Chapter I
INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Education plays a very important role for society. It is an essential element for the civilization of the society. Not only does it help us develop a healthy atmosphere around us, but also brings forth an advanced community. As a matter of fact, everything that we have created today is based on the knowledge that we have obtained throughout our life by means of education. This has assisted scientists in inventing equipment and devices, which has resulted in the advancement of technology today. The more developed the society becomes, the more necessary education is for everyone in the society.

Education is absolutely beneficial for society on the whole. However, we need an education system that may eradicate illiteracy and may provide the layman an access not only to basic education but also to higher and technical education (Jayson de Lemon, 2014). The nature of knowledge is not an object, but a series of flows; it is a process, not a product. The idea of acquiring knowledge, as a series of truths, is obsolete (Downes, 2009). Education can be defined as the process of facilitating learning or the acquisition of knowledge, skills, values, beliefs, and habits. Education frequently takes place under the guidance of educators, but learners may also educate themselves (Dewey, 1944).

In this era of technology and science; process of learning is changed a lot over time. From blackboard to smart boards, from notebooks to tablets, from computers to laptops etc. technology and science is everywhere. Information and Communication Technology is an inevitable part of most of the institution these days (Zhang & Aikman, 2007). Integration of Information Communication and Technology (ICT) in education refers to the use of computer-based communication that incorporates into daily classroom instructional process. In conjunction with preparing students for the current digital era, teachers are seen as the key players in using ICT in their daily classrooms. This is due to the capability of ICT in providing dynamic and proactive teaching-learning environment.

The importance of ICT in teaching and learning is to create a massive improvement in the educational sector. The use of ICT has the potential to enrich understanding of the changing nature of teaching and learning to an increasingly high technology dedicate environment (Brugnes, 2012). Information and Communication Technology has the potential to innovate,

accurate, enrich, deepen skill, to motivate and engage students to help relate school experience to practical works, create economic viability, for tomorrow's workers as well as strengthening teaching and help school changes (Yusuf, 2005). The integration of ICT into teaching and learning has greatly influence teaching strategies, instructional and learning outcomes.

ICT (Information and Communication Technologies) are defined as all devices, tools, content, resources, forums, and services, digital and those that can be converted into or delivered through digital forms, which can be deployed for realizing the goals of teaching learning, enhancing access to and reach of resources, building of capacities, as well as management of the educational system. The integration of Information and Communication Technology (ICT) in education has provided more variation in the process of teaching and learning. The function of ICT in systematic teaching and learning in Physics is to achieve the objectives of teaching and learning science at secondary level. i.e. at the secondary stage the students should be engaged in learning science as a composite discipline, in working with hands and tools to design more advanced technological modules than at the upper primary stage, and in activities and analysis on issues surrounding environment and health. Systematic experimentation as a tool to discover/verify theoretical principles, and working on locally significant projects involving science and technology are to be important parts of the curriculum at this stage.

Information and Communication Technology (ICT) provide an array of powerful tools that may help in transforming the present isolated, teacher-centered and text-bound classrooms into rich, student-focused, interactive classrooms. To meet these challenges, schools must embrace the new technologies and appropriate new ICT tools for learning. They must also move toward the goal of transforming the traditional paradigm of learning. Now information and communication technology is popularly used in educational field for making teaching learning process successful and interesting for students and teacher both. In 1998, UNESCO World Education report refers that student and teachers must have sufficient access to improve digital technology and the internet in their classroom, schools, teacher educational institutions. Teachers must have the knowledge and skills to use new digital tools to help all students achieve high academic standard. According to UNESCO (2002) "ICT is a scientific, technological and engineering discipline and management technique used in handling information, its application and association with social, economic and cultural matters". Educational systems around the world are under increasing

pressure to use the new information and communication technologies (ICTs) to teach students the knowledge and skills they need in the 21st century. The 1998 UNESCO World Education Report, Teachers and Teaching in a Changing World, describes the radical implications of the new information and communication technologies for conventional teaching and learning. It predicts the transformation of the teaching-learning process and the way teachers and learners gain access to knowledge and information.

In this age of Information and Communication Technology (ICT), there is growing concern for the use of ICT resources such as the computer, scanner, printer, Intranet, Internet, e-mail, videophone systems, teleconferencing devices, wireless application protocols (WAP), radio and microwaves, television and satellites, multimedia computer and multimedia projector in curriculum implementation. In e-learning, curriculum content in the form of texts, visuals, e.g. pictures, posters, videos, audio/sound, multicolour images, maps, and graphics, can be simultaneously presented online to students in both immediate locations (classroom model of e-learning) and various geographical distances (Distance Education model of e-learning).

It is strongly agreed that information and communication technology have a huge impact on education and society. With the advancement in ICT, it is easier to share the information or to connect with the people across the globe. Recently, the enhancement of student teacher interaction with ICT in the classroom has been recognized. The emergence of information and communication technology (ICT) in school is invincible. ICT covers all aspects of education, leading to the formation of new knowledge and networks of teachers, promoting the development of new methods and approaches to teaching. It is considered as an important instrument that can transfer the current isolated, teacher-centered and book-centered learning environment into a student-centered environment. It can be achieved by the use of technological advances such as video-conferencing, online forums, blogging tools etc. and putting teachers and students in contact with each other on global scale.

We the human beings uses the technology to access, communicate, share and support their learning in many different ways. In schools too, we are using our own technology system, websites and internet or virtual learning environment to make learning resources available online at any time. It has become essential need in educational institutions for learning and teaching in the present day of digital Era. The learners are using, accessing, capturing the important things

like video lectures, digital notes through electronic gadgets and teachers, researchers uploading their article, class lectures, videos through ICT tools and techniques. Educational institutions are also adopting the tools for better teaching, management and administration in the schools and campuses.

1.2   EDUCATIONAL TECHNOLOGY

In terms of terminology and structural composition, Educational Technology is the combination of two words namely education and technology. Technology as a subject has its own sole concern with the task identifying the most suitable, appropriate and developed technology for serving educational needs and purposes of the students and the society at a particular time and place. There has been a continuous shift in nature of use of technologies mean and measures for improving the process and product of education depending upon the type of excellence attained by members of society and communities all over the world in terms of scientific, philosophical, psychological and technological progress and advances in educational fields and also in other fields.

In teaching learning process, both teachers and students use many instructional materials like books, notes, chalkboard, pictures, chart, models, maps, diagrams and other graphic materials. But later on, with the industrial development and technical advancement, sophisticated scientific instruments, mass media and educational material were used. So, it brought the sophisticated hardware and software such as radio, television, tape recorder, films, transparency etc. in field of educational system. But after that development there is another concept of programmed instruction and theories added to another dimension educational technology which is again broadened when the new approaches in the form of system approach, microteaching, interaction, analysis and computer assisted instruction come into existence.

1.2.1   DEFINITION AND MEANING OF EDUCATIONAL TECHNOLOGY

According to the Association for Educational Communications and Technology (AECT), "Educational technology (ET) is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological process and resources". The definition contains four components-

1. First the focus is on "study and ethical practice". This immediately moves the definition beyond ET being only a tool. There is a tool component given later in the definition. But this is de-emphasized and incorporated as only one component of a technological system. This clearly indicates that educational technology is not a tool: it is a study and practice. Not only that, it is, by definition, an ethical practice.

2. Second, the component related to *purpose* of educational technology- it is for "facilitating learning and improving performance". These twin purposes reflect why we focus on technology. The present definition puts learning and performance at the forefront of our field of study and practice.

3. Third, this part of the definition tells us *how* we do this: "by creating, using and managing". In the twenty-first century, these three key words become far more subtle than at first glance. It also focuses on a systematic way of creating, using and managing the different processes. Traditionally these tasks related to three different kinds of people - a professional writer, director, artist, etc. was the creator; the teacher was the manager of instruction; the student or learner was the end user. But today this clear differentiation may not clearly exist and the tasks are converging as technologies converge. For example, anyone can produce a video for YouTube; everyone is their own editor; and the role of teacher as manager is on the verge of being replaced by teacher as designer and facilitator of learning and the end user could also be involved in creation and management.

4. Fourth, this part of the definition tells us *what* we work with: technological processes and resources. Here is where the common tools definition fits comfortably as resources. It is almost as if the tools concept just barely makes it into the definition at the very end. This definition emphasizes that "educational" should be of the main focus of what we do, and "technology" as a secondary focus on technological processes and resources.

This definition of 'educational technology' indicates that emphasis on 'facilitating learning and improving performance via technological processes and resources', versus 'products or tools', is vital to understanding the educational part of the definition. Distinct from computer scientists or engineers, most educators are not in the business of designing or inventing the hardware, cables and connectors. The concern and pre-occupation of educators constitute:

1. Selecting and evaluating technological processes and resources.

2. Creating environments to facilitate learning.

3. Designing learning experiences.

4. Assessing learners and evaluating the quality of performances.

In short, educational technologists are interested in creating and evaluating learning and performances that are more effective or efficient because of the technological processes and resources. Further, educators are interested in creating, adopting and managing new, novel an innovative learning experiences that only become possible because of technological processes and resources. (Hlynka, D and Jacobsen, M 2009)

1.2.2 TECHNOLOGY IN EDUCATION

Technology in education refers to the employment of technical equipment in the classroom. It mostly focuses on electrical and electronic equipment used to facilitate the teaching and learning process. The use of various pieces of equipment, materials, and machines for teaching is referred to as using "educational technology". It combines a variety of sophisticated audio-visual hardware technologies, including projectors, films, radio, television, tape recorders, teaching aids, and computer-aided instructions for both individualized and group learning. Thus, the word "technology in education" refers to a service idea, much like technology in agriculture or science in service of mankind. (Mangal, 2021)

The term "technology in education" describes the application of technological tools in the classroom. Here, more weight is given to the media utilized for carrying a message. It mostly focuses on electrical and electronic devices that aid in the teaching and learning process. This is a field that is always developing and is dependent on technical developments. Projectors, movies, television, tape recorders, teaching aids, Teletext, and computer-aided instruction are just a few of the advanced audio-visual gear, equipment, and electronic gadgets that are used for both individualized and collaborative learning. Similar to how technology has improved every part of life, using technology in education has many benefits. Technology in education can be used in a variety of ways to facilitate learning and teaching. (Jathol&Chabra, 2015)

The International Society for Technology in Education (ISTE) claims that several of the high-demand vocations of today were developed in the previous ten years. Teachers can help students

develop the abilities they'll need to succeed in their future employment as globalization and digital transformation are driven by technology breakthroughs.

What function does technology serve in the classroom? The COVID-19 pandemic is swiftly illuminating the importance of online education as a tool for teaching and learning. By incorporating technology into existing curricula rather than using it only for crisis management, teachers can use online learning as a potent teaching tool.

1.2.3 TECHNOLOGY OF EDUCATION

The active use of all the system resources of Education and Technology in Education's scientific knowledge of the learning process that each person must go through to acquire and use information is what is meant by "technology of education". It also involves choices on the educational goals to be achieved, the size of the learning groups, the order of the lessons, the teaching strategies, and the media to be used. It also covers the methodical planning, designing, production, management, and assessment of the educational process. This includes the careful application of media, persons, information, ideas, and resources. Education technology, also known as educational technology, is the incorporation of IT into the realm of the classroom. This is an ever-changing field that is dependent on technological advancements.

"Technology of education" refers to the purposeful use of items, procedures, equipment, events, and interactions in combination or separately to enhance the success of educational goals. Technology in education refers to the organized application of technological knowledge resources that each person must go through to acquire and use knowledge (Jathol, 2015). The internet has changed the way teachers can demonstrate concepts and ideas to students, making learning almost enjoyable. Today, information is encapsulated in the internet, which can be beautifully used to make learning enjoyable rather than drudgery as it once was.

1.3 DEFINITION AND MEANING OF ICT

Information and Communication Technology (ICT) may be defined as the convergence of electronics, computing, and telecommunications. It has unleashed a tidal wave of technological innovation in the collecting, storing, processing, transmission, and presentation of information that has not only transformed the information technology sector itself into a highly dynamic and expanding field of activity- creating new markets and generating new investment, income, and

jobs but also provided other sectors with more rapid and efficient mechanisms for responding to shifts in demand patterns and changes in international comparative advantage, through more efficient production processes and new and improved products and services. Today, the definition of Information and Communication Technology (ICT) is much broader, encompassing nearly every type of business. From manufacturers, retailers, banks, and publishers to research firms, medical institutions, law enforcement agencies, government companies, and libraries everywhere rely on Information and Communication Technology workers to run their daily businesses. ICT includes the Internet, wireless networks, cell phones, and other communication mediums. (Tech Terms, 2010)

Information and Communication Technology (ICT) first appeared in the mid-1980s and was defined as "All kinds of electronic systems used for broadcasting telecommunications and mediated communications," with examples including personal computers, video games, cell phones, internet, and electronic payment systems and computer S/W, etc. ICT is made of computer and communication technology. Computer technology is the tool for storing and processing information in digital form, while communication technology helps us to transfer and disseminate digital information.

Additionally, ICT means a variety of technological applications in the process and communication of information. The word ICT is a combination of two words information, communication & technology. Information means knowledge, and technology means the use of computers & communication. The term ICT can be defined as "the integration of computing, networking, and information processing technologies and their applications." Thus, ICT means a combination of computer applications and communication technology for gathering, processing, storing, and disseminating Information.

Information and Communication Technology is a common term referring to the technologies used for collecting, storing, editing, and communicating information in various formats. ICT means the use of computer-based technology and the Internet to make information and communication services available in a wide range of users. ICT is a Hardware and Software enable society to create, collect, consolidate, and communicate information in a multimedia format and for various purposes. The term ICT includes any communication device or application, encompassing radio, TV, cellular phones, computers and network, hardware and

software, satellite systems, and so on, and the various associated services and applications. ICT is playing a vital role in the current and future development of society and nation. ICT has affected all spheres of life and also the library. Information and communication technology (ICT) is a diverse set of technological tools and resources used to communicate and create, disseminate, store, and manage information.

1.4   ICT IN EDUCATION

Information and communication technology have a major role to play in forming the new worldwide economy to deliver fast changes in the society. Within the previous decade, ICT has advanced and changed at such a speed, that developing countries have not been able to catch up with the revolution and have been left behind and thus lag in their communication with the developed countries. ICT acts as the foundation stone of the contemporary world; thus, understanding this technology and its fundamental concepts is considered as part of the core of education (UNESCO, 2002). Technology has the potential to renovate the ways of instruction, where and how learning occurs and the roles of students and educators in the instructional process. ICT is transforming procedures of instructional process by contributing components of strength to learning situations involving virtual environment. It is an effective and influential instrument for providing educational opportunities; thus, it is difficult to envision future learning situations that are not bolstered by information and communication technology.

Educational institutions may utilize ICT to enrich the students with skills and knowledge for the 21st century, such that it can add to worldwide accessibility to education, educational equality, broadcasting of quality teaching learning programs, educators' professional growth and to help in obtaining a more effective educational management. In classroom teaching and learning process, the use of ICT is imperatives it gives chance to the instructors and learners to operate, store, control and retrieve data other than to promote self-regulated and active learning. ICT based learning includes an expanded propensity towards collaborative learning among learners and instructors, not just in a specific classroom. This kind of collaboration is in contrast to the conventional learning environment. The system helps instructors to plan and prepare lessons and design materials such as course content. Computers and the Internet have been touted as potentially capable means to empower the users for educational changes and improvement, by utilizing various information and resources and reviewing information from different points of

view; hence, cultivating the authenticity and actuality of learning situations. ICT helps to make complicated things simple to comprehend by simulations that once more add to real learning situations. Hence, ICT may act as a facilitator of dynamic learning and higher order thinking.

To enhance the academic performance of students, there is a need to turn from conventional teaching methods to modern teaching methods. Computer Assisted Instruction (CAI) is space and time independent making it convenient for students to go through the program either at home or on a school computer. This encourages interactivity, which individualizes content for each learner based on their needs and it provides formative feedback to multiple choice questions. CAI enhances learning rate where the learners can learn more materials given the same amount of time as compared to conventionally taught learners. Moreover, students receiving instructions through ICT retain learning better. The issue of low achievement among the learners has been tormenting the instructive framework right from the elementary classes to university level. This issue wastes human potential and facilities for education. The findings of the study will confirm the effectiveness of ICTs in teaching of Physics and predict that ICT based instruction is better than conventional teaching approach. In addition to enhanced achievement scores, the findings of the study will boost the interest and retention of the students in Physics. The findings of the study will confirm the effectiveness of ICTs in teaching of Physics and also predict that ICT based instruction is better than conventional teaching approach.

The rapid development in ICT has brought revolution in the twenty-first century and has influenced the needs of advanced societies. ICT is becoming progressively significant in education as well as in our everyday lives. The findings revealed that ICT positively affects students' academic accomplishment and retention in the subject of Physics. The media was found more compelling, effective, rewarding, and valuable in teaching of Physics at secondary level; therefore, it is suggested that teachers should employ ICT in teaching of Physics. ICT and other teachers should be taken on board in all schools on priority basis and should be given special training. It is strongly recommended that the infrastructure of the schools should be designed in such a way that ICT could be used successfully.

1.4.1 ICT EDUCATION IN INDIA

From a single channel of transmission in 1962 to over one hundred channels today, India's ICT has advanced remarkably quickly. The Satellite Instructional Television Experiment (SITE) was used in classrooms across the nation from 1974–1975. Gyan Darshan, Vyas Higher Education Channel, Eklavaya Technological Channel, and international internet communication all provide interactive multi-media, online learning. IGNOU is establishing a nationwide cooperative radio network called Gyan-Vani so that anybody who wants to learn may take use of it. (Sharma, 2011)

With a long-term plan, India is utilizing honorable incorporation of ICTs such as open source software, satellite technology, regional language interfaces, simple-to-use human-computer interfaces, digital libraries, and so on. Community service centres have been established across the country to promote e-learning (Bhattacharya & Sharma, 2007). In India, notable initiatives involving the use of ICT in education include: Indira Gandhi National Open University (IGNOU) makes use of radio, television, and the internet. The National Program on Technology Enhanced Learning is a concept similar to MIT's open courseware initiative. It includes technologies such as the internet and television and India has launched a different type of digital initiative learning platforms such as-

National Digital Library (NDL): The Indian Institute of Technology, Kharagpur created and maintains the National Digital Library application. This application is the country's leading provider of e-content, connecting the various institutional digital repositories of Indian educational and research institutions via a single platform. This program is also linked to UMNAG.

Digilocker: Digilocker is a secure cloud-based platform for storing, sharing, and verifying all documents and certificates. Digilocker is also linked with the UMANG application, allowing students to securely upload their testimonials.

National Knowledge Network (NKN): The National Knowledge Network project was created by the National Informatics Centre. This project aims to establish a strong Indian network for high-capacity and innovative multidisciplinary research that requires significant communication and computational power. The project National Knowledge Network (NKN) connects all

universities, institutions of higher learning, libraries, laboratories, health care, and agriculture. This network is extremely important in nuclear, space, and defence research.

E-PGPathsala: Information and Library Network (INFLIBNET) created E-PGPathsala for postgraduate students with financial support from the National Mission on Education through Information and Communication Technology (NME-ICT). This portal has the electronic contents of 723 articles from 70 different disciplines. E-resources for postgraduate students include 20,000 e-texts, 19000 video clips, 3200 experts, and 30,000 quizzes.

E-Granthalaya: The e-Granthalaya library management system was created by the Department of Electronics and Information Technology and the National Informatics Centre (NIC). This software provides many useful functions to library services, including active online member services, Unicode-compliant services, Web OPAC access via the Internet, and all library routine services.

Swayam: In collaboration with India's higher education agencies, such as the All-India Council for Technical Education (AICTE), the National Programme on Technology Enhanced Learning (NPTEL), the University Grants Commission (UGC), and the Consortium for Educational Communication (CEC), the Ministry of Education, Government of India, launched the SWAYAM portal of self-learning online courses.

UMANG Mobile Application: The Ministry of Electronics and Information Technology launched the Unified Mobile Application for New-Age Governance (UMANG) under the National E-Governance Division. Through a single platform, this application covered 1187 services across 158 departments in the state and central. This application also includes fields such as Education, Women and Children, Pensioners, Farmers, and Youth. This application is easily accessible via the Google Play store. (Kennedy, 2021)

India has a strong formal education system and a large proportion of young people among its billion-plus population. Education is in high demand in developing countries as education is still regarded as a luxury in India significant social, economic, and political link mobility. There are some communications, socioeconomics, linguistics, and physical abilities people who want to pursue a career in education face challenges in India. There are some disadvantages to general

education in India and around the world, such as inaccessibility of learning materials, teachers, and educational facilities, a high rate of withdrawal, and so on. (UNESCO, 2002)

1.4.2   ICT BASED TEACHING METHODS

There are many ICT tools that are being used in the field of education. Based on the functions and use of the ICT tools, they are classified as follows:

❖ **Computer Assisted Instruction**

Computers have become common in classrooms in the twenty-first century. Technology is being used to restructure many educational tasks. It is otherwise called as computer-based instruction (CBI) where the computer serves the base for an interactive and personalized or self-learning environment. The teaching material is saved in the computer and the computer takes the role of a teacher. It is a learner-centered mode of instruction wherein the learner can learn at his own pace.

❖ **Instruction through Interactive Whiteboard**

It is interactive, which is clear from the title. Students can make use of the whiteboard in an interactive method. The teacher can operate the board from her table itself. Other applications can also be used in the class in an interesting way.

❖ **Educational games**

Students can use it to refresh their minds at the start of the day or after a day's hard work. Brain teasers are well known among students which is a best example for these games.

❖ **E-books**

E-books help in access to resources outside the library. They serve as a very important source of locating learning material.

❖ **Virtual or online learning**

A virtual learning environment (VLE) is a web-based platform that is designed for the digital aspects of courses of study, usually arranged within educational institutions. VLEs in general, enable participants to arrange themselves into units, groups and roles. They facilitate activities and interactions within a course structure. They are of great help in the different stages of assessment. They provide details on participation and they are also integrated at some level with other institutional systems.

❖ **Blended learning**

Blended learning is a kind of formal education program. In this learning system, the student learns the content through instruction via digital and online media with some sort of control over time, place or pace. This can be accomplished while still attending a formal school structure, in which classroom methods are combined with computer mediated activities.

❖ **Radio-based instruction**

Radio-based instruction in a formal education setup in combination with school based educational resources and a variety of pedagogical practices is a useful method of instruction to enhance student outcomes.

❖ **TV based Instruction**

Television in the present day has been utilized successfully as a mechanism for reaching children and youth in a number of countries, especially in Latin America and China. The results of such projects have been widely discussed.

1.4.3   ADVANTAGE OF USING ICT IN EDUCATION

In education, communication process takes place between teachers, students, management and administrative personnel which requires plenty of data to be stored for retrieval as and when required, to be disseminated or transmitted in the desired format. However, ICT today is mostly focused on the use of computer technology for processing the data. In this context, advantages of ICT in education can be listed down as:

Quick access to information: Information can be accessed in seconds by connecting to the internet and surfing through Web pages.

Easy availability of updated data: Sitting at home or at any comfortable place the desired information can be accessed easily. This helps the students to learn the updated content. Teachers too can keep themselves abreast of the latest teaching learning strategies and related technologies.

Connecting Geographically dispersed regions: With the advancement of ICT, education does not remain restricted within four walls of the educational institutions. Students from different parts of the world can learn together by using online and offline resources. This would result in the enriching learning experience.

Catering to the Individual differences: ICT can contribute in catering to individual needs of the students as per their capabilities and interest. Crowded class rooms have always been a challenge for the teacher to consider the needs of every student in the class.

1.5   MEANING AND NATURE OF PHYSICS

The word "science" has been originated from a word in the Latin dictionary named "Scientia" which means "to know". Therefore, in one way, it can be said that science is nothing but to know the working of everything, from nature to machines. Under science, a category well known is nature science, which is the study of the physical world around humans. Physics, chemistry, biology, geology, all these fields lie under nature science.

A basic discipline of nature sciences is physics. Physics is also a word taken from the Latin dictionary which means nature. In Sanskrit, it is known as "Bhautiki" which is the physical world around. The definition of physics is not accurately present but it can be said that physics is the study of all basic laws of nature and their manifestation in a different phenomenon.

Physics as a whole explains the diverse physical phenomenon with respect to concepts and laws. For instance, from the falling off an apple on the ground and the law associated with it to the revolving of planets around the sun, to electromagnetism and its effects, physics defines it all. The major concept involved in physics is the use of basic approaches for bigger and complex problems, the process of solving a complex problem by breaking them into smaller parts is called reductionism. Then the act of unifying different laws is called unification.

1.5.1   SCOPE AND EXCITEMENT OF PHYSICS

The scope of physics can be majorly understood by looking at its sub-divisions. There are basically two types of studies in physics, macroscopic physics and microscopic physics. Macroscopic physics deals with phenomena on a terrestrial, astronomical scale, while microscopic physics deals with the phenomenon on an atomic, molecular, or nuclear scale. The macroscopic study is done mostly in classical physics that includes subjects like mechanics, thermodynamics, etc. The microscopic study is the study of the structure of the atom, etc. Classical physics is unable to contribute in this field and currently, quantum theory is referred for the microscopic level studies.

Therefore, it can be said that the scope of physics is really very vast. The study covers a plethora of physical quantities like length, mass, time, energy, etc. From the study of smallest quantities (ranging up to 10^{-30} or less) to the study of the quantities on an astronomical level (ranging up to 10^{20} or more).

1.5.2   BRANCHES OF PHYSICS

Physics is considered to be one of the primitive subjects and academic disciplines to be discovered. It encompasses the study of matter, its motion and behaviour along with energy and force. As a vast discipline, it intersects with many different subjects and disciplines such as bio-physics and quantum chemistry. Physics very often defines a wide range of principles and methodologies studied by other areas of science. It also suggests new areas of research for other academic fields, even mathematics and philosophy.

Physics is constituted of many interdisciplinary subjects and branches like –

- Classical Physics
- Modern Physics
- Nuclear Physics
- Atomic Physics
- Geophysics
- Biophysics
- Mechanics
- Acoustics
- Optics
- Thermodynamics
- Astrophysics
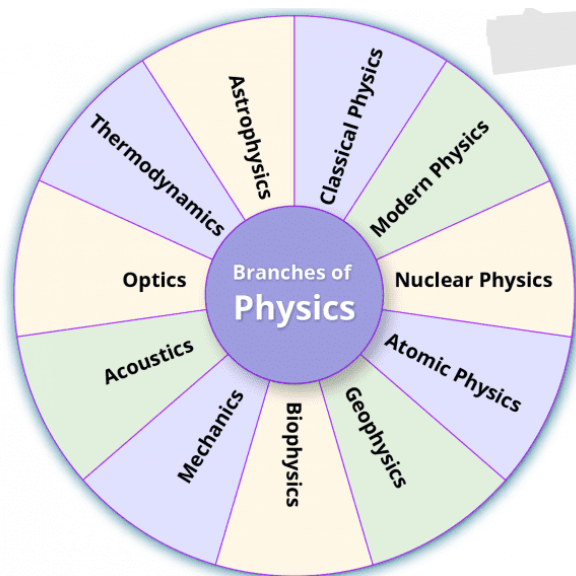
1.5.3   AIMS AND OBJECTIVES OF TEACHING PHYSICS AT SECONDARY LEVEL

Science is the outcome of human endeavour to build conceptual models to understand the world. It is a dynamic, expanding body of knowledge, covering newer domains of experience everyday. The scientific knowledge is generated through several interconnected processes such as observation, looking for regularities and patterns, making hypotheses, devising qualitative or mathematical models, deducing their consequences, verification or falsification of theories

through observations and controlled experiments and thus arriving at the principles, theories, and laws governing the physical world. Broadly speaking, these are the steps of scientific method but there is no strict order in these various steps. Sometimes, a theory may suggest a new experiment; at other times an experiment may suggest a new theoretical model. However, for a scientific theory to be acceptable, it must be verified by relevant observations and/or experiments.

Science is being taken as one of the core subjects in the secondary school curriculum. At this stage, the concepts which are beyond the direct experiences are also introduced. The abilities like abstraction and quantitative reasoning occupy a more central place, in the secondary classes than in elementary classes. While science is still an integrated subject at secondary stage, this is the time when the disciplines of physics, chemistry, and biology begin to emerge. The child should be exposed to experiences as well as modes of reasoning that are typical of these subjects while continuing to be encouraged to look at things across disciplinary boundaries.

Pedagogical process in science should facilitate learners to get engaged with various scientific processes such as observing, questioning, planning investigations, hypothesizing, collecting, analyzing and interpreting data, constructing and communicating explanations with evidences, justifying explanations, thinking critically to consider, and evaluate alternative explanation, etc. A wide range of strategies and their imaginative combinations such as activities, experiments, projects, field visits, surveys, problem solving, group discussion, debates, role plays, etc., can comprise pedagogical processes.

In a progressive society, science can play a truly liberating role helping people out of the vicious circle of poverty, ignorance, and superstition. The learner at this stage should be encouraged to reflect on the societal issues so that the learning of science becomes meaningful in social context. Therefore, participation in various curricular activities including projects that are connected with local issues and problem-solving approach using science and technology must be regarded equally important.

At this stage learners are expected to:
- develop understanding of concepts, principles, theories and laws governing the physical world, consistent with the stage of cognitive development.

- develop ability to acquire and use the methods and processes of science, such as observing, questioning, planning investigations, hypothesising, collecting, analyzing and interpreting data, communicating explanations with evidences, justifying explanations, thinking critically to consider and evaluate alternative explanation, etc.
- conduct experiments, also involving quantitative measurements.
- appreciate how concepts of science evolve with time giving importance to its historical prospective.
- develop scientific temper (objectivity, critical thinking, freedom from fear and prejudice, etc.).
- nurture natural curiosity, aesthetic sense, and creativity.
- imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment.
- develop respect for human dignity and rights, equity and equality.

1.6 IMPORTANCE OF ICT IN TEACHING-LEARNING OF PHYSICS

The importance of ICT in education cannot be overemphasize. Some of the benefit includes; improving the quality of instruction, transforming the school by improving school management, enhancing the tools and environment for learning because materials can be presented by using multimedia, increasing the quality of student learning through the access to the content through ICT facilities. The use of ICT in teaching and learning is to give better value to students. Teachers could use ICT in order to facilitate learning, critical thinking and peer discussions. ICT assist learners by developing cognitive skills, critical thinking skills, information access, evaluation and synthesizing skills. ICT has the ability to improve efficiency in the educational process, memory retention, increase motivation as well as deepens understanding. ICT can be used to promote collaborative learning such as role playing, group problem solving activities and articulated projects. ICT allow the establishment of rich networks of interconnections and relations between individuals. ICT provides fast and accurate feedback to learners. ICT promote deep learning and allow educators to respond better to different needs of different learners.

The need for ICT in education is crucial, because with the help of technology, teaching and learning is not only happening in the school environment, but also can happen even if teachers and students are physically in distance. A technology-based teaching and learning offers various

interesting ways which includes educational videos, simulation, storage of data, the usage of databases, mind-mapping, guided discovery, brainstorming, music, World Wide Web (www) that will make the learning process more fulfilling and meaningful. ICT integrated teaching can make the teaching process easy and more understandable. Students can easily achieve what the teacher taught in the class. Students can easily interlink what they have learned from class with their day-to-day life. So, ICT integration in classroom teaching learning process is very crucial. This type of teaching can enhance the student's abilities, develop the innovative powers, and their potential powers also.

1.7   RATIONALE OF THE STUDY

The scenario of the classroom is changing. There is a technological gap between the progress of the society and instructional activities of the teacher in the classroom. If we see in our society on the one hand technology has revolutionized our society and on the other hand the teaching learning activities at school level have remained so far away from technology. In our classroom the knowledge is imparted by the teacher in an ancient way, a teacher centric mode which is most of the time boring and not to gain interest to the student. But present 21st Century's education is student centric education. Students learn from multi sources and for this reason use of ICT and multimedia is very much essential in educational field and simultaneously. So, present study has great need and significance because this study shows the application of ICT in teaching Physics and its effectiveness on the student's achievement.

1.8   STATEMENT OF THE PROBLEM

Effectiveness of ICT Integrated Teaching in Achieving Learning Outcomes in Physics of Grade 9th Students.

1.9   OBJECTIVES OF THE STUDY

The study has the following objectives:

1) To know the effect of ICT integrated and traditional teaching method in achieving learning outcomes of grade 9th students.

2) To compare the effectiveness of ICT integrated and traditional teaching method in achieving learning outcomes in Boys of grade 9th students.

3) To compare the effectiveness of ICT integrated and traditional teaching method in achieving learning outcomes in Girls of grade 9th students.

4) To compare the effectiveness of ICT integrated teaching in achieving learning outcomes in Boys and Girls of grade 9th students.

1.10 HYPOTHESES OF THE STUDY

The study has the following null-hypotheses:

1) There is no significant difference in the learning outcomes of students taught through ICT integration and traditional method.

2) There is no significant difference in the learning outcomes among Boys taught through ICT integration and traditional method.

3) There is no significant difference in the learning outcomes among Girls taught through ICT integration and traditional method.

4) There is no significant difference in the learning outcomes between Boys and Girls taught through ICT integration method.

1.11 OPERATIONAL DEFINITIONS OF THE TERMS USED

Effectiveness: The ability to be successful and produce the intended results.

ICT: Refers for the technologies that provides access to information through telecommunications primarily focus on communication technologies.

ICT Integrated Teaching: ICT integrated teaching means use of ICT in the teaching learning process in order to make teaching and learning more effective, joyful, meaningful.

Learning Outcomes: They are the statements that describes the knowledge or skills students should acquire by the end of a particular course or program.

1.12 DELIMITATIONS OF THE STUDY

The study has the following delimitations:

1) The study is conducted in a limited sample only.

2) The study is confined to a particular chosen school of urban setup based in Bhopal.

3) The medium of instruction is English and Hindi in the study.