Application of an Open-Ended Approach to Science Learning During the COVID-19 Pandemic

Miftakhul Husna,' Sudiyanto, Peduk Rintayati
Universitas Sebelas Maret, Indonesia ,*E-mail: mitahusna41@gmail.com*

ABSTRACT
Online learning that was carried out by schools during the COVID-19 pandemik made teachers have to come up with bright, more innovative ideas so that the learning carried out was by the desired goals. Science learning must be designed as attractive as possible, so that even though learning during the COVID-19 pandemik, students can also understand science learning well. Therefore, it is necessary to use an open-ended science learning approach. The purpose of this study was to determine the application of open-ended science learning during the COVID-19 pandemik. This research was conducted in grade VI elementary school. Collecting data using in-depth interview techniques, questionnaires, analysis of documents, and test. The collected data is then validated using triangulation techniques to determine the relevance and suitability of the data. Through the results of in-depth interviews, it was found that the open-ended approach was very helpful for students in understanding science learning. Besides, according to the results of the questionnaire, an open-ended approach can be applied in learning in the COVID-19 pandemic.

Keywords
Open-Ended, Science Learning, COVID-19 Pandemi.
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Introduction

The COVID-19 pandemic has had a tremendous impact on the world. The pandemic has significantly disrupted the growth of countries where cases of the novel coronavirus are spreading. Since this pandemic virus spreads widely, various obstacles have been a particular concern to every element of education. Human activities in any part of the world have been disrupted by this epidemic, from the beginning it had a huge impact on the economic world which was starting to decline, but now the impact is also being felt in the field of education. The policies taken by many countries including Indonesia by closing all educational activities have made the government and related institutions have to present an alternative educational process for students and students who cannot carry out the educational process. The Indonesian government has issued regulations to close schools and colleges which aim to break the chain of spreading the COVID-19 virus. School closures not only impact teachers, students, and families but also impact the entire community.

UNESCO Director-General, Andrey Azoulayals cited by VOA News (2020), warned that "the global scale and speed of the educational disruption due to coronavirus is unparalleled and, if prolonged, could threaten the right to education". Related to the virus that has become a pandemic in the world, which greatly impacts the education system in Indonesia, the virus also caused significant changes in the learning system in Indonesia (Suci, etc 2020: 68). The school, which was originally a place for children to have fun seeking knowledge, playing with their themes to increase their social awareness and social skills, was suddenly closed by the government to take precautions. According to the United Nations Educational, Scientific, and Cultural Organization (UNESCO) monitoring, over 100 countries implemented nationwide closures, impacting over half of the world's student population (UNESCO, 2020a). Plus according to Preeti (2020: 3182) states that The closure of the schools has affected the structure of learning and schooling, it affected the teaching, assessment methodologies, and also parents are facing various issues because of the

change in teaching methodology. Globally, the results of UNESCO's monitoring state that as of April 13, 191 countries had implemented a national closure which affected 1,575,270,054 students (91.3% of the world's student population) (UNESCO, 2020). In the case of temporary school closures, support continued access to quality education, such as: use of online / e-learning strategies and assigning reading and exercises for home study (Unicef 2020: 5).

There are so many big surprises that occur in the learning system where students usually come face to face with the teacher and their friends are suddenly changed by a completely online learning system that has never happened before. The level of education that becomes the victim is not only elementary school / Madrasah Ibtidaiyah but also junior high school / Madrasah Tsanawiyah, and senior high school / Madrasah Aliyah, and even universities. Learning that was previously face-to-face must be replaced by online learning. Online learning is a way to be effective to be applied in education (Irfan Fauzi 2020: 59). This online learning was not carried out in a short time and it is not known the end of this online learning, this online learning can even happen until the corona outbreak disappears. The changes in the implementation of a new life in education are felt by all groups including teachers, students, and parents. Schools as educational providers must be prepared to facilitate any changes regarding the education of their students. Schools need to force themselves to use online learning so that the teaching and learning process continues.

There are many obstacles when learning is done online. some teachers have not mastered technology so that teachers also have to learn technology extra suddenly. Besides, many students do not have the necessary access to supportive technologies which makes it harder to maximize the potentials of learning technology during school closures (Edeh Michael, etc 2020: 112). Parents must replace the role of teachers in schools to assist the teaching and learning process at home. Parents face various problems due to changes in teaching methodology. The use of technology is not without problems, there are many variances of problems that hinder the effectiveness of learning with online methods. They are finally overwhelmed in online learning to assist their children because parents have to facilitate learning such as cellphones, laptops, and quotas.

The role of the teacher is no less important in learning the COVID-19 pandemic because the teacher determines the success of learning objectives. Teachers must ensure that the learning process goes well even though it is online so that teachers have a greater responsibility. There are many student subjects in SD, especially for private SD. The number of subjects and special or religious characteristics that make teachers have to be as creative as possible in providing learning so that students understand the learning. One of the elementary lessons in science. Science learning is an activation process that encourages students to develop their initial competencies into thinking, behaving, and acting competencies so that in science learning the goals can be achieved properly. Class VI science learning in elementary schools emphasizes the development of students' critical thinking skills.

One of the objectives of learning science material is to increase curiosity about the natural surroundings, namely to develop student insights that are useful for the advancement of science and technology. Learning science in elementary schools, especially in grade VI has not yet fully increased students 'curiosity about the universe so that students' critical thinking skills are not optimal. This is research from Trends in International Mathematics and Science Study (TIMSS) in 2015 on Indonesian science material which was ranked 62 out of 69 participants. Low student learning outcomes can occur because of many factors, such as students' initial abilities, teacher competence, learning objectives, learning methods, evaluation questions, and learning media. According to Susanto (2013: 166) which states that learning carried out by teachers cannot be active and creative which can involve students and have not used various learning approaches

that vary based on the character of the subject matter, especially science material.

In this COVID-19 pandemic problem, teachers must make an innovation that can increase students' curiosity about science. The approach that must be applied by the teacher must also be following the 2013 curriculum. Beside, learning approaches that support students to think openly and creatively even though during the COVID-19 pandemic must be given to students. Learning with a student-centered learning model, will provide a wider and more meaningful space for participants students in search of experience and construct experience into new knowledge, learners with independently looking for new things and also has complete control inside develop its learning (Elya, 2020: 186). There are so many approaches or strategies so that students are enthusiastic about learning science. One of them, learning can be designed using an open-ended approach. Teachers' relatively infrequent use of open-ended questions may deprive students of an optimally stimulating educational environment that maximizes cognitive and linguistic potential. Therefore, providing appropriate supports to enhance teachers' questioning behaviors is an important way to contribute to the quality of classroom conversation (Youngje Lee, etc. 2012: 568-569). Added according to Huda (2013), open-ended learning is learning in which the goals and desires of individuals or students are openly built and achieved. So that with this approach the critical thinking ability of children will increase and maximum results will be obtained.

Ariani (2014) states that there are differences in problem-solving abilities between students who take close-ended and open-ended learning. Open-ended problem learning will produce various alternative answers. Thus, training students to think critically and creatively. The results of research from Lestari et al (2017: 169) found that learning using open-ended explaining skills affected the competence of science knowledge in class V SD cluster IV Bali. This open-ended approach responds to problems in their meaningful way, students can be motivated in learning and have valuable experience in the process. The open-ended approach also demands activeness and creativity in answering the problems given and is not oriented towards the result (Dyah, 2015: 76).

The advantages of this open-ended, according to Shoimin (2014: 112), namely (1) students have more opportunities to take advantage of their knowledge, (2) students can be more active, (3) students with low abilities can respond to problems in their way, (4) students will be motivated to provide evidence or explanation, (5) students have a lot of ability to find something new. In this study, an open-ended approach was used in learning during the COVID-19 pandemic in science subjects, especially in the material of the solar system. A. Alman (2017: 112) Open-Ended (OE) as a learning method refers to a view regarding a process whose characteristics are still general; OE institutes inspires and reinforces theory-based learning methods. This open-ended learning can foster student activeness and creativity to find solutions in solving learning problems in the solar system. According to Suyatna in Darmayanti. Putu Laksmi, Putra, & Suara (2014, p. 3), the open-ended method is learning that implements open problems, which means that the learning process in this method presents problems which have many problems solving activities (flexibility) and in which the solutions can also be various (multiple answers and fluency).

Open-ended learning during the COVID-19 pandemic can be done through online learning. The use of applications is very helpful for teachers in providing open-ended learning. Lots of applications to carry out learning, such as WhatsApp, video call, google meet, zoom, google form, quizizz, google classroom, youtube, etc. Teachers can provide and monitor children's learning through social media. The combination of an open-ended approach with science learning will be seen when students are given assignments individually until they come to conclusions. By learning using an open-ended approach, it is

hoped that students can be more creative so that students do not only refer to books given from school. The knowledge that students get is not only limited to memorizing then forgetting, but the learning they get can be more meaningful and have a positive impact on learning outcomes.

I. METHODOLOGY

The general objective of this study is to determine the application of an open-ended approach in science learning during the COVID-19 pandemic. While the specific goal is to find out the methods, models, or approaches that teachers can take in fostering student creativity even though learning occurs online in the COVID-19 pandemic phase and develops student creativity during open-ended online learning. This research was conducted in one of the elementary schools in the city of Surakarta. The subjects of this study were teachers and grade VI students. The collection techniques used in the study were in-depth interviews, questionnaires, and documentation analysis. This study uses a qualitative method with a case study approach. Resource persons in in-depth interviews in this study were the class VI homeroom teacher and representatives of class VI students at the Surakarta elementary school regarding science learning and the application of the open-ended approach during the COVID-19 pandemic. Sampling for student interviews was carried out randomly which involved students with the best and lowest scores in the class. In addition to in-depth interviews, so that the data obtained is more in-depth, in this study, a questionnaire is used to determine the effectiveness of the application of an open-ended approach in this pandemic period aimed at students. In addition to in-depth interviews and questionnaires, researchers used document analysis which included the syllabus, lesson plans, a list of test scores for grade VI students in science learning subjects. The score list document is used to measure the initial ability of grade VI students for science subjects.

The instrument used in data collection is an instrument that has been validated by using triangulation techniques to determine the relationship and comparability of data. The analysis technique used in this research is an analysis technique that uses an interactive analysis model. The analysis technique used in this research is an analysis technique that uses an interactive analysis model. According to Miles & Huberman (2009) states that "the interactive analysis model has four components, namely: (1) data collection, (2) data reduction, (3) data presentation (data display), and (4) verification ". The validity of the data in this study was obtained through technical triangulation, and peer examination through discussion.

II. RESULTS AND DISCUSSION

This research is focused on finding out the application of an open-ended approach in science learning during the COVID-19 pandemic. COVID-19 (coronavirus disease 2019) is a disease caused by a new type of coronavirus, namely Sars-CoV-2 (Indonesian Ministry of Health, 2020). COVID-19 can be transmitted from humans to humans through close contact and droplets (splashes of liquid when sneezing and coughing). COVID-19 can cause acute respiratory symptoms such as fever above 38 ˚C, cough, and shortness of breath for humans. COVID-19 was first reported in Wuhan, China on December 31, 2019. The spread of this coronavirus is relatively fast, so far it has spread to various parts of the world. The situation when the population around the world is likely to be infected is called a pandemic (World Health Organization).

The COVID-19 pandemic has made major changes in various fields such as economy, society, and culture, including in the field of education. The influence in the field of education is mainly felt in changing mechanisms in teaching and learning activities. Schools are closed and learning is transferred online. The various approaches and strategies that have been carried out by teachers must be adapted to the situation and conditions during the COVID-19 pandemic. The goal is that learning can continue optimally and efficiently. In addition, teachers must use an approach in online learning so that students have a critical character. Based on the results of

interviews with classmates VI SD in Surakarta that in this COVID-19 pandemic, teachers feel it is difficult to teach, there are many obstacles that occur such as there are some students who do not have personal cellphones. In this case, the parents of students who were working from morning to evening took the cellphone. As a result, learning has become less effective. In addition, many students do not really pay attention to orders or assignments given by the teacher. During this online learning period, teachers must become more active and diligent and painstaking in reminding their students about the assignments given. However, sometimes there are some students who don't want to do and collect their assignments.

Interviews were also conducted from the side of the students' parents, where the parents also complained about having to accompany their children to study, and on the other hand, the parents were busy looking for money. So this causes a tremendous dilemma for parents. In addition, the quota runs out quickly because it is used for the child's online learning. In addition to interviews with teachers and parents of students, researchers also conducted interviews with students who also complained about learning during the COVID-19 pandemic. According to the student's point of view, online learning is considered to be ineffective at all and only makes assignments more pile up, but does not increase their knowledge. This is because there is no direct or face-to-face explanation so that students find it difficult to understand the material presented by the teacher online. The COVID-19 pandemic condition requires all teachers to change learning patterns. There are no choices regarding the learning system used and the only learning system that can be applied is to use online learning. It is the reason that online learning is very helpful in conveying learning to students in an emergency. Students prefer to study at school to meet directly with their teachers and friends rather than learning from home. Students are confused about online learning because they have never experienced it. Students also think that the teaching method during the COVID-19 pandemic is less fun in learning by way of teachers giving assignments every day and then students depositing them to the teacher on the same day.

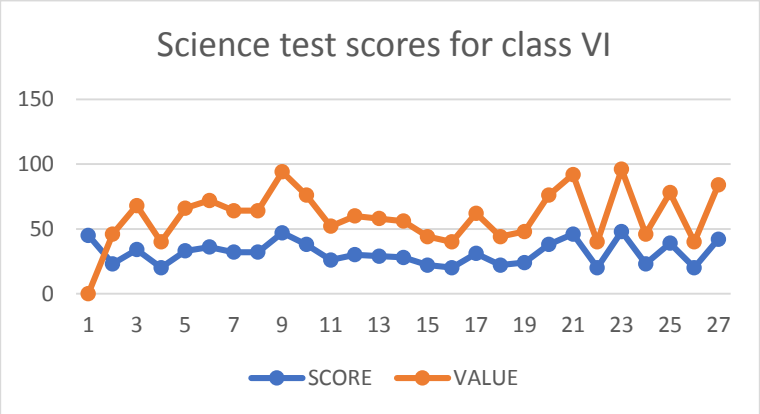
As a teacher who is required to be a professional in carrying out his duties in all situations and conditions, and innovation must be made by the teacher so that learning can take place effectively and efficiently. In this COVID-19 pandemic, teachers can use google meet, zoom, video call once a week to meet online with students. For daily tasks the teacher uses WhatsApp and Google Form to give assignments, sometimes the teacher also provides a YouTube link to clarify the ongoing learning. Strengthened by the results of documentation analysis in the form of RPP, syllabus, a semester program, promissory note, KKM, and a list of values. These documents are not used as a guide in implementing learning. Teachers only carry out learning according to their own will without looking at the references from the documents. Most of the documents that are made are simply searched on the internet and then printed so that there are no documents that are created by the teacher himself. Of course, this is a problem, so that the impact on the daily test scores of science lessons is unsatisfactory. This can be seen in the following table and figure.

Table 1. Science test scores for class VI

No	Score	Value
1	45	90.0
2	23	46,0
3	34	68,0
4	20	40,0

5	33	66,0
6	36	72,0
7	32	64,0
8	32	64,0
9	47	94,0
10	38	76,0
11	26	52,0
12	30	60,0
13	29	58,0
14	28	56,0
15	22	44,0
16	20	40,0
17	31	62,0
18	22	44,0
19	24	48,0
20	38	76,0
21	46	92,0
22	20	40,0
23	48	96,0
24	23	46,0
25	39	78,0
26	20	40,0
27	42	84,0
sum		1696,0
average		62,81

Based on the results of the test scores can be presented in the diagram below:



Picture 1. Diagram of class VI test scores for science

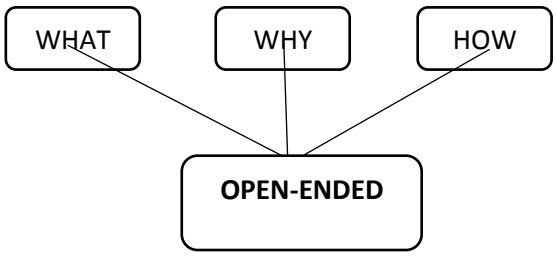
Based on the table and diagram above, it can be seen that there are still about 66.67% or 18 of the 27 students whose scores are not satisfactory or are still below the KKM, while 33.33% or 9 out of 27 students have scores already satisfying or are above the KKM. So that an average of 62.81 is obtained. This proves that there is still a low level of student understanding of science subjects. In particular, open-ended questions are believed to be particularly useful for developing student's cognitive skills, as these questions can encourage students to express and elaborate upon their thinking, and to provide rationales for their thoughts. An open-ended

learning environment must be able to immerse students in experiences that can jump-start their understanding through open-ended questions to understand an idea rather than a close-ended question.

Table. 2 Coding scheme for teachers' utterances

Code	definition	Example	Resource
Open-ended question	A question for which a number of different answers would be acceptable. A question which has no known answer and does not constrain child's response	What do the seeds look (or feel) like?	Hargreaves (1984), de Rivera et al. (2005)
Close-ended question	A question for which one answer is acceptable. A question which constrains a child's response such as test questions, yes-no questions and forced choice questions	Is a beach ball heavy or light?	Hargreaves (1984), de Rivera et al. (2005)

The open-ended approach was finally used in science learning materials for the solar system for learning during the COVID-19 pandemic. The teacher uses open-ended because it emphasizes students to think actively in emphasizing the process of looking for answers.



Picture 2. Schema question

Learning with an open-ended approach in science learning for solar system subjects uses 3 question words, namely: what, why, and how. These question words make students improve their critical thinking skills. So, students do not just memorize, but the learners become more meaningful. This open-ended approach is used in learning the solar system. Learning the solar system should be designed by the conditions of the times so that children can change their mindset from abstract to concrete things. Examples of questions about the solar system using 3 question words that can improve students' critical thinking skills during the COVID-19 pandemic:

Table 2. Examples of open-ended questions

WHY	When we are on earth, we see that the sun revolves around the earth, but actually what happens is the earth around the sun. Why did it happen? Explain!
HOW	How do you feel that the earth is spinning?
WHAT	What is the impact of the rotation of the earth around the sun?

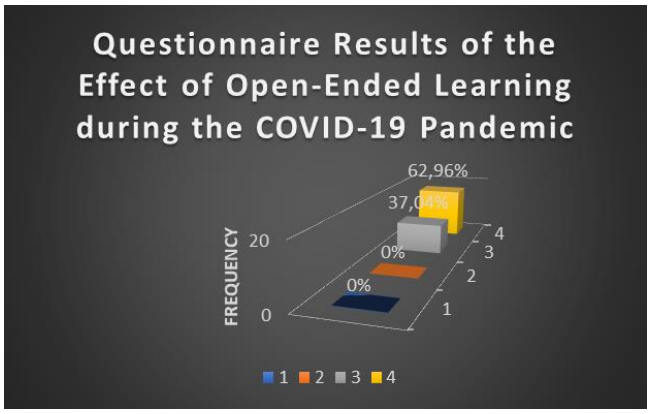
Researchers also distributed questionnaires in this study to determine the effect of this open-ended approach on science learning during the COVID-19 pandemic. The questionnaire was addressed to 27 students via a google form. The questionnaire was prepared using a scale of 1-4, namely strongly disagree, disagree, agree, and strongly agree. The results show that a scale of 3

or agree is chosen by 10 respondents, so that 10/27 x 100 = 37, 04%. A scale of 4 or strongly agree was chosen by 17 respondents, so that 17/27 x 27 = 62, 96%. So, from these respondents, it can be stated that this open-ended application has very influential in learning during the COVID-19 pandemic. These results can be seen in the table below:

Table 3.Frequency Distribution of Questionnaire Scores on the Effects of Open-ended Learning in the COVID-19 Pandemic

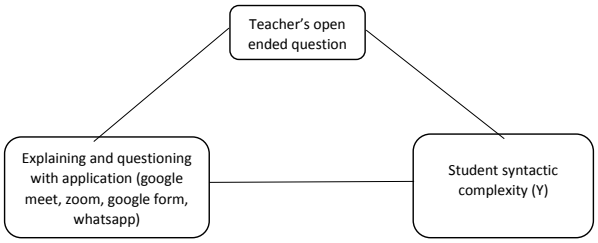
No.	Scale	Frequency (fi)	Percentage (%)
1.	1	0	0
2.	2	0	0
3.	3	10	37,04
4.	4	17	62,96
	TOTAL	27	100

Based on the results of the test scores can be presented in the diagram below:



Picture 3. Histogram Score Questionnaire for the Effect of Open-ended Learning in the COVID-19 pandemic

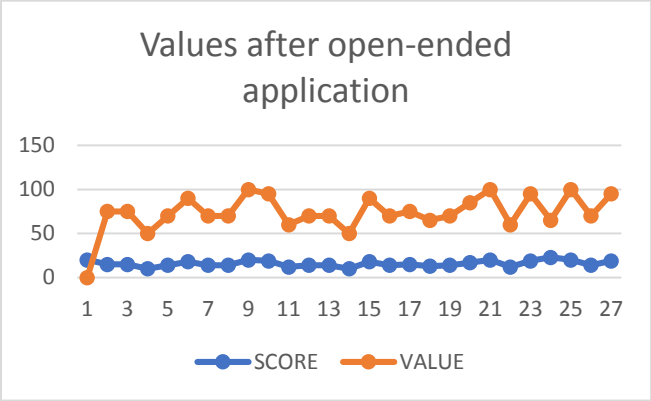
This open-ended approach is given from the teacher to students through an application via the web, namely, google meet in science learning solar system material with the following learning scheme:



The teacher at the end of the lesson also provides additional tests via google form to find out the students' final abilities. The following are the results of the grades from learning the solar system in class VI via google form:

Table 3. List of Values after open-ended applicationNO	SCORE	VALUE
1	20	100.0
2	15	75,0
3	15	75,0
4	10	50,0
5	14	70,0
6	18	90,0
7	14	70,0
8	14	70,0
9	20	100,0
10	19	95,0
11	12	60,0
12	14	70,0
13	14	70,0
14	10	50,0
15	18	90,0
16	14	70,0
17	15	75,0
18	13	65,0
19	14	70,0
20	17	85,0
21	20	100,0
22	12	60,0
23	19	95,0
24	23	65,0
25	20	100,0
26	14	70,0
27	19	95,0
Total Value		2085,0
Average		77,22

Based on the results of the google form test, it can be presented in the diagram below:



Based on the table and diagram above, it can be seen that 77.78% or 21 of the 27 students scored already satisfactory or were above the KKM, while 22.22% or 9 of the 27 students scored not satisfactory or were below the KKM. Based on the results of the students 'science test scores, then given an open-ended approach in the COVID-19 pandemic through online applications such as google meet, zoom, google form can improve students' critical thinking skills. The questions given in the open-ended approach are High Order Thinking Skills (HOTS) which make learning more meaningful. In online learning, the teacher also provides videos that make learning easier. So that the data obtained an average of 77.22. This proves that the application of an open-ended approach in science learning during the COVID-19 pandemic can be effectively applied.

III. Conclusion

Based on the results of research on the application of an open-ended approach in the COVID-19 pandemic, it was found that this approach could be applied in science learning, especially in the material of the solar system. This is by the results of interviews with teachers, students, and parents, which can be concluded that the open-ended approach can be effective even during the COVID-19 pandemic so that it can improve students' critical thinking skills. Based on the results of the questionnaire, it was found that 62.96% of respondents chose points that strongly agreed and 33.33% chose points to agree on the open-ended approach questionnaire in science learning used in learning during the COVID-19 pandemic. In addition to the results of the questionnaire, based on the results of the test with a google form, the results obtained after applying the open-ended approach were that 77.78% or 21 of the 27 students scored above the KKM, while 22.22% or 9 out of 27 students were under the KKM.

The results of this study can be used to encourage other researchers to conduct similar studies at a later date, with more complete and detailed research variables and results. This research can be used to add insight by applying approaches, models, or media during the COVID-19 pandemic so that learning becomes more meaningful. Beside, the results of the research can be a stimulus for teachers to be more creative in learning even during the COVID-19 pandemic. This open-ended approach can make students more active and pleasant in expressing their ideas. Students have more opportunities to comprehensively utilize their knowledge and skills.

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