Searching for New Dimensions of ICT Researches

Dr. Lalit Kumar
Faculty of Education
Patna University, Patna

Abstract

Research is essential for the development and for generating knowledge to solve many related problems. Research is also needed for training the future generation of researchers. Research has major characteristics as objectivity, precision, design and verifiability. Broadly it is either (i) Fundamental Vs Action Research or (ii) Qualitative Vs Quantitative Research. In Education usually four types of researches are undertaken as Philosophical, Historical, Descriptive and Experimental. Information and Communication Technology is a branch of knowledge which deals with Production, Preservation, Communication and Evaluation of Information and its impact. ICT related research is the demand of the day and so it needs to be undertaken in all four types of above mentioned researches. Review of literature reveals that maximum ICT related studies have been undertaken in Descriptive research followed by Experimental Research. Study of Development of ICT and its impact on different age can explore Historical Research. Horizon of Philosophical Research also needs to be broaden by studying the contribution of Education and Distance Education Philosophers. Review suggests that Historical and Philosophical Researches are the area in which ICT related studies need some serious attention. To search new dimensions of ICT researches is the demand of the day as it has become a major area of Instruction, Teaching and Education.

Research – How it functions ?

What is Research?

Research = Re + Search. Re means again and search means to find out and so research can be defined as a process under which an investigator observes or studies the phenomena again and again to find the solution or draw conclusions. There is no universally accepted definition of research, however it can be defined as a systematic process of identifying the problem, choosing the variables involved, collecting and analysing the data to make the conclusions in terms of chosen variables. In fact, research is an activity that helps us to generate new knowledge or to find a new way to express the existing knowledge.

Functions of Research:

Research has various functions or purposes. The first function of the research is to train the future researchers by providing them planned research experiences. If research is to continue and develop in days to come, the new generation of researchers must be trained in time. The training is to strengthen the conceptual aspect of research methodology to make the future researchers capable in the way they could adopt right choice of research designs, tools, techniques, methods, data analysis, drawing of conclusion, etc. Problem solving is another important function of research. Problem solving is associated with identifying and searching ways to solve the problems. Problems do not come from vacuum, it is based on felt difficulty, review of related literature and system generated. To identify the research problem

and suggest solution is the task that needs expertise. In fact, selection of a problem itself suggests the design or paradigm of the research.

An important function of research is to generate knowledge or to search for truth. What is the impact of different learning theories, teaching models, teaching methods, etc. on the development of ICT? Research generates knowledge to answer like questions. Research provides opportunity to generalise and this generalisation is really knowledge generation. As the generalisation leads towards the verification of fact or events through observation or experimentation, it can be concluded that research investigates truth.

Characteristics of Research:

The major characteristics of any research are objectivity, precision, design and verifiability. Research does not permit personal bias to affect the findings and this objectivity is achieved through standardisation of research tools, selection of appropriate research design, scientific analysis of data and cautious conclusion. Research has its own language to convey the exact meaning to the reader. Precision in quantitative research is achieved in terms of statistical finding whereas in qualitative research it is usually achieved through words rather than numbers. Research design is associated with the steps like defining the problem, specification of hypotheses or research questions,

collection and analysis of data, testing the hypotheses or answering the research questions and presenting the report. Research can not yield desirable result without the proper design. Research findings and ways to undertake research may be verified whenever needed. This characteristics of research allows to check the conclusions or generalisation made by a research. Verifiability, is related to the criteria of objectivity and precision. This is an important characteristics as without further investigation or replication the results of a single study can neither be confirmed nor revised. Verifiability is achieved by analysing the same data on the same sample through alternative analytical tools or by replicating the study on a different sample.

Types of Research:

Broadly we classify research either in terms of

(A) Fundamental Vs Applied or Action, and

(B) Qualitative Vs Quantitative

The purpose of Fundamental Research is to expand the frontiers of knowledge, whereas the purpose of action research is to improve the educational practices. Progress of educational practice is based on the progress in the discovery of general laws of learning and development of models of teaching through basic research in Psychology, Education and Sociology. Discovery of general laws of learning and development of models of teaching are examples of Fundamental Research. Applied Research is directed towards the

solution of an immediate, specific and practical problem. To find the causes of students underachievement in Mathematics or English is a example of Action or Applied Research. To facilitate the classroom teaching – learning situation one can depend on basic research for discovering the more general laws of learning, but it is applied research which needs to be conducted in order to determine how these laws operate in the classroom.

Qualitative Research is to examine the nature of human behaviour and experience and social conditions, whereas Quantitative Research focuses on Objective and Standardised means of inquiry and application of statistical analysis for attainment of objectivity and generalisations. Qualitative research permits the researcher to study selected issues, cases or events in depth. Data for Qualitative research is usually collected through Observation (direct & participative), interview (planned – unplanned, structured – unstructured), case studies, recorded documents, open – ended questionnaires, etc. Quantitative Research uses standardised measures that fit diverse opinions and experiences into predetermined response categories. In Quantitative Research the reactions of a large number of individuals is measured to a limited set of questions, and facilitates comparison and analysis of the data with the help of close-ended questionnaires, attitude scales, rating scales and postal surveys.

IGNOU (2008) through its Self Instructional Material developed for M.A. Education programme of Research Methodology has further categorised the Qualitative and Quantitative method. The category Quantitative has Experimental, Quaise-experimental and Correlational research in its domain. On the other hand Survey, Case studies, Documentary analysis, Developmental, Ethnographic, Historical and Philosophical researches fall in the domain of Qualitative research. Without making any hue and cry on the issue the paper is to discuss the types of research in terms of Survey, Experimental, Philosophical and Historical.

Historical:

The process of historical research involves investigation, recording, analysing and interpreting the events of the past in order to make generalisations. Generalisations made through the process helps in understanding the past, building a perspective about the present, and in anticipating the future. The broader objective of historical research is to arrive at an exact account of the past to gain a clearer perspective for the present.

Philosophical:

The process of philosophical research critically evaluate the thought of an individual or of a school. Classification and collection of data from original sources are made. Researchers

insight and his analysis capacity is necessary for the interpretation of data. Philosophical research does not require any elaborate technique as it is dependent upon analytical insight and synthesizing ability. It is a bookish business, even more than history, having to do largely with the close perusal of authoritative books and venerable tomes. The library technique and content analysis technique are used mainly in philosophical research. Philosophical research is also taken under historical research.

Descriptive:

Descriptive research investigates "what exists". It involves the description, recording, analysis and interpretation of conditions that exists. It involves some type of comparison or contrast and attempts to discover relationships existing between variables. The descriptive research is appropriate in behavioural sciences. In descriptive research the researchers, collect evidence on the basis of some hypothesis, tabulate and summarise the data carefully, and then analyse the results thoroughly to draw meaningful generalisation. Sampling is important for this research. Survey studies, Analysis of documents, Correlational studies and Causal-comparative studies are types of Descriptive Research. Quite often, Descriptive Research itself is termed as survey research, but it is better to think of it as a category under descriptive research.

Survey is probably the most widely used method for obtaining descriptive and evaluative information in education.

Documentary analysis is like historical research, but unlike historical research it is primarily concerned with the present. Data is being gathered from existing educational practices, administrative records, forms and reports, committee reports, minutes of meetings, budget, financial records, etc. correlational studies are concerned with determining the extent of relationship existing between variables. Causal – comparative studies is to compare the similarities and differences among phenomena to find out what factors or circumstances seem to accompany or contribute to the occurrence of certain events, conditions or practices.

Experimental:

This type of research describes what will be when certain variables are carefully controlled or manipulated. The focus is on the relationship between two sets of variables. It is concerned with the investigation of cause – effect relationships in educational events. Issues like which method of teaching is more effective in promoting students learning in a particular subject? are settled through well-designed experimental studies. Treatment (whose effect is to measure) is given to experimental group whereas another group is controlled (control group). If experimental group excels in post-test it is concluded that the difference is due to the treatment.

ICT : Meaning, Scope and Importance:

There are three distinct words in the concept Information and Communication Technology, i.e. Information, Communication and Technology. Information is a piece of knowledge which is generated, stored, transmitted and communicated. Communication means transmission of Information from one end to other. Technology is required to make communication and Preservation of Information easy. From the above discussion it can be concluded that Information and Communication Technology is a branch of knowledge which deals with Production, Preservation, Communication and Evaluation of Information and its impact. ICT has revolutioned the world, but it is not limited to the implication of machines only. Generation and transmission of Information is also based on the principle of psychology and management, besides Science and Technology. Development of Software, Presentation of Information and its communication needs human factor more than that of the machine.

ICT has been defined differently, but all the three types of Educational Technology, i.e., Hardware, Software and System Approach, are associated with the concept of ICT. It is also associated with Instructional Technology, Behavioural Technology, Teaching Technology, Management Technology and Communication Technology. The three aspects of Educational Technology, i.e., Input, Output and Process, are also associated with Information and Communication Technology. ICT considers teacher the power

house of Information generation and best communicator when it place the teacher in the Input-domain besides process and product domain. Teacher receives Information, communicates it properly and serves the education system as the ever-improving product. The discussion focuses on the fact that ICT is not limited to the implications of different machines only as it is being perceived and conceived by a group of people.

Mishra, Rajendra (2008) as quoting the definition of ICT given by United Nations have said, "As per the definition used by United Nations, ICT can be described as a varied set of goods, applications and services used to produce, store, process, distribute and exchange information. They include both the most familiar technologies of television, radio and telephone (now called older or traditional ICTs) and the relatively newer ones – personal computers, mobile phones, satellite and wireless technologies and the internet." NCF (2005) pronounces, "ICT is an important tool for bridging social divides. ICT should be used in such a way that it becomes an opportunity equaliser by providing information, communication and computing resources in remote areas." Taj, Hassen (2004) writes, "Information and Communication Technology (ICT) can be defined as tools and applications support through which or by means of which information is transferred, recorded, edited, stored, manipulated and disseminated with enormous quantities in the minimum possible time." From the above quoted

definitions and discussion made in the beginning of the concept ICT we can conclude that the ICT covers all the three types of technologies, i.e., Hardware, Software & System Approach and is based on the principle of Psychology, Science & Technology and Management, etc.

Importance of ICT is in every affairs of education. It is useful for curriculum planning, curriculum development, curriculum transaction and curriculum evaluation. ICT is associated with the objectives specification of a programme to the evaluation of the programme. Focusing the advantages of ICT in classroom situation Babu, S. Sudhakar (2007) concludes, "These advantages include : • Opportunities to deploy innovative teaching methodologies and to deploy more interesting material that creates an interest in the students; • Enables better management of classroom and students thereby improving the productivity of the tutor as well as the taught; • Enables the teacher to concentrate on other tasks such as research and consultancy; • Enables optimum utilisation and sharing of resources among institutions there by reducing the costs of implementing ICT solutions." Explaining the need of ICT for the development of Teacher education, Rathod, J. and Kella, A (2008) has conveyed, "Teacher education institutions may either assume a leadership role in the transformation of education or be left behind in the swirl of rapid technological change. For education to reap the full benefits of ICTs in learning,

it is essential that pre-service and in-service teachers have basic ICT skills and competencies. Teacher education institutions and programmes must provide the leadership for pre-service and inservice teachers and model the new pedagogies and tools for learning."

How ICT helps Teacher has been well summarised by Padhi, SK and Sahoo, K (2008), "ICT helps teachers in preparation for teaching. With the help of ICT, teachers can have access with institutions and universities, UGC, NCERT, NAAC, NCTE etc. ICT helps the teachers to interact with students. ICT enables the teachers to have access on online libraries, journals and research for individual learning. ICTs enable to give right feedback without making any biases." It is quite evident that it is difficult to talk education without ICT in this age of Information. Teacher, student, policy maker, curriculum planner, every one now need ICT to monitor their functions smoothly. What is more important in this connection is to study the negative impact of excessive use of ICT. Mind it, slide show is not teaching, creativity is not limited to Information and Communication, Imagination is not due to use of ICT only, excess use of machine may mar memory and use of ICT in an unskilled manner may create a lot of confusions in the mind of learners (specially during infancy and childhood). Few negative impact do not restrict the all round utility of ICT, but one has to answer what percentage of student and teacher population has

access to ICT? This may be taken as an important dimension of ICT researches.

Research Area and ICT:

Research in India is not capable to compete with the world standard and this is true for every branch of research – Education, Science, Behavioural Science, etc. Kumar, Lalit (2009) has lamented on the quality of research in higher education, "Although the quantum of research is increasing progressively, it leaves much to be desired in terms of range of variables and quality." Same dissatisfaction has been expressed by Sharma, M.C. (2008). Sharma by quoting Dr. C.N.R. Rao has written , "Dr. C.N.R. Rao in a talk recently felt that the gap between the research facilities in the country and the world which was narrowing, has widened in the last 15 years and is growing wider." He has also pointed out the poor quality of research and frustrating quality of Ph.Ds. produced.

Gupta, SM (1995) has expressed about research in Teacher education, "Techniques of research have been largely adopted in the third world countries without adaptation of contextual variables." About ICT related research he has further spoken, "It would also be desirable that the teacher under training should be introduced to a number of new technique like the use of television, programmed texts and language laboratories in class room settings. The effectiveness of these techniques and methods in developing the professional competence of teacher trainees can be fruitful topics for investigation." Malhotra, SP (1995) has suggested and hoped

that ICT may be helpful in undertaking the research properly, "With computer services at hand database sophistications available in various surveys, the researchers will have to modify their research programmes to resolve the existing crisis. Future researches need to be development oriented and cost effective. Purpose is to find answer to basic question – which technology will be most useful and economic for the best professional growth of teachers ?"

Overall quality of research is not satisfactory, ICT research is also not exception. ICT related research can facilitate the process of Teaching and Learning and following are the priority areas in which ICT related research may be undertaken.

(A) <u>Historical Development of ICT as a field of study:</u>

Growth and Development of ICT; Development of Distance teaching; Case study based on some open universities; Development of theories related to management; Communication, Media Integration; Reading and study skills, etc.

(B) <u>Philosophy behind ICT and its development</u>

Contribution of philosophers like Wedemeyer, Moore, Dohmen, Peters, Holmberg, Baath, Sewart, etc; Role of Educational philosophy (Idealism, Naturalism, Pragmatism, etc.) in the development of ICT; Contribution of Individual Philosopher and Educationist in the development of ICT.

(C) <u>Development of Learning Material & Software</u>

Programming, Self Instructional material, (Print and electronics.)

(D) <u>Impact of Different Techniques, Methods, Models, Media, Skills, etc.</u>

(E) <u>Sense organs related study.</u>

(F) <u>Economics of ICT.</u>

(G) <u>Constrain, Limitations and Ill-effect of ICT.</u>

IGNOU (2009) through its self instructional material developed for M.A. Education programme on Educational Technology has identified Research on the theory of learning and teaching and acquisition of teacher expertise, Research in classroom learning, Research in self-learning and Media utilisation investigations as major area of research in Educational Technology.

Types of Research employed in ICT

Research has been discussed in the form of Fundamental – Action and Qualitative – Quantitative in the early part of the paper. In the paper focus has been given to the types of research as Philosophical, Historical, Descriptive and Experimental. ICT related research can fall in any category, but most of undertaken researches are either from Survey (Descriptive) or from Experimental type. Following review of the study may provide the researcher insight or background to undertake ICT related research and choose the appropriate type of the research:

Philosophical

Philosophical research, as stated above, may be taken as a part of historical research, but to explore the field it would be more better not to dilute the field. Contribution of different philosophical schools and individual philosophers in the development of ICT need

to be studied. How these individual philosopher or philosophy has enriched ICT related study need to be studied in the category. IGNOU (1999) through its Self Instructional Material developed for the programme PGDDE has produced a list of philosopher who has contributed to the Distance Education. The list of contributors and their area may provide research problems for philosophical research. The list is as, "The proponents of the "theories" we have chosen are listed below for easy reference.

S.N.	Name	Major theoretical contribution
1.	Charles A. Wedemeyer	▪ Independent study
2.	Michael G. Moore	▪ Distance : a function of "dialogue" and "Individualisation" ▪ Learner autonomy
3.	Otto Peters	▪ Distance Education : an industrialised form of teaching and learning
4.	Borje Holmberg	▪ Guided didactic conversation
5.	John A. Baath	▪ Significance of two-way postal communication
6.	David Sewart	▪ Human element in an industrialised form of learning and teaching

Table – 1 : Distance Education Thinkers and Theories"

Historical

Evolution of ICT is the important field to study. How ways of Communication, Management and Teaching have changed due to advent of technologies ? may be fruitful problems of research in ICT. Policies regarding development of ICT by Central Government, State Government and other agencies can also be taken as research

problem. IGNOU (2009) through its self instructional material developed for M.A. Education course on Educational Technology programme has identified four phases of ET as (a) Audio – Visual phase, (b) Psycho – Sociological phase, (c) Cybernetic phase and (d) Information Communication Technology phase. Use of different technologies in different era or age and their relative impact on the teaching-learning process may be another important study related to ICT. How Learning theories, Models of Teaching, Theories related to Management and Communication have influenced the shape of schools and classrooms may also be an important study. ICT has different developmental phases in different area, and to explore and evaluate different development in different area historical research can serve the purpose in a better way.

<u>Descriptive</u>

As discussed above Survey is a part of descriptive research, but number of increasing survey research has made it as descriptive research. Survey or descriptive type of research is more in number, and ICT is not an exception. Karim, Salma; Kamal Mustafa Azad and Islam, Md. Mayenul (2001) made a case study of Bangladesh Open University and found problems in the use of Radio programme as unsuitable time schedule and non-availability of time due to the business and family involvement of students. Sharma, M.C. (2001) found practices of teacher education programme offered through distance mode needs improvement.

Dharma Raja, B. William, Anandan, K. and Mohan, S (2000) concluded, "In general, students had low computer anxiety and neutral attitude towards computer." Pulist, SK (2001) concluded "The University website needs to be managed professionally in order to enhance its performance level and outside agency could be engaged for the purpose in case in-house expertise is not available." Arya, Kalpana; Sharma, S and Dhaliwal, Y.S (2001) concluded, "Half of the children feel that television viewing has decreased their attention towards playing games. It is observed that children adjust their time to do homework according to the timings of the television programmes." Anuradha, K. and Bharathi, V.V (2001) has concluded, "The significant difference was found in children's amount of T.V. watching depending on the type of punishment exercised by the parents." Kaur, Jasraj (2001) concluded, "More male illiterates than female illiterates perceived negative impact of T.V. viewing on all the aspects of social interaction."

Sarupria, S (2005) summarised, "Most of the schools had computer laboratories with basis computer facilities, but there were certain issues that needed immediate attention like; status of contract computer teachers in terms of salaries; teaching experience; permanent appointment of staff and in-service training; budget for CEP; dissatisfaction of students towards the quality of study materials; Lack of correlation between theory and practice; guidance given by teachers during practical classes; and the ICT

policy of the state of Rajasthan for implementing CEP in schools." Rajasekar, S and Sini, SS (2005) concluded, "The Internet knowledge of Research scholars belonging to the Arts subjects was (Mean = 13.75) relatively low." Dey, B; Saxena, KM and Gihar, S (2005) summarised, "More than 80% teacher educators were found not using educational technologies like magic lantern, epidiascope, video camera, film projector, LCD projector, Radio and DVD in their teaching." Sidhu, R.K. and Kaur, K. (2005) concluded, "Socio-economic status and home environment are significantly jointly related to television viewing behaviour of male and female college students." Chaurasia, S (2005) concluded, "The Shikshamitras, BTC condense trained teacher and BTC trained teachers were found to be homogeneous with regard to teacher – student interaction and teaching activities." Gupta, M. and Jain, R. (2005) found, "The formal school teachers scored significantly higher on the self-appraisal of their teaching skills, i.e., instructional strategies, communication skills, motivation and class management than the distance mode teachers."

Mehra, Vandana (2007) found that teachers possessed fairly positive attitude towards computer uses but majority of the teachers need to be provided training for using computers in instructional settings. Rajasekar, S. and Vaijapuri, Raja P (2008) found that the entire sample of teachers has high level of computer anxiety. The teachers handling the subjects of the science group and those who have not attended any computer classes have high

level computer anxiety than their counterparts in the Arts group. Ragoonundum, Calawtee (2006) revealed through his study that 90% students are new to the system and were not familiar to the self-instructional material. The study further revealed that distance education institution of Mauritius run courses offered by their own institution and also offered by foreign universities. Anistha, K.S (2008) found, "(1) The beginning teachers do not demonstrate the basic teaching skills to the maximum extent in the actual classroom situation. (2) A low transfer of the teaching skills developed during the training period to the actual classroom situation was observed." Sahoo, Namita (2009) observing CIET Education programme has found it highly useful for school teachers and teacher trainees. She has expressed that such programme in recorded form can be incorporated in teacher training institutions as a component of training packages.

Experimental

Experimental research is very popular among the researchers engaged in the ICT related studies. Bawa, MS (1987) has summarised, "Exposure to microteaching results in improvement of teaching competence and this improvement is uneven for various component skills of teaching." Pretest-post experimental design was employed. Naik, Dalaganjan (1989) adopting the same method have concluded, "Exposure to micro-teaching results in improvement of efficiency of all participants as viewed by the observer as well as viewed by the student-teachers.

However, micro-teaching shows a similar effect on all the groups in developing efficiency. Exposure to micro-teaching practice results in improvement of the teaching competence of the student-teachers of all the groups and this improvement is even for all the groups. Exposure of micro-teaching results in improvement of altitudinal changes of all the student-teachers and this improvement is even for all the groups." Ojha, N.C (2000) found, "The Instructional Material developed through Concept Attainment Model was effective in terms of students achievement in economics and their reaction towards teaching." In the study two equal groups as experimental group and control group was formed. Sreelekha, S and Nayak, K. Ajitha (1998) found, "The Concept Attainment Model was effective in improving the overall level of achievement of the students in Chemistry."

Bairagya, S.S; Ghosh, S.K and Mete, J (2005) found, "The experimental group (CAM) achieved a significantly higher mean score compared to the mean test score of control group (TMT)." The study code Concept Attainment Model as CAM and Traditional Method of Teaching as TMT. Sidhu, RK and Singh, P (2005) found, "There is no significant effect between various teaching techniques, intelligence and achievement motivation on scholastic achievement of students for learning of the concepts in Physics." In the study three groups – two experimental and one control, were formed. Pre-test, post-test control group quasi experimental design was employed. Koshi, Suja (2005) concluded, "Reading aloud of stories

and poems can help the children to enhance their use of literature language." The study had a quasi experimental research pre-test/post-test design. Experimental group was given the treatment of reading aloud of stories and poems against conventional reading programme.

Saravan Kumar, AR and Mohan, S (2007) concluded, "The students who had been taught through effective stimulus variation on enhancing attention technique pattern fared better in their achievement." Single group pre-test/post-test design was used. Patel, Kinnary (2008) found, "Comparative effectiveness of the CAI method and the traditional method was measured by the experiment and CAI method was found more effective in terms of achievement scores."

Sum up:

ICT is an important field of study, and knowledge and Population Explosion has made it even more important. Research has no substitute to satisfy human curiosity and to expand the frontier of knowledge. Falling standard of research in India is a matter of concern in almost all the branches of knowledge. Educational Research is commonly classified as Philosophical, Historical, Descriptive and Experimental. ICT related studies can be undertaken in any type of research, but the review of the studies conducted reveals that Descriptive Research has been undertaken maximum, followed by Experimental Research. Researchers need to come to explore the field and touch almost all the dimensions of

possible studies. Philosophical and Historical researches in ICT need some attention as they have not be given the weightage they deserve. This is due to the fact that ICT has received a perception that it is being dominated by the machine and machine only. In the development of ICT Human Factor needs to be given some serious attention to explore the Philosophical and Historical research. It is an important field of knowledge and that is why Kshetrimanyum, Otojit (2007) has written, "From a pedagogical point of view, ICT appears to offer more educational benefits than other traditional teaching methods. ICT can be used for simulation, visualisation and modeling."

Suggestions given by Agarwal, R (2011) for teacher educators may also provide some insight for ICT related researches, "Professional development of the teachers requires understanding in following new areas of professional ability-

- To become familiar with the capabilities of newly emerging technological devices and systems.
- To be able to explore how these new devices and processes can be integrated into classroom practice and subject specific training.
- To be skilled in handling, sequencing and designing of information for various technologies." Again, suggestion made by Agarwal & Agarwal (2011) can be utilised in searching the other dimensions of ICT related researches, "In the changed scenario, when we have reached to the threshold of

development of new technologies which are likely to revolutionize classroom teaching, the role and function of teachers is changing. Now the emphasis is on the self-learning under the guidance of a teacher, who is more a facilitator, to introduce student with new technologies."

Another area of ICT researches can search its base in the saying of Raheem (2012) when he finds ICT essential for Rural Development, "In a developing economy like India, ICT has development applications in education, governance, environmental monitoring, health, human rights promotion, economic growth and other areas. An earlier research confirms that transaction costs have substantially reduced by adopting automated supply chain management models for selling agriculture produce. Other studies show that e-government projects are successful in rural India as it acts as an intermediary between government and recipients, while pursuing commercially sustainable objects." Hazra (2012) considers ICT as catalyst for empowering rural India, and this catalyst can further reflect other dimensions of ICT researches, "The power of knowledge for development can be greatly enhanced by ICTs if they are harnessed to improve, access and break down barriers to knowledge because while education develops cognitive skills, information gives content to knowledge." ICT research has many areas to cover and the researchers are not needed to extend the frontiers of ICT research only, rather they are needed to

undertake original initiative to answer the role of human, social, environmental, rural, developmental, etc related factors of ICT. To explore new dimensions of ICT related researches will serve teaching-learning process in particular and the mankind in general; and so the area of ICT related researches needs to be extended continuously and comprehensively."

References:

1. Agarwal, R (2011), " Making the Teacher Educators ICT Competent" , Teacher Education, IATE Journal, 45 (2), 51-57

2. Agarwal, SC & Agarwal, V (2011), " Excellence in Teacher Education Through ICT" , Teacher Education, IATE Journal, 45 (1), 55-63

3. Anistha, KS (2008), "Evaluation of Transfer of Teaching Skills from Teacher Education Centre to School Campus", Abstract presented in Indian Educational Abstracts, 8(1), Jan-2008, NCERT, New Delhi, 61-62.

4. Anuratha, K and Bharathi, VV (2001), "TV Viewing and Children's Academic Achievement with reference to Punishment Patterns Exercised by the Parents", Abstract presented in Indian Educational Abstracts, 2(1), Jan-2002, NCERT, New Delhi, 50.

5. Arya, Sharma, S and Dhaliwal, Y.S (2001), "Television Viewing and Its Effect on the Study and Playing Hours of School Going Children", Abstract presented in Indian Educational Abstract, 2(1), Jan-2002, NCERT, New Delhi, 44.

6. Babu, SS (2007), "Technological Advances and Role of ICT in Teacher Training and Higher Education", University News, 45(26), New Delhi, 12-15 & 23.

7. Bairagya, SS; Ghosh, SK and Mete, J (2005), "A Study on Relative Effectiveness between Concept Attainment Model and Traditional Method of Teaching in Economics", Abstract presented in Indian Educational Abstracts, 6(1), Jan-2006, NCERT, New Delhi, 17-18.

8. Bawa, MS (1987), "Effectiveness of Microteaching with Planned Integration Training Following Summative Model and Microteaching without Planned Integration Training on the General Teaching Competence of Teachers Trainees", Indian Educational Review, XXII(3), NCERT, New Delhi, 102-109.

9. Chaurasia, S (2005), "Analysis of Classroom Teaching Behaviour of Shikshamitras", Abstract presented in Indian Educational Abstracts, 6(1), Jan-2006, NCERT, New Delhi, 55.

10. Dey, B; Saxena, KM and Gihar, S (2005), "Information Communication Technology and Teacher Educators : An Empirical Study", Abstract presented in Indian Educational Abstracts, 6(1), Jan-2006, 20.

11. Dharma Raja, B. William, Anandan, K and Mohan, S (2000), "Computer Anxiety, Computer Attitude and Achievement in Computer Science among Rural and Urban Higher Secondary Students", Abstract presented in Indian

Educational Abstracts, 2(1), Jan-2002, NCERT, New Delhi, 21.

12.   Gupta, M and Jain, R (2005), "Self-appraisal of their skills by the Teachers Trained through Formal and Distance Mode : A Comparative Study", Abstract presented in Indian Educational Abstracts, 6(1), Jan-2006, NCERT, New Delhi, 54.

13.   Gupta, SM (1995), "Research Issues in Teacher Education", Teacher Education, XXVIII (1), IATE Journal, 56-62.

14.   Hazra, A (2012), "ICT:A Catalyst Intervention for Empowering Rural India" , Kurukshetra Journal, 60(7), 27-29

15.   IGNOU (1999), "Table-1", ES-311, Block-2, New Delhi, 19.

16.   IGNOU (2009), "Evolution of Educational Technology", MES-031, Block-1, 14-18.

17.   IGNOU (2009), "Dissemination of Research in Educational Technology", MES-031, Block-1, 80-84.

18.   IGNOU (2009), "Tab 1.3", MES-016, Block-1, 20.

19.   Karim, Salma; Kamal, Mustafa Azad and Ilam, Md. Mayenul (2001), "Role of Radio and TV Programmes in Distance and Open Learning : A Case of Bangladesh Open University", Abstract presented in Indian Educational Abstracts, 2(1), Jan-2002, NCERT, New Delhi, 3-4.

20.   Kaur, Jasraj (2001), "Impact of Viewing TV on the Social Interaction of Rural Illiterate, Neo-literate Adults", Abstract

presented in Indian Educational Abstracts, 2(1), Jan-2002, NCERT, New Delhi, 64.

21.   Koshi, Suja (2005), "Enhancing the Reading skills of Advantaged and Disadvantaged Children of Standard I through Systematic Reading of Children's Literature", Abstract presented in Indian Educational Abstracts, 8(1), Jan-2008, NCERT, New Delhi, 9.

22.   Kshetrimayum, Otojit (2007), "ICT Integration in School Education", Journal of Indian Education, XXXIII (1), NCERT, New Delhi, 62-70.

23.   Kumar, Lalit (2009), "Issues and Concerns of Higher Education", Patna University Journal, 33, Patna, 148-158.

24.   Mehra, Vandana (2007), "Teacher's Attitude towards computer use Implications for Emerging Technology Implementation in Educational Institutions", Abstract presented in Indian Educational Abstracts, 8(1), Jan-2008, NCERT, New Delhi, 18-19.

25.   Mishra, Rajendra (2008), "Evolutionary and Revolutionary : Information and Communication Technology", University News, 46(01), 17-20.

26.   Naik, Dalaganjan (1989), "Teaching Effectiveness and Teacher Attitude : Effect of Different Models of Integration Exercise of Teaching Skills Learned through Micro-teaching", Indian Educational Review, XXIV (2), NCERT, New Delhi, 77-86.

27.   NCF (2005), National Curriculum Framework, NCERT, New Delhi.

28.   Ojha, NC (2000), "Development of Instructional Material for Teaching Economics to Class IX through Concept Attainment Model in relation to Achievement, Retention, Self-concept and Attitude of students towards Economics", Abstract presented in Indian Educational Abstracts, 2(1), Jan-2002, NCERT, New Delhi, 36-37.

29.   Padhi, SK and Sahoo, K (2008), "ICT to Empower Prospective Teachers", Wholistic Teacher Education, Centre for Advanced Study in Education, MS University, Baroda, 126-128.

30.   Patel, Kinnary (2008), "Computer Assisted Instruction in Physics for the students of Class X : An Experimental Study", Abstract presented in Indian Educational Abstracts, 8(1), Jan-2008, NCERT, New Delhi, 49.

31.   Pulist, SK (2001), "Transition to Internet-Based Learning in IGNOU : A Learner's Perspective", Abstract presented in Indian Educational Abstracts, 2(1), Jan-2002, NCERT, New Delhi, 23.

32.   Ragoonundum, Calawtee (2006), "A Evaluative Study of Distance Education in Mauritius", Abstract presented in Indian Educational Abstracts, 8(1), Jan-2008, NCERT, New Delhi, 51.

33.   Raheem, A. A (2012), "ICT for Rural Development: A View" , Kurukshetra Journal, 60 (3), 31-33

34.   Rajasekar, S and Sini, SS (2005), "Internet Knowledge of Research Scholars", Abstract presented in India Educational Abstracts, 6(1), Jan-2006, NCERT, New Delhi, 19-20.

35.   Rajasekar, S and Vaijapuri, Raja P (2008), "Higher Secondary Teacher's Computer Anxiety", Abstract presented in Indian Educational Abstracts, 8(1), Jan-2008, NCERT, New Delhi, 19.

36.   Rathod, J and Kella, A (2008), "ICT in Teacher Education : Establishing New Learning Environment", Wholistic Teacher Education, Centre for Advanced Study in Education, MS University, Baroda, 116-125.

37.   Sahoo, Namita (2009), "Effectiveness of ETV Teacher Education Programmes of CIET", Teacher Education, 43(2), IATE Journal, 64-69.

38.   Saravan Kumar, AR and Mohan, S (2007), "Effect of Stimulus Variation on Enhancing Student's Attention", Abstract presented in Indian Educational Abstracts, 8(1), Jan-2008, NCERT, New Delhi, 12.

39.   Sarupria, S (2005), "Status, Issues and Future Perspectives of Computer Education in Senior Secondary Schools", Abstract presented in Indian Educational Abstracts, 6(1), Jan-2006, NCERT, New Delhi, 18-19.

40.   Sharma, MC (2001), "Teacher Education Through Distance Mode : An Indepth Study", Abstract presented in Indian Educational Abstracts, 2(1), Jan-2002, NCERT, New Delhi, 5-6.

41.   Sharma, MC (2008), "Higher Education : Challenges and Future Directions", University News, 46(27), New Delhi,   17-23.

42.   Sidhu, RK and Kaur, K (2005), "Television Viewing Behaviour of College Students in relation to their Socio-economic Status and Home Environment", Abstract presented in Indian Educational Abstracts, 6(1), Jan-2006, NCERT, New Delhi, 46-47.

43.   Sidhu, RK and Singh, P (2005), "Comparative Study of Concept Attainment Model, Advance Organiser Model and Conventional Method in Teaching of Physics in Relation to Intelligence and Achievement Motivation of Class IX Students", Abstract presented in Indian Educational Abstracts, 6(1), Jan-2006, NCERT, New Delhi, 38-39.

44.   Sreelekha, S and Nayer, K. Ajitha (1998), "The Effectiveness of Concept Attainment Model (CAM) in Learning Chemistry at Secondary Level", Abstract presented in Indian Educational Abstracts, 2(1), Jan-2002, NCERT, New Delhi, 39.

45.   Taj, Haseen (2004), "Information Communication Technology and Teacher Education", Edutracks, Sultan Bazar, Hyderabad, February, 21-25.

To cite the article:

Kumar L. (2014). Research in ICT. In In Perumalil, T. (Ed) *Application of ICT for quality enhancement in teacher education.* 69-87. Patna: St. Xavier's College of Education.

Contact e-mail: dr.lalitkr@gmail.com