

COMPUTER SCIENCE/INFORMATION TECHNOLOGY AT INTERMEDIATE LEVEL - CHALLENGES AND SUGGESTIONS: A CASE STUDY OF J&K SCHOOL EDUCATION SYSTEM

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ABSTRACT

With the dawn of Computer Science a new revolution is just beginning in science. The building blocks of this revolution are concepts, tools and theorems in computer science which are being transformed into revolutionary new conceptual and technological tools with wide-ranging applications in the sciences. Computer science teaching and research is currently at an awkward crossroads where it needs to decide whether it is something that serves other disciplines, is an engineering exercise, or a real science in its own right. What is clear is that computer science needs to be re-energized in schools/colleges and universities to inject new life into the discipline, and to focus around helping find solutions to 'grand challenges'. The structure of the Computer Science teaching system needs a consideration to help it grow as a subject that can augment any other subject to be learned to the maximum of its depth, with ease and least amount of time. Any topic, on any subject, regarding anything is just a click away; just the click is to be learned.

Key words: Computer Science, Information, Design, Online, Learning, Syllabus, Counselling

Introduction

IT deals with the use of computers and computer software to convert, store, protect, process, transmit and retrieve information. Information is the backbone of almost every system today. Information technology (IT), as defined by the Information Technology Association of America (ITAA) is:

"It is the study, design, development, implementation, support or management of computer-based information systems, particularly software applications and computer hardware."

The flow of information has changed the way we live in today world. Information Technology has changed the whole scenario. Today, the term Information Technology has ballooned to encompass many aspects of computing and technology, and the term is more recognizable than ever before. Every morning when we read a newspaper out, having so much information, we come to know the latest happening in the world, the internet edition of newspapers have it all. This is just a very basic example of IT. The Internet is used extensively in the sphere of education. On-line education is becoming more and more popular day by day. All our Railways, Air and even sea networks are connected with the help of IT. The information is very vital for running these smoothly. Even if we have do not have information for one minute it may result into a big disaster. Similarly if we want to travel around the world we can book airline tickets online and even book rooms for our hotels (of course at competitive rates- Online-Ticketing). In banking sector also the use of Computers and internet has grown at an immense pace. It is very to transact any amount of money from one part of the world to other with help of e-commerce (Online-Banking). We can purchase anything online with help of debit and credit cards. This has made our lives simpler. Nowadays if we want to buy to something and are not getting it in a nearby store, we can simply search for the thing on internet and then order it over the internet (Online Shopping). We will get it delivered at our

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doorstep with just few clicks of mouse. Companies can share data and technologies online. People are working on the internet without really having to go outside to their workplace. Even the doctors can guide/help other doctors, while operating on a patient, anywhere in the world, with the help of Information Technology. Today's architect relies on computer-aided design (CAD) programs that enable the visualization of structures in three dimensions. Now we don't have to sit for hours in the library and rewrite the material we need, we can just find it on the Internet and print it. So everything we need is at hand – any materials on any topic. It's also convenient for translators – instead of endless turning over the pages we just need to install an electronic dictionary, and our time is saved. Besides dictionaries, there are lots of other electronic programs almost for every profession. A whole new world is coming in our way with the help of Computers and Technology.

Local Scenario: Status in J&K- A Case Study

Nearly everything we do today in this world is helped or even controlled by computers. So it is difficult to overestimate their role and especially the role of the Internet in our life. The Internet is used extensively in the sphere of education. Online education is becoming more and more popular. Keeping in this perspective in mind, Computer Science has been introduced in School Education Department in J&K at 11th and 12th Level for last more than five years. The objective with which the course has been started has been innovative and revolutionary. The objective behind imparting Information Technology/Computer Science at Higher Secondary School level has been to make the younger generation acquainted with the latest technological dominance. The inclusive growth of Information Technology/Computer Science has influenced almost every aspect of life. The knowledge being incomparable commodity has also shifted from “bookish” approach to practical and technical approach. Computer Science is a recent discipline in the field of Science compared to others fields and has been divided into several specific areas which are diverse yet most of them are related. These include: Computer Science and Technology, Computer Engineering, Information Systems, Information Technology, Software Engineering, Computer Aided Design and Engineering, Computer Networks, Computer Administration etc. Information/Computer science courses are customized to prepare students for careers in the application and use of computers in almost every field of life. Due to the diversity of its use, several courses are proposed and designed to train youth for specialized tasks in the field of Computer science and Information Technology. The rapid spread of computers and information technology has generated a need for highly trained workers to design and develop new hardware and software systems and to incorporate new technologies. So the more people learn and acquaint themselves with the trends and uses of computer science and information technology, the better it will be in future.

Owing to this most computer specializations are classified by areas of focus. The following is a list of major specialty areas within computer science:

- Database and Information Systems.
- Artificial Intelligence.
- Programming Languages, Formal Systems, and Software Engineering.
- Office automation and specific business applications.
- Graphics, Visualization and the Human Computer Interface.
- Architecture, Parallel Computing and Systems.
- Computer System peripheral maintenance and Network systems.
- Computer and Network Administration.

Other short and long term, Certificate courses and diploma courses are also provided to develop and widen the human resource for present day requirements in various fields.

Present Day Functioning and Problems

Information Practices/Computer Science has been provided as an optional subject at Secondary School level to help develop interest among students towards the present day prerequisite of computer knowledge. The motive is surely spectacular, innovative and pioneering to provide basic level of understanding, usage and applications of computer systems. The base for any subject is “Learning About Learning” and the introduction of this course is the very first step in this direction. The course, started with this motive, will help develop interest and enthusiasm amongst students towards this very important and appropriate subject in this present world.

Objectives of the Study

The aim of this paper is to try to analyze the present system of introduction of Computer Science at secondary school level. The subject has been introduced with focus on improving the understanding and knowledge about computers and internet. This is a foundation stone of building young generation who are conscious and aware about the latest trends and technology. This will help them build and develop their future, no matter in which stream they are planning to go ahead. Better set of courses and education be provided to the students so that they are not overburdened. Rather they develop more interest learn things with great zeal and zest. More stress should be laid on practical learning and achievement in terms of better technological competence.

Findings and Observations

Going through the present scenario, several issues need to be addressed / acknowledged so that the intention, with which the initiative of introduction of Computer Science at Higher Secondary Level was taken, attains its final shape and it flourishes as a leading subject as is the need of the time.

The following concerns are to be considered:

1. Syllabus needs to be revised as per the class work and level (understanding) of students.
2. Distribution of marks for units requires reconsideration.
3. Number of classes (Theory and Practical) for the session may be balanced.
4. Proper counseling sessions are introduced for newly introduced subjects.
5. Level of students is to be taken into consideration, as most of the students study and operate the Computer System(s) for the first time.
6. Students be motivated and prepared for understanding the importance of homework/ self-study/ assignments.
7. Infrastructure be developed at school/community/area level to take full benefits of computers and the world wide web.(internet)
8. Student-Computer ratio in the schools should be maintained and other facilities like generator, essential power supply, broadband (internet) connections should be provided and maintained.

A detailed analysis of above issues:

1. Syllabus

The syllabus that is presently prescribed has been framed, rather is similar to that of Central Board of School Education (CBSE). The marks distribution for units, Number of classes for the academic session, essential for theory and practical, total number of classes (theory and practical's) required for the syllabus is imbalanced (needs re-consideration). The level understanding of students, no of working classes/periods

and without considering lack of prior knowledge among students, is a major concern. Since at class 11th, most of the students study it for the first time, and that too as an additional / optional subject, so the syllabus should have been such that the students should develop interest and feel comfortable while taking it as a subject. But the reality on ground is contrary to the expectations. The syllabus should have focused on developing basics of computers among students so that they would feel comfortable in studying it and at the same time learn the usage and importance of computers and information technology day-to-day life.

2. Status of CS as an Optional subject:

Since it is an optional subject most of the students avoid opting for it and try to choose some subject that they think is simple and easy (human nature). Considering the elaborate syllabus of Computer Science /IT and amount of time and effort the students have to put in, most of the students try to run away from it and instead look for some simple and easy alternative subject.

3. Marks distribution among units and elaborate syllabus structure:

The distribution of marks in units of the syllabus, theory and practical's, need consideration. (Marks distribution is uneven, as compared to that of CBSE syllabus). Quantity has been given preference over quality. Compact syllabus would have resulted in thorough teaching-learning process but here the syllabus is detailed and students get less time for understanding and mostly follow the procedure to just "pass" the subject. Units that have more elaborate syllabus have less marks allocated and less marks are allocated were practical work is to be learnt.

4. Very small or negligible counseling for subject selection:

It is an important factor that students must be counseled to select the subject that they like or are interested in. What happens on ground is that students select subjects that their friends select (or have selected) so as to keep company or based on the parental suggestions which, in most cases, is not survey oriented but sometimes a guess or good sounding subject, the result is disinterest and disconnection of the subject in students. Wrong subject selection further leads to depression followed by failures to cope up with the subject and finally failure in the subject. Due to lack of subject counseling at Higher Secondary level, students are left all alone and in most of the cases the parents of the students are also not able to provide proper guidance and counseling. Students study Computer Science in class 11th but soon after joining in class 12th, a majority of them change (or try to) the subject to other subjects as they do not feel comfortable with the subject keeping in view the crucial 12th class exam.

5. Disinterest in students:

Since for the class 11th student Computer Science is a new subject, students (usually in rural areas) start using and learning about computer system for the first times in their life so they are very excited. But this excitement does not last long, when they start studying the "extra stretched out" syllabus, it comes as a large burden. It needs consistency in studies, regular class work, regular home work and practical work. Very soon the students realize that it is not everybody's cup of coffee. They are not able to anticipate the advantages of the subject at this level and *feel* that their colleagues (those who have not opted for Computer Science) are fortunate, as they are able to enjoy more and put less effort in studies, can skip class and have to do less home work at home.

6. Science Vs Non-Science Students

Students who opt (or are forced to opt) for science know in advance that they have to study for extra hours and put in more effort and time for their core subjects. They (Science students) take it as a simple and unimportant subject and try to run away in the first instance and those who take it as subject,

pay least attention towards the subject and concentrate more on core subjects as their primary focus is on MBBS, Engineering and other professional/engineering courses. These students study it at the end of the year just to pass and overcome the problem. Though some of the students do put in good effort and time to learn Computer Science, but the number of such students is very small. These students try to learn the basics of Information technology that they may need in future or may choose Computer Science/Computer Engineering as their career. The Students studying Arts consider it as a difficult subject (a pre-conceived notion). These students choose arts subjects that they think are most easy to learn/study and will fetch them good marks to pass in the examinations; their objective is to simply choose a simple optional (subject) alternative optional subjects.

7. Homework/Assignments

Most of the students do not study at home. Even if home work is to only *study* at home, most of them do not do it at all. Science students put more effort in core subjects and take optional subject as for granted, while arts students do not bother about the assignment/self study at all. Even repeated attempts by teacher to make students study at home, proves ineffective.

Assignments are taken very lightly and usually not done at all. Though some students complete the given assignments but most of the students either copy from their friends/colleagues notes (readymade and effortless copying) or do not complete the assignments at all.

8. Infrastructure

The infrastructure in most of the schools is either not sufficient or not in proper state. The Student-Computer ratio and other lab facilities are not up to the mark. One computer is shared by many students at a time and the students get very small amount of time for practical work on computer. The students are divided in groups for conduct of practical work, and each group do the practical work according to time table and if some students miss one or more lab class, he/she is not able to cope it up in the next class.

Students are not able to see the components of the computer practically. The look and feel of various components remains imaginary in the minds of students. How CPU, RAM, BUS, Motherboard, Hard disk etc look like, what is inside a floppy disk, how is data stored in CD/DVD, pen drives, hard disks, external drives ; All this usually remains as theoretical concepts in the mind of most of the students.

9. Time table

Students studying various streams and various subjects need to be accommodated in a common slot for optional subject class and that is usually the class towards the end of the day, when students are exhausted and drained out. It also plays a negative role on the understanding and learning aspect of the students and enthusiasm of the teacher also. So the students try to look for easier alternative optional subjects that do not require much effort and time. They select those subjects that feel are easy and can be studied by them at home also. For students belonging to rural areas and the schools located in rural areas, the students lack exposure to use and utilities of computers in day-to-day life. They lack the exposure to present day knowledge base available on the internet through the use of computers. Places where news papers reach in afternoons, motivating people to study and use computers, is an uphill task. Non-availability or non-functionality of Community Centers, Internet Facility Centers and other online/computer based establishments keep the people unaware of the present day happenings and activities that can be accomplished with the help of computers and information technology. There is lack of knowledge and awareness of the fact that, the affairs that used to take a lot of time and effort manually can be handled easily, effectively and precisely, in the least possible time with the help of a computer system and internet facility.

All the factors above has lead to Decreasing trend in study of Computer Science as subject at Higher Secondary School level and the trend seems to be weakening with every coming year. Disinterest among students and lack of proper counseling and encouragement has led to the declining (or less growth) of the subject.

Possible Recommendations / Suggestions

It is very well said that “Just getting a good idea is sometime more than enough”. The rapid and widespread use of computers and information technology has generated a need for highly trained manpower/workforce, proficient in various computer based jobs and functions. These computer specialists include computer scientists, database administrators, network systems analysts and data communication analysts. Database administrators work with database management systems (DBMS) software and determine ways to organize, manipulate and store data. With the Internet and electronic business generating large volumes of data, there is a growing need to be able to store, manage, manipulate (process) and extract data effectively. With the growing volume of sensitive data and the increasing interconnectivity of computer networks, database security, data integrity and backup systems have become increasingly important. Network systems and data communications analysts, also referred to as network architects; design, test, and evaluate systems such as local area networks (LANs), Wide Area Networks (WANs), Intranets, the Internet and other data communications systems. Systems are configured in many ways and can range from a connection between two offices in the same building to globally distributed networks and e-mail systems of a multinational organization.

Computer engineers are the ones that develop the security algorithms that allow us to transmit data (text, audio, video, pictures etc) in a relatively secure manner over the internet, miles across countries, around the world. Computer scientists are the ones that created the algorithms that let search engines search the web and then process their data to look for key words and give you up-to-date results quickly. Computer scientists are the ones that designed modern relational database systems that can very quickly give you the data you want. Computer scientists are the ones that invented the protocols (eg: TCP/IP) that allows us to connect to web servers and get the requested data. Computer scientists are the ones that invented the web languages and scripts that we run on our computers.

As discussed above, there is an emerging and vast field of computer science in present world and the future as well. The things that need to be considered at this (School education) level may lead to development of improved and bright manpower that will lead all the fields in near future, provided proper care and development methods are introduced and considered.

1. Improve the syllabus and course structure

The most important change that should be considered and accomplished is changing the syllabus to present day needs. The most basic purpose of syllabus is to communicate the goals, organizational policies, expectations and requirements to students; i.e the course design should be highly sophisticated and innovative. The syllabus and courses are designed to ensure an appropriate balance between different aspects of learning. It should be ensured that the curriculum that is offered and the facility that is provided is the best that serves our students in the school and after the school as well.

The curriculum should integrate all the domains of child developments and design such that the designer(s) should:

- Be relevant, meaningful and based on prior experiences allowing children to make connection.
- Allow students to be active learners

- Integrate across content area and be based on each student's individual development.
- Be challenging, yet achievable with sufficient teacher guidance and support.

2. Subject Counselling

Counselling can be immensely beneficial for many people in a wide variety of situations including helping people to cope with depression and anxiety, difficulties and educational dilemmas. One of the major challenges associated with career counseling is encouraging participants to engage with it. At the same time, policy makers agree that the competence of career counselors is one of the most important factors in ensuring that people receive high quality support in dealing with their career questions. Proper counseling of the subject and its advantages, usage in present world and job avenues and how computers and Information technology has helped in overcoming limitations of time, space and communication.

3. Engage students / ensure participation

Motivating students to participate in classroom discussions is a subject unto itself. There are some students who seem to assume that as long as the assigned work is completed on time, test scores are good, and attendance is satisfactory, they shouldn't be forced to participate. It's not that they don't think participation improves the classroom experience, they just prefer that other students do the participating. Of course we all have a few over-participators who are eager to volunteer every answer (sometimes to the point of dominating the discussion, which creates its own problems for Teachers and fellow students alike) but a good number of students prefer to listen, observe, or daydream rather than engage in the class discussion. Whether they're shy, unprepared, or simply reluctant to share their ideas, getting students to participate is a constant struggle.

4. Develop/restore infrastructure at school / community / business level

The infrastructure at various levels should be developed and improved so that students get more exposure to use and benefits of computers in present day world. In schools, students get a very small amount of time to work on computers in schools, so encouragement of Community centers in rural areas and other online facilities should be encouraged.

5. Scientific methods of teaching and Active learning

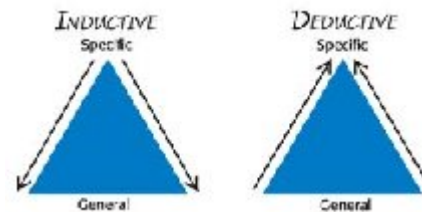
The *scientific method* is a great tool for scientific discovery and for coming up with sound scientific conclusions. The focus of curriculum should be to enable each child to think, reason and act independently with confidence and at the same time develop a readiness for formal academic skills.

This gives all higher education providers a shared starting point for setting, describing and assuring the academic standards of their education programmers' and the quality of the learning opportunities they provide.

5.1. The scientific methods of teaching-learning involve:

- Define the problem.
- Observe/Gather data
- Think about it/Predict.

Figure 01: Scientific Method of learning



- iv. Experimenting
- v. Forming conclusions.

Learning through Inquiry

Educators generally agree that children learn best by doing. It is puzzling, that this awareness is only rarely translated into classroom instruction methods.

5.2. Active learning

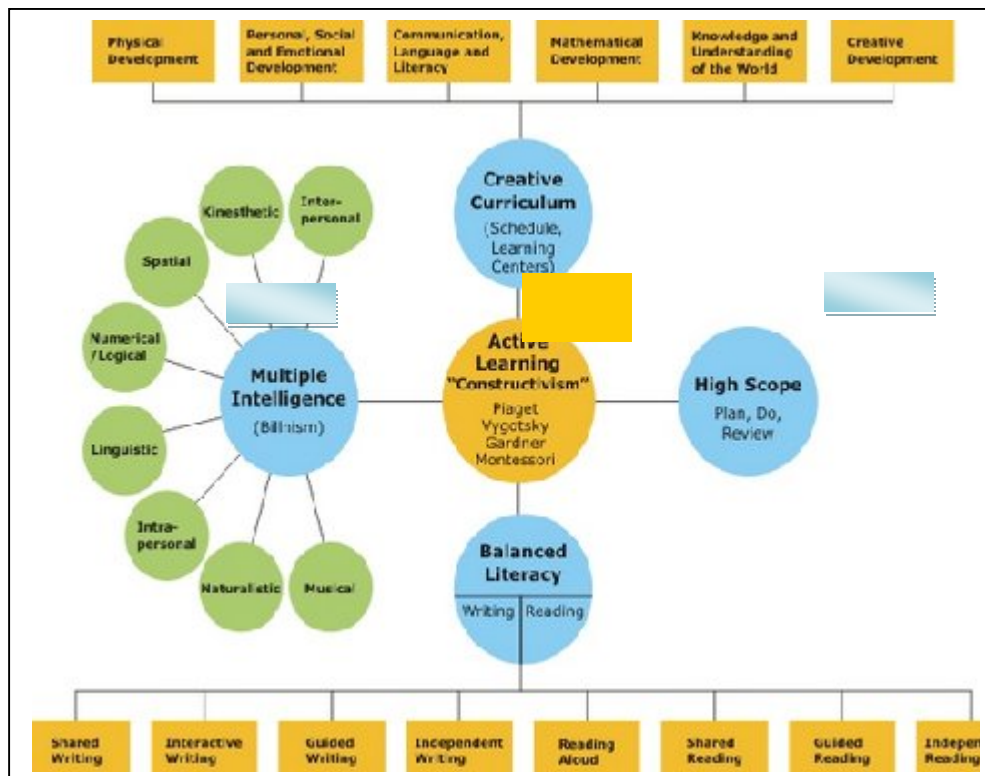
Defining “*active learning*” is a bit problematic. The term means different thing to different people, while for some the very concept is redundant since it is impossible to learn anything passively. We might think of active learning as an approach to give instructions in which students get engaged, the material they study through reading, writing, listening, and reflecting. Active learning stands in contrast to “standard” modes of instruction in which teachers do most of the talking and students are passive.

A large number of researches have made it clear, that the overall quality of teaching and learning is improved when students have ample opportunities to clarify, question, apply and consolidate new knowledge. In this case, instructors create opportunities for students to engage new material, serving as guides to help them understand and apply information. They help “light the lamp” of student learning. Active learning is experiential, mindful and engaging. We begin by defining the content (what to study) and establishing the objectives (what to learn), followed by reading and teaching. Then build a foundation of activities that can help learn and communicate what we have learned. Students and their learning needs are at the center of active learning. There are any number of teaching strategies that can be employed to actively engage students in the learning process, including group discussions, problem solving, case studies, role plays, journal writing, and structured learning groups.

5.2.1. Basic Elements of Active Learning

There are four basic activities through which all students learn; and specific active learning strategies use one or more of these elements. These four activities include Talking and Listening, Writing, Reading and Reflecting.





We need more (and perhaps more frequent) professional development opportunities for teachers. The more we share ideas about “what works” so that, as a community, we can improve the state of Computer Science as a subject at all levels of studies. Art of “**Learning about Learning**” should be emphasized. Use of **Multimedia** progressively more for **Learning and for Content Creation** should be promoted. Most teachers are using multimedia for teaching-learning to engage students in a more interactive and proactive manner. Facilities for online and projected content classes should be promoted to encourage better understanding among students and developing interest among students by interactive class. These are great opportunities to mix programming, media and other areas of study.

Encouragement and Accomplishment

Recognition of hard work and authentic accomplishment is the characteristic of an effort-based school. If we expect students to put forth and maintain high levels of effort, we need to encourage and motivate them by regularly recognizing their accomplishments and achievements. Recognition of accomplishment can be tied to an opportunity to participate in events that matter to students and their families, like symposiums, debates, house performances and other co-curricular activities. Writing a program in different ways, class presentations, self study and performance in tests must be accredited and acknowledged. This can develop sense of competition amongst the students that can help in developing the concept of research and exploring among students.

Conclusions

Computers play an important role in the lives of most of us today, whether we realize it or not. Some people, however, are beginning to ask if we really need them. Teachers seeking information about the nature and standards of work/study to be done in a particular subject or subject area is just a click away. Most of the intellectuals feel that computers have become a necessary part of modern life. The use of computers can save a lot of storage space. Storing data and information on computers' disks is one of the most efficient ways of permanently storing data for long periods of time. One computer disk can hold the amount of information that is contained in several books. Furthermore, computers save everyone a lot of valuable time and energy. Any information can be found at the touch of a button, whereas searching for it manually in books and other media takes much longer. Our everyday lives are made easier - from going to the bank to shopping and communication. Using a computer, we can make purchases, prepare documents, presentations, inventory details or just chat with friends, everything is easily possible with the help of computers and Information Technology. The time saved by using computers for repetitive tasks enables us to use our own time more creatively and productively. Computers have changed our lives for the better and there is no reason why we should not make them work for our advantage. We are able to carry out complicated mathematical calculations that are used by scientists to predict weather, assist in manipulating large volumes of data required in the field of research and development. Computers navigate the modern planes and ships, and such navigation is used in modern GPS devices that can identify the exact location of the car and make a route to any point in the world. The system structure of teaching-learning process should be designed such that we achieve or at least concentrate more on the following:

1. Syllabus should be Student centric with focus on the level at which the students are studying;
2. Develop interest among students with more stress on practical work.
3. More detail about learning basics of computers like devices, usage of basic software packages like Ms Office package in detail, CPU, basics of Operating systems etc.
4. To show how this course fits into a broader context ("the big picture") in the modern world. i.e, the use of internet, e-commerce, online shopping, online banking system and mailing systems is stressed upon. So we should **"Discuss the Big Picture" and Introduce Systems Thinking.**
5. To help students assess their readiness for the course by identifying prerequisite areas of understanding and their practical value.
6. Course requirements should be made clear. What a student is supposed to do in the course: regular attendance, home work, self study/analysis, participation, assignments, exams, projects and performances.
7. The course objective should be to develop Skills and attain knowledge that students must gain.
8. It is important on part of a teacher to consider whom they are teaching, taking into account the level of understanding of students, prior knowledge about the subject, Intellectual development and Interest in the subject.
9. Assignments should be an integral part of the curriculum so that the student is engaged in self study, research and self expression. Daily assignments help extend their knowledge and augment the understanding needed to complete a particular project
10. Units should be designed in such a way that the things should flow in a sequence in a related and appropriate manner. Basic (Simpler) things first followed by relatively complex and related to prior topics. The goal should be to make things explain in a systematic and strategic manner.

11. The project work should be taken up that includes almost all the concepts covered in the syllabus. So that the practical use of the topics studied by the students takes a shape in the form of a functional module. The final project represents a culmination of their studied knowledge combined with new knowledge of integration and assimilation and provides an opportunity to expand their understandings to a next higher level that may be required in the next higher class/course etc.
12. Brief introduction about the uses of computers should be included in other non-computer science courses also. These include the concepts like :
 - i. Data Communication
 - ii. Mobile Computing
 - iii. Parallel computing
 - iv. E-Technologies
 - a. Electronic Commerce :
 - b. Electronic Payment System
 - c. Electronic Data Interchange (EDI)
 - d. Data Warehousing and Mining

Computer science is expected to become more interdisciplinary than it already is, in the sense that other disciplines will use it more and more. There are many areas and a lot of them are represented here in the schools where computer science has had a very significant impact and very significant role. There is a lot of use for computer science in other disciplines and more and more of sciences and subjects are being brought into the span of computer science because it plays a bigger role. A study has considered the future of science, and in particular the role and impact of computing and computer science on other sciences. The study concluded with the finding that that computer science concepts and tools in science form a third, and vital component of enabling a 'golden triangle' to be formed with novel mathematical and statistical techniques in science, and scientific computing platforms and applications integrated into experimental and theoretical science. A scientific revolution is just beginning. It has the potential to create an era of science-based innovation that could completely eclipse the last half century of technology-based innovation; and with it, a new wave of global social, technological and economic growth. The basis for this revolution is the emergence of new conceptual and technological tools from computer science – tools which are already proving their potential to have a profound impact on science. This combination is likely to accelerate key breakthroughs in science and benefits to society, from understanding biology and revolutionizing medicine and healthcare, and from understanding the universe to the origin of life, and understanding and helping to protect the life-support systems of Earth on which we all depend for our survival. I distinguish computer science from computing. Computers have played an increasingly important role in science for 50-years, and in particular the past decade and a half, and will continue to do so. One of the purposes of the report is to help inform and generate discussion about the future of Computer science in the science community. If it helps to generate debate, dissent, ideas, better thought out arguments or indeed direction.

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