

Impact of ICT Tools in Teaching Learning of Chemistry: A Study on the Student's Academic achievement and written communication skills at Senior Secondary Level

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Abstract

The present study focuses on the impact of teachers using traditional method and ICT tools on the academic achievement of the students, to compare the impact of teaching with traditional method and ICT tools on the academic achievement of the students and to study the impact of teaching with ICT tools on written communication skills of the students. Sample for the present study comprised of 4 sections of class XII Science enrolled in Jamia Senior Secondary School and Syed Abid Hussain Senior Secondary School. Total sample of 103 students were selected from the four sections of class XII science of Jamia Senior Secondary School and Syed Abid Hussain Senior Secondary School. As random assignment of subjects to control and Experimental Groups has not been applied, the present study is **Quasi Experimental** in nature. Of the many quasi experimental designs, **Pretest- Posttest non-equivalent Groups Design** was employed for the present study. The following tools were used for attaining the objectives of the study: **I) Achievement tests:** a) Pretest b) Posttest **II) ICT tools** (Power Point slides, internet, CD-ROM, MS word, MS paint). In accordance with various objectives of the study, the obtained data was analyzed using specific statistical techniques, which include computation of mean, S.D, t-test, ANCOVA (analysis of covariance)

INTRODUCTION:

The rapid advances recently made in ICT, particularly in the Internet, have very important implications for us. As we begin the 21st century, it is almost impossible to imagine what ICT will be like by the end of the century. We can already start to see how these advances are changing our ideas about traditional education, distance education, just in time learning and the importance of life-long learning. Advances in ICT will mean an enormous increase in the amount of information available to our students as they study their courses and as they move into the workplace, but this must not be the limit of our expectations. If we wish to provide our students with a quality education, we must consider more than mere transmission of information and facts. We must take account of what the educational research tells us about learning, namely students learn best by building on pre-existing knowledge; active learning with understanding and adopting a metacognitive approach. It is generally accepted that new knowledge must be constructed from existing knowledge, that students are given opportunities to study topics in depth rather than superficially, that they are assisted to take more control of their learning and they engage in the internal

dialogue as they monitor and evaluate their own understanding and learning (metacognition).

Tell me and

I forget

Show me

and I

remember

Involve me and I understand

Potential role of ICT may play in revitalizing Science education to meet growing aspiration of today's World. ICT as a powerful tool can be employed flexibly to support new pedagogic approach, one that moves away from knowledge delivery to involving pupils more actively in engaging with science ideas and developing skills & hence enhance student's understanding.

Education embraces almost all activities of life. Education system is dynamic and vibrant. Education enriches a society with the help of dynamic teaching activity. It unfolds a world of knowledge and information to the learner. A good teacher can communicate the divine spark of learning in a barn. In the modern society the influence of teachers is much wider than their immediate impact on their pupils: through their work and example. They not only help raise cultural and moral standards, but contribute to economic betterment of society. What do our students really need to learn and what skills will they actually need when they move into the workplace. In 1996, UNSECO appointed the international commission for Education under the leadership of Jacques Delor. This commission came to be known as Delor's Commission. One of the members of this commission was Dr. Karan Singh. The commission believed that education must be organized around four fundamental types of learning, which through a person's life will in a way be the pillars of knowledge. These four pillars emphasized by Delor's Commission are: -

Learning to know: - That is acquiring the instrument of understanding. Learning to do: - So as to be able to act creatively on one's environment.

Learning to live together: - So as to participate and co-operate with other people in all human activities.

Learning to be: - To develop one's personality and be able to act with greater autonomy, judgment and personal responsibility.

Formal education system tend to emphasis the acquisition of knowledge to the detriment of other types of learning, but it is vital now to conceive education in a more encompassing fashion.

In recent years, we have seen a growing emphasis in many universities on their student's acquisition of "generic skills" or attainment of certain "graduate attributes". This is partly of employers, who express a need for graduates with well-developed skills such as: effective communication both orally and in writing, ICT skills, team work, problem solving etc.

Attributes of social responsibility, a global perspectives and a desire to undertake lifelong learning are similarly valued.

The face of the classrooms is changing; the teachers should prepare to keep up with the technology utility in classroom. ICT is not only an essential tool for teachers in their day to day work, but it also offers them opportunities for their own professional development. In conventional teaching, the most of the time is consumed for input output and less time left for process. But, in teaching with the ICT the input and output time is reduced and process time increased. When the process time is increased, the time of student’s activities, discussion, correlation with other subjects, brainstorming, learning etc. will increase. When we do teaching with the help of ICT, we give more time to process phase, which is more important in a period of 45 minutes or one hour.

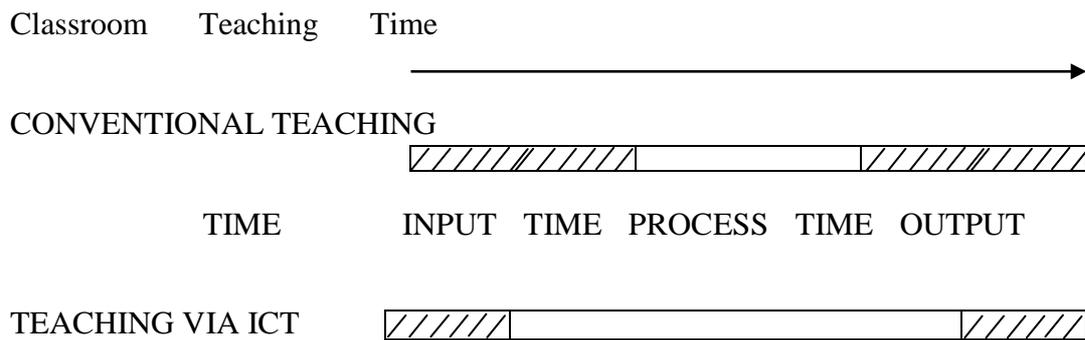


Figure 1 Time taken in Conventional Teaching and Teaching via ICT

Form of ICT in the Classroom

ICT can take in many forms in classrooms. We can use ICT as a core or complementary means to the teaching process. ICT in classrooms can be used in four forms, using the following framework:-

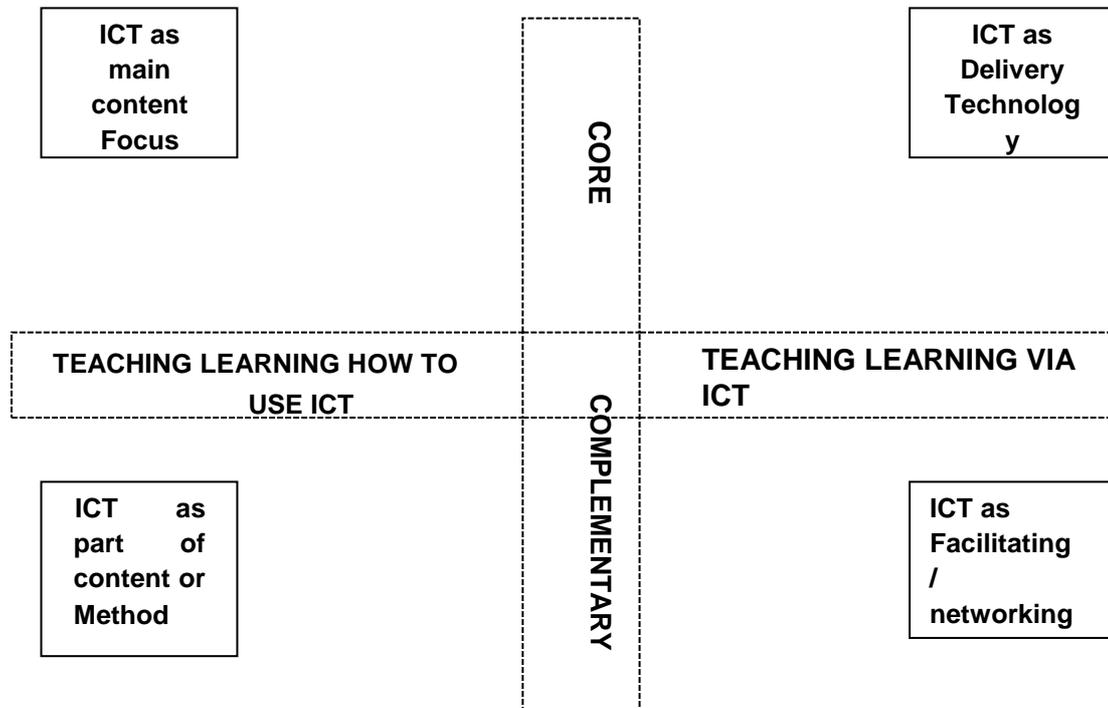


Figure 2 Forms of ICT in Classrooms

According to National Curriculum Framework (NCERT, 2005) children should be provided with more direct access to multi-media equipment and Information Communication Technology (ICT), and allowed to mix and make their own productions and to present their own experiences which could provide them with new opportunities to explore their own creative imaginations.

Such an experience of educational technology production can lay the foundation for far better utilization of the country’s enormous educational technology facilities. Interactive, net enabled computers, rather than only CD-based computer usage would facilitate a meaningful integration of computers, and enhance school curriculum in rural and remote areas by increasing connectivity and access to ideas, and information. It is such two-way reception that would make technology educational.

Keeping in view the dynamic nature of the world of today, it is difficult to predict what form and shape it will take in that tomorrow for which the children of today have to be equipped with latest technological advancements. The aim of modern education is to develop a

complete personality and many aided interest of the learner. So the teacher is no more an “information monger”, he is a friend, philosopher and guide.

The 21st century is in a crucial period for change and development and primarily known “information age” is now shaping up as ‘knowledge age’. One of the greatest achievements of this century is the remarkable development in the area of ICT. The rapid technological changes affect many aspects of our lives, including the ways we learn. The school of tomorrow will embed learning in technology rich educational environments. This will be natural for the new generation of children for whom the technology is already part of their everyday life. The introduction of computers is considered by many as the third revolution in education: the first was printing of books and the second was introduction of libraries.

Ely and Plomp (1996) quoted the four revolutions in education. These were:

- (i) The shifting of responsibilities from family to school.
- (ii) The adoption of written word instead of verbal communication only.
- (iii) The invention of printing process.
- (iv) The development of electronics.

We are now at the midst of another revolution, the ‘Information Technology Revolution.’ In the new technology era, the role of teacher has changed from being instructor to constructor or facilitator and creator of learning situation. The relatively recent change from the term Information Technology (IT) to Information and Communication Technology (ICT) due to the convergence of information technology has opened up new challenges for education. ICT, if used properly, has the potential to radically alter the manner in which students learn and teachers teach. Educational system, all around the world is under increasing pressure to use the ICTs to teach students the knowledge and skills they need in the 21st century. The 1998 UNESCO WORLD EDUCATION REPORT, TEACHERS AND TEACHING IN CHANGING WORLD, describes the radical implications ICTs have for conventional teaching and learning.

Use of ICT Tools in Teaching Learning Process

To meet growing aspiration of today’s world ICT as a powerful tool can be employed flexibly to support new pedagogic approach, one that moves away from the knowledge delivery to involving pupils more activity in engaging with science ideas and developing skills.

- Use of ICT can be in the following areas:

- **Changing Pedagogy:** To mediate the interaction between pupils and concept being taught it is necessary that the so talked “learner centered environment” should be actually brought into practice. Filling the minds of the students with the isolated information and facts will serve no purpose, until students themselves are given any opportunity to contribute to its learning processes. It is therefore essential to use interactive mode of instructional strategy. Various ICT tools may be used like science CD ROMs that can help the students learn at its own pace and also overcome the monotonous nature of lecture method, which tends to be vocal only. ICT with its auditory, visual and text-based impacts can serve to have interactive mode of learning. Also, in prevailing dominant examination system over emphasis on textbooks is seen. In fast growing world of today, it becomes necessary to develop in pupil skills for accessing information from various sources, which are more updated, valid and qualitative. Information derived from Internet is not only easy to access but also has an added advantage of speed, low cost and ease of downloading advantages.
- **Supporting Practical Work:** It is adage that the majority of the schools in India lack the sufficient infrastructure for the practical work. Also the importance of the experiments is marginalized at elementary level where the pupils are given no exposure to practical work. Justification for these are given related to space, funds and risk understanding experiments. However, this may cause the pupil to remain at a disadvantage as the skills related to experiments (design, observe, measure, record, draw conclusion, predict, analyze) are also not developed at the right age. However, this loss may be compensated by using ICT simulation software (either open or closed)
- **Rich resource of information:** Searching books offered at most of the schools represents drudgery and tedious work. Compounding this is the old audited books of which most of the pages are found torn. There is also a growing emphasis on availability and exposure to alternative sources of information other than books, which can provide qualitative and interesting representation of the content thereby improving the understanding of the students. For example, 2D diagram offered in textbooks often fails to represent a continuity of a science mechanism. A mechanical aspect, which includes limited number of books, rigid timings, of library does not later to needs of all the students. It therefore becomes the need of the hour to overcome the time barrier, limited number of books and providing qualitative information to the students. Internet and other ICT tools

serve as a panacea for providing the information efficiently, anywhere and anytime.

- **Enhancing Creativity:** Pupil's role can become more autonomous, if they are facilitated with the plethora of information and challenging situations, which can prompt pupils to remain engaged with concept taught, asking questions about data, finding possible solutions and interpreting them, rather providing them directly. Pupil's creativity can also be enhanced in area of presentation of their work. Instead of routine paper work various ICT tools like power point may be used where they can comate their assignments texted with sounds, appealing pictures and diagrams and various impressing writing formats etc. This give boost to their senses of achievements, which will further motivate their different ways of thinking.
- **Professional development of teachers:** ICT can in various ways help teachers in their professional developments, which are an ongoing process and should not be considered as "one injection of training", teachers need to update themselves as and when school curriculum and technologies changes. ICT extend a range of such opportunities through extensive relevant supporting material, for example:-
 - a) Teachers can undergo content enrichment as and when need arises.
 - b) Planning of learning activities can be supported through suggestions from experts and colleagues via e-mail.
 - c) One can download vivid pictures, diagrams and video clips to support lectures in class, saving time for making teaching aids.
 - d) It enables to bring world into the class just at the click of mouse and makes it possible to demonstrate experiments, which are otherwise not possible.
 - e) Teachers can also be aided to give immediate feedback and assess their students objectively with electronic worksheets.

The potential role of ICT in science education is multifaceted and evolutionary. This can be realized from the opportunities provided by various ICT tools to provide a huge range of resources that are of high quality and relevant to science learning. There is a considerable research audience that learners are more highly motivated when their learning is supported by ICT and ICT also provides opportunities for teachers to be creative in their teaching. It is established through various researches that ICT increase the efficiency of the subject to be taught.

Concept of ICT: For the purpose of this study, Information and Communication Technologies are defined as all digital devices, tools, content and resources, which can be deployed for realizing the goals of teaching and learning as well as management of the educational system. ICT tools in the present study may be understood as the application of digital equipments to all aspects of teaching and

learning. Thus the components of ICT would be video tapes, audio tapes, CDs, DVDs, television broadcast, video cassettes; computer based learning materials, teleconferencing, video conferencing, internet, web conferencing etc. ICT tools used in the present study are:-Internet, Power point Presentations, MS word, MS Paint, CD ROM. The potential role of ICT in science education is multifaceted and evolutionary. This can be realized from the opportunities provided by various ICT tools to provide a huge range of resources that are of high quality and relevant to science learning. There is a considerable research audience that learners are more highly motivated when their learning is supported by ICT and ICT also provides opportunities for teachers to be creative in their teaching. It is established through various researches that ICT increase the efficiency of the subject to be taught. In the present study, the impact of ICT tools on academic achievement and written communication skills of the students is studied.

Academic Achievement: It refers to the scores obtained by the students in posttest (based on content taught during treatment). The taxonomy of objectives given by bloom is used in the present study for preparing the blue print of the pretest & posttest. The steps given by Norman E Gronlund (1990) are considered for preparing the achievement test for studying the impact of teaching with ICT tools on the academic achievement of the students.

Written Communication Skills: Communication skills will become increasingly important as the new communication technologies facilitate collaboration and networking with colleagues and experts nationally and internationally to an extent difficult to imagine now. Our students will need to interact effectively with a wider range of persons as they solve more complex interdisciplinary problems in the future. The social construction of knowledge will become more prevalent and so we will need to expose our students to appropriate learning activities utilizing ICT to develop the skills required for this.

In the present study written communication skills may be defined as expressing your ideas to others in writing other than oral. This requires a good presentation skill which can be improved of the students when they are exposed to appropriate learning activities utilizing ICT tools to develop the skills required for effective written communication. Students through the interactive sessions were properly guided to develop information literacy and internet searching skills. They were also taught the use of MS-Word, Paint, and Power Point

Presentation. These interactive sessions were meant to help students to improve their written communication skills and thus to study the impact of teaching with ICT tools on written communication skills of the students.

OBJECTIVES OF THE STUDY: The study was planned with the following major objectives-

- i) To study the impact of teaching with traditional method and with ICT tools on the academic achievement of the students.
- ii) To compare the impact of teaching with traditional method and teaching with ICT tools on the academic achievement of the students

- iii) To study the impact of the ICT tools on the written communication skills of the students.

HYPOTHESES: There is no significant difference in the impact of teaching with traditional method on the academic achievement and communication skills of the students before and after the treatment phase.

METHODS AND PROCEDURE: An experiment involves the comparison of the effects of a particular treatment with that of a different treatment or of no treatment. In a simple conventional experiment, reference is usually made to an Experimental Group and to a Control Group. In the present study, there are two Control Groups and two Experimental Groups. As random assignment of subjects to control and Experimental Groups has not been applied, the present study is **Quasi Experimental** in nature. Of the many quasi experimental designs, **Pretest-Posttest non-equivalent Groups Design** was employed for the present study.

RESULTS AND DISCUSSION:

1) Impact of teaching with traditional method on Academic Achievement of the students of Control Group-I and Control Group-II: The t-ratio is calculated to be 3.02 of Control Group-I which is greater than the tabulated value at 0.01 level of significance (i.e. 2.02) and therefore can be said to be significant at 0.01 level. The t-ratio value therefore depicts the observed differences in mean scores of pretest and posttest of Control Group-I and Control Group-II is significant. The analysis of data revealed that traditional method has a positive impact on academic achievement of students and therefore may be considered as effective for teaching learning of chemistry in terms of academic achievement.

2) Impact of teaching with ICT tools on Academic Achievement of the students of Experimental Group-I and Experimental Group-II taught with the use of ICT tools: The t-ratio is calculated to be 5.44 for Experimental Group-I, which is greater than the tabulated value at 0.01 level of significance (i.e. 2.02) and therefore can be said to be significant at 0.01 level. The t-ratio value for Experimental Group-I and Experimental Group- II thereby depicts the observed difference in mean values of pretest and posttest scores is significant. Thus, it could be inferred that the use of ICT tools in the teaching learning of Chemistry has a positive impact on academic achievement of the students.

3) Comparison of the Impact of Teaching with Traditional Method and Teaching with ICT tools on Academic Achievement of the Students: Computed F ratio was found to be significant at 0.01 level of significance. It may be therefore inferred that posttest scores of Groups taught through traditional method and use of ICT tools differ significantly after they have adjusted for initial differences on pretest scores. It may therefore be inferred that there is a significant difference in the academic achievement of students taught through traditional method and use of ICT tools and null hypotheses is rejected with high degree of confidence.

4) written communication skills of the students in the pretest phase of Experimental Group-I and Experimental Group-II: From the analysis of pretest scores obtained on written scripts of Experimental Group-I and Experimental Group-II, on an average the performance of Experimental Group-I was 13 which was 43.33 percent of the maximum possible score (i.e. 30) and of Experimental

Group-II was 14 which was 46.66 percent of the maximum possible score (i.e. 30).

5) written communication skills of the students in the posttest phase of Experimental Group-I and Experimental Group-II: From the analysis of posttest scores obtained on written scripts of Experimental Group-I and Experimental Group-II, on an average the performance of Experimental Group-I was 18 which was 60 percent of the maximum possible score (i.e. 30) and of Experimental Group-II was 18.42 which was 61.4 percent of the maximum possible score (i.e. 30). On an average the Group performance of Experimental Group-I and Experimental Group-II on posttest was found better as compared to their pretest scores.

6) Impact of ICT Tools on the written communication skills of the students:

Impact of teaching with ICT tools on written communication skills of the students of Experimental Group-I and Experimental Group-II was analyzed by comparing posttest phase scores in relation to pretest phase scores on written scripts of Experimental Group-I and Experimental Group-II. The analyses showed that there is increase in scores in the posttest phase as compared to scores on written scripts in the pretest phase. However, in order to compare whether the observed difference in the mean values of the scores of the two Experimental Groups in the pretest and posttest phases is significant or not, t-test was employed. The computed t- values of the Experimental Group-I and Experimental Group-II was 10.24 and 23.021 respectively, which are greater than the tabulated value at 0.01 level of significance (i.e. 2.69) and therefore can be said to significant at 0.01 level. The t-ratio values thereby depict the observed difference in mean value of scores on written scripts in the pretest and posttest phase is significant.

CONCLUSIONS OF THE STUDY:

I. Impact of teaching with traditional method and with ICT tools on academic achievement of the students- It may be concluded that teaching with traditional method and ICT tools has a positive impact on academic achievement of students but use of ICT tools, through its interactive mode encourages sustained attention among students for meaningful learning and better comprehension.

II Comparison of the impact of teaching with traditional method and teaching with ICT tools on academic achievement of the students-It may be inferred that there is a significant difference in the academic achievement of students taught through traditional method and use of ICT tools. It may be interpreted that use of ICT tools in teaching not only offers an alternative way of teaching and learning; but also has learning benefits in terms of multi- sensory approach.

IV. Impact of ICT tools on written communication skills of the students- It could be inferred that use of ICT tools is effective in improving written communication skills of the students.

IMPLICATIONS OF THE STUDY: Teachers should be trained to use ICT in their pedagogy. This may be initiated with inculcation of ICT in teacher education, which already had started and should be done more rigorously on a wider scale. Lack of time, unavailability of ICT resources and untrained teachers are some of

the important reasons for the teachers not appreciating and using the ICT tools in the teaching learning process. Therefore, these constraints should be overcome through proper planning and initiatives on the part of higher authority. There should be programmes in the school itself for teachers by the Government agencies, private agencies and public-private agencies on effective integration of Technology (ICT) in the teaching learning process. There must be some special provisions for teachers attending such programmes, so that percentage of school teachers attending these programmes is high.

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