CHAPTER 1

INTRODUCTION

1.1 Introduction

The 21st century transformation of education systems across the globe is induced by the fast pace of rapidly advancing Information and Communication Technology. It opens up a wider array of exciting opportunities for the teaching-learning processes, and ICT has become one among its emerging norm-enhanced tools for better ways of teaching, learning, and assessing students' understanding. Furthermore, ICT-facilitated teaching has emerged as a potential avenue for offering more interactive, student-centred, and effective learning-the building blocks for subjects like Physics.

Information and Communication Technology has recently emerged as a significant resource for the development of education throughout the world. In particular, for science subjects such as physics, ICT provides an active environment to visualise abstract concepts and increase conceptual understanding through simulations, animations, virtual labs, and interactive media (Alagumalai & Amirtha, 2023).

Even though they are highly ubiquitous, conventional teaching methods cannot always be said to cater to the attentiveness and active engagement of students, particularly in subjects calling for strong conceptual clarity and critical thinking, such as physics.

In addition to space technology, India is also known for being a global leader in information and communication technology. Transforming the entire nation into a digitally-empowered and knowledge-oriented economy is the Digital India Campaign. Education would play a key role in that transformation process, but technology development as well would be important in the transformation of educational processes and outcomes; and hence the fact that the relation between technology and education inclusively at all levels is bidirectional (NEP-2020).

Basically total broadened cyberspace space teaching and learning integration has proved potential improvement in academic success and student motivation. Studies have shown that students exposed to ICT-based instruction exhibit better academic performance and retention of scientific concepts than their counterparts taught using traditional methods (Malik & Ashraf, 2023; Ohanaka & Onyia, 2024).

Physics is a core subject in the curriculum of secondary stage school, broadly developing a student's scientific reasoning, critical thinking, and problem-solving skills. Traditional teaching approaches (paper and pencil and teacher-centred) may not promote comprehensive understanding and sustained interest in the subject. This is even more true for Class 9th students who are going through a transition period in their academics and often develop discomfort in learning very abstract scientific concepts.

ICT mediated instruction through such instruments as digital simulation, animation, interactive presentations, and virtual laboratories offers alternative dynamism beyond conventional methods. These facilitate visualization of phenomena and manipulation of models, which lead to active student participation in the learning process. Benefit could thus be drawn in terms of enhancing conceptual clarity, improving academic performance, and catering to different learning styles.

The introduction of technology into teaching-learning transaction changes the teacher's role from simply holding chalk and talk 'sage on the stage' to what can now also be termed as 'guide on the side' changing the role of the students from passive receivers of content to more active participants and partners in the process of learning (Alley, 1996; Repp, 1996; Roblyer et al, 1997).

As per the World Education Report by UNESCO in 1998, the new technology is going to sever the link of chalk and talk teaching and learning, and it will transform the present processes of teaching and learning by changing how teachers and learners get access to knowledge. ICT enabled teachings provide an array of powerful tools which facilitate transformation from teacher-centered, textbound classrooms to rich interactive knowledge environments that are student-focused. Information and communications technologies (ICTs), then, are totally diverse among themselves as technology as tool and resources to communicate, create, disseminate, store and manage information. With communication and information, education is possible and takes into account formal and informal settings including programs by government agencies, public and private educational institutions, profit corporations and non-profit groups together with secular and religious ones.

As both technology advances and the widening classroom integration require an improved outcome of science education, actual empirical investigations into the impacts of ICT-mediated teaching upon student achievement need to be conducted. This

study will investigate whether and how much the ICT-based instructional strategies influence the academic performance of Class 9th students in physics.

Human life changes every day from before to now. From ancient times to the present day, human beings learn continuously in different aspects according to need-from building a shelter to form a roof to protect the body from the elements; to make food for the body to satisfy hunger; and to manufacture cloth to cover the human body from the climate condition.

NEP 2020 envisions the transformation of instructional processes in schools as well as their realities through effective use of technology for educators. It recommends digitalisation of tools like simulations and virtual laboratories, moving beyond textbooks for conceptual comprehension especially in subjects such as physics. Further, it recommends digital backbone development, teacher training in ICT skills, and provision of high-quality digital content for an inclusive and equitable education.(NEP 2020)

The NCF-SE 2023 presents various approaches to teaching which include learner-centric, competency-based, and technology-enabled education, including recommending the use of ICT tools augmented reality (AR), virtual reality (VR), data-loggers and interactive simulations-for the teaching of complicated scientific concepts. With respect to physics education, these tools link theory to context and enhance learner achievement and engagement. Furthermore, the framework promotes project-based learning and formative assessments in a digital context to enable deeper understanding and constant feedback.(NCF-SE 2023)

Information and communications technology: transfigures daily life. For example, one would have to depend on the postman in the past to communicate with people who live far away. Today, one can easily say that an email service is the cheapest and fastest communication method. Another area that greatly impacts is education. One was accustomed to having to physically read from books or attend actual classes where things are taught. This can now be done simply by softcopy books available online, and that person can learn through a non-traditional way using educational tools. The wide-ranging impact that ICT has attracted has drawn substantial attention in both industries and academia. From an industry perspective, it is argued that ICT impacts output growth in the economy and develops skill demand. From an academic perspective, ICT

is said to offer such alternatives for learning (self-learning through educational tools or distance learning) even if these learning styles are beneficial to the learner only when the academia is amenable to it. Considering the critical role ICT plays in human life, it must be also introduced to students in schools. Information, Communications, and Technologies (ICT) influence the all dimensions of life. The ICT employments are really and significantly important in workplaces, businesses, entertainment, and in fact education. There is a thing needed in supporting the teaching and learning processes. The students can be involved more in active learning and creative learning when the ICT is well applied.

According to one of his findings, ICTs may as well improve the quality, accessibility, and motivation to learn in their shed. For this reason, the study aims to equip students with knowledge regarding the integration of ICT so that they may realize progressive learning.

1.2 Concept of Information and Communication Technology (ICT)

Information and communication technology (ICT) can be understood as an elaborate array of technology and resources that assists in storing, creating, sharing, and exchanging information. These technologies are: computers and the internet (websites, blogs, and emails), live broadcasting technologies (radio, television, and webcasting), recorded broadcasting technologies (podcasting, audio and video players, and storage), and telephony (fixed or mobile, satellite, and video conferencing, etc.). ICT in education means using technology to support, enhance, and optimize the delivery of information. Global research has found ICTs to result in better student learning dependent on better teaching. Findings by Japan National Institute of Multimedia Education indicate a positive correlation between higher ICT use in education, wherein technology is integrated with curriculum teaching, and improved student achievement. Outcomes further showed that students continually exposed to technology during the teaching learning process exhibited better cognitive skills, presentation skills, innovative skills, and more willingness to expend effort in learning compared to students not exposed to technology (Fujitani et al., 2003).

The great information and communications technologies (ICTs) are the critical propellers of societal progress, economic victory, and global interconnectedness in today's digital revolution (Qiang & Rossotto, 2009). The seamless merging of the

various components of technology, such as computers, networks, software, and digital devices, has resulted in paradigm shifts in the conduct of human relationships and business. They have transformed industries, agriculture, medicine, business, engineering, etc. ICTs are thus instrumental in investing with the change and shaping of our lives in many ways as the globe becomes increasingly interlinked. In the digital age, ICT could facilitate bridging the socioeconomic divides and engender inclusion. ICT has changed the way information is accessed, exchanged, and disseminated, making information and resources available for people (UN General Assembly, 2015). With e-governance projects, citizens can be more engaged in decision-making processes, enhancing transparency and accountability. ICT will also transform education through new forms of learning and transform the roles of students and teachers in the learning process. Some interpretations that bring out the meaning of ICT say that:

"Information and communication technology deals with an information system, creation, data collection, data storage, access, processing, retrieval, analyses, use and dissemination of information accurately and effectively to enrich the knowledge and develop intelligence decision-making as well as the problem-solving capacity of the user"(Walia, 2011).

As for UNESCO'S point of view, "Information and communication technology (ICT) include scientific-technological and engineering disciplines and the management techniques employed in information handling and processing their application, computers and their interaction with the man and machines and also the socio-economic and their cultural dimensions".(Walia, 2011).

The document National Policy on Information and Communication Technology (ICT) in School Education (2012) defines Information and Communication Technologies as hardware, tools, contents, resources, forums, and services that can be transformed or delivered in digital format and used to actualize the objectives of teaching learning processes, enhance accessibility to resources, build capacity, and manage the education system.

This will cover everything from hardware and software to interactive digital content, internet and satellite communication tools, radio and television services, online content

repositories, interactive forums, learning management systems, and other management information systems.

1.3 Concept and Significance of ICT mediated teaching at Secondary Stage of schooling in India

The ICT in secondary school programs was initiated in December 2004 and revised in 2010 that provided opportunities to secondary stage students mainly to build on their capacity on ICT skills and to learn essentially through computer-assisted learning. Integration of ICT in school education is focused on preparing the young to participate creatively in establishing, sustaining, and furthering a knowledge society that is the foundation for both socio-economic development of the nation and global competitiveness. Per the 2012 National Policy on Information and Communication Technology in school education, information and communication technologies are defined as all devices, tools, content, resources, forums, and services, both digital or convertible into or delivered through digital means, that may be applied or availed for accomplishment of the teaching-learning goals, resource accessibility and reach, capacity building, and educational system management. These will include not just hardware tools in connecting desktop computers and software applications but also interactive digital content, internet, other satellite communication devices, radio, television services, web-based content repositories, interactive forums, learning management systems, and management information systems.

The one who does not consider or does not make use of ICT denies its impairment and import to life. Information and Communication Technology (ICT) is technology that supports activities within information gathering or data processing including storage and presentation. It contains any product that will electronically store, retrieve, manipulate, transmit, or receive information in a digital form like personal computers or digital televisions. Conventional ICT is the abbreviation for information and communication technology. In this sense, however, information (I in ICT) refers to meaning and value, controls over information, capturing, verifying, and storing data for later effective use, manipulation, processing and distribution of information and communications. The other part of ICT, C, refers to electronic means of communication of data over a distance. Most of these are wind up into networks with sending and receiving equipment connections through wires and satellites-reached links. T for

technology is a collection of techniques on storing, retrieving, manipulating, and transmitting or receiving information in a digital form electronically. Such can be found in personal computers, digital televisions, email, etc.

It is termed as ICT, which is a broad term for any device or applications used for communication such as Radio, Television, Mobile, Computer, Internet, Wireless and other associated means of communication. ICT is thus all the components coupled with Information Technology (IT) which mostly tend to put more attention to the effect of integrated united communication and convergence of telecommunications, computers, as well as necessary software, middleware, storage and audiovisual system that enables the users to access, store, transmit and manipulate information. It refers, in fact, to convergence of audio visual and telephone networks along with computer networks into a common cabling or link systems (Wikipedia). Information along with other forms of communication technology are important for processing of information. In other context, it refers to the use of computer, computer software and other devices to convert, store and process, transmit and retrieve information. According to Sansalwal (2000), 'IT is hardware and software for effective information management, that involves storage, retrieval, processing, communication, diffusion and sharing of information for bringing about social, economic and cultural upliftment.

The school, being part of the society or a miniature of the society, integrates ICT for the effective imparting of education. As stated by the National Curriculum Framework (NCF - 2000), the introduction of information and communication technologies is to be taken on a larger scale in education. Many attempts have been made previously for the same. ICT, according to NCF-2005, allows the students to interact and create their own productions and give expression to their own experiences, which could have provided them with new avenues for creative exploration. With respect to ICT, India first recognized this field in 1984-85 with the introduction of the computer literacy and studies in schools (CLASS) project. The initiatives have been initiated by the Education and Research Network (ERNET) during 1988-Winter by the Department of Electronics in association with the Government of India and United Nations Development Programme. Gyan Darshan was another national project initiated on 26 January 2000 to provide satellite-based Educational Channels nationwide. Gyan Vani, an interactive Radio Counselling initiative through an educational FM radio channel, is complemented by IRCs by IGNOU, which is amongst the largest open universities in

the world. The scheme ICT for schools launched in December 2004 was a window of opportunity given to the students of secondary stage schools across the country in collaboration with States and UTs. There was an emphasis on computer literacy programs, but advantages are now realized with using ICT tools for developing e-content for computer-aided learning activities. The prime objective of this scheme is to act as a support to teaching and learning in classrooms, making learning more interesting and interactive. Self-learning is also being strongly emphasized.

Goa University for the first time has established an Internet portal for administration and management, The Institute of Education DAVV Indore has started a project on computer literacy. Yashwantrao Chavan Maharashtra Open University (YCMOU) has put networking into the School of Science and Information Technology. Indira Gandhi Open University (IGNOU) through the project E-Gyankosh has developed digital repositories for enhancing knowledge accessibility with the aims of sharing its resources with educational institutions internationally."

Information and communication technologies (ICT), having evolved rapidly, have become one of the fundamental building blocks for the modern world. Understanding ICT and mastering its basic skills and concepts are now considered to be part of the core education in many countries, India included. In all likelihood, one of UNESCO's overriding aims will be to ensure that every country, both developed and developing, is equipped with appropriate educational resources that will permit them to prepare the youth for an active role in modern society, thereby making a contribution toward a knowledge nation.

1.4 The National Policy on ICT in School Education - 2012

The National Policy on Education 1986, even modified in 1992, laid stress and a need to use educational technology for augmenting the quality of education. This policy statement was responsible for the initiation of two major centrally sponsored schemes, namely, Educational Technology (ET), and Computer Literacy and Studies in Schools (CLASS). These schemes lead to a very much larger and comprehensive centrally sponsored scheme-under information and communication technology in schools-2004. Educational technology is also definitely a proper place to improve Science Education. Again, the special dosage that ICT has in school education has been emphasized in the National Curriculum Framework (NCF)-2005. Very much in like that, ICT figures

under the flagship program of Government of India on education, called Sarva Shiksha Abhiyan (SSA). In turn, it would be a document of comprehensive coverage about the norms of schooling recommended by the Central Advisory Board of Education (CABE).

It is now necessary, in light of convergence in all technologies, to take the comprehensive look at all possible information and communication technologies for improving school education in the country. Such a holistic approach to ICT as a means in developing education may only rest on a sturdy policy. Induced by the gigantic potential of ICT to extend the outreach and improve the quality of education, the Government of India launched "National Policy on Information and Communication Technology (ICT) in School Education-2012". This policy will thus bring guidelines out to help the States in realizing optimum utilization of ICT in school education within a national policy framework. The policy aims at preparing youth to creatively participate in the making, sustenance, and growth of a knowledge society that would lead to all-round socio-economic development and competition of the nation at the global level. The very purpose of this policy is to design, catalyze, and support as well sustain ICT and ICT-enabled activities and processes that aim at improving access, quality, and efficiency in the school system.

The ICT Policy in School Education will seek to achieve the following:

- the creation of an environment to develop a community knowledgeable about ICT;
- the creation of an ICT literate community whose members are able to deploy, utilize, benefit from ICT and contribute to nation building; collaborative and cooperative and sharing conducive environment towards demand for an optimal utilization and the most optimum return from the potential of ICT in education;
- facilitate open access to all students and teachers, at equal levels and with all fees waived, to state-of-the-art ICTs and ICT-enabled tools;
- create and nurture local and localized quality content, and enable students and teachers to partake in the development and constructive use of shared digital resources;
- develop professional networks of teachers, resource persons and schools to catalyze and facilitate resource sharing, development and continuing education

of teachers, guidance, counselling and academic support to students-resource sharing, management and networking of school managers and administrators to bring improvements in efficiencies in schooling process;

- ❖ foster research, evaluation and experimentation in ICT tools and ICT enabled practices to inform, guide and utilize the potentials of ICT in school education; promote critical understanding of ICT, its benefits, dangers and limitations; and motivate and appropriate all sections of society to wider participation in making the school education process stronger via appropriate use of ICT.

1.5 Integrating Information and Communication Technology (ICT) in School Education

Technology integration into education means that it is meant to use technology for improvement of student learning experience. Schools have developed diverse sets of ICT tools for communicating, creating, disseminating, storing and managing information (Blurton, C. 2000). In some ways, ICT has very much become part of that teaching-learning interaction as with replacing black boards by interactive digital smartboards, learning while in class with the students own smart phones or other gadgets, and such approaches as the “flipped classroom” model where learners watch lectures at home on the computer and spend time in the classroom engaged in more interactive activities.

Many of the major institutions have changed, and how we have lived our daily lives has much of an impact on the technological tools that have come to place today. The effect of such a tool, however, on education was just beginning to be felt as the new technology evolved into the teacher's methods of teaching and learning.

With the use of ICT in classrooms, new horizons have opened and pathways to the usage of ICT have broadened massively, making available resources from the four corners of the world at a click of a button for students and teachers. For example, the Internet carries all kinds of information and data, images, much more, and even computer software into the classroom from places it could have otherwise never entered, and it does all of that almost instantly. Such resources can empower learning by means of meaningful individual and collaborative learning settings.

Teaching methods, which include technology, when understood and used effectively by educators, cultivate higher-order thinking skills, foster creativity, and give students

individualized ways with which to express their understanding. Students also gain better readiness for adopting changes in technology in society and workplaces.

Since Technology provides instant access to information, its importance in the classroom cannot be overstressed. In the life of students and teachers, the use of smart phones, computers, and tablets is already a norm. Therefore, experimentation with the use of technological devices for creating constructive learning experiences for students learning at all levels can be expected.

Computer technologies and other aspects of digital culture have changed the way people live, work, play and learn, affecting global power and knowledge construction and distribution (Deuze, M., 2006). Thus, digital literacy-searching, discriminating and producing information, and critically using these new media to be active in society-becomes a consideration of major importance in any curriculum framework. Moreover, the application of any given technology in a classroom setting also encourages active learner engagement. At the same time, the application of technology also allows for differentiated instruction that will meet the individual needs of students as individual learners in the broader climate of classrooms.

Technology is an avenue for teachers to do differentiated instruction and to modify information for the appropriate level of learning ability of their students. The technology can also facilitate students to progress in learning at their own desired space. There are some challenges that encounter the integration of ICT in school curriculum.

Instead, ICT has facilitated convergence of a wide range of technology-based and technology-mediated resources that include teaching and learning. Thus, it has indeed become possible to consider ICT as an all-purpose support for education.

The following understanding ICT with respect to the Indian educational scenario would be like the following-

(i) ICT can be used in many ways: to disseminate information and advocate for adaptation/adoption. Translation and distribution of already available educational resources in varied media and forms would encourage its dissemination and use.

(ii) Digitisation and making available many academic audio-and video-products in diverse languages, media standards and formats are urgent.

(iii) In view of the few print-resource as well as web-content in Indian languages, the ICT should employed gainfully for digitizing. ICT will certainly be invaluable in digitizing and disseminating what is available in an existing vast repertoire of print materials such as books, documents, handouts, charts and posters, which have been used extensively in the school system, and make it reach and useable.

(iv) ICT can address teacher capacity building and ongoing teacher support, in addition to strengthening the ability of the school system to manage and improve efficiencies-in other words make it possible for the school system to develop the ability to manage and improve efficiencies-without referring to such an enormous system and traditional ways of training and support.

(v) Using computers and the Internet as mere information delivery devices grossly underutilizes their power and capabilities. There is an urgent need to develop and deploy a large variety of applications, software development tools, media and interactive devices to promote the creative, aesthetic, analytical, and problem solving abilities and sensitivities of students and teachers.

Less than satisfactory infrastructure for ICT, basic but minimum, should be made available for schools under their policies. Such infrastructure must comprise stable and affordable internet connectivity and security measures like filters and site blockers. On teacher policies, basic ICT literacy skills, ICT application in the pedagogical environment and discipline-specific applications should be targeted. This should be complemented by series of ongoing technical, human and organizational support on the issues to see to it that the students get access to and use of the ICT effectively in schools. (Kopcha, T.J., 2012). There exists the need for the inclusion of ICT in the school curriculum. Construction of digital content in the vernacular languages needs to be done along cultural lines (Voogt et al., 2013). This will help students be more effective learners of various concepts.

1.6 The Rationale for Integrating ICT Into the Teaching-Learning Process

ICT is a powerful tool that supports the transition to student-centered training in which teachers and students actively participate. Consequently, the process of integrating ICT will facilitate the creation of a new learning environment. The very successful

integration of ICTs into the educational system can analyze the paradigm shift concerning both content and pedagogy, which is integral to the education reform movement of the 21st century. ICTs particularly, computer and Internet technologies, provide opportunities for new methods of teaching and learning that do not merely enhance the existing methods, but truly transform them. These new methods of teaching and learning are theory-based on the constructivism of learning and are moving closer towards learner-centered pedagogy as opposed to teacher-centered pedagogies.

Actively engaging students in inquiry-based learning, ICT-enhanced learning mobilizes tools for examination, calculation, and analysis of information. Thus students learn from solving real-life problems becoming more decontextualized from mere memorization and rote learning. ICT blends in with "just-in-time" learning, allowing learners to choose what to learn at the time they need it.

Collaborative learning- It allows interaction and cooperation among students, teachers, and even authorities elsewhere, and strengthens the concept of collaboration beyond the real-world situations. ICT enables collaborative learning enhancing cross-cultural interaction; it helps learners develop communicative skills and global awareness.

Creative learning- ICT-supported learning encourages manipulating that existing information rather than regurgitating it for the sake of real-world learning environment.

Interactive learning- Now, ICT-enhanced learning encourages a thematic and interactive teaching-learning paradigm. This somewhat dissolves the artificial boundary built within traditional classroom between different disciplines and theory and practice.

Evaluative learning- Student-directed and diagnostic, the ICT-enhanced educational process recognizes the existence of multiple pathways for individual learning, as well as multiple articulations of knowledge. It differs from traditional forms of teaching and learning based on the transmission of information whereby students listen and remember. Instead, the use of ICT provides opportunities for learning through exploration and discovery.

1.7 Benefits of ICT Integrated Teaching Learning Materials at Secondary Stage

- It lets students easily get resources or information with a click of a button on sites like Google, Wikipedia, and Yahoo which enable students to type in their

query and get relevant results within seconds. Also, students learn to be effective independent learners, gear up themselves for their future.

- Integrated ICT at the High School stage gives the students headway towards their future by staying ahead of the rest.
- It augments the abilities of student critical thinking and problem solving as well as improves the oral and written communication, accessing and analyzing information, inquiry, and imagination.
- Cultivating skills by watching power point during the lecture, teacher uses interactive while bound during lecture, students view website on large screen, students listen to a lesson. Include these students are enhancing their competencies by technology use. They type papers using word make graphs with excel and online searches. They have the ability to record a product like movie, poster session in power point.
- Exploration, whereby the students are engaged in discovery learning prior to installing formal instruction. Students use an online applet to learn about a subject, students conduct a lab with probes, collaborating students interact with peers' instructors and outside resources students make group contributions in text format to a wiki, work together on a Google Doc, used web 2.0 tools email etc. They can use Excel, Probes and accompanying software power point MP3 Movies, wiki which are making sound choices about the appropriate synthesis to content and technology.
- Studies has shown that the appropriate usage of ICTs could be analyzed through paradigmatic shift in both content and pedagogy that is in education reform during the 21st century. When used, particularly appropriate, ICTs such as computers and Internet technologies are said to enable new ways of teaching and learning-the replacement of old ways which improved what learners and teachers have done previously. These new ways of teaching and learning are underpinned by constructivist theories of learning and constitute a shift from teacher-centered pedagogy-in its worst form characterized by memorization and rote learning-to learner-centered pedagogy.

1.8 Academic Achievement

Possibly one of the principal foundations for personal and professional development among students is found in academic performance. One principal achievement of the educational process has been academic performance. Whether indirectly or directly conversely, educators considered academic achievement since it represents an important need in the learners' lives. Teachers are also held to measure fairly the outcomes of their teaching concerning progress made by students in mastering the content taught. During their learning process, students come into contact with many different subjects and experiences, and they are also greatly affected by their academic results, which in turn greatly affect their future opportunities and well-being. The accomplishment of application is referred to as achievement, and depending on the leve1 of marks obtained, people are labelled as high achievers, average and low achievers. Academic achievement is the athlete's self-perception and self-evaluation of the athlete's objective academic success." Academic achievement generally means the learning outcome of a pupil.

Oxford Advanced Learner's Dictionary (2000) defines “achievement as a task that somebody has done successfully, especially using his /her efforts and skills. Academic achievement or performance is the outcome of education – the extent to which a student, teacher, or institution has achieved their educational goals.”

According to Good (1973) “academic achievement is a knowledge, attitude, or skill developed in the school subject usually designed by test scores or by marks assigned by the teacher or by both.”

To a student, a kind of success from fulfilling short- and long-term educational goals for academic achievement. The level of learning outcome in a certain area of subject related knowledge, understanding, skill, and application, which are usually evaluated by the concerned teacher in the form of test scores and examinations. This becomes one of the major tools through which the students can learn about their talents and competencies recognized as a vital part in developing aspiration in careers.

1.9 Rationale of the Study

Multiple sectors have been reshaped by ICT integration, including education. The actual integration of ICT within education has adapted the teaching-learning

mechanism radically, especially in science education. Rapid advances in technology have innovated tools and resources to enhance student engagement, simplify difficult scientific concepts, and create learner-accessible interactive learning experiences. Such tools include digital simulations, visualizations, and virtual labs which can promote deep understanding and learning outcomes among students, especially in science where much weight is given to abstract theories and experiments.

The rapidly growing age of digitization has witnessed the entry of Information and Communication Technology (ICT) in education as a means for "transformation." The conventional methods of teaching were relatively ineffective in motivating the student minds. Physics is a subject that has an abstract character, and consequently, because of that, in the minds of students, it does not have a clear concept in their understanding. Teaching through ICT brings something new-experiential with interactive, visual and simulation-based learning-that can render the obscure again illuminative and enjoyable.

Learning physics requires instructional strategies that go beyond rote memorization. Physics, being highly conceptual and application-based, requires the use of instructional strategies and methods that encourage the use of very visual ICT tools, such as animations, simulations, virtual laboratories, and interactive modules. These ICT tools can help to visualize the abstract concepts, shore up active learning, and provide real-time feedback. These facilitate better academic performance of students and also build conceptual understanding and retention of scientific principles for the longer term.

Though there is much availability of such resources in almost all schools, effective use of them in the classroom, especially for science education, is extremely low. There is an increasing need to evaluate the contribution of ICT integration in actual academic performance in the subject of physics for secondary school students. This study focused on filling that gap by ascertaining the effect of ICT-mediated instruction on the academic performance of 9th grade learners in physics.

This study has such findings that they would have to educate the educators and policy makers as well as curricular developers on the improvement of teaching practices which could make a positive change in student engagement and academic success as far as physics is concerned.

1.10 Statement of the Problem

The statement of the problem is '**A Study on Effect of ICT Mediated Teaching on the Academic Achievement of Secondary School Students in Physics'.**

1.11 Operational Definition of Key Terms

ICT Mediated Teaching :- Teaching is mediated through ICT, that is, instructional processes can be conducted using Information and Communication Technology (ICT) tools and devices. The inclusion of digital technologies using the computer, internet, and multimedia in a classroom for learning makes the experience more interesting and less boring.

Academic Achievement :- Academic achievement can be understood as the level to which a student has reached their educational objectives or an institution has with respect to them- short term or long term. It is measured quantitatively through different potential indicators like grades, standardized test scores, and degrees, among others.

Secondary School Students :- Pupils attending a school offering any secondary curriculum for grades 9, 10, 11, or 12. Individuals enrolled in a formal education stage that follows primary education and precedes higher education, typically encompassing grades 9-12.

1.12 Objectives of the Study

1. To analyze the effect of ICT-mediated teaching on the academic achievement of secondary school students in Physics.
2. To compare the effectiveness of ICT-based instruction with traditional teaching methods in Physics.

1.13 Research Questions

1. What is the effect of ICT-mediated teaching on the academic achievement of 9th-grade students in Physics?
2. What is the difference between the mean academic achievement scores of experimental and control group?

1.14 Variables of the Study

Use of ICT Mediated and traditional method are the independent variables in this study. Academic achievement in Physics is the dependent variable in this study.

1.15 Hypotheses

$H_0$1 : There is no significant difference between the mean scores of pre-test of the experimental and control groups in the academic achievement test of Physics.

$H_0$2 : There is no significant difference in the academic achievement of students taught through ICT-mediated teaching in Physics.

$H_0$3 : There is no significant difference between the academic performance of students taught using ICT-Mediated instruction and those taught using traditional teaching methods in Physics.

1.16 Delimitations of the study

1. The Study has been delimited to Jharsuguda district only.
2. The study has been delimited to the Physics subject only.
3. The study has been delimited to the 9^{th} class student only.