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Changing Scenario of Physics with the Introduction of Computers Science

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Abstract: ***Physics a science of nature and natural phenomenon, started with study of matter and energy. Generally considered as a difficult branch of science has revolutionized the scientific approach in the world with relation to its applications. Recent technological revolutions and incredibly fast development of physics has heralded the inventions and as a result has alleviated its dimensions. In this paper we have tried to explain how introduction of computers has revolutionized the physical science with having broad applications in terms of investigation and analysis. The computers have played a key role in physics and other branches of science, and is being considered as centre to modern scientific research which requires not just domain experts such as physical and environmental researchers etc, but also people with deep knowledge of computer technology who are able to develop algorithms and complex applications to facilitate scientific research by highlighting how computers are playing the key role in scientific advancements with having many opportunities that are available for those interesting in applying expertise in different ways that are deeply meaningful to humanity. Based on the review we have tried to summarize the effective approaches of computer simulations in physics education, together with the discussion of implications for future research in the field.***

Keywords: Physics, Computers, Nanoscience, Environmental Science, Education

1. Introduction

Physics is a vary vast subject encompasses the large and the small, the old and the new.From the atom to galaxies, electrical circuitry to aerodynamics, there are various levels through which we can understand Physics. At the school level the concept of the subject are understood a bit easily because the first language gives it a fundamental touch. But with the advancement of mathematical cources in physics, the understanding of physics becomes easy and faster and the subject becomes excited and more interested by solving difficult problems. Computational science is interdisciplinary field which combines science, computer science (CS) and applied mathematics, which has been established to understand and develop easy scientific models [1].The science and engineering fields has witnessed extraordinary advances in last two decads, that were fuelled and have shown dramatic increases in the power and pervasiveness of computers and communications. The modern research have capitalized techniques of modern computers that let us better understand systems with ever-increasing complexity and realism, which include climate modeling [2], material development [3], engine and vehicle design [4], quark structure of elementary particles [5], drug development[6], astronomy [7], non-linear dynamics and chaotic behavior [8], biodiversity, finance, and the mining of huge data sets such as the virtual humans and the digital sky observatories [9]. The success of this approach has led to the proposal that computational science be taught in secondary schools to expose students to this scientific method, and will acquire knowledge and strategies to solve complex problems. A number of computational environments are used for teaching computational science (e.g., EJS, VPython);each has its own unique features and which are having great advances on student learning effects. By working cooperatively to facilitate the result oriented investigations in physics, scientists and engineers are using computers for accuracy and time bound results, because in recent years use of computers has become an indispensable tool for education and research.

2. Applications of Computer Science in Science Teachings

The traditional teaching of science tends to focus on theory. The emergent computational tools and new developments in learning theories have contributed lot to change education, however the results are still far from the best intial expectations. By implementing the computer science education offers an understanding of science through the computer applications of mathematical models. The teaching of science via the method of inquiry in which the computer serve as virtual laboratory which simulates nature and presents the facts with clearification and visualization rather than to memorise individual objects [10], [11], [12], [13], [14], which complements the traditional teaching of science and mathematics. Many difficult science and mathematics concepts have became easily accessible. In addition, Computer science has enriched the science curriculum by extending the examples used in education to include problems that may not have analytic solutions, by extending the range of problems open to study.

In modern education it is assumed that via learner-centered or constructivist teaching the students learn better, when they are actively interacting with, rather than just receiving, knowledge. The computer based teaching is considered as both projectand team-based teaching as well as learner-based and supportive of authentic learning teaching and with success, this type of teaching combination confirms that of elements can be transformed uninvolved, at-risk students into active and invested learners, because it has developed

around the need to incorporate computation into modern scientific problem solving. The computer education has developed the need to incorporate computation into modern scientific problem solving and its findings to computer-based solution, which have been extend to theoretical and experimental efforts by having common applications in bothe by impliminting in various areas such as physics, chemistry, biology, earth sciences, business, and finance. The interactive computer enviorment may indeed help the students and researchers to correc is non scientific preconceptions. These type of concepts are usually naïve but extremely persistent and becomes richer if they have some characteristics of a play [15]. Starting with the basic nature of electric field, the forces involved and the results thereof, the use of computers has been beneficial. Electric field hockey app can be quoted as an example. One can easily know the effect of force, nature of force, role of distance etc by graphics displayed on the monitor. Likewise wave theory which involves nature of wave, superposition of wave, wave velocity, frequency , interface, polarization, diffraction etc can be well understood and investigated by using interactive physics software. The working of diffraction grating can easily be understood by the use of computers. The use of multimedia CD-ROM Cartoon guides to Physics has increased the number of physics learners many fold at different levels. It may be noted here that teaching of physics is JAVA-based has explored the need of computers in mathematical Physics, Mechanical oscillators, etc by the use of differential equation, vectors, and matricies facilities by using the concerned software in computers so that results are desired accurately. [16], [17], [18], [19].

3. Applications of Computer Science in Research

Today numerous equipments involved in the investigations are computer based, thus making it equally important. The computational science denotes the multidisciplinary combination of computational techniques, tools, and knowledge needed to solve modern scientific and engineering problems. The CSE denotes science or engineering that uses computer simulations as its basis, which sometimes denotes the research and development of computational skills and tools needed for applications. In modern research the most scientific disciplines appear to be benefiting from computer modeling, analysis, and visualization with having widespread of importance in computation which has shifted the paradigm of scientific research to include simulation, along with experiment and theory, as a fundamental technique of science [20]. The simulation and visualization have allowed us to acquire insights into real-life problems which are too complex or difficult to study analytically, or too expensive, big, small, or dangerous to access experimentally.

The scientists have incorporated computation into their work, by adding the value of CSE to the scientific community increases to by permitting other scientists to pursue their interests in science without to spend much time in developing algorithms and codes. The working groups are focusing on identifying, studying, and improving computational methods and software components that are having many common applications on testing the performance of the related software on various hardware platforms.

The other main applications of computer science in research is the development of mathematical Libraries, which are playing a main role in the subroutines for linear algebra, special functions, and other mathematical techniques. The various subroutines of mathamatics in CSE programs have solved various large-scale computer calculations, which is the interests of the CSE community to look after the accuracy, portability, performance, robustness,, and scalability of these libraries as they are ported to different high-performance computing architectures. These type of accomplishments have aided the progress in research made with supercomputers which have made phenomenal increases in desktop computing power with having wider uses [1].

In addition to the mathematical subroutine libraries, the computer science has developed and promoted simulation techniques with having widespread applicability in various fields. Like wise the computational technique known as “particle dynamics” in which individual particles are created and their paths are followed in time using the appropriate equations of motion [21]. These type of techniques are also used to simulate processes as diverse as the settling of sand particles in a tank, the creation of stars and planets, the motion of molecules in gases and liquids, the growth of thin films, the dynamics of droplets in engines, and the motion of ash particles in industrial burners. The techniques clearly educating its practitioners on how to use it better, for the benefit of science. The growing volume of computer science techniques in physics and associated software libraries represents a priceless wealth of tools and knowledge in modern advanced research and science. Modern research associated with physics is heavy reliance upon computer science community, and we expect that reliance will grow more in future. For these reasons, we need education in computer science to pass this wealth on to future generations of scientists and engineers.

The physics is an experimental science and the computer has already found a place in physics laboratory. The richness in computer based labs and associated modeling tools are are having major impact in teachings and learning of physics. In computer based learning and teaching of physics, the students at every level are having oppurtinity to do real physics experiments and participate fully in learning new facts about the natural science and hands of participation provides strong motivation and accuracy in understanding of science as compared with scienece education in which students only learn about science. Researchers have found that the pictures, equations and other types of representation available to students in sense-making situations can substantly impact in their discussions and thinking [22], [23]. The particular representations of tables and diagrams sparks new ideas or enable evalvations of current ideas which is playing crucial on understandings[24]. Thus it is important to understand how particular computer software and pedological structures are support interactions that leads to meaning learning and teachings. Visualized three dimensional scenarios virtual reality is a powerful visualization tool to handle 3D-Problematic situations. It

consists of a series of virtual words designed to aid students in mastering challenging concepts in physics. On the basis of theoretical concepts, the investigation in satellite remote sensing has become totally dependent on computers. Using sensors for the study of biophysical feature that occur on terrestrial and marine environments. The detailed analysis and monitoring various events like volcanic eruption, wild fires, floods, formation reduction of glaciers, besides the knowledge of wild life is all is the result of computers introduction in this field too. In addition the energy and motion also resource which only recently comes in to focus can be investigated further. For example magnesia modules found on the ocean floor and containing copper, nickel and other transition metals and the asteroids in near earth velocity space and possibly contain large volume recourses of Iron, Nickel, Copper, Platinum and gold metal could appear as energy sources, the credit goes to computer application with subject [25], [26], [27].

The concept of Geo-Stationary Satellite was proposed by Arthur C Clerk in 1945 and it was only in 1957 October, that Sputnik-1of erstwhile USSR provided the pictorial scene of universe .Since then continuous investigation about the outer space continued throughout the world as result of which moon was conquered and now Mars is the second step whether monitoring knowledge, detailed outer space investigation of other planets is going on well with the help of geostationary satellites. The process of sending different satellites of outer space is totally dependent on the computers, even the space shelters have the maximum use of computer based equipments so for outer space investigations computers behave as life line.
In the field of Astrophysics the use of computers is in evitable because the working of geostationary stations and the satellites is totally dependent on computer application. The instruments like Spin –stabilizer, two way ILNB, Trommel Screen Cup Anemometer/Windmill Anemometer, Transponders ,the different gauges and terrestrial networks (VSAT) all are computer connected to meet the requirements of geostationary stations. Calculation of orbital and escape velocity of different satellites is monitored and controlled by the computers. The functioning of different satellites in a circular orbit 35786 KM above the earth's equator is monitored by the computers.[29], [30].

4. Conclusion

The computers science education have revolutionised the education system by tending to focus on a common tool set of subjects, by proveing themselves useful in solving problems in a number of disciplines. Different subjects are getting coverage in different courses taught by traditional departments but in this paper we have stressed upon changing scnerio of different subjects like physics biology, chemistry etc with the use of computers by facilitating the knowledge construction in collubrative enviorment. The multidisciplinary nature of computational science and engineering (CSE) and its relation to other disciplines has been highlighted with having vast applications in different fields. The computers are playing important role in science education and in research. The wast application of computers in research by highlighting how computers are playing the key role in scientific advancements in different aspects like Physics, Mathematics, Geostalites, Astrophsics etc with having revolunised the scientic world by solving different problems in different ways that are deeply meaningful to humanity. We tried to summarize the effective approaches of computer simulations in physics education, together with the discussion of implications in future research.

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