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Philosophy of Science: Specific Methods, Elements, Structures, and Steps for the Development of Knowledge Methodology

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A R T I C L E I N F O

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ABSTRACT

There is a close relationship between the philosophy of science and the development of the scientific method. Philosophy of science is an integral part of the history of the development of science. Philosophy of science is inseparable from scientific rules relating to the scientific method used. The scientific method will produce scientific knowledge as well . There are four special methods used, namely the library method, the observation method, the interview method, and the observer participation method. The elements in the methodology of science are interpretation, induction and deduction, internal correlation, holistic, historical continuity, idealization, comparison, heuristics, analogical, and description. Meanwhile the composition of the scientific methodology includes problems, attitudes, using scientific methods, activities, conclusions, and influences. The steps for developing scientific methodologies consist of formulating problems, conducting library studies, formulating hypotheses, testing hypotheses, collecting data, interpreting data, making conclusions, and making scientific reports.

ABSTRAK

Terdapat hubungan yang erat antara filsafat ilmu dan penembangan metode ilmiah. Filsafat ilmu merupakan bagian yang terintegral dari sejarah pengembangan ilmu pengetahuan. Filsafat ilmu tidak terlepas dari aturan keilmuan yang berkaitan dengan metode ilmiah yang digunakan. Metode yang ilmiah akan menghasilkan pengetahuan yang bersifat ilmiah pula. Ada empat metode khusus yang dugunakan, yaitu metode kepustakaan, metode observasi, metode wawancara, dan metode partisipasi observer. Unsur-unsur dalam metodologi ilmu pengetahuan adalah interpretasi, induksi dan deduksi, korenesi intern, holistis, kesinambungan historis, idealisasi, komparasi, heuristika, analogikal, dan deskripsi. Sementara itu susunan metodologi imu pengetahuan antara lain adanya masalah, adanya sikap, menggunakan metode ilmiah, adanya aktifitas, adanya kesimpulan, dan adanya pengaruh, Langkah-langkah pengembangan metodolgi ilmu pengetahuan terdiri dari merumuskan masalah, mengadakan studi kepustakaan, memformulasikan hipotesa, pengujian hipotesa, mengumpulkan data, interpretasi data, membuat kesimpulan, dan membuat laporan ilmiah.

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I. INTRODUCTION

Current scientific progress requires humans to be able to use scientific communication and information technology so as to produce products and results that can be accounted for (Hastangka & Santoso, 2021) . The progress of science and technology that develops cannot be separated from

the influence of ancient Greek philosophy. In ancient Greece philosophy was not much different from science. All the patterns of thought that existed in ancient Greece were called philosophy (Natasya et al., 2022) . Scientific thinking focuses on science or science that produces a systematic mindset so that the truth can be accounted for (Hikmawan, 2017) .

Philosophy of science as part of philosophy that has the activity of studying science in the context of the overall human experience (Mahfud & Patsun, 2019) . Philosophy of science is also an integral part of the history of the development of science. Philosophy of science is inseparable from scientific rules relating to the scientific method used. Scientific methods will produce scientific knowledge as well (Natasya et al., 2022) . Philosophy of science is also an integral part of the history of the development of science which we know as ontology, epistemology and axiology (Subekti et al., 2021).

Methodology provides a philosophical understanding of the nature of a science or issues of truth, objectivity, and the structure of science, while the method invites a researcher to understand the technique of searching or using special methods, such as the library method. observation method, interview method, and observer participation method (Subekti et al., 2021) . These methods must be developed by researchers so as to get the correct research results. Philosophy of science is inseparable from scientific rules relating to the scientific method used. The scientific method will produce scientific knowledge which is understood as science. Scientific methodology is very important in the process of scientific activities. Without a science methodology, the work process of science cannot work properly (Sidik & Sulistyana, 2021) (Saifullah, 2013) . In a broad sense, methodology is understood as an analysis and compilation of principles, methods , or processes that govern scientific research in general and its implementation in science.
The importance of the philosophy of science in the development of the scientific method has resulted in many relevant researches relating to the object being studied. Research that is in line with this topic is as follows. First, the research conducted by Abdullah Affandi (2019) with the title "Functions of the Philosophy of Science in the Development of Scientific Methods". The results of this study indicate that the Philosophy of Science and the scientific method complement and expand knowledge, create disciplined understanding in scientific work, as well as increase motivation as a researcher to carry out research with good scientific methods.

Furthermore, research conducted by Alif Achadah & M. Fadil (2020) with the title "Philosophy of Science: Linking Scientific Activities, Scientific Methods and Systematic Knowledge." The result of this research is that Philosophy of Science is a means and process to find the truth so that humans can experience the progress of civilization in their lives. The human scientific process is the process of gaining knowledge. A similar study was also conducted by Sulhatul Habibah (2017) with the research title "Implications of the Philosophy of Science on the Development of Science and Technology", with the results of research that developing technology must be based on the Philosophy of Science as a direction in its development, so that scientists realize their limitations and not caught up in intellectual arrogance.

Based on several relevant studies stated above, it is clear that the Philosophy of Science has contributed in various aspects, both scientific aspects, as well as aspects of science and technology, so that the philosophy of science is used as a fundamental or basis in scientific thinking to find a truth.

II. RESEARCH METHOD

This study uses a qualitative approach with library research design. Thus, this research is carried out by examining reading sources that are related to the study discussed, as well as by using document studies of previous research results that have to do with the Philosophy of Science. Data collection was carried out by browsing reading books, reputable scientific journals, sources from

Google Scholar, digital libraries, and looking for references in the Padang State University Postgraduate library.

III. RESULT AND DISCUSSION

1. Specific Methods in Scientific Methodology

In learning the philosophy of science, especially the methodology of science, there are special methods. These methods are as follows. First, the library method . The library method can be interpreted as a step to obtain information from previous research that must be done, regardless of whether a study uses primary data or secondary data, whether the research uses field or laboratory research or in a museum. The library method also means data collection techniques by reviewing books, literature, notes and various reports related to the problem to be solved (Achadah & Fadil, 2020) . Second, the Observation method . The observation method is a method of data collection carried out by conducting an introduction and recording systematically both directly and at the place observed (Affandi et al., 2019) . This observation method has advantages, namely, it is very useful for fulfilling curiosity so that the learning process has high meaning, presents real media objects without manipulation, and is easy to implement. In addition to having advantages, the observation method also has disadvantages including, it requires a long preparation time, requires greater costs and energy in its implementation, and the object being observed will become very complex when visited. Third, the interview method. This method is used when the subject of study and research is directly face to face in the process of obtaining information for primary data purposes. Interviews are used to obtain information related to facts, beliefs, feelings, desires and so on that are needed to fulfill research objectives (Sidik & Sulistyana, 2021) . Interviews require that both parties, both researchers and study subjects, meet and interact directly and actively in order to achieve good and accurate goals and data. Interview techniques can produce more precise information compared to information obtained from other data collection techniques (Istikhomah & BS, 2021) . The truth and accuracy of the information obtained is also valid because researchers can ask for further information if they are in doubt about the correctness of the answers given.

Fourth, the observer participation method . Observer participation is the active involvement of researchers in observations or observations. The involvement of researchers in naturalistic observation consists of four observers, namely being full participants, participants as observers, observers as participants, and full observers (Winata, 2014) .

Elements of Scientific Methodology. The elements of the methodology of science are as follows. First, interpretation, namely making interpretations, but which are not subjective but must rely on objective evidence to achieve authentic truth. Second, induction and deduction. Every science there is the use of the method of induction and deduction, according to the understanding of the empirical cycle. The empirical cycle includes several stages, namely observation, induction, deduction, study (experimentation) and evaluation (Imron, 2016) .

Third, internal coherence is an attempt to understand correctly in order to obtain the essence by showing all the structural elements seen in a consistent structure. Fourth, Holistic, which is a deeper review to achieve the truth as a whole, where the object is seen from the interaction with the whole reality (Fadli, 2021) . Fifth, historical continuity, namely that man is a historical creature because he develops in experience and thought. In personal development it must be understood through a continuous process (Priyanto & Muslim, 2021) .

Sixth, idealization is the process of making ideals. Seventh, comparison is an attempt to compare the essential properties in the object of research so that it can be clearer and sharper. Comparisons can be made with other objects that are very close and similar to the main object (Habibah, 2017) . Eighth, heuristics is a method for finding new scientific ways to solve problems. Ninth, analogical, namely philosophy examines the meaning, value and intent expressed in facts and data. Tenth, description, that is, all research results must be able to be described. Explicit data allows it to be understood steadily.

2. Structure of Scientific Methodology

There are six components that must exist in order for something to be called science. First, there is a problem. Not all problems show scientific characteristics. A problem is called a scientific problem if it meets the requirements , namely that the problem is a problem faced with scientific attitudes and methods (Mahfud & Patsun, 2019) (Acep, 2019) . Second, there is a scientific attitude . The scientific attitude includes at least six main characteristics, namely: curiosity, speculation, willingness to be objective, willingness to suspend judgment, and temporality. Third, using the scientific method. This nature of the scientific method is seen as a hypothesis for further testing.

Fourth, there is activity . Science is what scientists do, which is then called scientific research. Such research has two aspects, namely individual and social. Fifth, there is a conclusion. Science is knowledge produced. Therefore, science is often understood as a collection of knowledge. Sixth, there is influence . The part worked on by science causes various influences, which can be related to two things, namely the influence of science on technology and industry which is called applied science and the influence of science on society and civilization.

3. Steps for Development of Scientific Methodology

The first step in research is to define the problem to be solved. So that there is no doubt in determining the problem, the problem must be clearly defined to what extent the problem to be solved (Affandi et al., 2019) . The second step is to look for available data written by previous researchers related to the problem to be solved. looking for material in the library is something that a researcher cannot avoid. The third step is to formulate a hypothesis. This is a tentative or conjectural answer to the question posed, the material of which is the conclusion of the developed framework.

Next, determine the model to test the hypothesis. After the hypotheses have been established, the next step is to formulate ways to test these hypotheses. Next collect data. Researchers need data to test hypotheses. The data, which are facts that are used to test the hypothesis, need to be collected. Data collection techniques will be different depending on the problem selected and the method used. After the data was collected, the researchers compiled the data for analysis. Before the analysis is carried out, the data is compiled in advance to facilitate the analysis.

Next, make generalizations and conclusions. After the interpretation is given, the researcher makes generalizations from the findings, and then gives some conclusions. These conclusions and generalizations must be related to the hypothesis (Affandi et al., 2019) . This is done to find out whether the hypothesis is true to be accepted or the hypothesis is rejected. The last step of a scientific research is to make a scientific report about the results obtained from the research. Scientific writing has its own technique as well.

IV. CONCLUSION

Philosophy of science is an integral part of the history of the development of science. Philosophy of science is inseparable from scientific rules relating to the scientific method used. The scientific method will produce scientific knowledge as well . Methodology is also called the science of methodos, namely the science that discusses ways , paths or practical instructions in research, so that research methodologies discuss the theoretical concepts of various methods.

There are four specific methods used in science methodology. First, the library method which can be interpreted as a step to obtain information from previous research that must be done. Second, the observation method is a method of collecting data by conducting systematic observations and recordings either directly or at the place observed. Third, the interview method namely the method of collecting data and information in which the observer gives questions related to the information and data needed to the respondents by meeting face to face. Fourth, observer participation is the active involvement of researchers in collecting data and information in observations and observations.

The research methodology is to discuss the basics of the philosophy of science from research methods because the methodology does not yet have practical steps. The derivation is the research method.

Methodological elements include interpretation, induction and deduction, internal coherence, holistic, historical continuity, idealization, comparison, heuristics, analogical, and description. As the object of science is the phenomenal world, and the approach method is based on experience using various methods such as observation, experiment, survey, case study, and so on.

These experiences are processed by the mind on the basis of orderly laws of logic. The collected data is processed analytically, inductively, and then the relationship between the data is determined, including causality. Conceptions and relations are arranged according to a certain system which is an integrated whole.

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