

## **Students' Scientific Ability through Contextual Scientific-based Learning Tools During Covid-19 Outbreak**

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### **Abstract**

This study aimed to find out how students' scientific abilities are using contextual scientific-based learning tools during the Covid-19 pandemic. The method used in this research is descriptive quantitative. This research was conducted by conducting structured observations and questionnaires. In the data collection process, the researcher conducted three different ways of collecting data: the door-to-door system, the home visit system, and conventional learning. The results of students' scientific abilities using contextual scientific-based learning tools with door-to-door data retrieval systems of 81.56%, which are included in the very good category, in the home visit data collection system of 84.06% which are included in the very good category and the system data collection of conventional learning in class by 88% which is included in the very good category. Based on the study's results, it can be concluded that contextual scientific-based learning tools can be very well used in science learning after going through 3 different ways: the door-to-door system, the home visit system, and the conventional one.

Keywords: Learning Tools, Scientific Ability, Covid-19 Outbreak

### **INTRODUCTION**

To determine the effectiveness of the learning process in achieving the learning objectives and ensuring student engagement, it is important to establish a mutual activity between teachers and students. Teachers play a crucial role as facilitators in delivering materials, while students are responsible for studying and understanding them. However, if the teacher fails to facilitate effectively, students may struggle to comprehend the material. The 21st century has placed a greater emphasis on critical thinking, creativity, and logical reasoning. In this context, the scientific method is crucial for developing students' scientific abilities, as reflected in the Indonesian 2013 curriculum. The curriculum emphasizes a scientific approach that involves observing, questioning, experimenting, processing data, and communicating results. This approach helps students better understand scientific concepts and internalize scientific attitudes and behaviors.

This study examines the effectiveness of contextual scientific-based learning tools in promoting scientific abilities among students during the COVID-19 pandemic. To achieve this goal, structured observations, and questionnaires were used to collect data through three different methods: door-to-door data retrieval, home visit systems, and conventional learning.

The study found that contextual scientific-based learning tools were effective across all three methods, leading to a very good rating for scientific abilities among the students. Previous studies have highlighted the importance of scientific-based learning tools and the scientific approach to teaching in promoting critical thinking and problem-solving skills among students. Scientific ability teaching is included in Indonesian's 2013 curriculum as an approach that must be implemented in every teaching process. A scientific approach is a teaching approach based on the scientific method, which means students are capable of digging for information through observing, questioning, experimenting, processing data, then providing based on analysis and conclusion (Daryanto, 2014: 51), so the learning process will bring the concept and internalize scientific nature and attitude which is developing mastery learning and meaningful learning alongside Indonesian's 2013 curriculum guidelines, where learning process has five parts of basic learning experiences, observing, questioning, collecting information/experimenting, associating/processing data and communicating the result. The scientific approach becomes one of the contextual scientific learning methods because students are trained to dig for information based on their experience and direct observation done by students in their surroundings. Therefore, this study builds upon previous research and contributes to the ongoing discussion about effective teaching methods and strategies in the 21st century. However, further research is needed to fully reflect the data and expand on the findings of this study.

The learning of natural science in elementary school is knowledge to explore nature systematically, so natural science is not only about a set of knowledge mastery in the form of facts, concepts, or principles but also one of an invention process. The learning process emphasizes empirical experience to gain the knowledge necessary to scientifically investigate and comprehend the natural world. Acquiring the ability to investigate and comprehend the natural environment through scientific means is the development of scientific competence. Learning natural science is directed to inquiry and to do, so it can help students to reach a deeper understanding of their surroundings. The learning of natural science process must emphasize providing direct experience to students to develop exploration skills and knowledge of the natural environment, eventually directing them to understand the concepts of the studied subjects (Andrianaet.al., 2020). Natural sciences are a learning subject that applies plenty of scientific approaches and involves students in inquiry-oriented investigations. Scientific methods become one of the learnings which can implement a scientific approach in the learning process.

Through a scientific technique in science learning, the learning process can be student-centered because students will be directed to develop critical thinking abilities, reasoning, and scientific work to resolve a problem that has been previously analyzed by way of direct observation and experience. They can be applied in science learning in elementary schools, namely by learning things about the universe and providing real material concepts obtained from observations of the surrounding environment. They can be taught to basic education level students via science learning by seeking student activity and direct involvement of students in learning materials by using the environment around students based on the stages of a scientific approach.

Based on the needs analysis that researchers in elementary schools have carried out, teachers still need clarification in implementing scientific approaches, especially those that exist. They are found in students' lives in the mastering process because of the lack of contextual scientific-based learning tools. Conditions in the field indicate that the availability of science learning tools in the 2013 curriculum is only limited to lesson plans, teacher books, and student books, and other tools such as media and modules still need to be made available. Hence, teachers use a lot of learning tools from the previous curriculum.

At the beginning of March 2020, the Indonesian government set rules regarding studying from home due to the impact of the COVID-19 pandemic in accordance with the advice issued by UNESCO (United nations educational, scientific and Cultural Organization) on March 4, 2020, suggesting implementing large-scale distance learning (UNESCO, 2020). This, of course, changes the community's lifestyle, including in the field of education, where teaching and learning activities that were previously carried out in schools have changed to study from home or distance learning. The unpreparedness of teachers in dealing with this new situation and the limited learning tools is certainly an obstacle to achieving learning goals, one of which is in science subjects that require the ability to think scientifically (Martin et al., 2022; Sawyer et al., 2020).

Students can use limited learning resources and distance learning, which tends to be one-way communication, decreasing students' scientific thinking skills. The concept of distance learning is considered underdeveloped, teachers need to develop an approach to independent learning that takes into account the needs of each educational environment. Therefore, researchers need to provide learning innovations by using learning tools made by researchers to optimize students' scientific abilities during the current pandemic. (Tarchi et al., 2022; Pressley & Ha, 2021).

Researchers used three different ways of collecting data to discover students' scientific abilities during the pandemic: door-to-door systems, home visits, and conventional learning. The door-to-door system collects data by visiting students' homes one by one, and the door-to-door system is considered more effective because researchers can interact directly with students. Home is an activity supporting observation to obtain data, information, convenience, and the student learning process. While conventional learning is doing activities in class as usual.

The purpose of this study is to determine students' scientific ability by using learning tools during the pandemic. Through interesting learning tools, the selection of activities, and the use of learning media make students more active in the learning process so that it can impact student success. Moreover, if the learning media used is technology-based. Technology-based learning provides opportunities for students to learn independently; technology-based learning combined with traditional teaching can encourage students to learn actively, especially in rural areas (Gaikwad & Tankhiwale, 2014). Science is closely related to the skills and character of students, ranging from perseverance, discipline, honesty, openness, democracy, creativity, perseverance, thoroughness, communicativeness, and responsibility, to scientific process skills and implementation. (Satria & Handhika, 2015; Dewi et al., 2019; Setiawan & Wilujeng, 2016; Dwianto et al., 2017).

## **METHOD**

This study uses quantitative descriptive research to reveal or explain something according to the data as it is. According to Arikunto (2013), descriptive research aims to describe or describe an object under study. At the same time, according to Sugiyono (2014), quantitative research reveals that research that looks at concrete or measurable uses data in the form of numbers. So it can be concluded that quantitative descriptive research in this study is to see the scientific ability of students based on numerical data obtained and explained in accordance with what was seen during the implementation of the research.

The variable used in this study used a single variable, namely the scientific ability of students by using learning tools such as modules, wooden puzzle learning media, and student worksheets. The samples used in this study were fifth-grade students. The data collection technique in this research is observation. Observation is a data collection technique by observing objects and recording them according to indicators. Observation is also one of the most important research methods in social sciences and simultaneously one of the most complex. It may be the main method in the project or one of several complementary methods

(Ciesielska, M., Bostrom, K. W., & Ohlander, M., 2018). The purpose of this study's observation was to determine students' scientific ability by using learning tools amid the covid 19 pandemic. The observation used was structured observation, where this study used guidelines that were clearly and firmly defined based on indicators: Observing, asking questions, collecting information, processing information, and communicating (Siregar, 2015).

## RESULTS AND DISCUSSION

We used different data collection methods to collect data on the scientific ability of each contextual scientific-based learning device. The difference in data collection methods is intended to see if there are differences in scientific ability during the pandemic. The module learning tools, wooden puzzle learning media, and contextual scientific-based used in this study have been validated by a team of previous experts because this learning tool is a continuation of the research "development of Contextual scientific-based science learning tools on natural events and disaster Mitigation materials in the region West Coast of Java Island". Modules are educational materials designed for students to learn independently, either with or without the guidance of a teacher. Therefore, they are composed of clear instructions and components that cover all the essential topics of the course. A module is a book that facilitates self-paced learning for students while providing teachers guidance. Media Puzzle is a game in the form of random pieces of images; the stages of play begin by assembling the pieces of the images into a complete picture to improve children's motoric and cognitive abilities, solving problems, practicing patience and cooperation with friends. Student Worksheets are learning tools in the form of sheets that contain instructions about assignments or work that must be completed by a student (Ramadhan, 2020; Milah et al., 2022; Ranti, 2019).

In collecting data using a door-to-door system or from house to house, the researcher visits the homes of grade 5 students individually. In collecting data by means of a home visit, the researcher collects grade 5 students in one house by dividing them into three learning sessions. In collecting data by means of conventional learning or classroom learning, it was tested about class 5 students. Based on the research that has been done, data on students' scientific abilities were obtained using learning tools during the pandemic in Table 1, Table 2, and Table 3.

Table 1. The results of students' scientific abilities by collecting Door To Door data

Observed Aspects	Score
Observe	61
Ask	51
Gathering Information	53
Processing Information	50
Communicating	46

Amount	261
Percentage (%)	81,56%

The results of students' scientific ability data using contextual scientific-based learning tools through door-to-door data collection in Table 1 obtained a percentage of 81.56% which was included in the "very good" category.

Table 2. The results of students' scientific abilities by taking home visit data

Observed Aspects	Score
Observe	58
Ask	54
Gathering Information	55
Processing Information	54
Communicating	48
Amount	269
Percentage (%)	84,06%

The results of students' scientific ability data (scientific approach) using contextual scientific-based learning tools through data collection by means of home visits obtained a percentage of 84.06% which was included in the "very good" category.

Table 3. The results of students' scientific abilities by collecting data on conventional learning in class

Observed Aspects	Score
Observe	39
Ask	37
Gathering Information	36
Processing Information	33
Communicating	31
Amount	176
Percentage (%)	88%

The results of students' scientific ability data (scientific approach) using contextual scientific-based learning tools through data collection by conventional learning methods or traditional learning methods commonly referred to as lecture methods in class obtain a percentage of 88% which is included in the "very good" category. The reflection of students' scientific abilities by using contextual scientific-based learning tools amid a pandemic by using contextual scientific-based learning tools.

The first indicator is "observing", which is the indicator with the highest score obtained from the use of scientific-based learning tools, namely where obtaining data retrieval by door-to-door method obtains a percentage of 95% and in collecting data using conventional learning methods in class obtains a score with a percentage by 97.5%. That is known because students look enthusiastic and thorough in seeing and reading the material on the learning device.

The second indicator is "Asking," where the data collection by door-to-door method gets a score with a percentage of 79.68%, the data collection by home visit gets a score with a

percentage of 84.37%, and data collection by conventional learning methods in class obtained a score with a percentage of 92.5%. Based on the percentage above, it is known that in conventional learning in class, the students' ability to ask questions becomes the 2nd highest score, while in door-to-door and home visits is the 3rd highest score. This can be visible due to the fact while given the possibility to invite questions, college students studying in class do not shy and enthusiastic about asking the teacher, while students with door-to-door learning and home visits are enthusiastic to ask questions, but some students tend to be shyer to ask questions.

The third indicator is "gathering information", whereby door-to-door, a score is obtained with a percentage of 82.81%; in data collection by home visit, a score is obtained with a percentage of 85.93% and in data collection by learning conventional class obtained a score with a percentage of 90%. Based on the percentage above, students' ability to collect information has a high percentage, and it is known that conventional learning in the classroom has the third highest score, while door-to-door and home visits have the 2nd highest score. It can be due to classroom learning. Student information sources are books, the internet, and discussions with friends. While students with door-to-door learning and home visits, apart from collecting information from books, the internet, and discussion with friends, are also allowed to ask their parents who are at home.

The fourth indicator is "Processing information", where in data collection by door to door a score of 78.12% is obtained; by home visit, a score is obtained with a percentage of 84.37%; and in data series by conventional learning in the class obtained a score with a percentage of 82.5%. Based on the percentage above, it is known that the indicator of processing information is the 4th highest score of all learning tools. This is because most students have been able to relate the material in the learning device to the environment around them.

The fifth indicator is "communicating," where the data collection by door-to-door method gets a score of 71.87%, the data collection by home visit gets a score of 75%, and the data collection by conventional learning in class gets a score with a percentage of 77.5%. Based on the percentage above, the indicator communicating is the indicator with the lowest percentage value compared to all indicators. This is because in learning using door-to-door, home visits, and conventional learning in class, some students still need more confidence to appear to convey the analysis results and are still not accustomed to communicating activities.

From this explanation, it was found that students' scientific abilities using contextual scientific-based learning tools such as modules, wooden puzzle learning media, and student

worksheets with different data collection systems, namely door-to-door, home visits, and conventional learning (in class), have the same highest score, namely observing aspect and the lowest score is communicating aspect. However, on the questioning aspect, learning using conventional learning has a higher score than learning with the door-to-door system and learning with the home visit system.

Science learning that uses contextual scientific-based learning tools such as wooden puzzles indirectly provide total freedom in exploring and creating. Through games, students get the means to create concrete abstract concepts so that students are not difficult to imagine. Based on research conducted by Bile (2022), the game is a fundamental phase for the growth and development of individuals. In addition, the game should not be ignored because it contains a social-communicative aspect. Therefore, wooden puzzle learning media is the right choice to support scientific-based learning.

Assessment in science learning is expected to be able to understand students' abilities because, in learning activities, especially science, students are not only required to have high scores or learning outcomes, but students need to have skills in creating discoveries and conducting investigations. The teacher's task is not only focused on cognitive matters, but the teacher needs to assess the process, or every activity carried out by students as a series of the learning process so that students' scientific abilities can be used as a reference for assessment. The teacher is not only fixated on the available teaching materials but rather explores the surrounding environment, which can be used as a learning resource (Segara, 2016).

Based on the study's results, the "observing" aspect shows that the score for that aspect is the highest in using contextual scientific-based learning tools. Basically, "observing" is one of the basic process skills in science learning. Elementary school students need to have these skills to equip themselves. Because the scientific process is seen as a problem-solving skill through a systematic process. Science process skills need to be taught to achieve knowledge. (Darmaji, 2019) Studies have demonstrated that acquiring science process skills in education can equip students with problem-solving abilities applicable to their daily lives. Cultivating critical thinking skills has been an essential objective in education for over a century.

The aspect of "observing" in conventional learning scores more than door-to-door learning and home visits. Conventional learning is a learning model that is commonly applied through the explanation of the material carried out by educators, and students pay attention to it. In this case, the teacher is the determinant of the course of the learning process, and the teacher is more flexible in implementing the question-and-answer learning model to students.



The teacher becomes the center of information giving that encourages students to understand the material being explained. In comparison, students have a passive role because they only receive information. In contrast, students receive knowledge from the teacher, observe it, and make assumptions as the output of learning activities. The aspect of "observing" is the same as the observation skill. There are three types of observation skills, namely, using various senses to identify similarities and differences, identifying changes, and observing an object or material. Appropriate teaching approaches and learning activity plans must be used so that scientific-based learning is carried out optimally. Utilizing a scientific approach in teaching and learning is advantageous for teachers and students, as it promotes systematic and holistic thinking skills through scientific thought processes. Incorporating a scientific approach into education positively impacts teachers and students by enhancing their abilities to think critically and systematically. Does not only see learning as an estuary but further builds linkages of knowledge reflected in process skills to explore and describe subject matter. It also provides the widest possible opportunity for teachers to explore students' knowledge according to their abilities and needs (Abdulhak, 2017).

Based on previous research, it is said that science process skills do not always occur during the teaching and learning process in science classes through a teaching approach by the teacher, activities carried out by students, and coaching materials used in learning (Rauf et al., 2017). The teacher approaches through discussions, exploration of student ideas, lectures, and student presentations. The scores obtained in door-to-door learning and home visits are lower than conventional learning systems because the atmosphere and environment also affect the assessment aspect. Conventional learning presents a more conducive and real learning atmosphere so that students are not distracted by things that can interfere with their science process skills.

The indicator with the lowest score is regarding the "communicating" aspect, and students feel less confident about something they have learned. They feel less confident because they have a negative view of themselves, so they are hesitant to carry out each task and are unsure of their ideas. In addition, the experience factor can also cause students to become less confident. In the learning process, students feel that their learning activities do not provide a memorable experience or do not understand the lesson. That's what makes it difficult to interact with the teacher or communicate anything about the lesson.

It is important to address the issue of low scores on the 'Communication' aspect of the Scientific Process Skill. This is because it can affect a student's ability to apply knowledge

effectively. Teachers can use various methods to help students express themselves confidently, including B. Create a safe and inclusive classroom environment, encourage students to participate in group discussions, and provide constructive feedback. Additionally, including interactive and engaging learning activities helps students understand the lesson better and creates a more memorable learning experience. By addressing these issues, teachers can improve student achievement and enable more effective teaching and learning processes.

## **CONCLUSION**

Based on the results and discussion on students' scientific abilities using learning tools, it can be concluded that the results of students' scientific abilities using contextual scientific-based learning tools with door-to-door learning systems obtained a score of 81.56%, students' scientific abilities using scientific-based learning tools contextual learning with a home visit learning system obtained a score of 84.06% and students' scientific ability using contextual scientific-based learning tools with conventional learning systems in the classroom obtained a score of 88% which was included in the very good category. The use of different data collection systems, namely door-to-door, home visits, and conventional learning, have similarities in the highest score, namely the observing aspect, and the lowest score, namely the communicating aspect, and differences in the questioning aspect, information gathering aspect and information processing aspect, where conventional learning has a score higher on the questioning aspect compared to door to door and home visits. Based on the research results and conclusions, the researcher would like to propose several recommendations related to contextual scientific-based learning tools. The suggestions are that students must be more active in learning to achieve the expected results; in this case, students can have high self-confidence. The tools developed are feasible to implement but need adjustments if applied to schools with different conditions.

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