

Study of ICT Based Learner Centered Approach for Teaching Learning of Science for Quality Education at Secondary Level

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ABSTRACT

“The only purpose of education is to teach a student how to live his life – by developing his mind and equipping him to deal with reality. The training he needs is theoretical, i.e., conceptual. He has to be taught to think, to understand, to integrate, to prove. He has to be taught the essentials of the knowledge discovered in the past –and he has to be equipped to acquire further knowledge by his own effort.”

- **Ayn Rand**

The problem under study is stated as: “**STUDY OF ICT BASED LEARNER CENTERED APPROACH FOR TEACHING LEARNING OF SCIENCE FOR QUALITY EDUCATION AT SECONDARY LEVEL**”. In today’s time, student and his learning has been the most important goal of education system of any country on this globe. Various approaches have been used till now and are being implemented in every school but still the effects are certainly not that better. Learner centered approach has been in terms of talk since 20th century, still we see devastating difference in the results every year. My topic basically emphasis on making the learning material ICT based as ICT and AI are the future of India in every field. Children have to be made equipped with the knowledge of ICT to make their learning more conducive, retentive and better results and learning oriented. Major use of ICT was witnessed using online classes due to Corona outbreak, and majorly id streamlined and planned well, can bring remarkable difference in the teaching learning system specially in the subjects like Science and Math. Though, this research has been done for secondary school students of sample size 120, researcher feels that the same approach can be introduced at elementary level or initial secondary stages so to bring fruitful results and provide students with experiential and heuristic learning leading to holistic development of the child. Keeping the present scenario and progressive growth of ICT, it has been realized that quality education may be imparted through ICT based learner centered approach. Keeping this view and to ensure the effectiveness of ICT, it is desirable to find out the effectiveness of ICT based learner centered approach for quality education in Science as ICT is playing a very important role in science teaching-learning process. The researcher having a science background feels that an attempt needs to be made through a study for enhancing the quality education in science using ICT based learner centered approach.

Present study is concerned with the development and implementation of learner centered teaching programme which can produce benefits viz, achievement and scientific attitude among students of grade X. Also in this study, investigator will find the effect of the ICT based teaching - learning programme on student’s achievement and development of scientific attitude needed for quality education in Science. Teacher is confined with only chalk & duster but on the other side has failed to make the subject

interesting & innovating. We can bring a change and innovation in the classroom teaching in future. Science has given us many teaching aids & now time has come to present the real interactive and interesting environment in the classroom. This can only be possible when the teachers who are undergoing training at various educational colleges are made aware of use of ICT and various teaching aids leading to quality education. Pandemic situation has brought in lot of changes, thus, it is desirable to explore on ICT based learner centered approach which can effectively be/is used for effective teaching learning process.

INTRODUCTION

A country's true development depends on its education system. Education is a pivotal part of human development and can positively influence standards of living, health and governance. Education is a tri polar process having student, parent and teacher to be important members of the loop but schools handle the important responsibility of imparting education to students and developing them into responsible and enterprising citizens which can only be achieved when the quality of education provided is the top priority of every government and the school in particular. (Salmi, 2000).

Learning is significant in present situation, effectiveness of teaching can only be measured in terms of quality education. Nowadays, the emphasis is on learner centered approach. In this approach, learner is considered as the focus and teacher's role is like a guide and a facilitator. Significant learner centered approaches are: Brainstorming, project based, activity based, heuristic etc.

Science is very important and demanding subject for human society, a subject which has its own culture and helps in developing one's logical abilities. The National Policy on Education (1986) has also considered the importance of science and mathematics in general education and suggests that 'science should be visualized as the vehicle to train a child to think, reason, analyze and to articulate logically. Quality education in schools has been a topic of discussion everywhere. There are numerous questions concerning the issues and problems existing in the Educational Systems as to how we can resolve it and the best way we could to attain that kind of quality of education we have been searching and longing for. Declining standards in schools is one of the most controversial education issues today and this has contributed to continuing decline in student's quality learning. (UNESCO, 2005)

"Science has added a new dimension to education and its role in the life of a nation, but central to all this is the quality of education. If Science is poorly taught and badly learnt, it is little more than burdening the mind with dead information and it could degenerate even into a new superstition. What we desperately need is improvement in the standard and quality of Science education at all levels in the country."

Education Commission (1986)

New technologies involving artificial intelligence, machine learning, block chains, smart boards, handheld computing devices, adaptive computer testing for student development and other forms of educational software and hardware will not just change what students learn in the classroom but how they learn, and thus these areas and beyond will require extensive research both on the technological as well as educational fronts. All these aspects are learner centered which is our main point of focus. The thrust of technological interventions will be for the purposes of improving teaching learning and evaluation processes, supporting teacher preparation and professional development, enhancing

educational access, and streamlining educational planning, management, focusing on child's self learning and administration including processes related to admissions, attendance, assessments, etc.

This NPE 2020 policy has been formulated at a time when an unquestionably disruptive technology - Artificial Intelligence (AI) 3D/7D Virtual Reality - has emerged. As the cost of AI-based prediction falls, AI will be able to match or outperform and, therefore, be a valuable aid to even skilled professionals such as doctors in certain predictive tasks.

In response to MHRD's formal recognition of a new disruptive technology, the National Research Foundation will initiate or expand research efforts in the technology.

ICT can play an important role in enhancing the efficiency of the teaching-learning process, to make children more creative & provide them with an individualized learning environment. For ICT, Computer literacy will be crucial in preparing children to cope with the Micro-computer explosion, which has the same potential for social change as the industrial revolution. ICT based learner centered approach focuses more a child's needs which is the priority of our education system.

Learner centered based ICT includes personalized instruction through scaffolded support and gamified activities which diversify the pool of available learning modalities, allowing students to make their own choices facilitating collaborative, project-based learning experiences with real-world relevancy. The most common uses of ICT are drill & practice, tutorial, simulation games & problem solving. Thus, it is a significant tool to move educational practice into the 21st century. The ICT is now regarded as a super teaching learning material and future of education. Its use in education has been tried as an innovation & it has proved its teaching efficiency in many developed countries.

Every girl and boy in India has the fundamental right to quality education, an education one that helps them to acquire basic literacy and numeracy, enjoy learning without fear and feel valued and included irrespective of where they come from.

UNICEF, India

OBJECTIVES

1. To develop learning material/programme in Science using ICT based learner centered approach for teaching science at secondary level (Grade X).
2. To develop learning material/programme in Science using Traditional based approach for teaching science at secondary level (Grade X).
3. To implement the ICT based learner centered programme and to study its effects on pupil's achievement in science for Experimental group of grade X.
4. To implement the Traditional based programme and to study its effects on pupil's achievement for traditional group in science for students of grade X.
5. To compare the effectiveness of Learner centered approach for quality education with traditional approach in terms of achievement in science for Experimental group of grade X.
6. To compare the effectiveness of Learner centered approach for quality education with traditional approach in terms of scientific attitude for Experimental group of grade X.
7. To suggest measures in teaching – learning process using ICT based learner centered and laboratory approach for quality education in Science.

RESEARCH DESIGN

Keeping in view the nature of research study, **Experimental method** will be followed.

POPULATION AND SAMPLE

Secondary Students of Delhi region have been taken

SAMPLING

The sampling technique used is: Purposive sampling, convenience sampling and random sampling. Sample size will be 120 students.

TOOLS TO BE USED

- IQ test, Achievement test, Scientific Attitude test
- ICT based learner centered instructional material (It is self constructed)
- Appropriate Statistical technique (Mean, Standard deviation, t-test, Statistical hypothesis testing) will be used depending upon the data collected and nature and objectives of the problem

REVIEW OF LITERATURE DONE IN INDIA

Basu, M.K.(1981) under his topic Effectiveness of Multimedia Programmed Materials in the teaching of Physics made an appraisal of the relative effectiveness of multimedia programmed instruction and programmed class-teaching on the criteria of immediate achievement and retention of a group of subjects at three levels of ability. The following were the findings of the study:

1. There was a significant difference among the different strategy means on the criterion on overall achievement. It was found that on the criterion of overall achievement the multimedia semi-programmed instruction was better than the strategy of programmed teaching; the multimedia linear programmed instruction was better than the multimedia semi-programmed instruction ; the multimedia branching programmed instruction was better than the multimedia linear programmed instruction ; and the multimedia hybrid programmed instruction was better than the multimedia branching programmed instruction.
2. The strategies of multimedia programmed instruction enabled learners to reach the level of mastery learning (mean score varied between 80.00 and 86.00 out of 100).
3. It was found that a significant difference existed in the achievement through the different strategies due to differences in ability.

Gupta, M. (1987) under the thesis Computer-Assisted Instruction in Chemistry stated the major findings of the study:

1. Students of strategy - I scored significantly higher than the students of strategy - II in terms of their mean gain scores and mean retention scores on the criterion tests,
2. Students of both the strategies revealed highly favourable opinion towards CAI in terms of the percentage of favourable responses,
3. Girls of both the strategies scored significantly higher than the boys of both the strategies in terms of their mean gain and mean retention scores,
4. The students of both the strategies learn more in terms of their mean gain scores in mathematical problems rather than logical ones through CAI.

Jeyamani, P.(1991) under the topic - Effectiveness of the Simulation model of Teaching through Computer Assisted Instruction (CAI) conducted a research on Effectiveness of Simulation Model of Teaching through Computer Assisted Instruction from Avinashilingam Institute for Home Science & Higher Education for Women, Coimbatore as a part of M.Phil, degree.

Major findings :

1. The experimental group obtained a higher mean than the control group,
2. The sex-wise comparison proved to be insignificant,
3. There was no significant difference in learning level between Tamil medium and English medium students,
4. On the basis of the research findings, it was concluded that the experimental group performed significantly better than the control group.

Singh, R.D. Ahluwalia, S.P.; & Venna, S.K. (1991) studied the topic Teaching of Mathematics : Effectiveness of Computer Assisted Instruction (CAI) & conventional method of Instruction which centers upon the problem of the effectiveness of Computer Assisted Instruction & of the conventional method of instruction in teaching Mathematics, in terms of achievement of Mathematics and direction of change in attitude towards Mathematics of male and female students.

Major Findings of the study were:

1. The students who used the computer scored significantly higher than those taught Mathematics through the conventional method,
2. The students who used the computer showed significantly highly favourable attitude towards Mathematics than those who did not use the computer,
3. Achievement in Mathematics and change in attitude towards Mathematics were found to be independent of the sex factor.

Khirwadker, A. (1998), Development of Computer Software for learning Chemistry of std. XI.

The Findings were that the software package developed for teaching three units of std. XI Chemistry textbook of GSTB was effective in terms of student's achievement. Also CAI was found to be time effective. The experimental group took 45 hrs time in average to complete the three limits of Chemistry. Later on the academic achievement of students of experimental group was found to be affected by variables like IQ, academic motivation and attitudes and lastly, majority of experimental group students had positive attitude about various aspects of software package especially regarding presentation of content logical sequencing and language used for understanding the content. The school subject teacher always held the positive attitude.

Arun Kumar Jindal, Manisha Rani, Nisha, Shobha, Tamna, 2018, conducted an evaluative study to assess the effectiveness of videotape- supported tutoring program on knowledge regarding CPR among the scholars of B.SC (N) 2nd time and GNM 2nd time scholars in Maharaja Agrasen College of Nursing Agroha, Hisar by using a accessible arbitrary slice fashion. The findings of the study revealed that the mean post-test scores were significantly advanced than mean pre-test scores.

Researcher – Kanupriya Joneja, under the guide, Syedah Fawzia Nadeem in 2018 in their study - Study of integration of ICT and its influence on higher order thinking skills of secondary school students revealed that at present integration of ICT is limited to use of smart boards for delivering content and using computers and software packages for administrative tasks. The opportunity of using internet for teaching and learning process is recognized by teachers but has not been taken advantage of due to several administrative issues especially due to lack of training and hurdles of unavailability of basic resources in schools. It can only be concluded that this complex variable is not dependent on any one factor but depends on student's background, their disposition and most importantly, the teachers. The study concludes that higher order thinking skills can be taught by teachers who are aware and competent to teach them. The role of technology in developing these skills is important and it should

form part of pedagogy for teaching students as it presents the prospect of evaluating the explored information. The technology brings the outside world to the classroom. Employing strategies which encourage engagement in the classroom often involve students working together and/or using internet to dig deeper into content and exploring different sources.

Lokhanath Misrhra, Tushar Gupta and Abha Shree in 2020 under topic - Online teaching-learning in higher education during lockdown period of COVID-19 pandemic stated that Liberalization, Privatization and Globalization of education has been deteriorated remarkably due to limited mobility and limitedly confined exchange programmes of academic activities among the countries during the COVID-19 lockdown. The third world countries are facing policy paralysis in handling the sudden shifting scenario of educational planning, management and organization during this pandemic with their fractured technical infrastructure, academic incompetency and lack of resources; especially among them, low and middle-income countries would suffer the setbacks most as they were already running out of finance (Thomas, 2020). But noticeably everyone must learn to live and survive with the present crisis as it is the beginning only; in the long run, no can afford the negligence towards digital transformation in HEIs. To develop multimodal approaches to achieve course content objectives for better learning outcome can be a better idea to deal with the complexity of online education. Undauntedly, the governments must ensure the availability of reliable communication tools, high quality digital academic experience, and promote technology-enabled learning for students to bridge the disparities originated in the education system before and after COVID-19 catastrophe which is also inevitably necessitated for uninterrupted learning. Few steps should be accounted in the wake of this pandemic; to develop such a curriculum that reflects the perceptible change in the content knowledge and learning experience of students as well as enable them to think critically.

REVIEW OF LITERATURE DONE ABROAD

Simin Ghavifekr, Wan Athirah Wan Rosdy Faculty of Education , University of Malaya, Malaysia, in 2015 under their research topic - Teaching and Learning with Technology: Effectiveness of ICT Integration in Schools concluded that the very first stage of ICT implementation must be effective to make sure that, teachers and students are able to make the best use of it. Thus, preparations of a technology-based teaching and learning begin with proper implementation and supports by the school top management. If the implementation process of technology integration in schools take place appropriately from the very beginning stage and the continuous maintenance are adequately provided, ICT integration in schools will result in a huge success and benefits for both teachers and students. The use of ICT especially in teaching and learning is more about practicality as compared to theories and that is why teachers must be given time to learn and explore it, face the “trial-and error” phase before they are completely comfortable with its usage and able to make use of it for teaching and learning.

Nelly C. Andieme (2016) under their research titled Effect of Child Centred Methods on Teaching and Learning of Science Activities in Pre-Schools in Kenya illustrated that Science is essential in the national development of any country. Teaching and learning of Science enables the ECDE learners to understand the world around them and be curious in nature. The desired goals of science in the early childhood curriculum include what we hope children will attain or achieve in three different areas: content, processes, and attitudes or dispositions. These all are accomplished when child-centred approaches are used for the purpose of improving science teaching methods. This study found out that

there existed a positive degree of influence on the Utilisation of child-centred approaches in the teaching and learning of science activities in ECDE which was significant at 99% confidence level. The statistics suggested that learners' ability to experiment, classify, observe, use their hands and differentiate natural features and environment could be adequately developed and enhanced if teachers would regularly use child-centred teaching method of discovery learning approach. To improve on the effective teaching and learning of Science activities, there is need for teachers to ensure that learners are not passive in classrooms but consider interaction with the natural world (active learning). Parents need to support ECDE centres to purchase reference books in which sample science syllabi and activities based on constructivist approach are provided. To foster scientific thinking, teachers should view young children as active learners (versus recipients of knowledge) and give them varied opportunities to explore and experiment. Such opportunities can allow children to construct meaning and develop understandings that are not only valid but also valuable to their ongoing intellectual development.

Aytaç, T., & Kula, S. S. (2020) under is research titled The effect of student-centered approaches on students' creative thinking skills: A meta-analysis study, concluded that there is a statistically significant moderate effect size which is determined according to the random effects model in favour of the students in the experimental group according to the SCA variable. This result is a medium level according to the classifications of Cohen (1988). The results of this meta-analysis study show that SCA practices are a significant variable that positively affects students' CTS. It is seen that approaches and methods that have the most effect among SCA on students' CTS are respectively; storyline, active learning, six thinking hats, brain-based learning, game-based learning and creative drama. The common point of these approaches are that they provide individual and group work environment, develop multiple learning skills, and bring in skills such as collaboration, discussion and empathy. It is seen that problem solving and communication skills stand out among the important variables that affect creativity. In this context, especially active learning, brain-based learning, creative drama and game/storyline methods can be considered meaningful in the context of having more of these two skills. On the other hand, the effects of research-inquiry based learning, argumentation, and cooperative learning approaches on students' CTS are slightly lower than other methods.

Gezim BARA and Nazmi XHOMARA in 2020 researched The Effect of Student-Centered Teaching and Problem Based Learning on Academic Achievement in Science concluding the results which showed that the student-centered teaching approach is used approximately in most of the lecturing times of the experimental group and very little in lecturing time of the control group. It is found that problem-based learning is used relatively a little in lecturing time of the experimental group and very little in lecturing time of the control group. The results showed that academic achievement are ranked mostly in medium and high levels of the experimental group, and mostly very low, low and, medium levels of the control group. There was a significant difference in student-centered teaching, problem based learning, and academic achievement scores for experimental, and control group of students. At the same time, the magnitude of the differences in the means was large, so the experimental group of students performs better than the control group. It is found that there is a low positive correlation between student-centered teaching and academic achievement, although there are significant differences between the experimental and control group. The study revealed that there is a medium positive correlation between problem-based learning and academic achievement, although there are significant differences between the experimental and control group. The study found that the total variance of academic achievement levels explained by student-centered teaching and problem-based learning is

relatively a high percentage. This indicates that student centered teaching and problem-based learning influence strongly academic achievement.

CONCLUSION

1. However, in present scenario, quality education has been given a lot of emphasis, appropriate utility of ICT based on learner centered approach for Science teaching needs to be investigated in order to find out the effectiveness of quality education specially in science at Secondary Stage as its the foundation stage.
2. Science teaching has not been found that much so it is desirable for the researcher to select the topic.
3. After pandemic, people have started talking about ICT tools and ICT assessment tools like – Kahoot, Mentimeter, Quizzez, Google classrooms and so on.
4. After corona impacted the world, ICT learning material has gained more acceleration in terms of execution in education field.

RESEARCH DESIGN

The researcher of this research work has selected the topic, “The Study of ICT based learner centered approach for teaching learning of Science for quality education in science at secondary level” for the study. The researcher has used experimental research design for the present research.

The present study is experimental in nature and consists of two parts:

- The first part consisted of development of the ICT program on one chapter of Science from Physics, Chapter for Grade X: Electricity
- The second part of the study was concerned with finding for quality education and the effectiveness in Science through developed ICT program.

In order to study the effectiveness of the developed ICT program the pre-test post-test control group design was employed. The pre-test post-test control group design adopted in this study provides control of some of the variables which jeopardize internal validity of the experiment. The sample consisted of students of standard X of Science stream of a private school of Delhi NCR. The students of the school were divided into two groups, traditional group and the experimental group for both grades. The students of the traditional group received the instruction through the traditional method. The students of the experimental group received instruction under strategy of ICT.

Learners of all the groups were pre-tested and post-tested on the contents of the chapter for standard X. NCERT textbook was selected for the present study. The mean gain scores of the students of traditional and experimental groups were taken to check the effectiveness of the ICT program. The students were also pre – tested and post tested to check their achievement using achievement test and scientific attitude using scientific attitude test. Research design has ICT based material based on learner centered approach which will be used for teaching students at secondary level after the pretest. Post-test design on experimental and traditional group will be administered after their respective treatments.

The researcher was interested to know whether students could learn through ICT based learning material because it included audio and visual presentation some additional laboratory approach which will make the learning more conducive, experiential, effective and retentive. To know the effectiveness of ICT based learner centered material, an experiment was carried out on students of X of the academic year 2023-24 of Prudence School, Dwarka 16B.

VARIABLES OF THE STUDY

In the present study,

Independent variables are:

1. Learner centered based ICT learning material
2. Traditional method of teaching

Dependent variables are:

1. Achievement of students for quality in Science
2. Scientific attitude of students

POPULATION AND SAMPLE SELECTION

POPULATION

In the present research, the population is consisting of students of English medium school of standard X studying the syllabus of Central Board of Education of Science stream of Delhi NCR.

For the preliminary test of the ICT based learning program, 120 students were selected randomly from prudence school, Dwarka 16B. The sample was divided into two groups:

- Experimental group (Grade X)
- Traditional group (Grade X)

consisting of 60 students each. The selection of the school was done using purposive and convenience sampling. Selection of the students was random sampling.

The main purpose of the research was to check the effectiveness of ICT in Science and to study how far this material helps the students to learn themselves. For the main test of ICT program, the researcher used multistage sampling technique. The researcher used purposive sampling technique for selecting the city, school and students. For this, the researcher selected the following school: Prudence School, Dwarka16B. This school was selected with purpose of getting all the required facilities and the researcher's convenience for the study. The purposive sampling is selected because it is known to be representative of the total population, or it is known that it will produce well - matched groups.

The idea is to pick out the sample which is considered important for the particular study. Next, the students from standard X were selected by purposive sampling. In each group of X grade, 60 students each were present in both groups. Thus, total 120 students were selected from the school.

Disconnect between science and science education

It has been observed that philosophy of science has influenced science education in the past. But the present science curriculum has failed to present the contemporary view of science. Martin (as in

Hodson, 1985) says that science curriculum has generally presented the confused and contradictory views about science based on old and discarded philosophies of science. Thus, there is a need to review science curriculum in the light of contemporary philosophy and sociology of science (Hodson, 1985).

Authoritative nature of science

What dominates science classrooms is the very nature of scientific practice that claims to find definitive answers following a particular method. We see that the authoritative nature of science dominates the practice and the communication of science. Thus the practical work carried out in schools is heavily constrained by the authority of the textbooks, teacher, protocol, apparatus, style of reporting, etc.

Disconnect between textbooks, laboratory work and everyday experiences There is a huge disconnect between what is written in textbooks or said by teacher, what actually happens in laboratory and what students observe in the outside world, for instance, a circuit diagram in book is one thing whereas the actual circuit laboratory is quite different (theory does not tell us that the resistance of connecting wires can have effect on the overall resistance of the circuit). Furthermore, textbook hardly induce any questions that create the need for experimenting. What students study in the 25 textbooks and what they do in the laboratory is not related to their everyday experiences. There is a need to connect students' everyday experiences with their school experiences.

Conflict between Students' ideas and the ideas conveyed by the teacher or textbook Many studies report that students hold some preconceptions (different than scientific ones) about the natural world which are sometimes very difficult to overcome (Driver, 1983). They construct knowledge through interaction with physical and social environment. If one has to start from the point where students present state is then one has to explore his concept. In a lab environment students find very different materials than their day to day material and this could be the reason that their existing ideas do not fit in that alienated world. Children' prior ideas also influence their observations. When experiments are designed to answer real life problems, they fulfill the curiosities arising from everyday observations.

Limitations of the laboratory set up Laboratory apparatus constrain students' thinking in the sense that the equipment or set up for one experiment is designed to make students follow a particular procedure leading to one specific result. The lab equipment seems to be very alienated for children. There are very less chances for the students to do any manipulations with the given apparatus. Thus it limits students from thinking beyond the particular apparatus. Also sometimes students find it very difficult to understand how a particular tool works and they are unable to use it correctly for measurement, for example, using a vernier callipers, an ammeter/voltmeter. Also at the same time they need to fit in their ideas in the context of the experiment. So here we see a number of cognitive processes occurring simultaneously like understanding of the apparatus, relating this understanding in the context of the experiment and understanding the experimental context as well. Given all this there is hardly any scope for students' to develop their ideas or formulate their own conceptions regarding the particular experiment. Experiments performed in a natural setting using everyday material are more authentic. If the equipments are simple and familiar, like ordinary day to day objects, there will be more chances of exploration possible. This has been observed while designing investigatory projects during a workshop with TPD teachers and also from our experiences of designing science activities for the visually impaired children (age 8-17 years) during our weekly visits to a blind school. Thus designing experiments in contexts where learners feel the need of extracting information from the nature to answer questions or derive information about it is more productive. This experience cannot be provided in an artificial context with constraints like obtaining a desired result using a specific laboratory equipment. Children are motivated if they are either given a chance to explore materials or given some challenging problems to solve (Hodson, 1990). So to motivate children they should be encouraged to solve their own problems by designing their own experiments under the guidance of teacher whose role could be of an expert in the whole activity. A similar position has been advocated in the Homi Bhabha Small Science textbooks which gives examples based on everyday experiences and the activities in the textbook are suggested such that they can be done using simple everyday materials and objects. The NCF 2005 also contends a similar view for science learning which reflects in the present NCERT science textbooks.

We strongly contend that students should be provided with a learning environment that offers a myriad of problems gathered from everyday experiences and interests to develop a deeper understanding of the process of science, gain conceptual clarity and develop problem-solving skills. Details are as below

TOOLS FOR THE PRESENT RESEARCH

In the previous section the researcher gave the importance of tools of the research. The topic of the research was—“THE STUDY OF ICT BASED LEARNER CENTERED APPROACH FOR TEACHING LEARNING OF SCIENCE FOR QUALITY EDUCATION AT SECONDARY LEVEL”.

Keeping in mind the topic the researcher decided to use the following tools which were developed by the researcher for the collection of required data are listed below:

1. I.Q TEST
2. LEARNER CENTERED BASED ICT LEARNING MATERIAL
3. ACHIEVEMENT TEST
4. SCIENTIFIC ATTITUDE TEST

1. Intelligence test by KG. Desai

To equate students (sample) on basis of Intelligence quotient required to form experimental and traditional group, a reliable and valid measure of intelligence was needed. For this purpose intelligence test prepared by K.G.Desai (Desai Verbal and Non-verbal Group Intelligence test) was used. It included 88 numbers of items.

In spite of I.Q test, another method used to equate the sample to form traditional and experimental groups was on the basis of their performance in science subject in their previous class. Like for grade 10th students, 9th grade science result was analysed.

2. Discussion with Science experts and teachers from the field of Science

Discussions with the learners, teachers and science experts were conducted to identify the topics on which ICT based learning material was to be developed. Selection of topic was done based on:

1. Difficulty faced by the students in understanding the topic
2. Importance of the topic in the field of Science, daily life situations and future advancements
3. Suggestions offered by the experts and teachers

Child's ability is understood by a teacher in course of time but some discussions really help in understanding the understanding level of the students. Also, discussion with other teachers was taken into consideration regarding understanding the topics which need more attention and constructivist approach for student's learning.

3. ICT Based Learning Material : Learner centered approach

ICT Based learner centered material was developed for the experimental group. Topic was selected from the NCERT. Microsoft power point was used to prepare the slideshow with the content and video links, audio, GIFs and animated videos were inculcated in the learning material to make it more effective. Script was prepared initially in accordance with the principles required for the development of ICT based learning material keeping in view the learner centered approach. Planning out the sequence of topics, presentation and requirement of audio and visual effects to make the classroom more conducive and interesting was done and executed.

The researcher selected one chapter, Chapter: Electricity from the Science textbook of which according to the researcher was the chapter where the need was felt for the ICT as many topics are related to day-to-day lives. Then the researcher analyzed the content of each chapter and made small frames along with

the animation and figures wherever required. Then the researcher consulted the software developer. Virtual labs were also used wherever required. The recording of the commentary was held in the researcher’s own voice wherever necessary at the studio of the software developer.

Details of the software program:

PROGRAM LEVELS

Topics as per ICT based learner centered approach

GRADE: 10TH

CHAPTER: ELECTRICITY

Level	Description
1	Introduction
2	Charges and its types
3	Electric current
4	Electric potential and potential difference
5	Resistance, resistivity and its factors
6	Joules law of heating
7	Electric power

4. Achievement Test

For the present research work pre-test post-test control group design was followed. An achievement test was prepared for this purpose. Blueprint following Bloom’s taxonomy as per given by CBSE was constructed on basis of which achievement test was made. This test was designed to measure the outcome at the end of the experimentation for the students of standard X for both the experimental and traditional group.

Test was having 15 questions. Total marks was 30 marks. 60 minutes were given to complete it. The students had written down the answers in the question paper. Different types of exercises were asked which is given in table below:

Table

Types of Exercises in Achievement test – LEARNER CENTERED BASED

S.NO. Number	Type of Question	Total Questions	
1.	Fill in the blanks	2	2
2.	True or False	2	2
3.	Short answer questions	2	2
4.	Long answer questions	3	9
5.	MCQ : Choose anyone/more than one	3	3
6.	Define the following terms	1(3 PARTS)	3
7.	Label the diagrams	1	4
8.	State an activity with a diagram	1	5
	Total	15	30

The test was administrated before the experiment, immediately after the experiment and after a week again to check the reliability of the test. The scores obtained from all the tests were analyzed using

proper statistical techniques.

For the qualitative evaluation of the ICT by the experts, face validity was conducted. An evaluation sheet containing 10 aspects regarding ICT was prepared by the researcher. The teachers and experts were requested to express their views on five point scale.

5. Scientific Attitude Test:

Descriptive survey method of research was employed for the present study. Sample of 30 secondary school students each from a group of grade 10th consisting of both boys and girls were selected randomly from Prudence School, Dwarka 16B. Among the tools developed in India, the scientific attitude scale developed by J.K. Sood and R.P. Sandhya was finalized for the final administration to measure the scientific attitude of secondary school students. Scientific attitude scale contained 36 statements of which eighteen were of positive polarity and 18 were of negative polarity. The distribution of items was as follows:

The scientific attitude scale consists of 6 dimensions - rationality, curiosity, open mindedness, aversion to superstitions, Confidence in scientific method.

DISTRIBUTION OF ITEMS

DISTRIBUTION OF ITEMS		
	POSITIVE POLARITY	NEGATIVE POLARITY
RATIONALITY	1,2,3,6	4,5,7
OPEN MINDEDNESS	10,11,15	8,9,12,13,14,16
CONFIDENCE IN SCIENTIFIC METHOD	17,18,19,21,23	20,22,24
CURIOSITY	25,26,29,30	27,28
AVERSION TO SUPERSTITION	31, 35	32,33,34,36

The data was analysed using t-test.

Reliability And Validity of Tools

Reliability

Reliability refers to the degree to which a measure, test or instrument consistently produces the same results when used under the same conditions. There are several methods for calculating reliability such as test-retest method, equivalent or parallel forms method, split half method and rational equivalence method.

Validity

Content validity is the degree to which a test measures the intended content area. It requires both item validity and sampling validity. In order to ensure contained validity, discussions were made with experts in the field and modifications were made based on their suggestions.

Face validity is the expression of logical relationship between the instrument used and its purpose. It is a measure of appearance, which indicates whether the instrument seems to measure the ability to supposed to measure. In contain validity, evidence is obtained by looking for agreement in judgments by judges. But face validity can be established by one person. As a check on the facility, test items were sent to teachers to obtain suggestions for modification.

Achievement Test

The researcher created an achievement test after delivering the topic using ICT based learner centered approach learning material. The test consisted of 20 questions. For correct response, one mark is gifted and zero mark for an incorrect response. To ensure the quality and validity of the test, the researcher involved the input of five experts in the area of teacher education and science field. The specialists were given the test questions to review and edit with the aim of finalizing the questionnaire. The researcher took steps to create a valid and reliable assessment tool for measuring student's knowledge of the concept and the involvement of specialists in the editing process suggested that the test was carefully designed and reviewed to ensure its quality.

Selection of the topic

Following the implementation of the CBSE, the NCERT curriculum for grade 10, the researcher reviewed the existing and current revised curriculum of CBSE for Delhi - NCR region. NCERT Textbook was taken up for the reference. Additionally, the researcher had discussion with experts and science teachers about choosing topics that would help develop and design the module to improve student's achievement. Also, the researcher had a discussion with the students regarding how and on what topics they are facing problem which can be cured with ICT based learner centered as per the researcher. Good reliability in an observation protocol certifies that observations will be consistent across time or observers. Good validity in an observation protocol ensures that the observation instrument actually measures what it is intended to measure.

Content coverage

The test was developed for the grade 10th students consisting of one chapter. The revised Bloom's Taxonomy was used to guide the selection of the content related to comprehension and analysis. A blueprint was created and the item construction criterion offered proposed by various authors (Garret 1981, Freeman 1960, Best and Kahn 1995) were followed to ensure that each statement was clearly carefully constructed. The content validity was determined by consulting with the five professionals in the field of teacher education and science background and expertise who deemed the content relevance and covered necessary material. The process helped to ensure the accuracy of the test's content.

Expert opinion

The researcher gave the achievement test related to the ICT based learner centered material to a panel of specialists in the area of teacher education and science expertise. They assessed the item appropriateness in the light of the courses subject matter. From the original 30 options, 10 items were rejected by the majority of the experts and the remaining 20 items were chosen for the achievement test. The selection of the 20 items was based on their difficulty value DVD and discriminating power DP. The difficulty value indicates how difficult the question is and the discriminating power measures the ability of the question to differentiate between the high performing and low performing students. The items chosen had the appropriate balance of difficulty and discriminating power for the courses objectives.

Reliability of the achievement test

The reliability of the test was assessed using the test-retest method. This method involves administering the same test to a sample of participants at two different time. In this case, a pretest and post test with a week's interval time between them was conducted. The purpose of this method is to determine the consistency or reliability of the test results over time.

The investigator has chosen the test and re-tests method and pilot study was conducted among 30 students were chosen from both groups in total, 15 students from each group of grade X from Prudence

School, Dwarka 16B. The gap of 7 days (a week) was applied to estimate the reliability co-efficient and 25% of the sample was taken out of 120 students of grade 10th. **The estimated test – retest reliability of the students on their achievement was found 0.89.** Thus, the reliability of the tool was established. The correlation coefficient is a statistical measure that indicates the strength and the direction of the relationship between two variables. In this case, it represents the relationship between the scores obtained by the participants in the pre-test and post-test.

No	Coefficient of Cronbach's Alpha	Reliability Level
1	More than 0.90	Excellent
2	0.80-0.89	Good
3	0.70-0.79	Acceptable
4	0.6-.69	Questionable
5	0.5-0.59	Poor
6	Less than 0.59	Unacceptable

PROCEDURE FOR DATA COLLECTION

The procedure for the Data collection is as follows:

- To conduct the experiment, the researcher adopted pretest, post test for traditional group and experimental groups.
- Students of grade X were selected as per their IQ test and science result in previous classes of secondary school.
- Observation was held and discussion with co-teachers to decide upon the topics to be taken up from secondary school science stream for the research work.
- Pretest of achievement test was conducted on the selected topics which require experiential learning, day to day life activities and heuristic approach. Also, the topics were done in their previous classes too which checked their retention of facts and understanding. Scores were recorded.
- Scientific attitude test was conducted for both the groups.
- Traditional method: Notes were prepared by the teacher to teach in the class and lecture was given. The traditional learning group received instruction through the lecture method for 32 hours, spread over 8 weeks.
- Experimental method: An ICT based learner centered and learning material was developed based on the prescribed syllabus by NCERT for the students of grade 10 students of Delhi NCR, participating in the study. The course material was divided into the levels as mentioned already. The experimental group received instruction through the ICT based learning material.
- Children were divided into two groups – traditional group and experimental group as 60 students in each group accounting to total of 120 students.
- The traditional learning group completed paper pencil test. Finally post test work was administered for both the groups and the scores were recorded for further analysis.
- Scientific attitude was re-conducted.
- Results were prepared and analysed.

STATISTICAL TECHNIQUES USED FOR DATA PROCESSING

Statistical procedure followed in this study was based on the hypotheses, the appropriate statistical treatments of the data have been done with the help of SPSS. This chapter presents the following Statistical methods:

1. Descriptive statistics used to sort and explain the data.
2. Inferential Statistics to test the hypotheses. The statistical procedures in the analysis of the study are:
 - a) Descriptive statistics were used to describe the sample with reference to the variables taken for the study.
 - b) The differential analysis was done by the means of t-test, mean, standard deviation, skewness and kurtosis.

Hypotheses:

The present research was of experimental type and so the researcher had formed the following null hypotheses:

H01: There will be no significant difference between the Pre test score of traditional classroom based teaching and learner centered approach ICT based experimental classroom teaching in terms of Achievement test for grade X

H02: There will be no significant difference between the Pre test score of traditional classroom based teaching and learner centered ICT based experimental classroom teaching in terms of scientific attitude for grade X

H03: There will be no significant difference between Achievement of grade X students in Pre-test and post-test score of learner centered ICT classroom teaching.

H04: There will be no significant difference between Achievement of grade X students in Pre-test and post-test score of traditional based classroom teaching.

H05: There will be no significant difference between scientific attitude of grade X students in Pre-test and post-test score of learner centered ICT classroom teaching.

HYPOTHESES TESTING

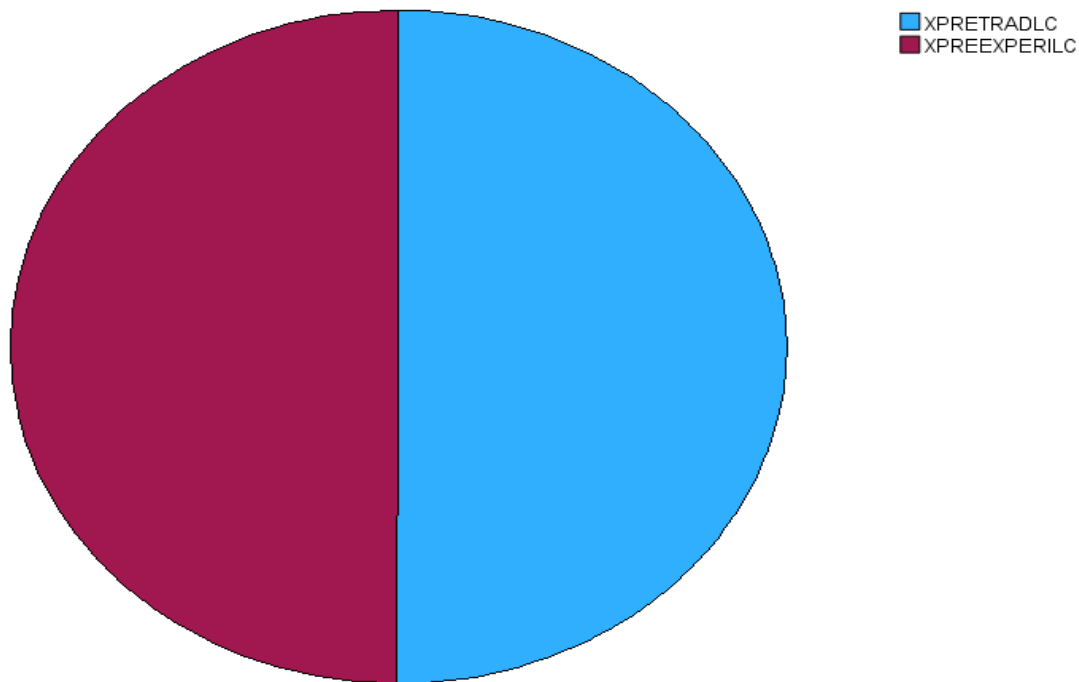
Analysis of H01: There will be no significant difference between the Pre test score of traditional classroom based teaching and learner centered approach ICT based experimental classroom teaching in terms of Achievement test for grade X

Table 4.1(a) Analysis table presenting the Pre test score of traditional group and learner centered ICT based experimental group of grade X, emphasizing achievement.

	XPRETRADITIONAL	XPREOFEXPERIMENTAL
N	60	60
Mean	15.84	15.80
Std. Deviation	6.278	5.251
Skewness	-.004	.220
Std. Error of Skewness	.309	.309
Kurtosis	-.346	-.178

Std. Error of Kurtosis	.608	.608
Range	27	25
Minimum	3	4
Maximum	30	29

Pie chart presenting the Pre test score of traditional group and learner centered ICT based experimental group of grade X, emphasizing achievement:

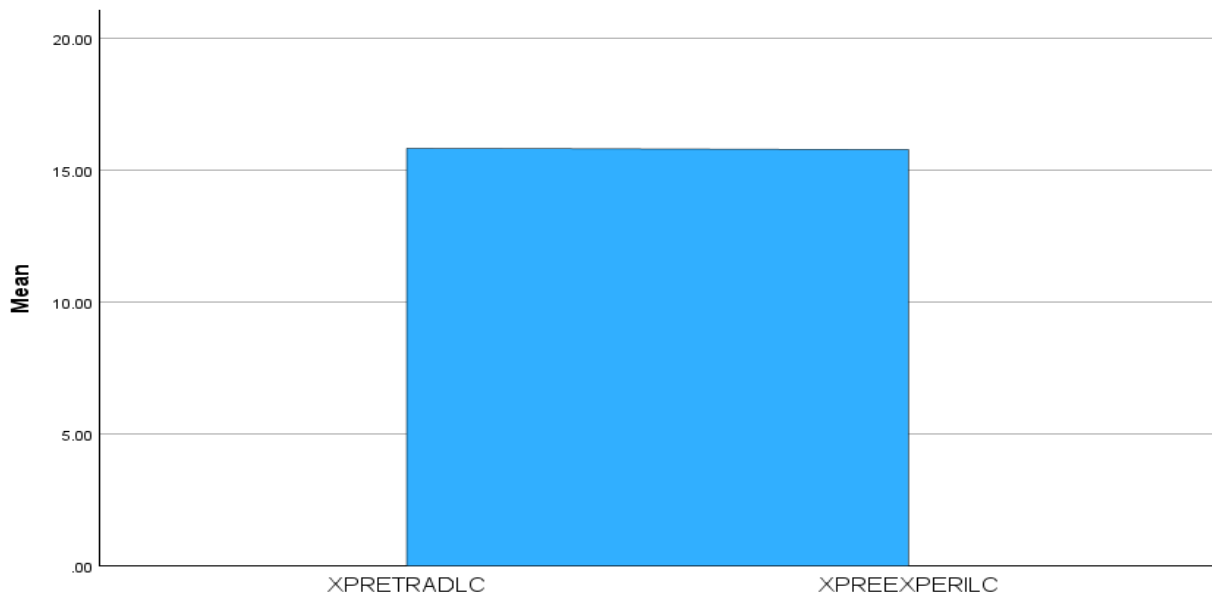


Descriptive Statistics									
Table 4.1(b)									
Table comparing the achievements of score of traditional group and learner centered ICT based experimental group of grade X									
	N	Minimu	Maximu	Mean	Std. Deviatio	Skewness		Kurtosis	
		m	m			Statistic	Std. Error	Statistic	Std. Error
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic
PRETRADITIONAL	60	3	30	15.84	6.278	-.004	.309	-.346	.608
XPREOFEXPERIMENTAL	60	4	29	15.80	5.251	.220	.309	-.178	.608
Valid N (listwise)	60								

Table 4.1(c)
T – Test Result

	Paired Differences						t	Df	Significance	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		p			One-Sided p	Two-Sided p
				Lower	Upper					
XPRETRADITIONAL XPREFEXPERIMENTAL	-.042	8.472	1.094	-2.147	2.230	.038	59	.485	.970	

Graph comparing the means of Pre test score of traditional group and learner centered ICT based experimental group of grade X, emphasizing achievement



CONCLUSION:

As the P-value in this case is more than 0.05, null hypothesis in the above case will be accepted. The findings of the study indicate that there was no significant difference between the pretest score of the two groups which implies that the hypothesis – “There will be no significant difference between the Pre test score of traditional classroom based teaching and learner centered approach ICT based experimental classroom teaching in terms of Achievement test for grade X” **is accepted.**(Tables 4.1(a),(b) and (c))

Analysis of H02: There will be no significant difference between the Pre test score of traditional classroom based teaching and learner centered ICT based experimental classroom teaching in terms of scientific attitude for grade X

Table 4.2(a)

Analysis table presenting the pre - test result for the traditional group and learner centered ICT based experimental group of grade X, emphasizing scientific attitude.

Statistics		
	XPRETRADSA1	XPREEXPERISA1
N	30	30
Mean	49.1850	49.9443
Std. Error of Mean	3.50604	3.63421
Std. Deviation	19.20336	19.90536
Variance	368.769	396.223
Skewness	.641	.449
Std. Error of Skewness	.427	.427
Kurtosis	-.553	-1.146
Std. Error of Kurtosis	.833	.833
Range	63.89	66.67
Minimum	25.00	22.22
Maximum	88.89	88.89

Pie chart presenting the pre - test result for the traditional group and learner centered ICT based experimental group of grade X, emphasizing scientific attitude.

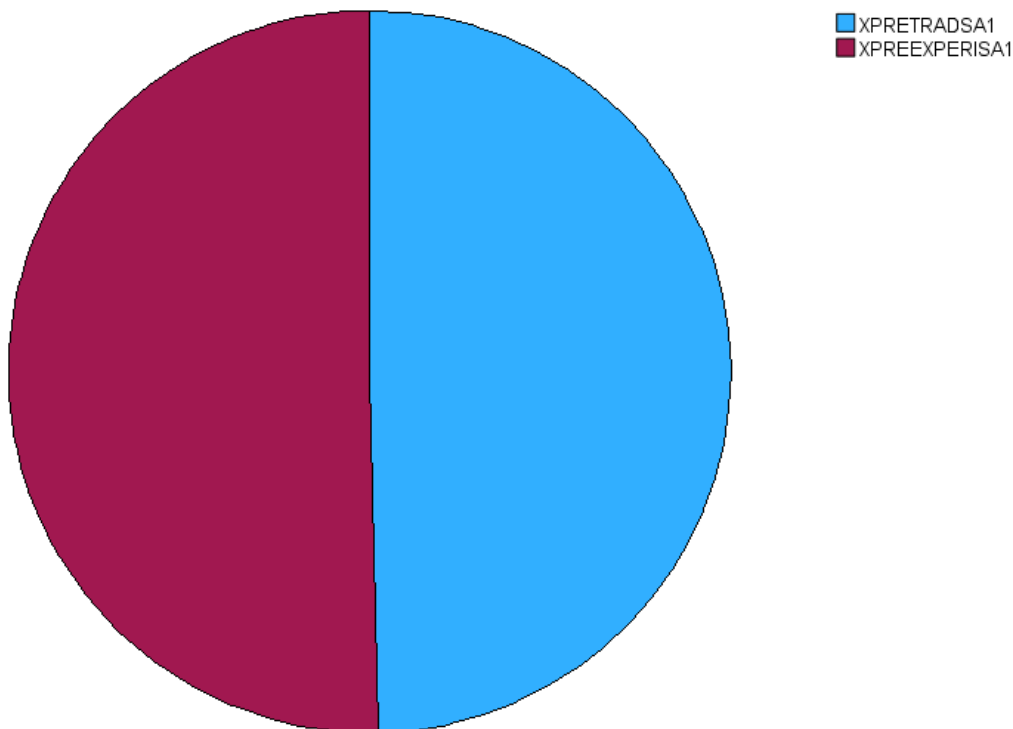


Table 4.2(b)

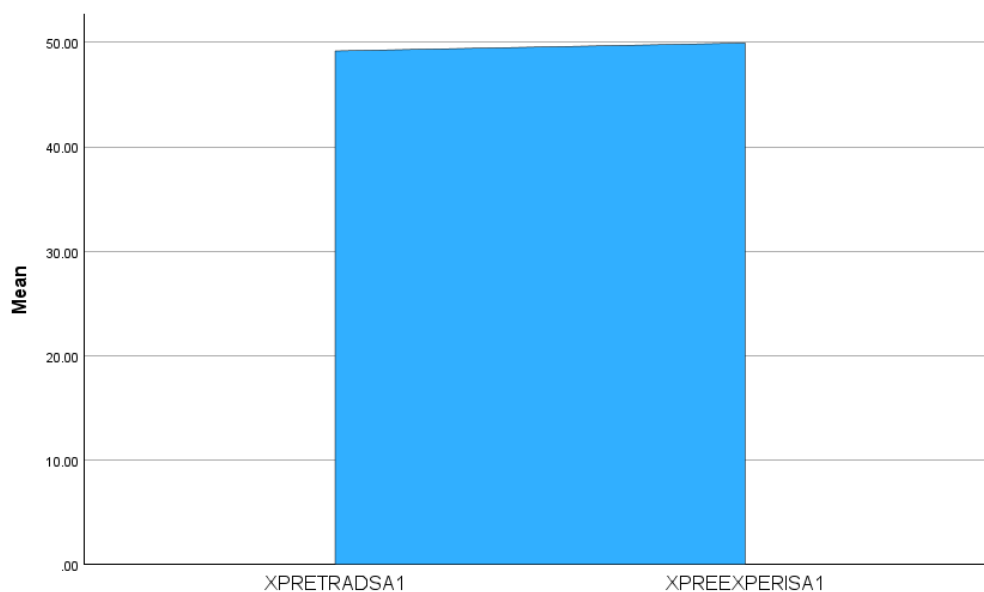
Table comparing the pre - test result for the traditional group and learner centered ICT based experimental group of grade X, emphasizing scientific attitude

	N	Minimum	Maximum	Mean		Std. Deviation	Skewness		Kurtosis	
				Statistic	Std. Error		Statistic	Std. Error	Statistic	Std. Error
XPRETRADSA1	30	25.00	88.89	49.1850	3.50604	19.20336	.641	.427	-.553	.833
XPREEPERISA1	30	22.22	88.89	49.9443	3.63421	19.90536	.449	.427	-1.146	.833

**Table 4.2(c)
T – TEST RESULT**

	Paired Differences						t	Df	Significance	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		One-Sided p			Two-Sided p	
				Lower	Upper					
XPRETRADSA1 - XPREEPERISA1	-.75933	15.22468	2.77963	-6.44432	4.92566	-.273	29	.393	.787	

Graph comparing the means of pre - test result for the traditional group and learner centered ICT based experimental group of grade X, emphasizing scientific attitude



CONCLUSION:

As the P-value in this case is more than 0.05, null hypothesis in the above case will be accepted. The findings of the study indicate that there was no significant difference between the pretest score of the two groups which implies that the hypothesis – “There will be no significant difference between the Pre test score of traditional classroom based teaching and learner centered ICT based experimental classroom teaching in terms of scientific attitude for grade X” is **accepted**. (Table 4.2(a), (b) and (c))

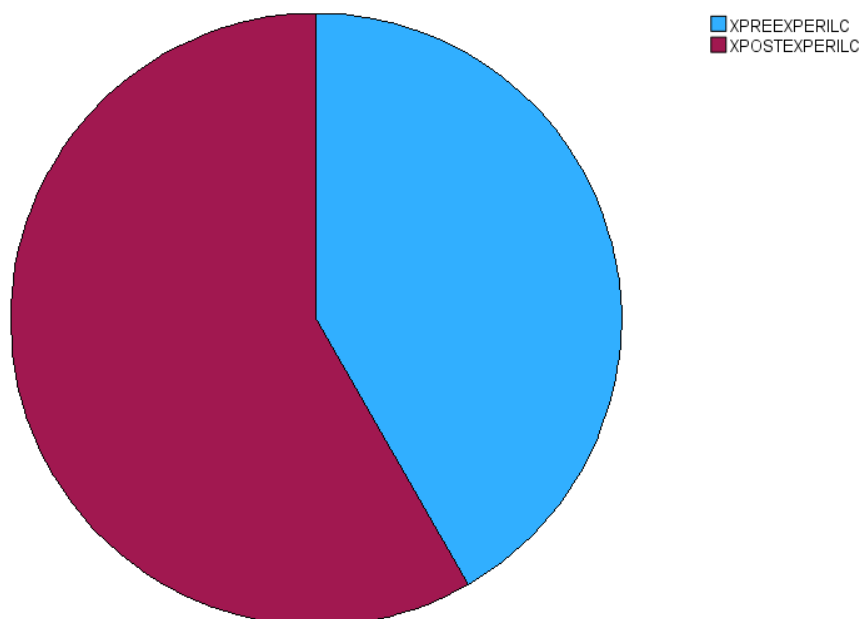
Analysis of H03: There will be no significant difference between Achievement of grade X students in Pre-test and post-test score of learner centered ICT classroom teaching.

Table 4.3(a)

Analysis table presenting the Pre - test and Post – test result for the learner centered Experimental group of grade X, emphasizing achievement.

Statistics For grade X		
	XPREOFEXPERIMENTAL	XPOSTEXPERIMENTAL
N	60	60
Mean	15.80	22.08
Std. Deviation	5.251	4.459
Skewness	.220	-.118
Std. Error of Skewness	.309	.309
Kurtosis	-.178	-.635
Std. Error of Kurtosis	.608	.608
Range	25	18
Minimum	4	13
Maximum	29	30

Pie chart presenting the Pre - test and Post - test result for the learner centered Experimental group of grade X, emphasizing achievement.



Descriptive Statistics

Table 4.3(b)
Table comparing the achievements of the Pre – test and post - test of learner centered Experimental group of grade X

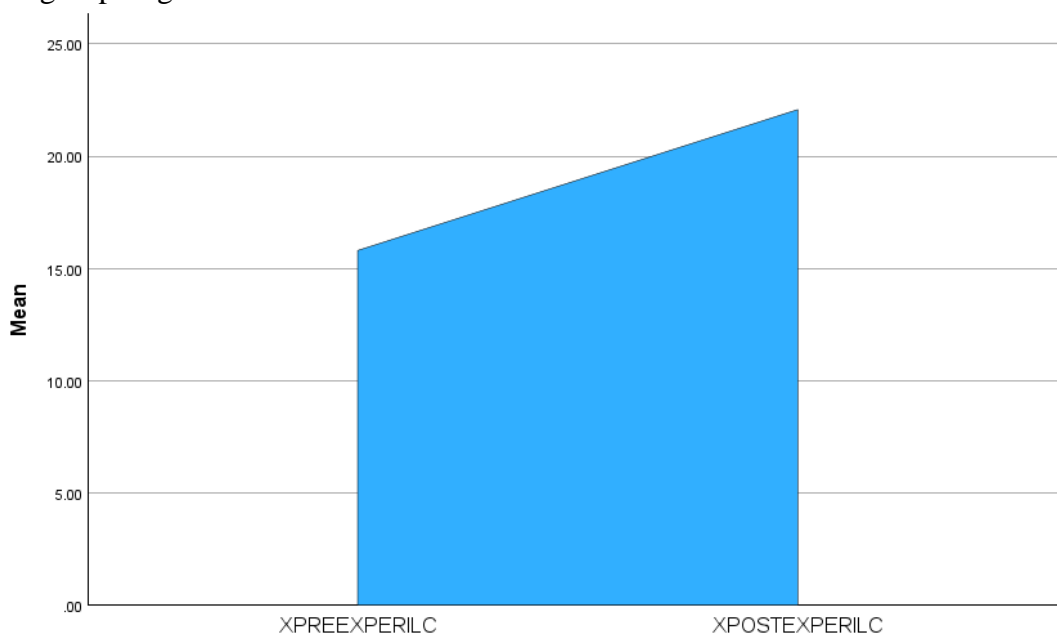
	N	Minimu m	Maximu m	Mean	Std. Deviation	Skewness	Kurtosis		
	Statisti c	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Erro r	Statistic	Std. Erro r
XPREOFEXPERIMENTAL	60	4	29	15.80	5.251	.220	.309	-.178	.608
XPOSTEXPERIMENTAL	60	13	30	22.08	4.459	-.118	.309	-.635	.608

Table 4.3(c)

T -Test Result

	Paired Differences					t	df	Significance	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				One- Sided p	Two- Sided p
				Lower	Upper				
XPREOFEXPERIMENTAL XPOSTEXPERIMENTAL	-6.277	3.705	.478	-7.234	-5.320	-13.124	59	<.001	<.001

Graph comparing the means of achievements of the Pre – test and post - test of learner centered Experimental group of grade X



CONCLUSION:

As the P-value in this case is less than 0.05, null hypothesis in the above case will be rejected. The pre - test and post - test results of the experiment group students who took classes in the ICT blended learning environment were significantly different, so it was concluded that there is a significant difference between the pretest and post test of the experiment group students who have studied in the ICT based learner centered environment.

Thus the hypothesis – “**There will be no significant difference between Achievement of grade X students in Pre-test and post-test score of learner centered ICT classroom teaching**” was rejected. (Table 4.3(a), (b) and (c)).

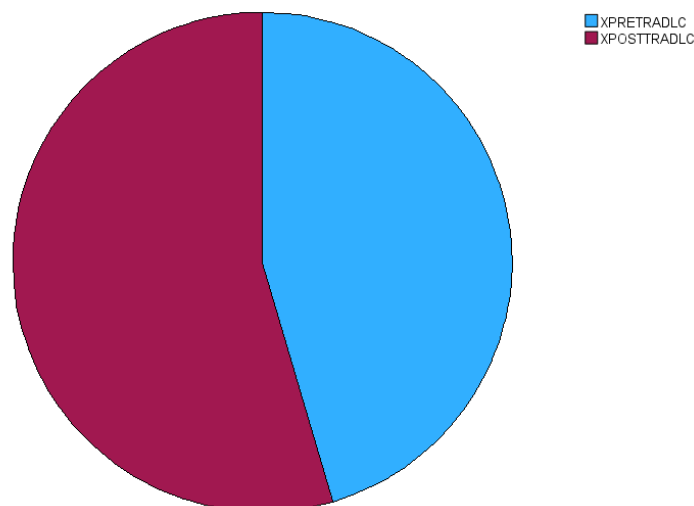
Analysis of H04: There will be no significant difference between Achievement of grade X students in Pre-test and post-test score of traditional based classroom teaching.

Table 4.4(a)

Analysis table presenting the Pre test and Post test result for the Traditional group of grade X, emphasizing achievement.

Statistics		
	XPRETRADITIONAL	XPOSTTRADITIONAL
N	60	60
Mean	15.84	19.00
Std. Deviation	6.278	5.072
Skewness	-.004	.119
Std. Error of Skewness	.309	.309
Kurtosis	-.346	-.526
Std. Error of Kurtosis	.608	.608
Range	28	22
Minimum	3	9
Maximum	30	30

Pie chart presenting the Pre test and Post test result for the Traditional group of grade X, emphasizing achievement.



Descriptive Statistics
Table 4.4(b)
Table comparing the achievements of the Pre – test and post - test of Traditional of grade X

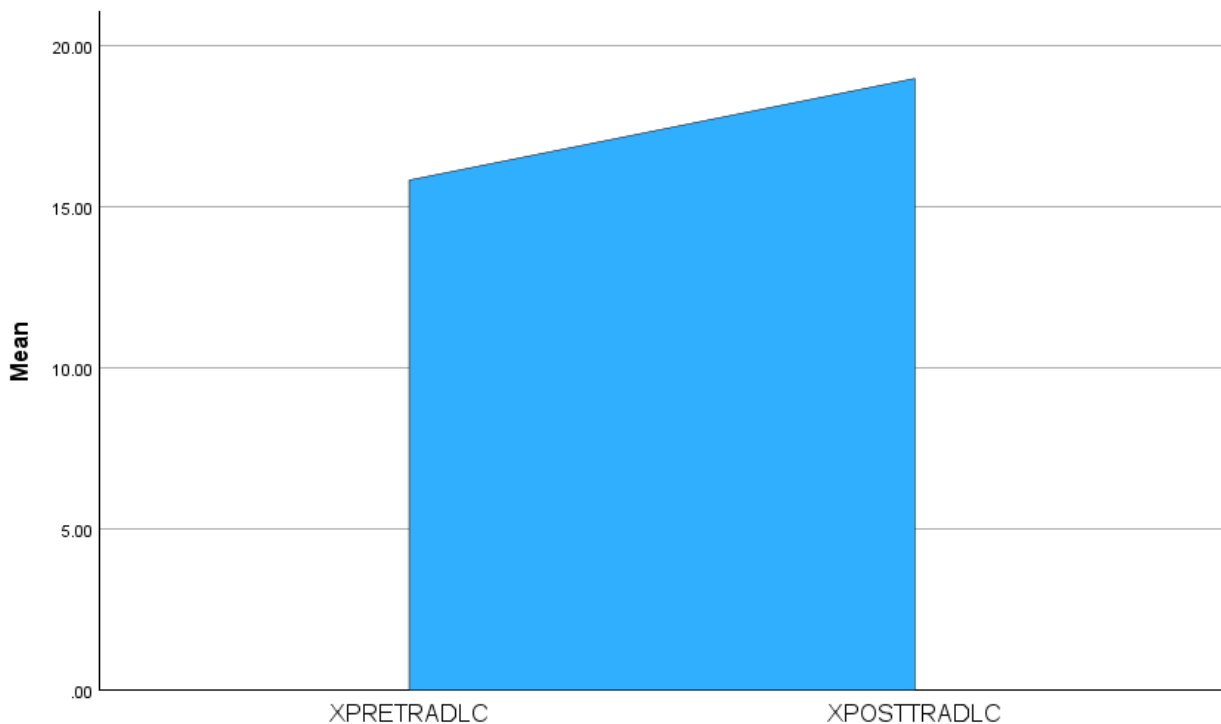
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Std. Error
XPRETRADITIONAL	60	3	30	15.84	6.278	-.004	.309	.608
XPOSTTRADITIONAL	60	9	30	19.00	5.072	.119	.309	.608

Table 4.4(c)

T – Test Result

	Paired Differences					t	df	Significance	
	Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				One-Sided p	Two-Sided p
				Lower	Upper				
XPRETRADITIONAL XPOSTTRADITIONAL	-3.158	2.999	.387	-3.933	-2.384	-8.157	59	<.001	<.001

Graph comparing the achievements of the Pre – test and post - test of Traditional of grade X



CONCLUSION:

As the p value is less than 0.05, the null hypothesis is rejected. The pre - test and post - test results of the traditional group students who took classes in the traditional learning environment were nearly different, so it was concluded that there is a less significant difference between the pretest and post test of the traditional group students who have studied in the traditional teaching environment.

Thus the hypothesis – “**There will be no significant difference between Achievement of grade X students in Pre-test and post-test score of traditional based classroom teaching**” was **rejected**.(Table 4.4(a), (b) and (c)).

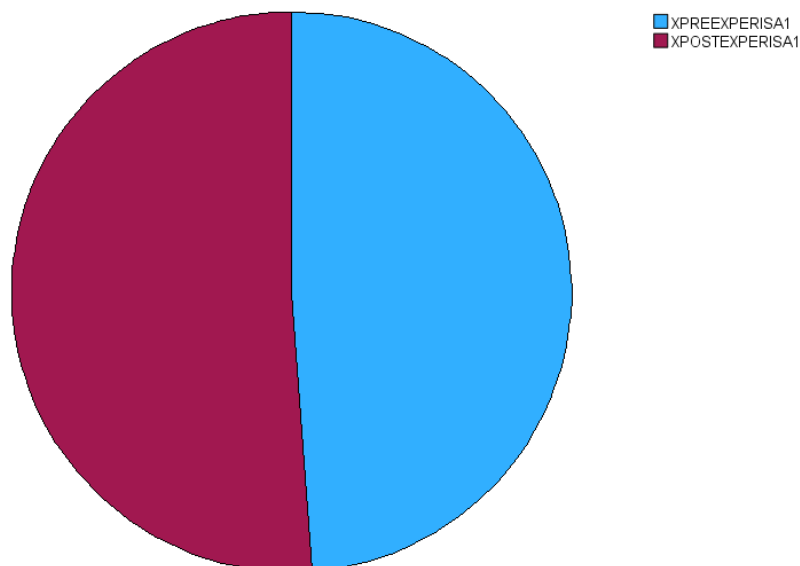
Analysis of H05: There will be no significant difference between Scientific attitude of grade X students in Pre-test and post-test score of learner centered ICT classroom teaching.

Table 4.5(a)

Analysis table presenting the Pre test and Post test result for the Experimental group of grade X, emphasizing scientific attitude.

Statistics		
	XPREEXPERIMENT ALSCIENTIFICATT	XPOSTEXPERIMENTALSC IENTIFICATTITUDE
N	30	30
Mean	47.3767	52.3667
Std. Deviation	19.96923	19.98949
Skewness	1.064	.565
Std. Error of Skewness	.427	.427
Kurtosis	.554	-.903
Std. Error of Kurtosis	.833	.833
Minimum	22.20	25.00
Maximum	94.40	94.40

Pie chart presenting the Pre test and Post test result for the Experimental group of grade X, emphasizing scientific attitude.



Descriptive Statistics

Table 4.5(b)

Table comparing the achievements of the Pre – test and post - test of Experimental group of grade X emphasizing scientific attitude

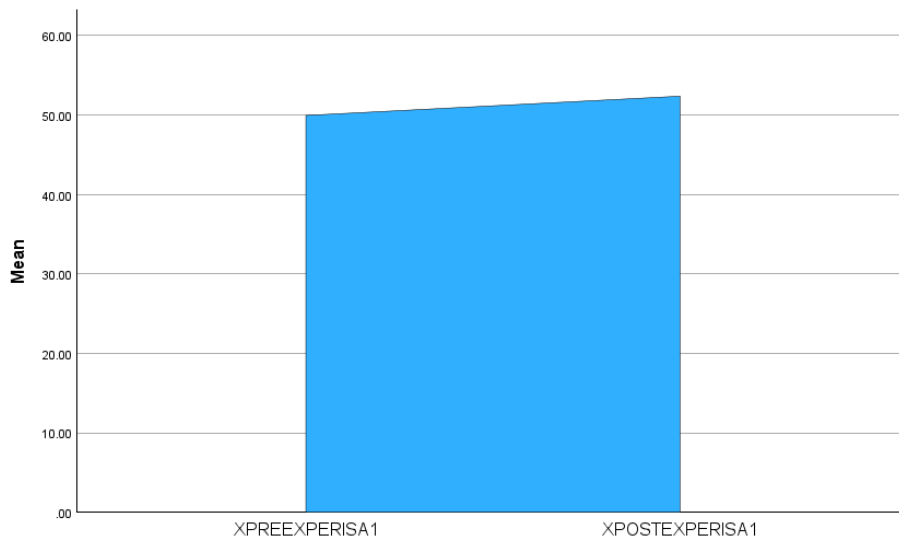
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
						Statistic	Std. Error	Statistic	Std. Error
XPREEXPERIMENTALSCIENTIFICATT	30	22.20	94.40	47.3767	19.96923	1.064	.427	.554	.833
XPOSTEXPERIMENTALSCIENTIFICATTITUDE	30	25.00	94.40	52.3667	19.98949	.565	.427	-.903	.833

Table 4.5(c)

T – Test Result

	Paired Differences					t	df	Significance	
	Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				One - Side d p	Two - Side d p
				Lower	Upper				
XPREEXPERIMENTALSCIENTIFICATT – XPOSTEXPERIMENTALSCIENTIFICATTITUDE	-4.9900	25.52916	4.66097	-14.52275	4.54275	-1.0791	29	.147	.029

Graph comparing the means of achievements of the Pre – test and post - test of Experimental group of grade X emphasizing scientific attitude



CONCLUSION

The P value in this case is less than 0.05, so null hypothesis in this case will be rejected. The pre - test and post - test results of the experimental group students who took classes in the ICT learning environment were significantly different, so it was concluded that there is a significant difference between the pretest and post test of the experimental group students who have studied in the ICT based student centered teaching environment. Thus the hypothesis – “There will be no significant difference between Scientific attitude of grade X students in Pre-test and post-test score of learner centered ICT classroom teaching” **was rejected.**(Table 4.5(a), (b) and (c)).

CONCLUSION AFTER DATA INTERPRETATION AND ANALYSIS OF HYPOTHESES

This suggests that the use of ICT based learning with learner centered approach had a significant impact on the post - test scores of the experimental group on a higher level compared to the traditional group as per the achievement. As per scientific attitude too, a significant difference was observed between pre - test and post - test scores as per scientific attitude of experimental group than traditional group. The results of the study indicate that the students who studied with learner centered ICT based learning material were more successful after the study than the students who studied in a traditional way. Experimental group who studied through the learner centered had a higher post test academic achievement and scientific attitude score than the traditional one. This suggests that ICT based learner centered teaching learning approach would be more effective than the traditional teaching. Also, the achievement test was reliable.

MAJOR FINDINGS OF THE RESEARCH

1. ICT based learner centered learning material was developed by the researcher for teaching of science. For grade X, chapter electricity was taken into consideration. In this majorly, the focus was the active participation of students making it more child centered and the whole learning material was to make the teaching - learning of science effective and conducive in the classes.
2. Learning material using traditional approach was developed for the students of science for both grades X. The researcher used NCERT, Exemplar and CBSE curriculum for making the notes of instructions. Topics catering to the laboratory use were included in the learning material. Write up for lab manual work was also prepared for the students.
3. To achieve these objectives, the researcher developed the ICT based learner centered program. It was implemented on the experimental group of both the grades. Various animations, gifs, presentation effects and sound modulations were used in the learning material. It may also be mentioned that the investigator used developed questionnaires using kahoot and mentimeter for making the learning more effective and recapitulating topics done in the class.
4. Learning material using traditional approach was delivered to the students of science for both grades X and VIII. The researcher used white board and marker to deliver the learning material. Children learned all the topics using listening to the instructions delivered by the researcher. Topics catering to the laboratory use were discussed both in the classes and the students were taken to the laboratory for the same. Electricity for grade X and chapter light for grade VIII were considered.
5. The effectiveness of learner centered approach was way more on the experimental group as compared to the effectiveness of traditional approach on the traditional group. Students even were well versed with the precautions to be taken care of and mentioning sources of error while

performing the experiments which were less seen with the traditional group while they were performing the experiments. Making of circuits, calculation of equivalent resistance and current across the circuits select easily done by the students of experimental group rather than traditional group.

6. Scientific attitude was compared between the experimental group and traditional group of both the grades. However there was a significant difference between the pre test and post test results of experimental group. As a researcher, it's felt that if a science teacher keeps on delivering the learning material using learner centered approach for the whole ongoing session, the scientific attitude will also be developed in the students at a remarkable difference which will inculcate scientific bent in their lives and make their science learning more effective. Development of scientific attitude takes a lot of time and if we start our teaching learning like this at an early age of secondary schooling, it will surely bring remarkable changes in the results of the student and holistic development of their personalities.
7. The findings of the study indicate that the students who studied with the ICT based learner centered and laboratory approach were more successful after the study that the students who studied in traditional way. The experimental group who studied through blended way had a higher post test academic achievement and good technological skills test score than the traditional one. This suggests that ICT based learning module was more effective than the traditional learning.
8. On the basis of findings of the study, relevant literature studied and observations made by the researcher during the study, a few recommendations could be made:
 1. It is much necessary that these types of programs should be used in the school and must start at secondary level students, ie, grade VI, as secondary schooling ranges from grades VI-X, children ageing from 11-15years.
 2. The teachers of the schools should be provided training for use of computer and different audio visual equipments. Teachers must also be provided training in virtual laboratory applications and AI tools which will make more effective learning environment.
 3. The teacher of the schools should be provided special training to develop such programs on different units.
 4. The ICT programs should be made according to the level of the pupils. Age criteria should be taken into consideration. Language and power points aligned should also be age wise as per to make the ICT based programmes interesting and retentive.
 5. Special grants should be provided by the government for having such equipments.
 6. Such ICT program should be made available to both the students and the teachers. Government school students and teachers should also be facilitated using this approach.
 7. Spoon feeding for the students of secondary section in the schools should be completely avoided. Opportunities should be given to them for self learning which would indirectly help them for the development of their independent and critical thinking. Heuristic approach should be developed in students.
 8. Pre recorded ICT programmes, learning materials and tutorials can act as relearning resources enabling students to come prepared to in-person classes. This can also help when a teacher is on leave and she is not able to take her class, recorded ICT based programmes will help the students to continue with the pace of the curriculum.

9. Online quizzes and assessments offer immediate feedback and reinforce learning, while discussion forums and virtual classroom sessions facilitate collaborative learning and active engagement of the students developing all forms of intelligence.
10. Every school should register their personal portal and upload the videos of every subject and e - homework for the students to be ICT competent for future.
11. Students should also be encouraged to develop online quizzes and discussion forums so that collaborative learning can be in-built in the students and continuous evaluation could take place at their end.
12. The non board classes, ie, grades VI - IX can be given various AI and ICT based projects in the field of science.
13. In traditional way, the teacher delivers the lecture only one time. Inculcating ICT based learner centered and laboratory approach will bring a change in the delivering of the lectures as lectures will always be available with these students and they can view it as many times they want for their understanding.
14. Viewing the natural phenomena of nature using virtual labs, this ICT based program will indeed bring a remarkable change in every student's learning of science whether the child is from a rural background or an urban background.
15. Traditional method of teaching is moreover teacher centered. ICT based learning material focuses more on needs of children and how to cater to their interests.

CONCLUSION

The present research reveals that if the students are taught through ICT based learner centered learning material, they can have better performance on their achievement test than traditional method. Another important finding of this research was that scientific attitude will also be developed if the same starts at an early age of secondary schooling. Students can remember the content for a longer time if they are taught through ICT package. Hence, ICT is a learner-centered approach with the help of which students can learn themselves independently at their own pace of learning. In conclusion, it can be said that ICT programme could prove to be effective teaching - learning approach if it is used in classrooms. With all its limitations, the researcher hope that the present study would help in the field of software development for all the chapters of Science and it would surely provide inspiration to the researchers who wish to join this field. Present research was a humble attempt to check the effectiveness of ICT based learner centered for quality education for secondary school students in the subject of Science. The researcher ventured to select the problem investigated in a spirit of inquiry and in conclusion the researcher is fully satisfied that it has been a learning experience that was rewarding in itself enhancing the quality of education specially in subject like Science. It will provide inspiration and necessary guidance for carrying out further research in this field. The strategy that has been evolved out of this study if adopted could pave the way for qualitative improvement of education. In a developing country like India much could be achieved with the existing resources if an attempt is made to develop such ICT programme which is both learner centered approached programs with maximum effectiveness.

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