

ROLE OF COMPUTER APPLICATIONS AND TOOLS IN THE SCIENTIFIC RESEARCH PROCESS

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ABSTRACT

The most emerging tool in the research process is computer. Computer is an essential tool for research, whether for academic purpose or for commercial purpose. Computers play a major role today in every field of scientific research from genetic engineering to astrophysics research. It led the way to a globalized information portal that is the World Wide Web. Using WWW, researcher can conduct research on massive scale. Various programs and applications have eased our way into computing our research process. In this paper, various software applications and tools are discussed with respect to research activities like data collection, analysis, etc.

Key words: WWW, portal, research process, applications, tools

INTRODUCTION

Computer have always assisted to solve the problems faced by the mankind since the time of invention, the size of the computers have drastically reduced from that of a room to that can be accommodated in a human palm. The word computer means something which computes or a machine for performing calculations automatically, but, today computer means not merely a calculator. It does vast variety of jobs with tremendous speed and efficiency. Today people use computers in almost every walk of life. Electronic computers have now become an indispensable part of every profession: so do research. Computers have a very important role to play in all research activities.

WHY COMPUTERS?

The importance of computers in scientific research is exceptionally high and the use of a computer can help scientific research immensely, and is an almost invaluable tool [5]. There are many reasons why computers are so important in scientific research and here are some of the main reasons:

SPEED: computer can process numbers and information in a very short time. So researcher can process and analyze data quickly. By saving time researcher can conduct further research. A

calculation that may take a person several hours to process will take computer mere minutes, if not seconds.

ACCURACY: Computer is incredibly accurate. Accuracy is very much important in scientific research. Wrong calculation could result an entire research or project being filled with incorrect information.

ORGANIZATION: We can store millions of pages of information by using simple folders, word processors & computer programs. Computer is more productive & safer than using a paper filing system in which anything can be easily misplaced.

CONSISTENCY: computer cannot make mistakes through “tiredness” or lack of concentration like human being. This characteristic makes it exceptionally important in scientific research.

COMPUTER IN THE RESEARCH PROCESS

Research process consists of series of actions or steps necessary to effectively carry out research and the desired sequencing of these steps. The following order concerning various steps provides a useful procedural guideline regarding the research process: (1) formulating the research problem; (2) extensive literature survey; (3) developing the hypothesis; (4) preparing the research design; (5) determining sample design; (6) collecting the data; (7) execution of the project; (8) analysis of data; (9) hypothesis testing; (10) generalisations and interpretation, and (11) preparation of the report or presentation of the results, i.e., formal write-up of conclusions reached. [1]

There are five major phases of the research process [4]. They are:

1. Conceptual phase
2. Design and planning phase
3. Data collection phase
4. Data Analysis phase and
5. Research Publication phase

1. Role of Computer in Conceptual Phase

The conceptual phase consists of formulation of research problem, extensive literature survey, theoretical frame work and developing the hypothesis.

Use of computers in extensive literature review: computers help for searching the literatures (for review of literature) and bibliographic reference stored in the electronic database of the

world wide webs. It can thus be used for storing relevant published articles to the retrieved whenever needed. This has the advantage over searching the literatures in the form of books, journals and other newsletters at the libraries which consume considerable amount of time and effort.

2. Role of Computers in Design and Planning Phase

This phase consists of research design preparation and determining sample design. Design and planning phase also consists of population, research variables, sampling plan, reviewing research plan and pilot study.

Role of Computers for Sample Size Calculation: Several software's are available to calculate the sample size required for a proposed study. The standard deviation of the data from the pilot study is required for the sample size calculation.

3. Role of Computers in Data collection phase

This Empirical phase consists of collecting and preparing the data for analysis:

In research studies, the preparation and inputting data is the most labor-intensive and time consuming aspect of the work. Typically the data will be initially recorded on a questionnaire or record for suitable for its acceptance by the computer. To do this the researcher in conjunction with the statistician and the programmer, will convert the data into Microsoft word file or excel spreadsheet or any statistical software data file. These data can be directly opened with statistical software's for analysis.

Data collection and Storage: The data obtained from the subjects are stored in computes are word files or excel spread sheets or any statistical software data file. This has the advantage of making necessary corrections or editing the whole layout of the tables if needed, which is impossible or time consuming incase of writing in papers. Thus, computers help in data entry, data editing, data management including follow up actions etc. computers also allow for greater flexibility in recording the data while they are collected as well as greater ease during the analysis of these data. Examples of editors are WordPad, SPSS data editor, word processors, others like ultraedit etc.

Data exposition: Most researchers are anxious about seeing the data: what they look like; how they are distributed etc. you can also examine different dimension of variables or plot them in various charts using a statistical application.

4. Role of Computers in Data Analysis

This phase consist of the analysis of data, hypothesis testing and generalisations and interpretation. Data analysis phase mainly consist of statistical analysis of the data and interpretation of results.

Data analysis: many software's are now available to perform the mathematical part of the research process i.e. the calculations using various statistical methods.

Softwares like SPSS and spreadsheets are the widely used. They can be like calculating the sample size for a proposed study, hypothesis testing and calculating the power of the study. Familiarity with any one package will suffice to carry out the most intricate statistical analysis.

Computers are useful not only for statistical analysis, but also to monitor the accuracy and completeness of the data as they are collected. These software's also display the results in graphical char or graph form.

5. Role of Computer in Research Publication

This phase consists of preparation of the report or presentation of the results, i.e., formal write-up of conclusions reached. This is the research publication phase.

The research article, research paper, research thesis or research dissertation is typed in word processing software and converted to portable data format (PDF) and stored and/or published in the world wide web. Online sites are available through we can convert our word file into any format like html, pdf etc. Various online applications are also available for this purpose. Even we can prepare our document using online word processing software and can store/edit/access it from anywhere using internet.

ROLE OF COMPUTERS IN SCIENTIFIC RESEARCH

There are various computer applications used in scientific research. Some of the most important applications used in scientific research are data storage, data analysis, scientific simulations, instrumentation control and knowledge sharing. [2]

Data Storage

Experimentation is the basis of scientific research. Every experiment in any of the natural sciences generates a lot of data that needs to be stored and analyzed to derive important conclusions, to validate or disprove hypotheses. Computers attached with experimental apparatuses, directly record data as it's generated and subject it to analysis through specially designed software. Data storage is possible in SPSS data file, lotus spreadsheet, excel spreadsheet, ASCII/DOS text file etc.

Data Analysis

Analyzing tons of statistical data is made possible using specially designed algorithms that are implemented by computers. This makes the extremely time-consuming job of data analysis to be a matter of a few minutes. In genetic engineering, computers have made the sequencing of the entire human genome possible. Data from different sources can be stored and accessed via computer networks set up in research labs, which makes collaboration simpler.

Scientific Simulations

One of the prime uses of computers in pure science and engineering projects is the running of simulations. A simulation is a mathematical modeling of a problem and a virtual study of its possible solutions. Problems which do not yield themselves to experimentation can be studied through simulations carried out on computers. For example, astrophysicists carry out structure formation simulations, which are aimed at studying how large-scale structures like galaxies are formed. Space missions to the Moon, satellite launches and interplanetary missions are first simulated on computers to determine the best path that can be taken by the launch vehicle and spacecraft to reach its destination safely.

Instrumentation Control

Most advanced scientific instruments come with their own on-board computer, which can be programmed to execute various functions. For example, the Hubble Space Craft has its own on-board computer system which is remotely programmed to probe the deep space. Instrumentation control is one of the most important applications of computers.

Knowledge Sharing Through Internet

Lastly, in the form of Internet, computers have provided an entirely new way to share knowledge. Today, anyone can access the latest research papers that are made available for free on websites. Sharing of knowledge and collaboration through the Internet, has made international cooperation on scientific projects possible.

Through various kinds of analytical software programs, computers are contributing to scientific research in every discipline, ranging from biology to astrophysics, discovering new patterns and providing novel insights. When the work in neural network based artificial intelligence advances and computers are granted with the ability to learn and think for themselves, future advances in technology and research will be even more rapid.

TOOLS AND APPLICATIONS USED IN THE RESEARCH PROCESS

Statistical Analysis Tool: SPSS

SPSS is the most popular tool for statisticians. SPSS stands for Statistical Package for Social Sciences. The latest version of SPSS is IBM SPSS STATISTICS 20 (purchased by IBM after version 19). It provides all analysis facilities like following and many more.

- Provides Data view & variable view

- Measures of central tendency & dispersion
- Statistical inference
- Correlation & Regression analysis
- Analysis of variance
- Non parametric test
- Hypothesis tests: T-test, chi-square, z-test, ANOVA, Bipartite variable....
- Multivariate data analysis
- Frequency distribution
- Data exposition by using various graphs like line, scatter, bar, ogive, histogram, pie chart....

Data Analysis Tool: SPREADSHEET PACKAGES

A spreadsheet is a computer application that simulates a paper worksheet. It displays multiple cells that together make up a grid consisting of rows and columns, each cell containing either alphanumeric text or numeric values.

Microsoft Excel is popular spreadsheet software. Others spreadsheet packages are Lotus 1-2-3 Quattro Pro, Javeline Plus, Multiplan, VisiCalc, Supercalc, Plan Perfect etc.

OTHER STATISTICAL TOOLS

SAS, S-Plus, LISREL, Eviews etc.

WORD PROCESSOR PACKAGES

A word processor (more formally known as document preparation system) is a computer application used for the production (including composition, editing, formatting, and possibly printing) of any sort of printable material.

The word processing packages are Microsoft Word, Wordstar, Word perfect, Softward, Akshar (Gujarati), Amipro etc.

PRESENTATION SOFTWARE

A presentation program is a computer software package used to display information, normally in the form of a slide show. It typically includes three major functions: an editor that allows text to

be inserted and formatted, a method for inserting and manipulating graphic images and a slide-show system to display the content.

The presentation packages are Microsoft Powerpoint, Lotus Freelance Graphics, Corel Presentations, Apple keynote etc.

DATABASE MANAGEMENT PACKAGES (DBMS)

Database is an organized collection of information. A DBMS is a software designed to manage a database.

Various Desktop Databases are Microsoft Access, Paradox, Dbase or DbaseIII+, FoxBase, Foxpro/ Visual Foxpro, FileMaker Pro

Commercial Database Servers that supports multiuser are Oracle, Ms-SQL Server, Sybase, Ingres, Informix, DB2 UDB (IBM), Unify, Integral, etc.

Open source Database packages are MySQL, PostgreSQL, Firebird etc.

BROWSERS

A web browser is a software application which enables a user to display and interact with text, images, videos, music, games and other information typically located on a Web page at a website on the World Wide Web or a local area network.

Examples are Microsoft Internet explorer, Mozilla firefox, Opera, Netscape navigator, Chrome (google browser), Safari

TOOLS THROUGH INTERNET

SEARCH ENGINES (to search the information)

Google (popular search engine)

Yahoo!

Webcrawler

Excite

Altavista

Online Data/Documentation Management (to manage your documents online)

Dropbox

Google Drive

Google Docs

MS Sky Drive (free)

Microsoft 365 (paid version)

Online Data Collection (To collect data online from different users)

Online forms

Online questionnaires
Online surveys
Collaboration tools
Skype : Voice and video conferencing
Google Hangouts :Voice and video conferencing
Modern Research tools
Zotero
Evernote

Modern electronic research tools, like [Zotero](#) and [Evernote](#), make the collection of research data, and collaboration between colleagues possible, which that in the past would have been difficult, expensive, or even impossible. They also save large amounts of time citing and creating bibliographies. Evernote allows the user to capture digital content, including web pages, PDF files or snippets of web pages, organize them, annotate them, share them, publish them and search them.

CONCLUSION

Use of computer in research in science is so extensive that it is difficult to conceive today a scientific research project without computer. Many research studies cannot be carried out without use of computer particularly those involving complex computations, data analysis and modeling. Computer in scientific research is used at all stages of study-from proposal/budget stage to submission/presentation of findings.

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