ICT in Education: Indicators for Meaningful Integration in Government Schools

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The journey of Information and Communication Technology in Indian school education started through National Policy on Education in India in the year 1984-1986, modified in 1992, stressing the need to include technology in school education to improve the quality of education. This policy led to two central schemes for ICT and Education in 2004, revised in 2010, focusing mostly on computer literacy and Computer Aided Learning. In 2012, the ICT policy in School Education came into existence with the mission of developing accelerating, supporting and sustaining ICT and ICT-enabled activities and processes to improve access, quality and efficiency in the school system.

Over time, the emphasis of ICT in education schemes and policy progressed from computer literacy to making ICT connected to school subjects to improve learning. However, the ground reality is that the use, role and relationship of ICT with quality learning remains elusive. This opaque relationship is a global phenomenon. OECD report (2015) challenged the value of ICT in influencing learning in classroom. Infodev (2010) reported that, while in India and other South Asia countries the interest to employ ICT tools and devices in schools is high, its actual use is low.

Infrastructure challenge is huge especially in government schools in India: the erratic availability of power supply and connectivity further exacerbates use in rural areas. Further infrastructure and connectivity alone do not ensure use. Mobile phones have high accessibility in the interior rural areas, but their use in schools is unacceptable.

On the other hand, schools which have ample infrastructure do not necessarily use ICT to improve learning of school subjects. In my extensive field visits in about eight states in 2011-2013, I found that government and aided schools used ICT in computer labs primarily for digital literacy, computer science classes, or for an NGO-driven intervention using CDs, DVDs, server-box based computer aided learning. A few states also used radio and satellite connections to conduct audio- and video- based lessons from external experts. In this sense, at many semi-urban and connected rural areas, ICT use had moved beyond digital literacy to Computer Aided Learning (CAL) and audio-visual learning delivered through a device. CAL was mostly run by an NGO facilitator or a computer instructor and even today is mostly seen reinforcing basic learning skills in mathematics and languages at primary school level, and remedial learning through DVD- and CD- based content at secondary school level.

From 2014 onwards, I have been witnessing more classroom use of ICT in the form of Smart Classrooms, where packaged multimedia and lesson plans are delivered, mostly by vendors, for teacher use in the classroom. These are mapped to textbook chapters and aimed at aiding teachers to deliver their lessons with media-rich resources. This type of teacher centric content delivery packaged for classroom use is also sometimes called 'Smart classrooms'. Here, I sense a clear dichotomy of platforms of ICT use in schools: computer labs is where ICT tools are in the hands of the students, but the activities in the labs are not connected to mainstream subjects; on the other hand, classroom is where the ICT tools are in the hands of teachers not students, and here is where the tools deliver the content relevant to mainstream subjects. It seems subject teachers and computer teachers have fixed territories and they seldom want to cross these boundaries of space, role and expertise.

Although the Karnataka Open Education Resources (KOER), started much earlier (in 2013), where subject teachers mainly Mathematics and Sciences teachers make and upload teaching resources, OER has only recently become the the new buzz word in government schools across states Free, but not necessarily Open (anyone can legally and freely copy, use, adapt and re-share them, UNESCO), many video-based tutorials have mushroomed and claim to contribute in improving conceptual understanding through the power of digital media, potentially replacing tuition classes.

National platforms like e-pathshala and the National Teacher Platform and subsequent workshops for teachers on OER have very rapidly become popular. Different forms of OER run on a wider spectrum and can vary from offering tutorial kind of videos for better remembering and understanding with some quiz like questions (lower order learning goals). They sometimes also offer higher order thinking skills and only sometimes are designed to fostering student agency. A good example is Pratham's Story Weaver, where children can read digital stories in their local language and context and Creative Common License allows students, teachers and educators to contextualise or remake the stories in their local language/dialect and milieu. The digital platform makes engagement with high quality language material in local context and language accessible and flexible.

Another good example of OER is the Connected Learning Initiative (CLIx) with which I am closely associated. It is designed for higher order thinking skills in Science, Mathematics and English for high school students and is designed within the academics context. The Open Educational Resources created here are based on three pedagogic pillars of enhancing collaboration within students, allowing students to learning from mistakess and fostering authentic learning. An example from the CLIx student OER, is a game called Police Quad offering hands-on knowledge construction on geometric reasoning. In this, students take on the role of the police and try to find the 'thief' which is a shape. The police are supposed to eliminate 'suspects' and identify the 'thief' by using geometric properties. Scaffolding is provided to understand the properties of each shape before a choice is made. Students learn by trial and error and gradually start constructing their understanding around the concepts and properties of shapes.

English resources focus on story-based learning for communicative English. Contextualised to suit local culture, these stories allow students to attempt listening comprehension, speak and record their own voices till they are satisfied with their audio creations. Also, the Open Story tool within the module allows them to select pictures from the gallery, record their voices and create a story.

In all the student modules of CLIx, the technology is in the hands of the students and they engage directly with it, manipulate it and recreate learning experiences. The role of the teacher is to facilitate these experiences and make decisions on when and how to integrate the CLIx resources or parts of it in their lessons. The purpose here is not to create OER for each and every chapter of the textbook, but a few modular exemplars and capacitate teachers to use other available OER from the open space.

CLIx works with four states in about 478 government schools reaching out to about 33,000 students and 2500 teachers. The modules are designed by Tata Institute of Social Sciences (TISS) faculty and staff with design inputs from MIT (USA), state curriculum experts and teachers. The programme is implemented by either state government departments or local organisations or state universities with the support of TISS teams.

Capacity building of teachers is an important component of implementation and sustainability of the intervention and is now offered as a 17 credit certificate program in Reflective Teaching with ICT. The offering is in a blended mode, where online interaction, practice-based assignments and F2F meet-ups and workshops are all part of the pedagogy. The state funds the logistics costs of the training, including the TA-DA for teachers attending the training. Some of the key challenges faced at CLIx are getting the labs ready and being kept functional for CLIx content, continuously adapting technology platforms, contextualising modules and certification for all different states. The dissemination is restricted to three languages, sustaining teachers' interest beyond workshops in distance mode to complete the courses.

Another approach which I got an opportunity to pioneer in 2012 at Tata Trusts is the Integrated approach to Technology in Education (ITE). What sets ITE apart from OER and CAL is that it focuses on students' creating a learning artefact and teachers themselves designing the learning activities integrating ICT. Thus here, teachers get to decide the ICT applications and how students will creatively develop a learning artifact, and when and how to integrate OER applications and other ICT tools in their teaching. Thus the central pedagogy of this intervention is that, based on the concepts from the textbooks, the teacher designs and students create the learning artefacts. This approach was designed for upper primary, mainly targeting the most marginalised sections including interior rural tribal areas, Muslim minority communities in slum and rural areas. The

platforms used are community learning centres, government schools and madrasas. Students use ICT tools and applications for seeking information as well as to construct and organise their learning and represent it through computer applications. This project based learning allows them to use and adapt the learning within the local context. A few examples of students' creation are: weather charts as a spreadsheet for deeper and connected learning for the chapter on weather and climate, a video on sound pollution in environmental science by collecting sound pollution clips from their own environment, charts using the *Audacity* application to measure sound waves they have collected from the environment, a diet chart to compare and relate calorie intake and BMI of their classmates, using *Scratch* application to create a road-crossing game and many other relevant topics. This approach has become popular over the years, as it is fun and interesting for students to engage deeply with the subject concepts in the textbook, allows expression of creativity, local context and language. Students in tribal area also use local dialect and integrate with the State language. Since no readymade content is provided, the teachers get ample opportunity to design the lessons, use other web resources and decide on what and how students will create projects or learning artefacts.

Although started in learning centres and private madrasas in the initial years, these places have now become islands of excellence for the neighbouring government schools where the intervention has been scaled up. The expansion is result of multi-stakeholder partnership between local NGOs, State and district education administrations, Tata Trusts and TISS programme and resource team. ITE reaches eight states and about 29000 students, about 600 government schools and 1500 government teachers.

The teacher professional development at ITE is key as the intervention is dependent on teachers' competence to design an ICT activity and facilitate students to create artefacts. Situated in the Centre for Education Innovation and Action Research, the ITE teacher capacity building also offers a four credit certificate course in ICT and Education. Since it is a standalone course, the completion rates are as high as 90 percent. Here teachers learn through practice and implementation of ITE lesson plans, online quizzes on contemporary literature in ICT and Education and engagement in Community of Practice groups using online platforms, and more importantly orienting fifteen more teachers in ITE approach at block level. The major challenges at ITE are infrastructural access and use in schools, working with the districts and state organising block level trainings, gearing states to organise follow-up trainings after the certificate course, streamlining growing database of students' learning artefacts.
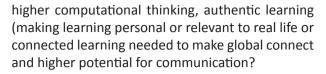
Apart from being part of CLIx and starting and spearheading ITE, exposure to academic programmes and various knowledge groups in ICT has shaped my understanding in the sector. Education 2030 goals at the Incheon Declaration clearly states that Information and communication technologies (ICTs) must be harnessed to strengthen education systems, knowledge dissemination, information access, quality and effective learning, and more effective service provision. Various national and international frameworks in education and ICT like comparing 21st century skill frameworks (Dede, 2010), ISTE (2016), TPACK (Kohler & Mishra, 2008), NCF (2005), and ICT Policy (2012) have reiterated that ICT use should be leveraged effectively to make teaching and learning deep, authentic and contextual.

Although there is no standard framework to measure improvement in learning through ICT in India, a relevant question is: what kind of learning can ICT offer? In the TISS Masters' course on ICT and Education, students are expected to engage with different readings and observation of ground practice and develop a framework to assess an ICT practice. The central factors in the framework emphasise on learning, others deal with adoption design, digital equity, and infrastructure accountability. Although a lot is expected from ICT, it is reasonable to justify that in India we would like to concentrate on improving learning of students. However, this outcome is often, a variable influenced by many layers of factors including teachers, school environment and leadership, curriculum, home environment, schooling system and policies.

In my understanding, here are some criteria in the form of questions and discussions that can be used as indicators or framework to view understand or assess ICT interventions in government schools in India. These are classified under Learning Design and Systemic Adoption.

Learning Design

Type of learning: Is the learning with ICT targeted or limited towards remembering the content, remedial practice or is it aiming for deep subject learning,

higher computational thinking, authentic learning (making learning personal or relevant to real life or connected learning needed to make global connect and higher potential for communication?

Role of the teacher: Is the role of the teacher focused on delivering the content which is packaged by an outside agency or has the teacher been involved in the design of the content, media, and pedagogy? Is the teacher central to making decisions on ICT use and subject connection and pedagogy or is it the digital intervention that dictates its delivery?

Role of the student: Are students mere recipients of the digital content? Is technology in their hands and are they actively engaging with it? Are they merely responding to the digital media and content or creating their own learning material?

Open: Are the ICT tools and resources accessible, free and open to be adapted and reused? Although most of the video-based OER are freely accessible they may not be truly open if they do not allow users to adapt, change and recirculate. This condition becomes important especially when the resources need to be adapted in local languages and context. Also, if the intervention requires hi-speed Internet and other devices without providing any alternative for low access users, then the digital resources further divides the gaps of learning and opportunities.

Contextual: Whether the ICT intervention is situated and adapted to the local context: use local language, reflects local culture and its resources, allows students to express local culture and further facilitate them to connect with the concepts constructing their own meaning and knowledge.

I believe that there is no scarcity of ICT innovations in the country, what really counts as innovation is what works for the targeted audience, shows impact at scale, and has potential for systemic and sustainable transformation. Some of these innovations are situated in its design, others, in implementation strategies like accessing infrastructure, nature of collaboration, teacher professional development and situating intervention within the systemic fabric. Otherwise from blackboard to smart board, from print to digital content, if the ICT tool or intervention cannot transform the teaching and learning practices or where the teacher or ICT is still a sage on the stage, then it is a waste of resources and efforts at all ends.

Systemic Adoption

Infrastructural access: Not idealising the 1:1 computer to student ratio, but one that allows meaningful engagement with ICT infrastructure fostering collaboration. Access to adequate infrastructure in terms of devices, electricity and some Internet connectivity are essential to make an ICT intervention work to keep its users motivated and focused towards learning. Thus, the system needs to consolidate models that have worked to make informed decisions to bridge this infrastructure divide. Outsourcing to external vendors has created problems in the past, where the vendors had created their separate space within the school making unilateral decisions on access and use. These schemes and distribution of services need to be carefully examined.

Nature of collaboration: Public private partnerships are crucial to make meaningful ICT integration in education for the government schools. However, private partnerships interests and offerings in government schools need to be assessed in terms of indicators discussed above under Learning Design. Civil societies play an important role in bringing all stakeholders together and implement an ICT intervention collectively on the ground. But care should be taken that interventions do not stay as projects which come and go with financial support. One of the ways out would be to seek academic collaboration for interventions within In-service and pre-service teacher professional development for systemic and sustainable engagements.

Teacher Professional Development: ICT trainings are part of in-service teacher professional development. These are either focused around digital literacy or to a very specific of a particular device, intervention or a platform layered in schools. Here tie-ups with academic institutions would be ideal as ICT in Education has to go beyond a particular intervention or tool. Both ITE and CLIx have taken the route of certification for In-service Teacher Professional Development. The certificate courses aim to developing critical understanding and competence in teachers to choose, use and assess any ICT applications and resources which potentially augment learning experiences and substantiate curriculum goals. Certification also offers the opportunity to engage in continuous professional development through blended learning modes (F2F, practice and online platforms) and develop large and sustainable community of practice groups of teachers.

Finally, any intervention which fails to integrate itself in the existing system is just a splash in the ocean. Systemic integration would indicate for example, negotiating space of ICT intervention within the subject classes, maintaining existing infrastructure and capacitating school staff for lab maintenance, orienting school heads and sharing with them the monitoring responsibility and tools and negotiating assessment allocation and curriculum adjustment to integrate the intervention within the system. The last one is the most difficult. For example, negotiating 20 marks for practical exams in 9th and 10th grade for ITE project is a difficult as ITE is not used by all the schools in the state it serves. Curriculum textbooks using CLIx, OER or ITE projects as optional activities will demonstrate a very big jump but a useful one to sustain pedagogic transformation in the system.

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