Fifth lecture

Basics of scientific research

Types of scientific research

The goal to be achieved

The student gets to know the different types of scientific research

-Preface

- Stages of development of scientific research
- Criteria for classifying types of scientific research
- Division based on their connection to theoretical thinking or practical reality
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Introduction:

Scientific research of all types and levels is the only way for the researcher to investigate facts and study phenomena that disturb his mind and arouse his curiosity to discover the reasons for their occurrence. In the course of his research over time, the researcher developed his techniques and methods for dealing with the problems he faces according to the circumstances surrounding him, until scientific research reached what it is today in terms of scientific innovations and achievements.

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Stages of development of scientific research

Ahmed Badr believes that the starting point for scientific research in human history is not a completely clear idea, as the foundations of scientific thinking and research developed very slowly, and this development took several centuries, to which ancient civilizations and Arab thought contributed, and the Europeans transferred what the Arabs had achieved and Develop it... We will briefly present these stages below:

1- Scientific research in ancient times:

These are the time periods in which the ancient Egyptians, Greeks, Babylonians, and Romans lived. In that era, the thinking of the ancient Egyptians was characterized by taking a practical and applied approach in order to achieve utilitarian interests and goals. They excelled in engineering, arithmetic, mummification, medicine, agriculture, and astronomy, and they invented surveying to restore the necessary and correct boundaries after the annual periodic flood of the Nile River. They recorded much of their science and knowledge on plant leaves such as papyrus, and they used stones to write in hieroglyphics on them to record their science and knowledge as well.

The famous historian Herodotus transmitted and recorded the research conducted by the kings of Egypt on the state's economy, which included population and wealth.

As for ancient Greek civilization, it relied on contemplation and an abstract view of the mind. Thus, Greek philosophy expressed the spirit of the ancient era and the nature of the society in which they lived. Thus, they have made significant progress in the foundations of research.

With regard to research methods and the foundations of thinking, Aristotle established several rules, including the analogical method and inference. Although Aristotle tried to integrate experimentation and observation into his rules, the speculative nature prevailed in his thinking.

The Greeks used the previous discoveries of the ancient Egyptians and Babylonians within their scientific construction, then they branched out into several fields such as medicine, astronomy, physics, engineering, and geography to reach new scientific facts, in addition to their interest in studying morals and ethics.

2- Scientific research in the Middle Ages:

It extends from the eighth century until the sixteenth century AD, during which the Arab Islamic civilization flourished, and Europe followed suit within the Renaissance. There is no doubt that human civilization is nothing but an interconnected chain of links. The Arab civilization transmitted the Greek civilization after adding to it their own mark of many sciences and arts that were

distinguished by scientific originality. Thus, the Arab-Islamic civilization formed the link between previous civilizations and the European civilization that appeared in the Renaissance.

The research method in Arab-Islamic civilization was characterized by its comprehensive observation and experimentation, and was not limited to formal limits as in Aristotle's logic. Thus, the Arabs opposed the standard approach and relied on observation, scientific experimentation, and extrapolation using measurement tools in order to reach practical results.

Among the most prominent scholars of that era who followed the experimental method in scientific research were Jaber bin Hayyan, Al-Hasan bin Haitham, Muhammad bin Musa Al-Khwarizmi, Ibn Sina, Abu Bakr Al-Razi, Al-Biruni and many others.

He also used some proofs carried out by the Greeks in their own way by representing numbers using lines.

The science of algebra in the Middle Ages was based on the aforementioned book by Al-Khwarizmi, where Al-Khwarizmi introduced the decimal system in Europe.

It is known that the study of chemistry began among the Arabs, and chemical knowledge was then transferred to Europe in what is known as the Renaissance.

Converting various metals into gold is the most prominent interest of the Arabs in the past within the science of chemistry.

The Arabs contributed to their scientific production by creating a new method known as induction, which was based on taking:

Observation and experimentation are the basis of scientific research by re-modeling previous civilizations such as Greek and Indian civilizations and transferring them to the civilization of European countries at the beginning of the Renaissance.

Learning about Arab civilization was the starting point for European civilization and its prosperity.

Among the most prominent European scientists who established the rules of scientific research and the foundations of thinking were Roger Bacon and Leonardo de Vinci, who called for the introduction of observation and experimentation as one of the measurement tools within scientific research methods to arrive at facts and results, instead of Aristotle's method within logical analogy.

3- Scientific research in the modern era:

The foundations of thinking and the foundations of scientific research were completed in Europe from the seventeenth century to the present era, and this period of time was called the modern era. Galileo's physical experiments at the

beginning of the seventeenth century are considered the basis of scientific research.

The seventeenth century was characterized by the flourishing of scientific experiments and was full of scientific research, during which the scientist Napier discovered the logarithm. Harvey continued the work of Ibn al-Nafis with the discovery of blood circulation, and the decimal symbol system was spread by Briggs.

Francis's theories spread when he published his book (The New Instrument of Science), in which he detailed the rules of the experimental method.

Boyle adopted the science of chemistry and was called the father of modern chemistry. The laws of gravity that sparked mathematics appeared at the hands of Newton. As for the method of experimental scientific research that emerged in that era, Bacon summarized it with two stages of scientific research, the first of which expressed experimentation and the second of recording and codifying the experience.

The experimentation phase included several aspects, the most important of which are:

 Diversifying the experiment: It includes diversifying the researcher either in the materials from which natural phenomena result or the conditions through which the experiment passes in order to discover new characteristics of the nature of things.

 Prolonging the experiment: by exposing the affected person and making him under the influence of the stimulant for a specific, rather long period to determine whether it changes the nature of the affected person or results in the production of new phenomena.

 Experiment transfer: This means that the researcher transfers the guidelines and instructions that he applied in a particular experiment and applies them to other experiments within various branches of science.

 Among the sciences that have flourished in the modern era are the geological and biological sciences, which have formed new fields of research and study.

 Both Lyell and Darwin contributed to the study of archeology by changing the stereotyped image of the natural world.

-It resulted in the discovery of fossils by Schliemann during the nineteenth century, and new fields were developed, such as social relations, economic systems, and the foundations of education. The remarkable growth of technology was the result of the explosion of knowledge and the use of scientific research, as everything around us in terms of tangible progress in lifestyle constitutes the results of scientific research.

Criteria for classifying types of scientific research

Types of scientific research can be classified according to different criteria, such as whether they are classified according to whether they are theoretical or applied, or according to the nature of the person or entity conducting the research, or according to the type of data collected, or even classified according to the time standard, and when using a specific standard. As a classification framework, we actually use a special approach to thinking, and we look at the research from a certain angle. When we use another criterion, we look at the research from another angle, and therefore there is no contradiction between the different methods of classifying research, nor is there any preference for one method over another, as the methods overlap and complement each other to give a more detailed description of the research... They are divided as follows:

1- Division based on its connection to theoretical thinking or practical reality:

It is divided into (03) categories, which are:

1-1- Basic research or pure research: Basic Research

It includes research directed towards developing theories through the discovery of principles or generalizations. Basic research is also called theoretical research or pure research (the researcher aims to uncover new scientific facts and laws that may contribute to the advancement of knowledge in a specific field). This research is usually conducted in laboratories and controlled situations, and this control and precision in control is often done at the expense of realism and relevance to natural situations.

This type of scientific research has been of interest to psychologists for a long period of time during which traditional theories of learning were developed. This research has often used animals as individuals for study, because it is more concerned with the basic principles of behavior than with applying the research results to humans. Humanitarian problems. Therefore, it was not surprising that learning theories, for example, faced many questions and challenges on the basis that the studies they produced were related to the behavior of animals in controlled laboratory situations, which cast doubt on the possibility of applying them to humans in natural situations.

1-2- Applied Research: Applied Research

It relates to the application of new knowledge in solving daily and actual problems, and it participates with basic research in applying the scientific method in research, but its primary goal is to improve practical reality by testing theories in real situations, and solving actual problems under the same conditions in which these exist. Problems in reality. Also, basic research may depend in its conduct on the results of applied research in order to complete theoretical formulations and

crystallize concepts (it depends on the existence of a realistic problem that is intended to be solved through studies carried out by the researcher).

1-3- Action Research: Action Research is known as action-oriented research. It understands the scientific method in a more liberal way, because its interest is focused on a specific problem in a specific situation, and it does not emphasize the necessity of obtaining scientific knowledge that can be generalized, but rather on specific knowledge that suits a purpose. And a specific situation, and therefore action-oriented research does not entail the same conditions imposed on applied research. While applied and basic research in its various fields is carried out by specialized researchers, research centers, universities, governmental institutions, or specialized professional associations, procedural research or work-oriented research in the educational sciences is carried out, for example, by teachers in their school classes, or principals in their schools, or supervisors in cooperation. With the teachers associated with them, all in order to improve practices in the fields of work or to increase the understanding and development of these fields.

2- Division based on the people conducting the research: we find two categories:

• Postgraduate students: academic research

• Faculty members at universities and specialized researchers: professional research

The following is a detailed explanation of each of them:

2-1- Academic Research - Postgraduate Students: Academic Research

Postgraduate, master's and doctoral programs in many universities require the student to carry out scientific research according to specific conditions, and this research is usually called academic research. The report prepared by the researcher, which is called a master's thesis (which is an original, innovative research that addresses a problem and seeks to reach new results in a relatively long period of time), is considered one of the complements to obtaining a high academic degree such as a master's degree. It is also considered an exam for the student, as it gives an idea of his talents. It is valid for a doctorate in the future (or a doctoral dissertation), which is a scientific research in which the researcher chooses his topic and defines its problem and methods. It is characterized by adding new things to the field of research with a deeper and higher level through the adoption of broader references and skill in analysis and organization of scientific material in A period exceeding two years, which gives an idea that the person submitting it can independently research without the need for supervision.

2-2- Professional research - faculty members and specialized researchers: Professional Research. Faculty members and researchers conduct scientific research as part of their work and professional practices in exchange for the

salaries and wages they receive. It can also be part of the requirements for advancement and promotion in the ranks. The profession, and it is often required that the research be published by a committee of arbitrators who carefully examine the research in terms of the method of its design, the effectiveness of its tools, the analysis of its data and the validity of its results according to special scientific and technical standards, which are called the scientific research arbitration standards.

3- Division of research based on the data collected and analyzed: It is divided into two categories:

- Quantitative Research
- Qualitative Research

Below is a brief explanation of each type:

3-1- Quantitative Research: Quantitative Research is research that is concerned with collecting data using tools designed to measure quantitative variables. These tools are being developed so that they have validity and reliability and are applied to a sample of individuals that represents the original community. In quantitative research, quantitative data is processed using statistical methods that ultimately lead to results that can be generalized to the original community within a certain range of confidence. The quantitative research approach dominated some areas of the human sciences, such as education, for a long period, during which it gained such a prestigious status that the value of quantitative research was estimated in light of the size of the study sample, the degree of complexity in its design, and the development of statistical methods used in the statistical analysis of its quantitative data. Especially after the introduction of computers and the development of data analysis software.

Quantitative research often aims to test some hypotheses related to describing a specific reality. Hypotheses are tested by measuring some variables and using the available data to find correlational or causal relationships by calculating the value and direction of the appropriate correlation coefficient between those variables.

3-2- Qualitative Research: Qualitative research depends on studying the phenomenon in its natural conditions as a direct source of data, and on the researcher himself as an essential tool in collecting this data.

Qualitative research data is descriptive, using words and pictures, not numbers, and the research results are supported by excerpts from people's sayings and memoirs, or pictures of their activities. Data are collected through direct observation, in-depth interviews, and careful examination of documents. Recorders and television cameras are sometimes used for further analysis of situations and voices.

Qualitative research is concerned with processes more than just results. If quantitative research, for example, can show the occurrence of change in trends, by comparing the results on the pre-test and the post-test. It shows how these trends are translated into daily activities, practical procedures, and social interactions.

Quantitative research depends on analyzing data in an inductive manner. It does not search for data to prove or refute a specific hypothesis that was formulated before starting the study. Rather, qualitative research builds scientific principles and theories by collecting partial information and linking it to each other. These principles and theories are being tested and developed on an ongoing basis by continuing to collect data, and observing the extent to which they relate to the general principles that were developed during the research stages.

4- Division based on thinking style: divided into two parts:

4-1- Inductive research: It seeks to build an intellectual structure based on individual details that help form a framework for a theory that can be generalized to all of those details. In application of the principle that what applies to the whole applies to its parts. Inductive research in communication contributes to answering questions such as: What? how? from? where?.

4-2- Deductive research: It is a research that goes in the opposite direction to the previous type, as it moves the researcher from general principles to individual details and conclusions.

5- Division according to activity: divided into two parts:

5-1- Exploratory research: It is research that aims to collect facts only without passing judgment on them, and does not aim to generalize the results or use them to solve a problem, such as the research that a student carries out to discover a group of references related to a specific topic or idea.

5-2- Critical interpretive research: It depends on logical and rational reasoning to reach a solution to the problem by interpreting accepted ideas, presenting arguments and justifications, and discussing them in a clear and precise manner, in order to arrive at solutions to the issue at hand, or at least the most likely opinion about it. .

5-3- Complete research: This research aims to collect facts and evidence on them, then develop hypotheses and verify their validity or error in order to reach logical results to solve the problem under study, with the ability of these results to be generalized to similar cases.

5-4- Exploratory scientific research: It is research that aims to identify the problem only, especially if it is new, or if there is little information available about it. This type of research is usually a prelude to other research that seeks to find solutions to these new problems.

5-5- Experimental research: It is research based on observation and experimentation to ensure the validity of hypotheses using scientific laws.

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Conclusion

The researcher in his research path, even if his methods are many and different, his goal is to reach accurate and logical results that represent a starting point for future research aimed at facilitating and solving the problems that people face in their daily life.

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