

The Limitations of Science and Its Implications in Human Life

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Abstract

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Science has made a major contribution in advancing human civilization. However, it is important to recognize that science has inherent limitations. This limitation arises from the scientific method which relies on empirical observation and experimentation, making it difficult to study phenomena that are subjective or spiritual in nature. In addition, science is also limited in predicting random or complex events. The implications of these limitations of science are far-reaching, ranging from science's inability to answer questions about the meaning of life to difficulties in making ethical decisions involving technology. A deep understanding of the limitations of science can help society to appreciate the role of science in life while remaining aware of the importance of other values such as religion, arts and humanities. In this way, humans can build a more holistic and balanced world view.

Keywords: *limitations of science, scientific method, subjective phenomena, spirituality*

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INTRODUCTION

Science has significantly transformed the course of world history across all aspects of human life. Thanks to advancements in science and technology, human needs can now be met more quickly and easily. Developments in health, transportation, housing, education, and communication have greatly facilitated human life, highlighting the substantial role of science in helping people achieve various life goals. However, the spectacular progress of science and technology has unfolded over decades marked by uncertainty.

Discoveries have not only brought satisfaction and excitement but also severe consequences and negative impacts on human life, such as the invention of chemical and biological weapons used for destruction. Additionally, advancements in science and technology have fostered a social system dominated by capitalist economic ideologies, encouraging pragmatic competitiveness aimed at maximizing material gain with minimal investment. The high productivity of technology and industry, combined with human greed, has driven secular and hedonistic behaviors, where science is exploited according to personal desires, as if it were value-neutral and usable for any purpose. In reality, scientific values should be universally beneficial for everyone.

LITERATURE REVIEW

Definition of Science

Science, derived from the Latin word *scientia*, meaning "knowledge systematically organized," represents a fundamental concept that has played a crucial role in human evolution. According to Dawson and Futcher (2019), human curiosity about the surrounding environment and the desire to understand, control, and utilize nature are the reasons science involves critical and systematic thinking processes to comprehend various natural phenomena. Abrucasto views science as information acquired through an efficient cycle to uncover everything related to the universe. Meanwhile, Carin and Sund define science as a framework for understanding the universe through controlled perception and testing (Nasution et al., 2024).

The Scientific Method and Its Limitations

The scientific method is a systematic approach to acquiring scientific knowledge, involving a carefully designed series of steps to ensure the information obtained is well-founded and accountable. Each step of the scientific method must be followed with discipline and structure to produce accurate and relevant conclusions. This method combines rationalism, emphasizing logic and reasoning, with empiricism, which relies on data and evidence obtained through experience and observation. It ensures that the thought process adheres to logical principles and that the results of observations and experiments can be validated. The scientific method is used to answer critical questions, test hypotheses, and provide a deeper understanding of natural and social phenomena. Thus, its application across various disciplines is essential to ensure the development of objective and measurable knowledge. Scientific knowledge is generated through the use of the scientific method, which relies on data to test hypotheses. This data is collected through sensory observations. However, the human senses have limitations in capturing facts, leading to potential inaccuracies in the data. Consequently, conclusions drawn from erroneous data may not be valid. Scientific conclusions or truths, including those in natural sciences, are therefore tentative and considered valid until disproven by new scientific evidence. New scientific findings that challenge previous conclusions become the new scientific truths. Another limitation of the scientific method lies in its inability to address values, art, beauty, or to test the existence of God (Aly and Rahma, 2022: 16).

Limitations of Scientific Knowledge

Some fundamental concepts in the philosophy of science, such as ontology, epistemology, axiology, and logic, help us understand the boundaries of scientific knowledge. Ontology is the theory of the existence of scientific objects, focusing on the nature of reality or everything that exists. It encompasses both physical and metaphysical phenomena. Metaphysics, as part of ontology, provides a comprehensive discussion of reality, including cosmology and theology, which explore the origins, purposes, and existence of the universe. Epistemology, on the other hand, is a branch of philosophy that discusses the theory of knowledge acquisition. It focuses on the sources of knowledge, methods of obtaining it, and the validity and limitations of knowledge itself. In this context, epistemology raises questions about what we can know and how we can justify the truth of such knowledge. Axiology, on the other hand, concerns the value or benefits of knowledge, examining its purpose and applications in human life and the ethical considerations surrounding its use. Logic, as a branch of philosophy, investigates the formal principles of inference to achieve rational truth, ensuring that reasoning used in forming and concluding knowledge is valid and consistent. Within epistemology, various perspectives explain how we acquire knowledge, such as rationalism, which emphasizes reason and intellect, empiricism, which views sensory experience and observation as the sources of knowledge,

and realism, which argues that objective reality exists beyond our perceptions and that our knowledge should reflect this reality (Mahardika et al., 2023).

Implications of the Limitations of Science for Human Life
In natural sciences, particularly fundamental sciences, the study of natural phenomena forms the basis for disciplines such as biology, chemistry, and physics. Through this, we gain a broader understanding of the universe's fundamental principles and mechanisms, such as how biology governs the human body or how physics dictates the motion of objects. Research in the natural sciences has enabled remarkable technological advancements, allowing for feats like intercontinental travel within a short time. While science and technology can explain "what is possible" and "what can be done," they do not address moral or ethical questions about "what should be done" or "what is right to do." Science merely presents possibilities based on natural laws but cannot determine the best choices. This limitation becomes evident in decision-making processes that require moral, ethical, and social considerations, which cannot be resolved solely with scientific data. For example, decisions regarding the use of certain technologies and their impacts on the environment and society must factor in human values. Beliefs and convictions—be they religious, cultural, or philosophical—are crucial in navigating moral dilemmas that science and technology alone cannot resolve. While technological progress brings many benefits, it also presents new challenges that require careful deliberation. Without thoughtful consideration, technology may lead to unforeseen negative consequences but can also open up new opportunities across various life domains. Consequently, since science and technology cannot provide moral guidance, a broader perspective incorporating humanistic values is essential in decision-making that affects shared life (Sujalu et al., 2020).

RESEARCH METHODOLOGY

The research method employed to address the problem is conceptual analysis, a method used to understand, explore, and analyze various concepts or ideas relevant to a discussion. In the article "*The Limitations of Science and Their Implications for Human Life*", conceptual analysis focuses on breaking down and gaining deep insight into key concepts such as the limitations of science, moral choices, and the social implications of how science and technology function in life.

DISCUSSION

The Nature of Science and Its Limitations

a. Limited Objectivity

Science is often defined as an attempt to understand the world objectively, free from bias or subjective influence. However, science is not always entirely objective. Scientific paradigms, personal values, and cultural contexts often influence the choice of research topics, data interpretation, and experimental design. For instance, researchers may prioritize subjects driven by social or economic demands. Since humans are the primary agents in science, complete freedom from subjectivity is difficult to achieve. Nonetheless, science seeks to minimize bias through rigorous scientific methods.

b. Limitations of the Scientific Method

The scientific method is a systematic approach to observation, hypothesis testing, and drawing conclusions. However, it cannot answer all questions or encompass all aspects of the real world. Questions related to metaphysics, morality, or aesthetics often lie beyond the reach of scientific inquiry. Furthermore, the results of scientific experiments rely on basic assumptions that sometimes cannot be directly tested. The ability of the scientific method to uncover certain truths is also constrained by the limitations of tools and technology.

c. Uncertainty of Change

Scientific knowledge is inherently unstable and constantly evolving. As new information emerges, research findings can be modified or even rejected. For example, Newton's theory of gravity, once deemed perfect for centuries, was eventually refined by Einstein's theory of relativity. Uncertainty is also an integral part of science, particularly in fields like quantum physics, where

experimental results are often probabilistic rather than deterministic.

d. Reductionism

Science often employs a reductionist approach by breaking down complex phenomena into simpler components for examination. While this technique aids in understanding specific aspects of a system, it frequently overlooks the holistic relationships between its parts. For instance, in biology, a reductionist approach might explain the function of individual genes but may fall short in comprehending the intricate interactions within ecosystems or organs.

e. Limitations in Predicting the Future

Although science can anticipate natural phenomena based on observed patterns or laws, its predictions are often imprecise, especially in the long term. This is due to the limitations of mathematical models, uncertain environmental variables, and complex interactions. For example, while meteorology can accurately forecast weather for a few days, predicting comprehensive climate changes over decades is much more challenging.

Implications of the Limitations of Science

a. The Need for Wisdom

While science provides extensive knowledge and understanding of the world, wisdom is essential when applying its findings. Scientific knowledge alone cannot always determine what should or should not be done. Wisdom helps individuals consider human values, collective interests, and long-term consequences when utilizing scientific discoveries. Without careful application, science can negatively impact both society and individuals.

b. Importance of Multidisciplinary Methods

Scientific research often focuses on specific aspects of a problem and may not address it comprehensively. Thus, adopting a multidisciplinary approach that integrates diverse perspectives—social, cultural, economic, and ethical—is crucial. This approach fosters more comprehensive solutions that align with societal needs and facilitates more informed decision-making in addressing complex issues like social inequality or climate change.

c. Awareness of Adverse Effects

Despite its numerous benefits, science can lead to unintended negative consequences, either deliberately or inadvertently. For instance, technologies designed to enhance quality of life may result in social inequality or environmental degradation. Therefore, scientists and stakeholders must identify and mitigate these risks. Scientific advancements should aim to avoid harm to humanity or ecosystems by being mindful of their negative impacts.

d. The Role of Morality and Ethics

Given the limitations of science, moral and ethical considerations are critical in decision-making. Science cannot establish moral standards or differentiate between right and wrong. Consequently, ethical and moral guidelines are necessary to ensure the use of science aligns with human values. For example, ethical concerns surrounding human cloning or genetic modification must be carefully addressed in biotechnology to protect human rights and dignity.

e. Openness to Non-Scientific Perspectives

Science cannot always answer profound questions about the meaning of life, human purpose, or spirituality. Thus, openness to perspectives beyond science, such as philosophy, religion, or art, is essential. These approaches enrich human understanding and help balance rational and emotional dimensions, as well as logic and intuition. By doing so, individuals can approach life more holistically and harmoniously.

Appreciating Science Wisely

a. Science as a Tool, Not an End

Science serves as a tool for understanding the universe, developing technologies, and solving problems. However, it is crucial to recognize that its value lies in enhancing the quality of life, facilitating better decision-making, and promoting human welfare. Science itself should not be treated as an ultimate goal but rather as a means to achieve broader, meaningful objectives. Conclusion if science becomes the ultimate goal, we risk losing the understanding of how scientific discoveries should be wisely applied for the greater good. Therefore, science must always be guided by moral values, humanity, and sustainability.

b. Openness to Discussion and Criticism

Constant change and openness to criticism and improvement are core characteristics of science. Scientific theories or discoveries are not always correct; they must be tested and updated through discussion and new information. An open attitude toward criticism fosters the advancement of science and reduces the likelihood of errors or misuse. Furthermore, interdisciplinary dialogue broadens perspectives, making science more relevant in addressing complex societal problems.

c. Comprehensive Science Education

Quality education in science is fundamental for a society that values and understands knowledge. Developing critical thinking skills, logic, and moral understanding should be integral to scientific education. Holistic science education helps cultivate individuals capable of making informed decisions and being accountable for the impacts of scientific advancements on society, the environment, and technology. A comprehensive approach also raises awareness of the broader implications of scientific progress on these areas.

CONCLUSION

Despite its profound impact, science has limitations. It cannot address deep, subjective philosophical, moral, or spiritual questions. Human emotions and experiences are often overlooked due to science's focus on measurable and verifiable facts. Therefore, a holistic approach that integrates science with other fields, such as philosophy and the humanities, is necessary for a deeper understanding of life. These limitations remind us that science is part of a broader quest for knowledge and not the sole source of truth. In practice, wisdom in applying scientific discoveries is essential to balance their benefits and risks. Moreover, it is crucial to acknowledge that science cannot fully explain existence or the value of life. Recognizing the limitations of science enables us to think beyond and gain a more profound understanding of the broader aspects of life.

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