



Scientific Approach to Learning Science in Elementary Schools

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Abstract: Science learning elementary schools aims to maximize the concept of science in helping daily life processes that aim to increase students' positive attitudes in solving problems in the community environment. Through the literature research method, the researcher will carry out the process of collecting literature data that has relevance to the research topic chosen by the researcher. The collected data will undergo categorization and analysis by researchers. Before drawing conclusions, a comprehensive review of the relevant literature will be carried out. The scientific approach to learning is a pedagogical method that aims to equip students with the ability to identify or find problems through observation, asking questions, formulating hypotheses, collecting data using various techniques, analyzing data, drawing conclusions, and communicating findings, concepts, laws or principles. The scientific method has been developed to facilitate students' acquisition of knowledge and understanding of diverse subject matter. The scientific method allows the acquisition of information from a variety of sources, apart from one-way instructions from an educator. Utilization of the scientific method in the process of scientific learning is a scientific inquiry approach that is systematic and rigorous.

Keywords: Elementary Schools; Scientific approach; Science learning

Introduction

The inclusion of science in the elementary school (SD/MI) curriculum is deemed necessary. Science education is concerned with acquiring knowledge and skills related to natural phenomena, which are investigated through scientific methods such as experimentation and observation (Karyadi et al., 2018; Zuryanty et al., 2019; Amini et al., 2019). Mastery of science at the elementary school level must be implemented effectively (Artaga, 2021). The aim of teaching science at the elementary level is to improve the creative abilities of elementary school students (create something). The main objective of incorporating science education in primary schools is to increase students' understanding of scientific concepts and their application in everyday life, thereby cultivating positive dispositions to address environmental challenges in their communities. The goal of science in elementary schools is also to develop process skills and educate elementary school children to protect God's creation (Fraser et al., 2010; Pratama et al., 2018; Fitria et al., 2019).

Therefore, from some of the science learning objectives above, it can be seen that the primary school science learning objectives are to improve the knowledge, attitudes and scientific skills of elementary school students (Subali et al., 2019).

Learning is a process that involves integrating various elements such as human factors, materials, space, equipment, and methods, all of which work together to achieve certain learning goals. The aim of education is to impart knowledge and skills to individuals, enabling them to enhance their capabilities and contribute effectively to society as responsible citizens. This statement is in line with the National Education Goals as outlined in Article 3 of Law Number 20 of 2003. These goals aim to develop the potential of students, instill in them confidence and respect for a higher power, foster strong character, improve good health, good facilitating the acquisition of knowledge, developing skills, fostering creativity, encouraging independence, and cultivating democratic and responsible citizenship.

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The scientific method is a form of learning that prioritizes direct experience, such as observation and experimentation and takes into account the knowledge gained from the data obtained. This approach emphasizes the importance of qualifications in the pursuit of knowledge. Researchers use the scientific method to acquire knowledge by leaving empirical evidence based on conclusions, researching theories after their validation, and discarding theories after their falsification.

This study aims to determine the scientific approach in science education in elementary schools, as described in the description above. The use of the scientific method in education is not an unusual or anomalous practice, but is a necessary component of the learning process because learning basically involves a scientific process.

Method

This study uses a qualitative methodology to describe and characterize the scientific approach used in the context of science education at the elementary school level. The data is described and analyzed through input from several experts. Thus, through a qualitative methodology, this research is expected to provide complete information regarding the scientific methodology used in acquiring knowledge in basic educational institutions.

This study used the library research data collection method, systematically collecting research-related materials from scientific journals, literature, and authors. The aim of this research is to gain theoretical knowledge that will equip researchers with a solid theoretical foundation for scientific findings. The authors sourced the data for this study from the academic journal concerned. Conducting literature research involves collecting references from several previous studies, which are then synthesized to draw conclusions. This study uses qualitative data analysis as the main methodology for data analysis. This study seeks to gather expert opinions about the scientific method, which are then used to support the author's argument regarding the role of the scientific method in elementary school science education.

Result and Discussion

The field of study, called natural sciences or natural sciences, is recognized as a branch of scientific research. The etymology of the term science can be traced back to the Latin word *scientia*, which translates to "I know". The etymology of the term science in English can be traced back to the Latin word *scientia*, which denotes

knowledge. The natural sciences are characterized as a body of knowledge that uses experimental, observational, and deductive methods to collect data and produce reliable explanations for various phenomena. The field of science encompasses three distinct abilities, which include: the ability to understand and interpret observed phenomena, the ability to predict unobserved phenomena, and the ability to evaluate subsequent experimental results. In addition, science is characterized by the development of a scientific attitude (Sakliressy et al., 2021).

The definition above conveys the notion that natural science is a field of study that depends on the observation and categorization of information, usually expressed and confirmed through quantitative principles, which require the use of mathematical logic and examination of data to understand natural events. In short, Natural Science refers to the systematic study of natural phenomena, which involves establishing factual information, conceptual frameworks, basic principles, and empirical laws that have been validated through rigorous scientific research.

The science field has distinct characteristics that set it apart from other disciplines. This text describes the special functions mentioned above, namely: Science has scientific validity, meaning that the truth of scientific findings can be replicated by anyone using scientific techniques and protocols similar to those used by the original researcher. The scientific significance of the chemical reaction that occurs during the burning of a candle. The above statement implies that an object which has undergone chemical modification exhibits an irreversible change in its properties, thereby making it unable to return to its original state or characteristics. Natural Science is an organized and structured collection of knowledge that is primarily applicable to studying natural phenomena. The advancement of scientific knowledge is marked not only by the accumulation of empirical data, but also by the emergence of the 'scientific method' which is articulated through a series of 'scientific practices', principles and 'scientific dispositions'. Science refers to a body of theoretical knowledge that is acquired or collected through different and specific methods such as observation, experimentation, reasoning, theory building, and observation, among others. These methods are interrelated and contribute to the development of scientific knowledge. Science consists of a network of interrelated concepts, represented by concept maps, which are defined through experiments and systematic observations, and developed through subsequent experiments and observations. Science consists of four basic components: products, processes, applications, and attitudes. Various types of products including factual information, basic principles,

theoretical frameworks, and established laws. The methodology used includes solving problems through a scientific approach, which includes the stages of observation, formulation of hypotheses, experimental design, implementation of experiments or investigations, testing of hypotheses through experimentation, assessment, quantification and inference (Henukh, 2016; Juhji, 2016). The term "application" refers to the use of scientific methods and concepts in practical, real-world situations. Attitude refers to a state of curiosity towards various objects, natural phenomena, organisms and causality, which raises new questions that can be dealt with effectively through appropriate procedures (Lee & Kim, 2018; Latipah et al., 2020; Maison et al., 2020).

Science Learning Capability in SD/MI involves the application of the scientific method, which aims to develop basic processing abilities for lower-level SD/MI and comprehensive processing abilities for higher SD levels. Utilization of scientific methodology can help cultivate scientific dispositions among students, especially with regard to desire, curiosity, careful observation and measurement, acceptance, impartiality, integrity, skepticism, adherence to principles, critical analysis, logical reasoning, perseverance, perseverance, and reason. The concept of responsibility is currently under way. The field of natural science consists of three interrelated dimensions, namely processes, products, and attitudes.

The scientific approach to learning is a pedagogical process that aims to equip students with the ability to observe, identify or find problems, ask questions, formulate hypotheses, use various data collection techniques, analyze data, draw conclusions, and communicate findings, concepts effectively, laws or principles (Rahmi, 2017). The scientific method is a structured approach that facilitates students' acquisition of knowledge and understanding of diverse subject matter. The scientific method allows the acquisition of information from a variety of sources, apart from one-way instructions from an educator. The learning conditions anticipated to be established are intended to encourage student discovery from multiple sources through observation, rather than relying solely on didactic instruction (Syahroni et al., 2016; Suparsawan, 2020).

Scientists adhere to scientific standards using a methodology or work process that prioritizes inductive rather than deductive reasoning. Deductive reasoning is a logical process that involves drawing specific conclusions from general phenomena. Unlike deductive reasoning, inductive reasoning involves examining a particular phenomenon or situation and then drawing general conclusions from it. Inductive reasoning is able to find specific evidence that contradicts a broader

concept. The scientific method usually involves precise and comprehensive research on different phenomena before formulating universal conclusions (Kementerian Pendidikan dan Kebudayaan, 2013). The scientific method relates to the methodology used in researching phenomena or symptoms, acquiring new knowledge, or revising and integrating pre-existing knowledge. For a methodology to be considered scientific, it must rely on evidence derived from observable, empirical, and measurable objects, and adhere to certain principles of reasoning. The scientific method usually includes a sequence of procedures involving gathering empirical evidence through observation and experimentation, followed by developing and verifying hypotheses.

In more depth, the first scientific learning method is observing. The observation method emphasizes the acquisition of significant knowledge. This methodology offers specific benefits, including the presentation of authentic media artefacts, the provision of engaging and stimulating experiences for students, and the simplicity of implementation. The use of the observation method is very useful in fulfilling students' curiosity. Facilitating a learning process characterized by a high level of significance. Anticipated expertise requires cultivating originality, rigor, and an inclination to seek knowledge. Observational learning includes various activities such as reading, listening, observing, and visualizing, with or without the aid of tools.

The second scientific learning method is questioning. In the context of educational practice, teachers facilitate observation activities that provide students with various opportunities to inquire about their perceptual experiences, including visual, auditory, and textual stimuli. This statement deals with the difference between factual and hypothetical questions. Encouraging student curiosity through the implementation of question and answer based learning activities. When one asked frequently, an increase in one's curiosity level would probably occur. The research mentioned above served as a foundation for pursuing diverse and incremental data, ranging from instructor-pointed to student-designated sources, and from single sources to multiple sources. The next action after starting the research is to collect data. The development of this campaign involves comprehensive exploration and collection of information from various sources through various means. To achieve this goal, students can engage in activities such as reading additional literature, increasing their focus on observable events or entities, and potentially conducting experimental research. Information obtained from these activities.

The competencies observed include cultivating awareness, integrity, and decency, respect for other people's perspectives, skills in communication, the capacity to utilize information obtained through various

learning modalities, and the formation of effective learning practices and continuous learning. The acquisition of knowledge and skills in the field of asking questions includes various learning activities which can be described as ask about observations made by students that they cannot understand; inquire further to obtain additional details about observations made by students; the research process usually begins with factual questions and progresses to hypothetical questions; facilitate examination of the current state and exploration of alternative roads; and when asking questions, it is very important to establish an environment where educators encourage students to ask questions.

In reasoning/associating/processing information activities, the processing of information collected is limited to the results of collection and experimentation activities, but also includes observational activities and information gathering activities. Some of the expected qualities are the cultivation of honesty, thoroughness, discipline, obedience to rules, hard work, the ability to apply procedures, and the ability to reason inductively and deductively. These learning activities include: Processing of collected information, which is limited to the results of activities involving collection and experimentation, as well as activities involving observation and gathering of information; Process the information obtained from them, increase the breadth and depth of information processing, and seek answers from various sources, which have various perspectives.

Students need to test and experiment, especially with appropriate materials and substances, so that they achieve real or authentic learning outcomes. Students are expected to understand scientific principles and how these concepts relate to life outside the classroom, for example in science class. Students need to have process skills in addition to content knowledge to gain an understanding of the natural world around them, as well as the ability to apply the scientific method and solve problems they encounter in a scientific manner. As part of this activity, participants will conduct experiments, read material other than textbooks, observe objects, events and activities, and conduct interviews with informants.

In order for the experiment to run smoothly, what needs to be done is the instructor needs to determine the purpose of the experiment to be carried out by the students, and then instructors and students need to prepare the materials to be used and it is important to consider specifying the location and time, next step the instructor gives each student a worksheet containing instructions on how to complete the activity and the instructor discusses the issues that will form the basis of the experiment and next the instructor distributes worksheets to students and students do experiments

while the instructor supervises; and the end step the instructor collects and evaluates the work of students, then discusses the results.

At this point, information is shared between students and teachers, and students are free to obtain information from any source they choose, including the Internet. The problem is, there are still many educators who cannot access the internet or use it for the benefit of professional development. This task requires conveying observations and arriving at conclusions based on spoken, written, or analysis of other forms of media. The five scientific approaches described above must always be put forward in every learning process, both taking place inside and outside the classroom, with the aim that the learning felt by students becomes more meaningful. As can be seen from the explanation above, learning the scientific method is a learning process in which students actively develop concepts, laws, or principles through steps of observation (finding or finding problems), making questions, and asking questions. This can be considered as a learning process. Alternately, one may propose hypotheses, collect data using various methods, analyze the data, arrive at conclusions, and propagate the "found" concepts, laws, or principles. Students are given the opportunity to learn about and gain an understanding of a wide variety of topics through the use of the scientific method. Information can come from anywhere and anytime using the scientific method; one need not rely solely on information received from one source, such as a teacher. Therefore, the learning conditions that are anticipated to be generated are intended to be developed in such a way as to enable students to find information from various sources for themselves through observation rather than simply being told that information.

The implementation of a scientific approach to learning science in elementary schools can improve student learning outcomes (Firman et al., 2018). When studying science, students are instructed to apply the scientific method by conducting experiments to test their own hypotheses and validate or refute existing theories. Teaching science in schools is expected to equip students with the means to investigate themselves and the world around them and increase the development of possibilities for applied scientific education for use in everyday life based on the scientific method.

Both the science learning process and the process of scientific discovery are interrelated in the application of science learning. To achieve mastery of the concept, the process of discovery is needed. According to Iman et al. (2017), Setiawan et al. (2019), Asmawati & Kejora (2020), Kejora (2020), an emphasis on direct learning helps students improve their ability to understand natural science. These results come in the form of understanding science. The learning process is needed so that students

are able to understand how a phenomenon occurs and are able to understand and explain why it happened (Delen & Kesercioglu, 2012; Aydogdu et al., 2014; Güden & Timur, 2016; Duruk et al., 2018). This learning process trains students to understand how a phenomenon occurs (Akben, 2015; Tosun, 2020).

Scientific education strongly emphasizes hands-on experience, fosters interdisciplinary skills, enables students to understand nature through processes of "discovering" and "doing", and helps the development of deeper understanding among students. These abilities are referred to as "inquiry skills" or "inquiry process skills," and they include observing, measuring, classifying, questioning, formulating hypotheses, planning experiments to answer questions, classifying, processing, and analyzing data, applying ideas to new situations, using simple tools, and communicating information in a variety of ways, including pictorial, oral, written, etc.

Skills, attitudes, and values such as curiosity, honesty, patience, openness, non-superstition, criticism, hard work, perseverance, thoroughness, discipline, respect for the environment, work safety, and cooperation with others are fostered through the use of processes (Suryawati & Osman, 2018). The process of seeing, asking, trying, associating, and communicating provides the foundation for the development of learning activities in scientific disciplines. The learning models or systems, methods, techniques, and strategies used all combine these five different learning experiences. The following will provide an overview of educational experiences sequentially.

Learning is intended to be closely tied to real situations encountered in everyday life, and observation activities are designed to achieve this goal. Searching for information, seeing, listening, reading, and/or listening are all components of the process of observing a fact or phenomenon. Through observing, listening, reading and listening exercises, the teacher provides opportunities for students to make broad and varied observations as part of the observation activities. Students are guided through a process of observation by their teacher, who instructs them to focus on an object or aspect of that object that is most important. In addition, teachers create opportunities for children to ask questions about what they see, hear, and read through the use of question and answer sessions.

Implementation of learning steps using a scientific approach in elementary schools, the first to observe. Through the process of asking questions students construct their knowledge, which may take the form of facts, concepts, principles, procedures, laws, and theories. Students will be given the opportunity to develop higher-order thinking skills, including critical, logical, and systematic higher-order thinking skills. The

process of asking questions can be done through various activities, such as discussion activities and group work, in addition to class discussions. Students are given the opportunity to articulate their thoughts in their own words by participating in group discussion activities.

The next activity is questioning, students make observations of objects ranging from concrete to abstract, and the teacher helps them to ask questions about facts, concepts, procedures, and other things that are more abstract based on these observations. The questions that have been prepared can be factual or hypothetical. Students are trained by the teacher using the questions that have been generated, and the teacher helps students understand how to ask questions so that students can ask themselves. Activities that include asking questions should be used to encourage curiosity in students. The more involved in the habit of questioning others the more curious they become. These questions will form the basis for pursuing more and more diverse information from a variety of sources, some of which will be suggested by the instructor while the students themselves will select others. Research should start with one source and then progress to several sources.

Through data collection, developing creativity, and cultivating scientific work skills, experimental activities help stimulate students' natural interests while increasing their understanding of various facts, concepts, principles, or methods. This effort requires planning, designing, and conducting experiments, as well as presenting data, processing data, and synthesizing conclusions. It is highly recommended to be able to take advantage of various available learning materials, including the application of information and communication technology. The purpose of the follow-up question and answer activity is to investigate and collect data from various sources using various methods. Students have a number of options available to them for gathering information; they can read extra books, pay more attention to events or things, or even do experiments. Students need to test and experiment, especially with appropriate materials and substances, so that they achieve real or authentic learning outcomes. Students are expected to understand scientific principles and how these concepts relate to life outside the classroom, for example in science class.

Students need to have process skills in addition to content knowledge to gain an understanding of the natural world around them, as well as the ability to apply the scientific method and solve problems they encounter in a scientific manner. The last activity in learning with a scientific approach is associating or reasoning. Activities during the association are directed at fostering the ability to think and behave scientifically. Information (data) generated by an activity seeks to become the basis for subsequent activities, namely

processing information to find the linkage of one information with other information, find patterns of information linkages, even to draw various conclusions from the patterns found. After data acquisition, classification and processing occurs, and certain relationships are found. Teachers can use engineering contexts in a number of activities to structure exercises for students to work on through discussions or practice worksheets. These activities can include analyzing data, classifying and classifying information, summarizing information, and predicting or estimating results. Students are able to think critically at a higher level of metacognitive thinking (also known as higher order thinking skills) as a result of activities such as exploring new things and making connections. And the term "reasoning" is used in the 2013 curriculum within the framework of a learning process that uses the scientific method to emphasize that both teachers and students are active actors. This is done to show that "reasoning" is an important part of the curriculum. The crux of the problem, of course, is that students are expected to be more active than teachers in various contexts and settings.

The process of thinking logically and methodically about observable empirical facts and drawing conclusions in the form of knowledge is known as reasoning. The reasoning alluded to is scientific reasoning, although there are times when non-scientific measurements may be helpful. While it can also denote reasoning or reasoning in other contexts, the term "reasoning" in this context simply means "association". This is not a translation of the word "reasoning." Consequently, the reasoning activities that take place within the context of learning the scientific method in the 2013 course mainly refer to the theory of associative learning or associative learning. In an educational context, the ability to classify thoughts, make associations between events, and store information in certain parts of memory is referred to as association. Experiences are stored in the brain with reference to other events as part of a process that involves the communication of certain events to the brain. Memories in the brain store memories that relate to and interact with other experiences that were previously available. The activity referred to here as association or reasoning explains the process. From a psychological point of view, the relationship between ideas or mental entities that arises as a result of the similarity between ideas or the proximity of place and time is called an association.

Conclusion

In the process of obtaining scientific knowledge, the use of the scientific method is a scientific process. Many

professionals argue that the scientific method, in addition to enabling students to create knowledge and skills more actively, can motivate students to research and find facts about an event or phenomenon. This is because the scientific method is based on the idea that the scientific method encourages students to do it. In other words, during the learning process, students are instructed and accustomed to finding scientific truths, but are not invited to express their thoughts or even encounter a phenomenon. Instead, they are tasked with discovering scientific truths. Higher-order thinking skills are used to train individuals to think in a logical, linear and systematic way. The scientific method is a fundamental understanding that embodies, stimulates, encourages, and supports thinking about how to use learning methods based on certain beliefs. Scientists in the 17th century developed it. A scientific approach to learning involves the following components: observation, asking, reasoning, trying or creating, presenting or communicating. This concept is based on scientific learning methods.

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Author Contributions

Conceptualization, Lukmanul Hakim; methodology, Siti Nur'Ariyani; validation, Suroso Mukti Laksono; formal analysis, Lukmanul Hakim and Suroso Mukti Laksono; investigation, Jumyati and Siti Nur'Ariyani.; data curation, Jumyati; writing – original draft preparation, Siti Nur'Ariyani.; writing – review and editing, Jumyati and Yuliyanti supervision, Lukmanul Hakim.

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Conflicts of Interest

The authors declare no conflict of interest.

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