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"Development of Technology and Science as a Need for the Future of Education: Philosophy of Science"

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Abstract
Technological advances have had a significant impact on the world of education, especially in the learning process. Information and Communication Technology (ICT), as part of science and technology (IPTEK), includes all technologies related to the retrieval, collection (acquisition), processing, storage, dissemination, and presentation of information. Even until the beginning of the 21st century, it is believed that the ICT field will continue to grow rapidly and has not shown signs of saturation for the next few decades. At the global level, the development of ICT has affected every aspect of human life. The integration of ICT into various fields of technology has reached such a level that there is not a single piece of equipment resulting from technological innovation that does not utilize ICT devices.

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1. INTRODUCTION

Science and technology (IPTEK) are two important aspects of human life that continue to experience rapid development from time to time. Science, as the result of human activity in studying various things both about humans and realities outside themselves, provides a basis for a deep understanding of the universe and various phenomena in it. Meanwhile, technology, as a tool that humans use to fulfill their needs, makes it possible to apply this knowledge in various aspects of life, from health, communication, to space exploration.

The developments that have occurred also touch aspects of educational development. Technological advances have had a significant impact on the world of education, especially in the learning process. Information and Communication Technology (ICT), as part of science and technology (IPTEK), includes all technology related to the retrieval, collection (acquisition), processing, storage, dissemination and presentation of information. Even until the beginning of the 21st century, it is believed that the ICT field will continue to develop rapidly and will not show any signs of saturation for the next few decades. At the global level, ICT developments have influenced every aspect of human life. The integration of ICT into various technological fields has reached such a level that there is not a single piece of equipment resulting from technological innovation that does not utilize ICT tools.

This article will discuss in detail the form of development of science and technology in the world of education through the perspective of the Philosophy of Science.

2. METHOD

In this literature review article, the method used includes several systematic stages to collect, analyze and synthesize various literature sources relevant to the topic of characteristics and competencies of educators in the digital era. According to Sudibjo (2019), there are several stages that must be passed. The first stage is literature identification and selection, where relevant sources are selected based on inclusion criteria such as year of publication, journal credibility, and relevance to the research topic. Academic databases such as Google Scholar, PubMed, and JSTOR are used to search for

relevant articles, books, and conference papers (Triyanto, 2020). The second stage involved a critical analysis of the selected literature, including an evaluation of the methodology, main findings, and contribution of each study to the general understanding of the characteristics and competencies of educators in the digital era. The final stage is a synthesis of findings, where information from multiple sources is combined to provide a comprehensive picture of the topic. This approach allows the authors to identify patterns, trends, and gaps in the existing literature, as well as provide recommendations for further research and future educational practice.

3. RESULTS AND DISCUSSION

Ontological Foundations in ICT

Ontology is the study of universal existence, with the aim of discovering universal thought. Ontology tries to find the essence of every reality or explain existence in all its forms. Ontological studies explore the deepest nature of every reality, such as questions about human freedom of choice, the existence of God, the essential nature of material or spiritual, and whether the soul can truly be distinguished from the body. In the context of science, ontology limits itself to the space of scientific study that can be understood by humans rationally and can be observed through the five senses.

Epistemological Foundations in ICT

Epistemology is a branch of philosophy that investigates the origins, nature, methods, and limits of human knowledge. Also known as the theory of knowledge, epistemology comes from the Greek words episteme which means "knowledge", "true knowledge", or "scientific knowledge", and logos which means theory. Epistemology can be defined as a branch of philosophy that studies the origins or sources, structure, methods and validity of knowledge.

Epistemology is the study of the origins, nature, and reach of knowledge. Questions faced in epistemology include whether experience is the only source of knowledge, what distinguishes true beliefs from false ones, whether there are important questions that science cannot answer, and whether we can know the thoughts and feelings of other people. Epistemology studies cover the nature of knowledge which consists of four main aspects: validity, structure, boundaries and sources of knowledge.

Axiological Foundations in ICT

Axiology is concerned with the issue of the value and usefulness of knowledge. Science is not completely free from values, meaning that at a certain stage, science must be adapted to the cultural and moral values of society so that its benefits can be felt by society in an effort to improve collective welfare, and not cause disasters. Axiology is defined as a theory of values related to the use of acquired knowledge.

The Relationship between Philosophy of Science and Information and Communication Technology

Experts agree that the main foundation of communication science is philosophy. Philosophy underlies communication science through the concepts of ethos, pathos, and logos from the theories of Aristotle and Plato. Ethos is a component of philosophy that teaches scientists about the importance of normative principles in the development of science, which is the main key to the relationship between science and society. Pathos concerns aspects of emotions or feelings in humans as creatures who love beauty and appreciation, thus allowing for improvisation in the development of science. Logos is a component of philosophy that guides scientists to make decisions based on rational and

logical thinking, with reasonable arguments. Other components of philosophy include ethics, logic, and aesthetics, which synergize with aspects of the study of ontology (existence), epistemology (how to obtain knowledge), and axiology (the use of knowledge).

Basically, communication philosophy provides knowledge about the position of Communication Science from an epistemological perspective:

Ontological

Ontology is the study of the meaning of "being" and "being", as well as the essential nature that exists within itself. itself, in its most obscure form. Ontolgy means understanding what science is, in this case communication science. The forms of ontology questions that concern this area include: What is communication science? What does communication science study? What is the object of study? What is the nature of communication which is the object of study? Communication science is understood through material objects and formal objects. Ontologically, communication science as a material object is understood as something monotheistic at the most abstract or highest level as a unity and similarity as a creature or object. Meanwhile, the formal object sees Communication Science as a point of view, which then determines the scope of the study itself.

Epistemological

Communication science epistemology, or theory of knowledge, focuses on the central question: "What can we know, and how do we know it?" According to Lacey, the matters related to this study include various aspects such as belief, understanding, reason, judgment, sensation, imagination, supposing, guessing, learning, and forgetting. Each of these aspects plays an important role in the process of understanding and evaluating information in science communication, as well as in developing valid methods for acquiring and testing knowledge. Through in-depth analysis of these components, communication science epistemology seeks to explain and optimize the way we acquire and use knowledge in the field of communication.

The basic questions related to Epistemology include: What is the process that allows knowledge to become science? What is the procedure, methodology? What things must be paid attention to in order to get the right knowledge and knowledge in terms of communication? What is meant by truth? What are the criteria for truth and logic of truth in the context of communication science?

The debate about the epistemology of Communication Science has existed since its inception as a scientific discipline. The question of whether Communication Science can be called a science or not is closely related to how a field is viewed and defined as a science. Historically, Communication Science was seen as the result of the strong influence of pre-existing social sciences, especially Sociology and Psychology. These two disciplines have contributed greatly to the formation and development of Communication Science, enriching the theoretical and methodological framework used to understand communication phenomena in the context of society and individuals.

Names such as Laswell, Schramm, Hovland, and Freud have had a very significant influence on the development of communication science. Communication Science as a new scientific discipline was researched in depth in the 19th century in America, which is closely related to the axiological aspects or values contained in this science itself. The epistemological process in Communication Studies can be seen concretely from the development of communication studies in America, as described in the book "History of Communication" by Griffin (2002). The increasingly deepened study of Communication,

especially in the context of human interests during the war period, increasingly confirms its status as an established and relevant science in its understanding and use.

Axiology

The individual nature of science is often related to ethical aspects regarding the usefulness of the science itself. As has been discussed in an epistemological context, the axiological aspect of science is closely related to pragmatic philosophical goals, namely the principle of usefulness for the benefit of humans. The development of communication science is closely connected to the basic human need for communication.

The following is a question regarding Axiology. Concerning questions include: What is communication science used for? What is the relationship between the way knowledge is used and moral principles? How is communication science related to moral choices? What is the relationship between the operationalization of scientific methods in efforts to generate and discover theories and applications of communication science with moral and professional norms? The need to influence (persuasive), rhetorical (public speaking), spreading of information, propaganda, are a small part of the benefits of Communication Science.

Philosophy begins with questions and ends with questions. The essence of philosophy is a continuous process of questioning, so it is said that philosophy is the attitude of questioning itself. Through the process of questioning, philosophy seeks truth, but never accepts truth as something final. On the other hand, philosophy fosters a critical attitude that continues to doubt the truths discovered. In this way, people who philosophize face the reality of life as a problem that requires solving, as a question that requires effort to find the answer.

In contrast to natural sciences which have exact objects, such as biology which makes it possible to clearly differentiate between cats and dogs, as well as organs such as the heart and liver without requiring strict definitions, social sciences, including Communication Sciences, have more abstract objects. . Communication Science studies human actions in a social context, which becomes an abstract object because of its complex and multifaceted nature. The word "communication" as an abstract concept is difficult to define precisely. Many scholars have attempted to define communication differently. Therefore, Communication Science as part of the social sciences demands a sharp and clear definition to explain the abstract object of study.

Not all events are objects of communication science study. As stated, the object of a science must consist of a group of problems of the same nature. Because the object is abstract, the condition for the object of communication science is to have the same object, namely human action in a social context.

The Influence of Epistemology on ICT

Epistemology is the study of science. As a theory of scientific knowledge, epistemology has the function and responsibility to critically analyze the processes carried out by science in forming itself. However, science must continue to experience growth because if it stops, it will lose its dynamic nature. Science must continue to develop, and often scientific findings that first appear will be challenged or improved by newer scientific findings.

Epistemology also provides high critical abilities towards existing concepts or theories. In the world of philosophy, many concepts that were initially accepted from the thoughts of philosophers can later receive sharp criticism from the thoughts of other philosophers based on an epistemological approach. Mastery of epistemology, especially in methods of acquiring knowledge, helps a person to critically correct and improve thought structures proposed by others and himself. This process of continuous correction of one's own

thinking aims to improve arguments or reasons to the maximum. This shows that epistemology can direct someone to criticize other people's thinking (external criticism) and their own thinking (internal criticism). The implication is that epistemology always encourages the dynamics of corrective and critical thinking, so that scientific development can be achieved better, especially if scientists strengthen their understanding of epistemology.

4. CONCLUSION

Overall, the philosophy of science which includes ontology, epistemology, and axiology provides a solid foundation for the study of Information and Communication Technology (ICT). Ontology helps in understanding the essence of existence and nature of Communication Science as a social science that studies human actions in complex social contexts. Epistemology, as a theory of scientific knowledge, provides guidance in the process of acquiring, validating, and developing knowledge in Communication Science, as well as teaching critical skills to evaluate existing theories. Meanwhile, axiology emphasizes the importance of the value and usefulness of knowledge, so that Communication Science can be directed to make a positive contribution to society in improving collective prosperity.

In the context of ICT, a deep understanding of ontology helps explain the essence of the phenomenon of digital communication and information technology in modern human life. Epistemology helps build valid methods to better understand and develop information technology, while maintaining criticism of innovation and new discoveries. Meanwhile, axiology emphasizes the need to consider ethical and moral values in the development and use of information technology, so that its positive impact can be felt widely by the global community. Thus, the philosophy of science provides a comprehensive and in-depth view of the relationship between ICT, humans and society in this digital era.

5. SUGGESTION

The following are suggestions, which researchers hope that the development of ICT studies can be more focused, ethical, and make a significant contribution to the development of global society in the current digital era:

Mastery of Epistemology: Strengthen understanding in epistemology to deepen research and analysis methods in ICT studies. This includes understanding valid sources of knowledge and being critical of existing theories to build a strong foundation of knowledge. Integrity and Ethics: Emphasize integrity and ethical values in the development and implementation of information technology. Ensure that any innovation or use of technology is directed at providing positive benefits for society as a whole. Interdisciplinarity: Take advantage of an interdisciplinary approach in the study of ICT by considering contributions from fields such as computer science, social sciences, and humanities. This integration can produce a more comprehensive and applicable understanding of information technology phenomena. Engagement and Openness: Encourage active involvement in the scientific community and ICT industry and embrace openness to diverse views and approaches. This collaboration not only broadens horizons but also accelerates progress in research and development of information technology that is more sustainable and has a positive impact.

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