ICT in Education: A Study

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ABSTRACT

ICT (Information and Communications Technology - or Technologies) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning. ICTs are often spoken of in a particular context, such as ICTs in education, health care, or libraries. The term is very common and globally known now. Importance and use of ICT in India like developing countries should be implemented for advantages of all the stakeholders. The myth that it requires huge amount of initial investment in the organisational set up and teachers will not accept to forego the conventional method has been proved wrong in the developed countries. The article discusses its importance in the current context of 'Digital India' movement.

Keywords: ICT, India, Teaching, Learning.

INTRODUCTION

Introduction

Why ICT in Education: Worldwide research has shown that ICT can lead to improve student learning and better teaching methods. A report made by the National Institute of Multimedia Education in Japan, proved that an increase in student exposure to educational ICT through curriculum integration has a significant and positive impact on student achievement, especially in terms of "Knowledge Comprehension", "Practical skill" and "Presentation skill" in subject areas such as mathematics, science, and social study at the K-12 level. However, this concept is equally applicable to all UG programs in colleges and universities. 3-main advantages of ICT:

(a) Images can easily be used in teaching and improving the retentive memory of students.
(b) Teachers can easily explain complex instructions and ensure students' comprehension.
(c) Teachers are able to create interactive classes and make the lessons more enjoyable, which could improve student attendance and concentration.

Why Students Learn Better Through ICT?

Information and Communications Technologies (ICT) education is basically our society's efforts to teach its current and emerging citizens valuable knowledge and skills around computing and

communications devices with relevant software that operates them, applications that run on them and systems that are built with them.

ICT is complex and quickly changing, and it is confusing for many people. It is pervasive in the modern world that everyone has some understanding of it, but those understandings are often wildly divergent. If we try to visualise the knowledge-map, we try to start with the base of current knowledge-foundation i.e., what we know, what we believe and what we don't. Recent work of ICT created a series of Knowledge Maps of what is known and what isn't about ICT use in education. These knowledge maps reveal that, despite a decade of large investment in ICTs to benefit education in many countries, and increasing use of ICTs in education in developing countries, important gaps remain in the current knowledge base. In addition, there appears to be a dearth of useful resources attempting to translate what is known to work; and not work; in this field for policymakers and donor staff working on education issues in developing countries, especially those issues related to 'Education For All' and other education-related 'Development Goals'.

This K-M exercise investigates ten topics grouped into four major themes (Impact, Costs, Current Implementations and Planning):

- Impact of ICTs on learning and achievement;
- Monitoring and evaluation
- Equity issues
- Costs
- Current projects and practices
- Specific ICT tools
- Teachers, teaching and ICTs
- Content and curriculum
- School-level issues
- Policy issues

The work is done in USA and can be found in World Bank site but we are more interested to throw light on the findings.

Impact

- The impact of ICT use on learning outcomes is unclear, and open to much debate.
- There is an absence of widely accepted standard methodologies and indicators to assess impact of ICTs in education.
- There is a disconnect between the rationales most often put forward to advance the use of ICTs in education (to introduce new teaching and learning practices and to foster 21st century thinking and learning skills) and their actual implementation (predominantly for use in computer literacy and dissemination of learning materials).

Costs

There is very little useful data on the cost of ICT in education initiatives, especially those attempting to assess neither Total Cost of Ownership, nor guidance on how to conduct cost assessments.

Current Implementation with the Role of the Teacher

ICT-Training: Teacher training should be introduced and must be continued for on-going relevant professional development if benefits from investments in ICTs are to be maximized.

Role of the Teacher

Teachers remain central to the learning process; a shift in the role of a teacher utilizing ICTs to that of a facilitator does not obviate the need for teachers to serve as leaders in the classroom; traditional teacher leadership skills and practices are still important (especially those related to lesson planning, preparation and follow-up).

Lesson planning is crucial when using ICTs; Teacher lesson planning is vital when using ICTs; where little planning has occurred; research shows that student work is often unfocused and can result in lower attainment.

Pedagogy; Introducing technology alone will not change the teaching and learning process the existence of ICTs does not transform teacher practices in and of itself. However, ICTs can enable teachers to transform their teacher practices, given a set of enabling conditions. Teachers' pedagogical practices and reasoning influence their uses of ICT, and the nature of teacher ICT use impacts student achievement.

ICTs seen as tools to help teachers create more 'learner-centric' learning environments; In European countries, research consensus holds that the most effective uses of ICT are those in which the teacher, aided by ICTs, can challenge pupils' understanding and thinking, either through whole-class discussions and individual/small group work using ICTs. ICTs are seen as important tools to enable and support the move from traditional 'teacher-centric' teaching styles to more 'learner-centric' methods.

ICTs can be used to support change and to support/extend existing teaching practices; Pedagogical practices of teachers using ICT can range from only small enhancements of teaching practices using what are essentially traditional methods, to more fundamental changes in their approach to teaching. ICTs can be used to reinforce existing pedagogical practices as well as to change the way teachers and students interact.

Using ICTs as tools for information presentation is of mixed effectiveness; The use of ICTs as presentation tools (through overhead and LCD projectors, television, electronic whiteboards, guided "web-tours", where students simultaneously view the same resources on computer screens) is seen to be of mixed effectiveness. While it may promote class understanding of and discussion about difficult concepts (especially through the display of simulations), such uses of ICTs can re-enforce traditional pedagogical practices and divert focus from the content of what is being discussed or displayed to the tool being utilized.

Teacher technical abilities and knowledge of ICTs; Preparing teachers to benefit from ICT use is about more than just technical skills only. Teacher technical mastery of ICT skills is a not a sufficient precondition for successful integration of ICTs in teaching.

'One-off training' is not sufficient; Teachers require extensive, on-going exposure to ICTs to be able to evaluate and select the most appropriate resources. However, the development of appropriate pedagogical practices is seen as more important that technical mastery of ICTs.

Current implementations of ICTs; the practices of ICTs are being widely used in education, and interest in their use appears to be growing, even in the most challenging environments in India like developing countries.

Planning Policy for Lessons Learned and Best Practices

1. There are emerging best practices and lessons learned in a number of areas, but with a few exceptions they have not been widely disseminated nor packaged into formats easily accessible to policy makers in developing countries, and have not been explicitly examined in the context of the education-related decisions.
2. While much of the rhetoric (and rationale) for using ICTs to benefit education has focused on ICTs' potential for bringing about changes in the teaching-learning paradigm, in practice, ICTs are most often used in education through service providers to support existing teaching and learning practices with new tools.
3. While impact on student achievement is still a matter of reasonable debate, a consensus seems to argue that the introduction and use of ICTs in education can be a useful tool to help promote and enable educational reform, and that ICTs are both important motivational tools for learning and can promote greater efficiencies in education systems and practices.

What are the Important Dimensions to ICTs in Learning?

ICT/Digital Literacy—Today, everyone needs a basic understanding of ICT and how to make productive use of it, just to be good students, workers and citizens. Teaching people how to be competent basic users of ICT technologies is an important role of ICT education, so they will be successful in their academic and work careers, and so they can efficiently participate in modern technical society. As part of its study validating U.S. Department of Labour, IT Competency model content in California, it was determined with 99% confidence California employer agreement with the following statements regarding Digital Literacy: "Information and communication technologies (ICT) competencies are increasingly important for most of our employers, regardless of role. If there was an agreed-upon standard for "digital literacy", or ICT competencies expected of all workers, regardless of workplace role, my organization would value a credential based on that standard as a way of validating ICT skills for non-ICT workers." (70.5% agree or very much agree)

"In the 21st century, an ability to work with information and communication technologies is becoming as essential to education, life and workplace success as "reading, writing and arithmetic"." ICT Digital Literacy should be considered a basic skill by educational systems, something taught to and assessed for all students. (85.2% agree or very much agree)

This study details 49 competencies for ICT User level knowledge and skills, as an actionable, teachable and assessable definition of what people need to know and be able to do to be "digitally literate."

ICT Infrastructure and Support Applied Technologists – Beyond a basic user competency, our society also needs more knowledgeable and capable technical people to deploy, manage and maintain ICT equipment, software and systems, so they work well for users. In all industries, these people manage computer and communications hardware, software and applications; networked systems;

online information sharing, communication and commerce systems; business processes making use of these systems; and user support.

Specialized Business and Industry Uses of ICT – As enabling technologies, ICT is used strategically in almost all businesses and industries. Many have developed specialized systems and uses of ICT, and many have specialized legal and regulatory requirements; quality control systems; integrations with production and research equipment and systems; security requirements; and software applications.

For example: Bioscience industries rely on specialized ICT systems and applications to conduct research, analyse organic materials, produce biotech products and do required reporting; Financial services industries rely on ICT to maintain customer records, do business, conduct trades, do financial reporting, secure proprietary information and comply with regulations;

Manufacturing industries use specialized computer controlled systems and robotics to design, produce and test products. Property management operations use ICT to network and control heating and cooling, lighting and building access systems.

Electric utilities use ICT to monitor and manage electricity distribution, customer billing and smart metering systems. Telecommunications, cable TV and other entertainment industries use ICT to store content, manage customers and deliver their services. We need to develop a competent workforce that understands not only relevant technologies, but also specialized business and industry environments and operations, to meet these specialized needs.

ICT Research and Development Scientists – ICT fields themselves are under constant pressure to evolve and improve. We need people who deeply understand the science and technologies underlying ICT and who can work to advance the fields.In virtually all modern businesses and industries, and in modern society in general, ICT has key strategic roles. It is strategically important to develop citizens and workers who can competently and efficiently operate and add value in these systems and environments.

Famous Findings at the Primary Level of Knowledge for Successful and Innovative Practices

1. ***Analysis of recent 1:1 learning initiatives in primary and secondary schools in Europe***; This article analyses the "Overview and analysis of one-to-one computing initiatives for Education and Training in Europe" (1to1Learning) project which aimed to provide an overview of recent 1:1 learning initiatives in primary and secondary schools across European countries, and to identify major bottlenecks and barriers to the implementation of 1:1 learning in schools.
2. ***SimAULA: Training our teachers through innovative methodologies based in serious games***; SimAULA is a European Lifelong Learning Programme project aimed at offering a virtual medium for initial and lifelong teacher training. The project's originality lies in the tool that its participants have designed, a simulation of the serious game variety which enables users (teachers in training, in this case) to put their skills into practice in an environment that faithfully recreates the reality of teaching.

3. ***Engaging primary students in project-based learning***; From March to July 2012, primary school teachers and students from various countries – Canada, China, Korea, Philippines, Malaysia and Bangladesh - have been communicating and collaborating with their int ernational counterparts through a series of web-based activities and projects.
4. ***Hong Kong primary school bolsters interactive learning***; Fanling Public School was chosen as a Centre of Excellence for using ICT in education by Territory's Education Bureau. This article explains how this school integrated ICT in teaching and learning in details.
5. ***Kkulmat Rainbow School in South Korea - Virtual school for students in the hospital***; The Korean Ministry of Education, Science and Technology established the Kkulmat Rainbow School to provide formal education to students with health problems in December 2006.
6. ***ABCs and ICTs: Delivering scale and value with a whole class learning solution***; In partnership with USAID/Senegal and Columbia University's Earth Institute, CyberSmart Africa has introduced a whole- class learning solution that integrates the use of a specially adapted interactive whiteboard directly into classroom instruction.
7. ***Mobile Science Project: Engaging students in science through mobile learning***; The Mobile Science Project aims to ingrain in students a sustained interested in science by nurturing the interest of students towards science subjects at a young age. Through the use of mobile ICTs – in this case, smart phones - the project implemented an inquiry-based approach to learning which would consequently develop students' positive attitude towards science.
8. ***Village teacher training via video conferencing***; This essay illustrates a short-lived project in rural villages in Mexico and challenges the project team faced. Three organisations partnered to train undereducated teachers on a project designed to bring Internet access to rural villages in Mexico. Local schoolteachers, many of whom had not received any training beyond a standard high school diploma, were to be trained by experts via videoconferencing.
9. ***SchoolNet SA is learning from experience***; SchoolNet SouthAfrica aims to create communities of teachers using ICT to enhance teaching and learning. It concentrates on teacher development with a particular emphasis on ICT integration and on underserved schools.
10. ***Fighting against "infollution" that contaminates ou r children's minds and their thoughts***; As one of the measures to fight infollution in Korea, the ‚Green Digital Kids' programme helps children understand the potential harmful effects of digital media, and aims to teach them practical safety guidelines and cyber ethics with interactive digital educational tools that maximize learning effectiveness and motivational appeal for children.
11. ***Singapore 'Future school' Project***; In 2007, FutureSchools@Singapore was initiated to promote innovation and facilitate ability-driven education paradigm in school by integrating frequent use of ICT in students' daily school lives. Through this initiative of digital learning, schools aim to equip students with essential ICT skills they need to become effective global workers in the fast changing digital age.
12. ***Innovation in the connected classroom, India;*** This publication by UNESCO Bangkok, as a part of the series In Search of Innovative ICT in Education Practice, describes how the S.D. Public School in New Delhi implemented ICT integration in teaching and learning through various measures (e.g. updating the knowledge and skills of teachers, wiki-centric extended classroom,

Offline eXe Learning Materials, blog, Webcam Wall, podcast and panorama view in teaching geography).

13. ***One computer in multi-grade classroom: case of Buan elementary school, Philippines;*** This publication by UNESCO Bangkok, as a part of the series In Search of Innovative ICT in Education Practice, shows initiative of the Asuncion National High School to support the learning of students in rural multi-grade class to develop their life skills through ICT and to decrease the digital divide among the teachers, students and the community. An example of a weekly schedule is included to show how a big class of 60 students shared one computer to carry out their task. Multimedia presentation rubric is also included to show how students were assessed. The publication shows the mentor system by paring up students from different grades when using computer was advantageous to students' human development.
14. ***Student Peer Teaching Strategy, Malaysia***; This publication by UNESCO Bangkok, as secondary school in Malaysia. SPTS is where a group of students prepare an e-lesson on a given topic from the curriculum in order to teach other students in the class about it. The evaluation of the strategy clearly shows positive impact on students' performance.
15. ***Computing at school: Educate... engage... encourage... A spotlight on CAS***; CAS is an acronym for Computing at School, a self-professed grass roots organization and a UK based working group. CAS is active at many levels, having developed a body of knowledge for school-level computing; in spinning up ‚hubs' that bring teachers together in local groups; and in developing new material that teachers can use in the classroom.

Recent Researches on Evaluation and Cost-Effectiveness of ICT

1. Evaluating 'Technology Project' is difficult. Even more so is the evaluation of educational interventions. Influence of academic institutions on pupils' academic or social outcomes explains only about 12 to 15 per cent of the variance, leaving 85 per cent or more to be explained by the influence of factors such as the child's family background, lifetime experience, natural ability and so forth.

   Many early experiments with ICTs in classrooms were based on nothing more than enthusiasm or hunch. However, the growing emphasis on the need to show concrete benefits has led to more attempts to evaluate the impact of ICTs in classrooms. But evaluating ICTs in education is particularly hard, for a number of reasons. Even in schools/colleges that make extensive use of ICTs, the amount of time spent using them in class is still generally tiny in relation to the time spent using more traditional teaching tools, from blackboard and chalk to photocopied hand-outs. In UK, children use ICTs for an average of 45 minutes a week in primary school, and for 75 minutes in secondary school. In addition, technologies and the way they are applied both vary greatly from one school or university to another.

   Many studies merely collect examples, rather than attempting to gauge teaching effectiveness. Many, too, attempt to measure the effectiveness of ICTs against quantity measures—how many computers, how much ICT software, and so forth—instead of attempting to assess quality, by looking at the ways ICTs is deployed in the classroom.

   One of the most thorough attempts to set out the measurement issues in the evaluation of ICTs in schools, published in April 2002, picked out three problems:

- "Terms such as 'technology' and 'technology integration' mean different things to different people."
- "Most of the measures used in evaluation are 'home grown'…measures that directly measure the effects of each grant."
- "There is a tendency to f ocus more on short-term outcomes and effects, rather than seeing the interventions as part of a total package designed to change how schools function."

"Evaluations" are more likely to look at whether students have specific knowledge (standardized tests) than whether students have acquired higher-order thinking and problem-solving skills that would allow them to gain and apply knowledge effectively." Moreover, "evaluations are more likely to look at whether teachers have mastered specific technology skills than to what extent they can effectively apply those skills to enhancing teaching and learning."

2. Few studies use random control groups of students. The result, not surprisingly, is that most studies suggest that the effectiveness of ICTs depends on how computers are used, in what context and with what expectations.

   The most intensively studied application of computers in education, and one of the oldest, is that known as "computer-aided instruction": drill programs that repeatedly test a student's factual knowledge. The program poses a multiple-choice question; the student gets an immediate result. Most research suggests that, when such testing is the only basis of instruction, its result is mixed. But when it is combined with traditional instruction, in frequent and short sessions, it is more effective and speedy than traditional instruction alone. Few studies have explored whether such instruction is cost-effective. One that did, conducted in the 1980s, found it more cost-effective for improving maths scores than lengthening the school day or reducing class size, but less effective than peer tutoring. Such a use of computers is relatively simple and therefore easy to test.
3. Much more complex to assess is the effect of ICTs when teachers use them to encourage a class to do independent research. Many such studies fall back on anecdotal evidence, or largely subjective reports of changes in children's attitudes after ICTs became available.
4. A rare exception is a study by two economists of the introduction of computers into many of Israel's primary and middle schools in the mid-1990s.33 The way in which computers were allocated among schools gave the authors something that most studies lack: comparable groups of children with and without access to computers. The authors compared the test scores for maths and Hebrew achieved by children in the fourth and eighth grades in schools with and without computers. They also asked the classes' teachers how they used various teaching materials, such as photocopied worksheets and computer programs. The researchers found that the Israeli scheme had much less effect on teaching methods in middle schools than in elementary schools. It also found no evidence that the use of computers improved children's test scores. Instead, it found the reverse. In the case of the maths scores of fourth graders, there was a consistently negative relationship between computer use and test scores. The authors suggest three possible explanations for this disappointing outcome. First, the introduction of computers into classrooms might have used up cash that would otherwise have paid for other aspects of education. However, because the money for the computer programme came from the national lottery and not the main education budget, this is unlikely to have been the case. Nor did the study find any significant change in teaching resources, methods or training in schools that

acquired computers through the scheme. A second explanation is that effective adoption of computers in education takes time to have an effect. However, the schools surveyed had already been using computers for a full year. The third explanation is the simplest: that the use of computers in teaching is at the least no better than other methods and may be worse. As one of the authors concludes, "the costs are clear-cut and the benefits are murky."

5. It may be difficult to produce incontrovertible evidence on the impact of classroom computers on children's learning. At the least, it would be helpful to have some properly randomized tests, set up with the precision that would be used to test an expensive new drug. Even then, it may be hard to reach enduring conclusions, just as it has proved hard to establish without doubt that children benefit from smaller class sizes. But at the very least, there are grounds for schools to hesitate before investing in computers in classrooms, if the aim of that investment is to improve the teaching of subjects other than computer literacy. Other investments, in teaching materials or in teacher development, may have more impact on educational outcomes. Without effective evaluation of educational impact, it is hard to measure the cost-efficiency of the use of technology in classrooms. Yet this measure becomes increasingly important as the size of ICT investments increase, and as education budgets are more constrained.
6. In the United States, the tightening economy has caused a greater emphasis on thinking about the real benefits of technology investment, compared with its cost. For instance, a technology planning guide released in January 2001 by the California Department of Education said, "Technology planning needs to be comprehensive and include considerations of the long-term implications of the choices made … Hardware purchased should meet district needs and have the lowest cost of ownership over the long term." This shift of emphasis from effectiveness to cost-effectiveness is not surprising, given the weaker economy. But it may slow down the application of ICTs in public education.

CONCLUSION

ICTs are a more expensive policy intervention than most others. State Governments increasingly ask, not "Do ICTs have an impact on educational attainment?" but instead "Which policy interventions get the most bangs for the buck?" One of the characteristics of much cost-effectiveness research is to find that very cheap interventions with relatively small effects are more cost effective than larger and more expensive interventions with larger effects. In addition, a greater emphasis on cost-effectiveness may well slow the pace of innovation. That is a process that requires a certain amount of wasteful experiments in order to succeed.

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