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Research Article

Importance And Use Of Statistical And Mathematical Tools In Geographical Study And Research

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ABSTRACT

In this paper a long journey of revolution of using statistics , mathematical tools and other scientific techniques in the study of Geography has been explained . Before this revolution geographers operated the activities of geographical study and explanation with traditional methods .However, after the introduction of mathematical and scientific techniques and instruments the geographic scene has greatly been changed . Computer aided cartography, geographic information system, remote sensing ,geographic positioning system, automatic weather station etc are some important parts of technological revolution in Geography. Thus, geographers are now capable of performing many valuable geographical activities in a scientific ways with a high speed and high accuracy in fact.

Key words: statistical, models, Geographic Information System, Remote Sensing, Cartography

Introduction

Geography studies different natural and cultural phenomena which occurred on the surface of the earth and also their changing nature in the context of both time and space . From the very beginning of the course of the subject many geographers have been working on different aspects and dimensions in order to enrich the wealth of Geography by contributing their own special skills and know- how for many years. Because of their efforts the scope and subject matters of Geography have been expanding and growing gradually . In the olden days its scope was too small and the contents were also too meager. It was just like an encyclopedia which contains the names of hills , mountains, plateaus, deserts, rivers, seas, oceans, and some data of commercial items like rice, wheat, maize, and potatoes etc. The idea of map was born in the minds of ancient geographers, specially the Greeks,the Romans,and the Arabs etc. With the coming of this thought many geographers have begun to use old scientific techniques to measure various dimensions of the earth. As a result of it the then world maps were produced ,since then the revolution of technology has been started . Thus the quality and accuracy of the maps have been increasing gradually. The inventions of scientific instruments help the geographers in many ways of data collection, analysis and interpretation to a great extent. It also enables them to access inaccessible areas of the earth.

Objective of the study

This research paper tries to disclose the important characteristics of the introduction of scientific technology and mathematical and statistical techniques in the field of Geography.

Research methods

This study is mainly based on secondary data which are found in various books and journals. It also shows the present scenarios of geography at different regions of the world in higher educational sectors.

Discussion

The word Geography has been in used since the time of Eratosthenese ,who became the father of Geography after coining the term for the first time in world. He was a great Greek scholar . The term Geography consists of two Greek words – geo which means the earth and graphein n which means to write. Geography may be

defined as the study of the earth as a home of man. There are varieties of phenomena existing on the surface of the earth, some belong to physical phenomena and some other belong to human phenomena, they are either mutually inclusive or exclusive. Some of them are interrelated and interacting on the surface of the earth. All these phenomena ,whether physical or human ,are related each other ,in as much as they have unique place of their localization.The combined phenomena of physical and human elements represents the core and the raison d' etre of Geography. The word Geography can be well explained understand by the sentence " where do the people live"? The word where refers to place and localization on the surface of the earth where people choose, and the word live refers to distribution concentration of the people. Geography has been rightly defined as to provide accurate, orderly, rational description and interpretation of the variable characters of the earth surface(Hartshorne, 1959).

Geographers are mainly associated with the study of these relationships all over the earth surface which is made up of lithosphere, hydrosphere , atmosphere and cryosphere. The localization ,distribution and concentration of various geographic phenomena are precisely studied and explained with the help of cartographic activities since early times. Both spatial and temporal analysis of geographic phenomena are well supported by various types of maps and other cartographic tools and methods. The cartographic work includes almost every operation from original field work to collect data to final printing and marketing of maps and books. Map constructions has been the main concern of cartography since 2500 BC., Babylonian cuneiform clay tablets were produced. Ptolemy's book Geographia in 150 BC .helped spark European exploration of the world from about 1500 to 1700.A good map can be produced only by a logical combination of knowledge of earth sciences, communication science, computer programming and aesthetics.

Cartography devises ways and means to brig order and system ,generality and simplicity, refinement and legibility and ease of use and comprehension to an almost incomprehensible range of complex details of the earth through a medium ,called map. Cartography is closely aligned to earth sciences and subject matter is to represent the earth surface. It seeks to represent the huge and spherical earth on small paper as realistically as possible. Cartographic representations also involve the choice of what is important and rejection or suppression of what is unimportant. It needs prior knowledge of the elements to be generalized undertaking. Cartography is an auxiliary science that acts as a bridge between techniques , art and earth sciences. As map is a generalized picture of the earth surface, the cartographers have the difficulties of generalizing the complex details of the earth surface. To perform all these successfully , they have to have the background of not only geography but also of other disciplines in which maps needs. The geologists and topographic surveyors give the size and shape of the earth and gives the locations of its different surface features , the economists , sociologists ,geologists and botanists etc., gives the subject matters to be generalized.

The communication school of cartography was founded by Arthur Robinson, with his dissertation which laid emphasis on cartography as science communicating spatial information graphically to the reader through a map.' Nature of Maps' written by Robinson and Petchenik was a part of the blooming of cartography as a communication science.

The objective of the cartography during this phase is to communicate facts as they appear on the surface of the earth. Most maps are made to communicate facts and ideas in which geographers are interested. Thus, the success of a map is indicated by the effectiveness with which it is able to convey the massage. Now map becomes a very powerful medium of communication and cartography a strong communication science. The main aim of cartography is to communicate the changing realities of the surface of the earth. With the development of the artificial satellite we can get small details of whole earth or part of it. Yet people continue to be ignorant about much of world partly due to the satellite imageries are not accessible to all but mainly because unless these imageries are converted into map.

A communication system consists of five elements vize, source, destination, channel, transmitter and receiver . All natural and social sciences are related with the study of earth and its surface features and it represents the source of the cartographic systems. The ideas and facts of the earth and its surface features are represented by words ,drawings ,and symbols and comes out though maps and cartographic products.

A remarkable contribution was made by the four generations of the Cassini family. Jean Dominique used the movement of Jupiter's satellite to find out the longitude of a particular place. A complete triangulation survey of France based on lunar eclipse was conducted by Cassini and Jacques and produced Cassini map comprising of 182 sheets. Delisle published a general map of world between 1724 and 1745. D'Anville's better ways of showing relief by symbols to represent mountains and hills and by shades to represent escarpments and valleys. During eighteen century J.G.Lehman introduced the principles of hachuring. The techniques of representing relief by contours was also developed by Murcan and Phillip Buache in 1749 and 1737 for land and submarine surfaces respectively.

Kent prepared the earliest British map showing spot heights in his Physico- chorographical chart. The other British geographers started to use different colors of different shades in order to distinguish successive contours. The advances made in the field of mathematics and astronomy during the 18th century also helped improve surveying and measuring instruments. The quadrant was improved with the addition of reflecting mirrors and Vernier scale by John Hadley. John Harrison invented chronometer in 1772. During this period theodolite was also produced and used in Triagulation survey of England, France and India subsequently. The map of Hindustan was prepared by James Rennel ,the first Surveyor Genera of India in 1779.

The major events which took place in the first half of the twentieth century include organization of national topographic surveys, mass production and use of maps, increase in the influence of science and technology and international cooperation mapping and related issues. A number of nations established their own national survey institutions during this period to survey their lands. Gradually the surveying instruments were improved and the errors resulting from were removed .The accuracy and efficiency in regard to all activities of surveying considerably improved with the use of theodolite ,wireless and other scientific mechanical aids. With the invention of camera in 1920 it was possible to aircraft and balloon for surveying purposes in the real of Geography. After this the aerial camera enhanced the mapping of the visible faces of the earth a faster speed and with a fullness of details never obtained before. It became possible to photograph even those areas which could not be seen by observer from the ground surface. Inventions of several electronic devices further revolutionized the cartographic processes which are related with various geographical phenomena on the surface of the earth.

The use of maps as tools for research demonstrated by early geographers like Alexander Von Humboldt and Carl Ritter, the famous German geographers. Mass production and use of maps of various types in connection with geographical studies is also a distinguishing features during this period.

During the post world war period computer technologies have brought revolutionary changes in the field of cartographic processes and geographical researches in the world .Cartographic algorithms were used by governmental and development units in the early part of this revolution. In the next part remote sensing and satellite imageries entered the cartographic arena and in the later part of it the horizon of computer cartography expanded and it replaced all techniques in the field of geography .Today we have satellite imageries for the whole world at different scales which can be used as based maps to make new maps both general thematic with the helps of computers.

We are flooded with information on what is going on in different parts of the world . To convert these knowledge in a faster rate we need to use computer. Computer has proved to be a great help in this respect for it can store and process large amount of data and give the desired results. Computers accept data and instructions and then process the data according to the given instructions and give the results in the form of numbers and words or graphic patterns including maps.

Computer technology offers unparalleled opportunities for cartographic expressions in the field of geography which include unlimited number of colours and patterns to represent finer details of reality, high resolution of graphical displays to distinguish one phenomenon from the other and also to represent even a point or line to scale, generation of realistic three or four dimensional pictures to take map nearer the real world, making the scales and projections dynamic ,making cartographic products dynamic by introducing animation, making displays dynamic , interlinking of multiple perspective of the phenomena displayed , increasing possibilities of inter- conversion of digitial maps and mathematical equations etc. Now the table is turned in favour of the geographers. The geographers not only use maps but also creats maps on the computer screen to suite his requirements . The symbols used in the paper maps encoded a given set of data which the user had had to decode using the legend printed along with the map. It is now possible to make maps whose symbols once clicked by the computer mouse would present to the map user all the detailed data which underlies them. The geographers no longer needs to take the trouble of decoding the values. The geographers need no longer use his time in symbolizing data, he can now use his time to design and implement various interactive techniques which enhance the role of maps as tools of visual thinking.

Now geographers are able to modify the map symbols to get a specific objectives. To remove congestions from general maps , geographer can now remove certain elements without affecting the required elements. For instance, to show the railways alone ij a general transport map , it is possible to remove the roads and waterways leaving the railways there . Geographers can enlarge map to accurately measure distances between any two points located closely on the surface of the earth which would not be possible on small scale map.

Computer technologies allow geographers to perform many things that we couldn't do with the help of traditional techniques. But ,now it is possible to do it by even animated maps and software packages for it are now in the markets. It is also possible to add a third dimension which is time in cartographic products.

With the development of technologies related with aircrafts and artificial satellites ,now geographers can collect ,retrieve and transform geographic data into maps and other diagrams very speedily and accurately. Geographic information system is also one of the most powerful tools which helps geographers to a great extent. This system consists o hardware , software and procedure designed to support the capture management ,manipulation, analysis, modeling and display of spatially referred data for solving complex planning and management problems . The important practical application of geographic information system in the fields of geographical study includes mapping , batabase management, data queries based on spatial location, attribute and spatial modeling such as capability assessment ,suitability analysis etc. This system can answer questions like where is a particular phenomenon take place , what is the speed of flow of river at a particular place , what changes take place in water when the level is lowest, which is the shortest way to go ,which is the best way to go , what is the pattern of a given phenomenon, is there some pattern in the distribution of a phenomenon ,what if climate changes continue infuture etc. In geographical research like network management which includes address marching , vehicle routing , scheduling, location analysis, site

selection, development of evaluation plan etc. geographic information system can help to a great extent to the geographers. In terms of natural resources management like conservation of forests , wildlife habitat ,migration routes , river preservation, recreational resource planning, floodplain and wetland preservation , agricultural land planning, groundwater modeling, environmental impact assessment etc., geographers are now able to do at full swing some needful works with the help of geographic information system. It also helps geographers to do many works such as land zonation, land acquisition , water quality management etc.

Conclusion

It is a known fact that the nature and scope of Geography has greatly been changed due to the outbreak of technological revolution . Many impossibilities that lies before this revolution becomes possible now with the help of a large number of scientific instruments which are produced during this revolution. It enhances geographical studies mainly the aspects of physical geography.

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