; Kartikaningtyas et al., 2018). The materials are the means to further develop students' HOTS. Methods to develop the skills for each skill level are different. For elementary school level, it must put forward the use of simpler and easy-to-understand languages.

Conclusion

The research concluded that the average score of students' HOTS was 2.58 for measurement using Anderson's taxonomy and 2.27 for measurement using Ichsan's taxonomy. Moreover, the results indicate that WhatsApp was the most frequently used learning media (65.97%). In terms of learning duration, the ideal duration was less than 3 hours (67.36%). The research limitation is related to the limited number of instruments in several items; therefore, it cannot discuss a variety of research topics extensively. Suggestion for further study is the need to develop ideal learning media such as serial book for concerning self- and environmental cleanliness topics.

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