DOMINATION AND EMANCIPATION: A FRAMEWORK FOR ASSESSING ICT AND EDUCATION PROGRAMS

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Domination and emancipation,

a framework for assessing ICT and Education programs

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Add

HARDWARE to include connectivity (sophisticated in edusat, Internet provides simpler options)

spectrum not binary, elaborate

Add caveats and exceptions to the exclusion section and mention the limitations, exceptions etc

1 Preface

As an employee for over a decade in a transnational IT (Information Technology) company, then in an NGO, which implemented a large-scale ICT (Information and Communication technologies[1]) program in schools, I have had different kinds of exposure to digital technologies. In my current engagement at IT for Change, (ITfC) as a member of the team working on ICTs and education, my focus has been to critically examine how digital technologies can support the goals of social justice and equity. Since education is in itself a social project aimed towards a just and equitable society, the role of digital technologies in education has been an important focus-area for us. Through teacher capacity building on digital technologies, demonstration projects in schools and school systems, research (action-research connected to our engagement with schools and case study research of other experiments), ITfC has attempted to develop and strengthen the existing understanding of what role digital technologies could play, in promoting progressive education agenda.

This intensive praxis has provided me, and the team at ITfC, many insights into analyzing the transformatory potential of digital technologies in school education, from a practitioner's (in the field of education) perspective. This paper is an attempt to consolidate some of these insights into a cohesive assessment framework for studying ICT programs in the public school system in India, informed by an analytical perspective on domination and emancipation in education.

2 Background

ICTs have always been a critical part of educational processes. ICTs include language, script, print material, chalk and blackboard. However, the availability of digital technologies has given birth to a new set of ICTs. These 'new ICTs' (the term 'digital technologies' would therefore be more appropriate than ICTs), have created a range of possibilities for the core educational processes of curriculum design, material development, transaction and assessment.

Over the last three decades, schools and school systems across the world have invested in a variety of ICT programs, to explore the possibilities of improving educational processes and outcomes. In India, the central and state governments have also launched many programs. The first large ICT project using computers in education, the Computer Literacy and Studies in School (CLASS), was started in 1984 in 250 higher secondary schools. In the SSA program for elementary education, there was a component for 'innovative projects' and many states implemented the 'Computer Aided Learning' (CAL) program under this component. The Azim Premji Foundation supported the CAL program in 14 states by providing digital content on CD-ROMs. Microsoft 'Partners in Learning', and Intel's 'Intel Teach' programs for training school teachers on basic computer literacy were popular from the early 2000's, and were supported by many states in India.

Government of India started providing support for ICT programs in high schools from 2005, aiming to provide a ICT Lab in every government high school in the country. Many state governments have implemented this program using the 'BOOT' (Build-Own-Operate-Transfer) model, in which the entire program is outsourced to a private company. This company installs the ICT infrastructure in the ICT Lab, maintains the same and provides a 'faculty' in each school who will teach the students computer literacy as well as transact computer aided

1 The business sector uses the term IT, the development sector prefers ICT, to refer to digital technologies

learning[2].

3 Limited impact on educational processes and outcomes

The ICT@Schools program, like many other ICT programs in education, has had limited impact on educational outcomes[3]. The Becta research on ICT programs in education across the world, deduced that programs fail due to an overwhelming emphasis on supply of hard infrastructure[4]. The programs neglected the need for building the capacities of teachers to understand the relevance of ICTs in education and possibilities for its appropriation. The same research revealed that a significant number of schools reported that little progress was being made because ICT was no longer on the development plan. One interpretation is that schools felt that once they had achieved certain, primarily quantitative, targets, the rest would almost inevitably fall into place. On the whole, the evidence is that there is a lot more to integrating ICT into the educational experience of pupils than achieving a set ratio of computers to pupils and networking them.

A second reason for failure is the curricular content of ICT programs, which is largely restricted to few popular software applications used in business, such as the office suite. This has meant focus on *ICT education*, rather than *ICTs for education*. For these reasons, teachers have not found ICTs to be highly relevant to their subject teaching, and hence the adaptation of ICTs in the subject teaching-learning has been limited. The promise of ICTs for transforming educational processes and outcomes has by and large not been realized.

4 Program choices

There is increasing realization, that 'magic-wand' claims about the impact of ICTs are to be taken with a pinch of salt. Yet, bureaucrats, who are approached by vendors with their 'offerings'[5], tend to be unclear about what should inform the design of ICTs-in-education programs. So while, state governments often tout 'ICT' programs as an important part of their efforts for quality education, and thus draw regular visits by various vendors for 'collaboration' and procurement of products, bureaucrats are unable to assess these proposals, in terms of possible impact on educational processes and outcomes.

Hence, program choices are often made on tacit and even explicit beliefs that the private sector is most competent to design and manage ICT programs in education. On one hand is the lack of enthusiasm amongst teachers to learn and adopt ICTs. On the other hand, vendors provide 'ICT solutions', minimizing the critical role of the teacher.

There is a pressure on bureaucrats to 'invest' in ICTs in education, and hence they tend to be open to experiment with many of the products offered. Often the costs are hidden and the system is locked into the vendor's

2 Kerala was a notable exception to this, when in 2001, teacher unions persuaded the government to implement the program 'in-house' by procuring the required hardware, train teachers to use the lab for subject teaching of students. One teacher from each school coordinated the program as the 'school IT coordinator'.

3 Condie R. and Munro B. (2007). *The impact of ICT in schools- a landscape review*. University of Strathclyde: Becta Research, pp.13, http://webarchive.nationalarchives.gov.uk/20101102103654/publications.becta.org.uk/download.cfm?resID=28221

4 Ibid, pp.13.

5 Prathap Chandran D. (2011). Towards a National Policy on ICT in School Education in India – A Critical Perspective. The ICT education 'market' tends to be vendor driven

proprietary products, which may initially be offered at no or low cost. As has been observed by Prathap Chandran (2011),

> *"Although the services of private sector can be beneficial to education, we also need to be sensitive to the predominantly profit making outlook of these private players. While schools might not be a very lucrative marketplace for MNCs and the sale of such products and services might not be their best source of revenue, we need to think about the other indirect benefits these companies get. These schools represent an opportunity for these private players to build themselves a loyal customer base and increase their brand awareness"*[6].

There is thus a need for a framework that can support bureaucrats in making investment decisions relating to ICTs and education. This paper attempts a framework that is situated within teacher agency and autonomy.

5 Teacher agency and autonomy: a pre-requisite for education as emancipation

The critical role that the teacher needs to play, in enabling education to be emancipatory, is widely acknowledged. According to Prof Poonam Batra,

> *"In order to revive our state school system of education, and simultaneously facilitate larger goals of social and gender justice and equity, it is important that we enable schoolteachers to become professionals who can undertake this mammoth task with responsibility and commitment"*[7].

If teacher professional development has to strengthen the abilities of teachers to take on the normative project of social justice and equity, this can only happen if teachers see themselves as agents of social change. Teacher agency thus becomes an important focus of teacher professional development. However, as Prof. Batra says,

> *"with massive public investments in school infrastructure and the transformation of standardized curriculum, the primary agent of educational change - the teacher, has been since the 1970s relegated to the periphery as a passive agent of the prevailing ideology of the state. If we truly want students to develop the ability to listen, speak and write a 'multi-perspectival' discourse*[8]*, their teachers will need 'to redefine their role from servants of a hegemonic power to public transformative intellectuals'*[9].

Along with the support for teacher agency, providing 'spaces' to enable teacher autonomy is therefore necessary so that teachers can become public transformative intellectuals. The improvement in school infrastructure, access or curriculum, in and of itself, cannot lead to the strengthening of teacher agency, unless attention is devoted to the creation of enabling structural spaces within the education system[10].

Teacher agency and autonomy must be the starting point of any assessment framework for evaluating the emancipatory potential of 'ICTs in education' programs in the public school system. ICTs are not value-neutral tools that are mere add-ons. Their introduction transforms the existing structures of the public education system, and consequently, impacts teacher autonomy and agency (sometimes positively, and at other times in constraining ways).

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6 Chandran P (2011). op.cit.

7 Poonam Batra (2005) *Voice and Agency of Teachers: The Missing Link in the National Curriculum Framework 2005*, EPW, Vol. XL, No. 40, October 1, 2005. pp. 4347-4356

8 Essential ingredient of the emancipatory project

9Giroux urges educators to redefine their role from servants of hegemonic power to public and 'transformative intellectuals' who commit themselves to furthering equality and democratic life. See Giroux, Henry, A. (1997) Pedagogy and the Politics of Hope: Theory, Culture and Schooling, Boulder, CO: Westview Press.

10 ibid

This paper seeks to study the effectiveness of ICT programs in education, relating the program design to the manner and extent to which it has supported teacher agency and autonomy. The implicit and explicit pedagogy in the programs, involved in design of hardware, software and content, influence teacher agency and participation. Harlen and Deakin support this thinking:

> *"In considering the implications for policy and practice, Harlen and Deakin Crick stressed the importance of recognizing that ICT is not a single entity and that its use should be based on a consideration of how it can be integrated into the processes of learning, teaching and assessment. They argued that the way to bring about the effective use of ICT in the classroom is through the professional development of the teachers."*[11]

Therefore, ICTs in education program design can be assessed with regard to the manner in which the structural shifts they bring about, impact teacher autonomy and agency. Building on this line of analysis, we propose that the impact on teacher agency and autonomy that ICTs facilitate, require to be mapped along the following four elements that are usually used to assess ICT programs:

1. Hardware (hard infrastructure)
2. Software (soft infrastructure)
3. Content (curricular materials)
4. Pedagogy (learning processes)

We will briefly discuss the aspects of teacher agency in each of these aspects

5.1 Hardware (hard infrastructure)

The extent to which hardware is available locally and can be maintained locally will allow greater sense of agency. More sophisticated the hardware, less this will be possible. Open hardware (where the specifications are publicly available) is an emerging idea, this will support easier and local repair or maintenance of hardware as well as re-use, multi-use possibilities which will reduce obsolescence. Planned obsolescence[12] is a feature of IT hardware, which takes away from agency, since a piece of hardware becomes unusable, even though it is otherwise usable.

5.2 Software (soft infrastructure)

Where teacher can make copies of the software and share with others and can customize the software as per requirements (local language customization) etc, it aids agency. Conversely, where software cannot be copied or customized, it would constrain agency. Software locally available provides more opportunities for agency than software available remotely[13], since the installation, configuration, upgrade etc are remotely done. Planned obsolescence is a feature of software, which takes away from agency, since a piece of software becomes unusable when it is no longer suported by vendor or otherwise, though it may be functionally usable.

11 Condie and Munro (2007), op.cit., pp.28.

12 when the vendor stops support for the software used in the hardware and nobody else can provide support

13 In cloud set-ups

5.3 Content (curricular material)

Curricular material is the vehicle for the teacher to interact and function in her environment. Teachers' ability to create and interpret content is an important contributor to agency and empowerment. Often ICT programs seek to deliver 'high quality and uniform' content. The underlying idea in this is that of a dominant curriculum and that ICTs can be used to effectively deliver this. Here, the teacher's ability and even possibility to interpret and modify content is not seen as important. Explicit and implicit restrictions on the ability to create and modify content can further limit teacher autonomy.

On the other hand, ICTs can be used effectively to create diverse materials and locally relevant content if it is accompanied with access to infrastructure and software environments that are free and open. The Open Educational Resources (OER) movement has defined five 'rights' with respect to content – re-use, retain, revise, re-mix and re-distribute, these would support teacher agency.

5.4 Pedagogy (learning processes)

The role of the teacher varies in ICT programs from being an operator of the equipment, who is expected to simply transact the content provided, within a defined suite of applications (teacher as a minor technician), to someone who can adapt these to her contexts and requirements, including being an arbiter of the curriculum. A one-way transmission of information denies any constructivistic learning possibilities and peer learning opportunities. Often the ICT programs offer limited or no possibilities for the content to be altered or sequenced or supplemented in any way by the teacher, who along with the students is a recipient of the transmission, thus being an observer in her own classroom.

6 Exploring domination and emancipation through axes of implementation and ownership

This paper argues that such expansion or constraining of teacher agency and autonomy in 'ICTs in education' programs is determined by 2 critical axes of the program structure:

1. Nature of implementation (centralized v/s decentralized) of the program
2. Nature of ownership (public ownership v/s private ownership) over the program

It demonstrates in the following sections, how these 2 axes become critical for any assessment framework for ICT and Education programs, that uses the analytical lens of domination-emancipation.

6.1 Centralized - decentralized

The nature of this centralization can be along hardware and infrastructure choices, software applications used as well as in the pedagogy adopted. In a centralized model, a teacher is often reduced to an implementer with little or no agency; the restriction of choices of delivery limit participation. In such a case, the teacher's role is that of implementation. The hardware may be remote or sophisticated. The software may not be locally available. Teacher may not have a role in creating content.

Where the school and the teacher have a role in co-designing the program, the program implementation is 'decentralized' and provides scope for being participatory. In such a case, local requirements and contexts can be factored into the program design. Hardware may be local and easily available and maintainable by the school, software installation, configurations and content creation and modification may be locally permissible.

Thus, in case of a centralized implementation, the program is fully controlled by institution external to the school (teacher), whereas in a decentralized implementation, the school (teacher) has a role in determining the nature and scope of the curricular content, the transaction and assessment.

6.2 Public-private

If the program is outsourced (services provided by private vendors), it has private ownership. In such a program, besides the lack of ownership of infrastructure (which means the school or the teacher cannot add to the existing hardware or modify it), the teacher may be prevented from re-using or modifying the software and curricular resources, or the transaction methods being used in the program. Such restriction will reduce the scope for teacher agency in the teaching-learning processes. If the program design, infrastructure and resources are owned by the public education system, it is a 'public' project, with greater possibilities (permissions) for making changes and additions to the hardware, software and content.

The paper explores the categories of “centralized-decentralised” and “public-private” as binaries. While this simplification enables us to more sharply juxtapose the aspect of teacher agency and program effectiveness, it should be remembered that both categories represent spectrums rather than binaries. With the increasing role of the Internet in society and education, we see emerging program models that are fudging these categories even more.

If we take these two axes together, we get a 2 by 2 matrix; *centralized and public* program implementation, *centralized and private*, *decentralized and private* and, *decentralized and public*. The paper draws on primary and secondary research on ICT programs in education, to examine the design of different projects, within this four-way framework.

6.3 Exclusion

Many other factors are relevant to making ICT programs in education effective, such as the basic infrastructure available in a school including electricity, ICT hardware, quality of the educational content provided.

However, in developing this framework, program effectiveness has been seen in terms of the impact of teacher agency reflected in teacher engagement and ownership on program processes and outcomes.

Nature of ownership →	**Public**	**Private**
Nature of implementation		
Centralized	Public and centralized	Private and centralized
Decentralized	Public and decentralized	Private and decentralized

The paper discusses each of these four quadrants, with reference to available empirical data on ICT programs in education in India. The analyses cover the actual effectiveness of the programs in meeting their aims as well as their explicit and implicit beliefs regarding role played by educational content and the teacher in educational processes and outcomes.

7 Public and Centralized

In a “public and centralized” ICT program, the ownership over the program is with the public system and the implementation is centralized.

In centralized program implementation, ICTs are largely seen as a “delivery mechanism” for centrally created content. Content can be created in a single location and broadcast across wide geographies, not easily reachable. Here ICT is seen as a 'one way pipe' for 'dissemination'. In such one way flow, the school and the teacher obviously have limited role. The benefits of 'scale' and 'reach' is seen as a worthy trade-off over local participation.

7.1 EDUSAT

The EDUSAT program of ISRO[14] is a good example of a such a 'broadcast' program. EDUSAT was a dedicated satellite launched by ISRO in 2004, as an exclusive education program room for delivering educational materials to schools and colleges. Teachers had very little role in the program design or content. The hardware was complex, with specialized 'receive only terminals' installed in the schools to receive the transmission, these terminals could be repaired only at the state headquarters. The content was broadcast uniformly across the entire geography, teachers had no ability or role in sequencing or interpreting the content during the transmission.

The basic assumption of EDUSAT design appeared to be that teachers across schools in the entire geography, would be transacting exactly the same work plan, and teachers did not need to make changes to any such work plan based on their local needs, contexts and priorities. That was found to be erroneous. Studies of the EDUSAT program reveal that,

> *"... the project is at best underutilized and at worst, some may even say, an imposition on regular curricula.. An overwhelming majority of teachers felt that EDUSAT programs clashed with the schedule of their lectures... The academic quality and the attendance suffered ... because of a perceived “top down approach” to a planning process that did not adequately involve teachers and principals.”*[15]

Secondly, uniform program content may not relevant to all teachers, given diverse learning contexts and varying transaction stages. The premise of 'universal good quality' content being made easily available appears to be flawed. The centralized system for the design of curricular resources and the selection of trainers has alienated students from rural and remote districts -- who cannot connect with the standard Kannada dialect and the examples and analogies used in classroom sessions.[16]

Thirdly, the 'broadcast' mode of the centrally implemented programs require specialized receivers[17]. With little know how on maintenance, this takes away local possibilities for upkeep. In all schools studied, the 'receivers' for the broadcast, were not working and teachers could only register a complaint and wait. Also the audio and video quality of the broadcasts and the interactivity aspects of the satellite system were found wanting[18].

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14 See http://isro.gov.in/Spacecraft/edusat

15 Gandhi, Divya. (2007). "Is EDUSAT a ‘turkey in the sky’?” *The Hindu*, March 13, http://www.thehindu.com/todays-paper/tp-opinion/is-edusat-a-turkey-in-the-sky/article1809763.ece

16 Kasinathan, G. and Vishwanath, K. (2010). *ITfC Case Study: ICTs programs in schools in Yadgir district,* http://www.itforchange.net/Yadgir_ICT

17 This is now less required, with the emergence of the Internet at the method of communication, more of that later in the paper

18 Gandhi (2007), op.cit.

> *"The case of EDUSAT clearly brings out the limitations and issues in using uncommon and sophisticated hardware - these are prone to damage which can make the program dysfunctional. Secondly, given high rate of obsolescence as well as fragility of computer hardware, maintenance and support costs tend to be significant."*[19]

Bureaucrats seem to believe that centralized program design and implementation is most likely to be effective. This mirrors the traditional curricular resource creation and sharing process (where the text books and other curricular materials are produced at the state SCERT and distributed for use in the schools). It does not leverage the possible for much easier possibilities for decentralized creation and peer sharing of curricular resources that digital technologies allow.

8 Private and Centralized

In a "public and centralized" ICT program, the ownership over the program is with a private actor (usually a for profit business) and the implementation is centralized.

This is similar to the 'public and centralized' approach discussed in the first section, except that the ICT infrastructure and / or content is privately owned and not available to teachers for free sharing or adapting. In addition to the challenges of the 'public and centralized' model, here there are likely to be restrictions on the rights of the teachers to share or adapt the content.

8.1 Tele-education program

Indian Institute of Management, Bengaluru is implementing a 'tele-education' program in Karnataka. This is similar to the EDUSAT broadcast model, with specialized receivers in the schools, which the teachers are not allowed to operate (the program has a separate 'school operator' in each school). Teachers cannot moderate or interpret the content, since it is transmitted in a one-way communication mode in all schools at the same time. In addition, the content broadcast is proprietary, which means teachers are forbidden to make copies or adapt. Since teachers need to mediate the content for meaning making, depriving them of rights to re-use, adapt or share can be detrimental to the learning process. As we observed during our case study of the initiative, teachers feel helpless when there are issues with the receiver equipment or with the network. The school operator is unable to respond to their support requirements in such cases, and is not accountable to them. Teachers are also unhappy that they are not allowed to access the resources or the laptop[20].

At the same time, the challenges of disconnect with the teachers' own transaction plans are the same as seen with *the* public-centralized model, this is inherent in centralized design. The teachers have no role in determining the nature of content or the schedule of transmission and are also quite aware that they have no role.

> *"Most teachers felt that the sessions were not integrating well into the regular school timetable. The level of the content in the telecast was felt to be too difficult, sometimes the content was condensed, and many teachers felt rural students would not be able to understand. Linking the session contents to what they were transacting at that point, was felt to be difficult. In some schools, teachers do not even view the program, leaving the students with the school program operator".*

8.2 Private and proprietary

The traditional 'public' and 'private' ownership over property is partly based on the principle of 'non-rivalrous'

19 Kasinathan and Viswanath (2010), op. cit., pp.10-11

20 Study on the IIM- Bengaluru Tele-Education program, ITfC. Not yet published

use. If an individual owns a book, either it can be with her or with another person. Property law can enable the individual who 'owns' the book to prevent anyone else from taking that away from her.

In case of digital 'goods' given the possibilities of replication at virtually nil marginal costs, 'non-rivalrous' principle does not apply. The same digital content or application can be shared without needing to spend the same amount producing additional copies. Any digital content that is 'public' can be freely shared, this is an important factor supporting the emergence and growth of the 'Free and Open Source Software (FOSS) and the 'Open Educational Resources' (OER) movements. In order to prevent such sharing, special legal (license preventing sharing and modifying) and technological (technically preventing 'copy paste') processes need to be undertaken. This is the 'proprietary' model we are familiar with.

In the case of the digital environment, since it is non-rivalrous, the same digital resource can be shared by many people without any conflict. Hence, a rich public environment can be created with access to a large number of publicly owned resources, such free sharing and modifying processes could enhance the possibilities for teacher agency.

8.3 Increasing trend towards 'private and centralized' models

Technology companies have long demonstrated a tendency to capture new markets, by creating special offerings for schools and colleges, to attract a new set of consumers. However, such offerings, such as Apple's 'iBook' that permits users to create their own textbooks, have extremely restrictive end user licenses that prevent users from adapting the product beyond the boundaries drawn by the product company and the copyright, or freely sharing it with other users[21].

An even more pernicious trend is the capture of previously Open standards by product companies, through the use of an 'embrace, extend and extinguish' tactic – that refers to the ploy of creating a new technology product on a popular Open Standard, extending that standard with some distinguishing, proprietary capabilities, and using this new closed standard to edge out competitors from the market. Again, Apple adopted this tactic to consolidate its iBooks market – Version 2.0 of iBooks locks out the popular industry-leading digital book standard EPUB[22]. As commentators have pointed out, such proprietarisation and vendor lock-ins are strong disincentives for 'teacher-driven' change in school systems – as in this situation, teachers cannot share learning resources that they have created freely with peers or students[23].

This trend towards creating attractive 'walled gardens' for teachers and students is proliferating, as this model offers the maximum potential for profit making. In fact, other private IT companies such as Google, Amazon, Microsoft are investing hugely in this space.

Another development is the push for cloud technology in 'ICTs in education' spaces. As technology scholars such as Prabir Purkayastha (2015) have pointed out, cloud computing has largely been used for the

21 Kasinathan, G. (2012). "i-cage for the education system". *The Hindu,* January 29, http://www.thehindu.com/sci-tech/technology/icage-for-the-education-system/article2840498.ece

22 Bott, Ed. (2012). "How Apple is sabotaging an open standard for digital books". *ZDNet*, January 22, http://www.zdnet.com/article/how-apple-is-sabotaging-an-open-standard-for-digital-books/

23 Martellaro, John. (2012). "The State of the iPad in Education: a Giant Mess". *The Mac Observer*, September 19, http://www.macobserver.com/tmo/article/the-state-of-ipad-in-education-a-giant-mess

consolidation of platform monopolies on the Internet[24].

In the near future, it is easy to see why this dominant cloud technology model, even if monopolistic, will catch the imagination of policymakers in the 'ICTs in education' arena. This model offers the ease of access, reach, minimal investment in infrastructure (all technology parameters) as critical selling points. However, what may go unnoticed is that this model may impose the highest hegemonies on learning and knowledge, and constrains teacher agency the most – as monopolistic platforms are most likely to have the maximum number of restrictions on end-user freedoms to re-use and share resources, and push for centralized content creation models, which will reduce the scope for the development of teacher agency and autonomy. The teacher will only be encouraged to see herself as a 'consumer' of products provided.

In a monopolistic cloud technology model, the only question that the teacher can ask is 'what can this product do for me'? Whereas the question can be 'what resources do I need and what can I do with the resources available', if a non-proprietary, free and open, and public model can be created in this space.

9 Private and decentralized

This approach combines decentralized implementation and private ownership of infrastructure and content.

9.1 ICT@Schools

In India, this has been adopted in the ICT@schools program of most state governments, as the popular 'BOOT'[25] (Build-Own-Operate-Transfer) model. The vendor provides a 'computer faculty' in each school, who is not part of the regular teaching staff. The operator maintains the lab infrastructure, teachers are not allowed to add or modify the hardware or the software in the lab. Schools cannot add computers which may be donated to the school by the community or other organizations, or could be purchased with school funds. The operator teaches applications and content directly to students, in the schools, without involving teachers.

CIET (Central Institute of Education Technology) has done an evaluation of ICT@Schools program, covering 10 states. Their report stresses the lack of involvement of the teachers and the limited integration with the mainstream educational processes of the schools:

> *The implementation of the ICT@Schools scheme largely focuses on providing infrastructure to schools with little attention to how technology can be integrated in educational processes such as teaching learning. In its current format, the scheme imparts only computer literacy to students and teachers[26]... 90% of the State evaluation reports include information on the usage, access and, in some cases, the feedback from students and teachers on the ICT infrastructure available in schools. Analysis of this information broadly suggests that students do not have sufficient access to school computers and that only a small percentage of teachers use technology for lesson planning.*

School principals have low levels of awareness towards the implementation of the ICT@Schools scheme. This contributes to the lack of infrastructure maintenance and the low levels of technology integration in teacher practice and administrative tasks, another observation made by the same report:

> *.. implementation of the program issues appear to be arising out of an absence of ownership on the part of the school. Outsourcing the implementation, appears to have shifted the issues on to the service provider or the ICT*

24 Pukayastha, Prabir (2015), Net neutrality in the age of Internet monopolies, The Marxist http://cpim.org/sites/default/files/marxist/201501-marxist-internet-prabir.pdf

25 Kasinathan, G. (2010). *PPP Models vs Integrated Approach*. ITfC, http://www.itforchange.net/BOOT_Integrated.

26 Central Institute of Educational Technology. (2014). *ICT@Schools Scheme Implementation in the States: An Evaluation*. New Delhi: National Council of Educational Research and Training, pp.15.

teachers appointed by this provider[27].

In most cases, at the end of the project period, given lack of teacher engagement or understanding, the program does not sustain. What is transferred is e-waste, rather than useful infrastructure or resources. In our study of this program in Yadgir, it was found out that none of the 30 schools studied had a lab in which all computers were working, and a fourth had none working.[28] No school had working Internet facility, though that was a part of the program. The program was at the mercy of the computer faculty provided by the vendor and the school was completely dependant on the operator for running the program[29].

In the BOOT Model, while implementation is decentralized, the design is still centralized. A single MOU is signed by the education department with the vendor, in this the school authorities have no role. This impacts the nature of accountability of the vendor to the school. Decentralization of the design would be further decentralization of the program wherein the school has a role in the nature of infrastructure, content etc. This is in fact recommended by the CIET evaluation as the way forward for the ICT@schools program.

9.2 "Partners in learning" or in marketing?

In case of private vendor implemented programs, vendors can use also these programs as an opportunity to market their own products.

Under the 'Partners in Learning' program, 'Microsoft established "Microsoft Academies", this appeared as a benevolent corporate program to build digital literacy skills of teachers. The teachers who attended the program and were trained on the applications of Microsoft (mainly the operating system Windows and the Microsoft Office suite), did not get a copy of the software since it was proprietary and could not continue their learning beyond the training period. Since the proprietary software was expensive, teachers could not afford to buy individual copies of the license to use and while some installed pirated versions on their computers, the training could not be effectively followed by teachers with self-learning.

Since the MOU had an explicit clause that 'syllabus will be decided by Microsoft' and the applications taught were products of Microsoft, the education departments could not use the same infrastructure to train teachers on other digital resources. Microsoft denied the state education departments any right to include any other product or application in the program[30]. Thus, the program can be seen was more of a vendor marketing program, funded by state education department, to create a market for Microsoft's products.

10 Public and decentralized

In this approach, the ownership over the infrastructure and content is public, and the implementation is decentralized.

27 Ibid, pp. 12

28 Kasinathan and Viswanath (2010), op.cit., pp.12.

29 Kasinathan and Viswanath (2010), op.cit., pp.12.

30 In a teacher training program that I conducted for Karnataka teacher educators in the Microsoft Academy at Kalburgi in 2007, I requested to be allowed to install the free and open source office suite 'Open Office' on the lab computers, this was denied, and the MOU was cited in support of the denial

10.1 IT@Schools

Though the Kerala IT@Schools began, in 2001, as a project designed and implemented by Intel and Microsoft, teachers unions' asserted that they found no value in teaching their students proprietary software applications. The department then changed the program design and trained teachers on free and open source educational applications using the 'cascade' model, used for regular in-service teacher training, this model enables covering a large number of teachers.

In this program, the department supplied computers as per the norms of the program, but schools were free to add computers and other equipment to the lab and many of them did, with support of the local community bodies. Teachers were able to install the free and open source software used in this program on these additional computers, and install on their home computers as well. Teachers also learnt to maintain ICT hardware, exercising their agency in infrastructure maintenance. Teachers learnt to use these tools for creating digital learning resources and lessons, for their classroom teaching. As per a study, the teacher training structures which are fully responsible for the teacher training also conduct the teacher training for this program. This approach has also helped the program to become one of the school, supported by the school system[31].

10.2 University School Resource Network

In the 'University School Resource Network' (USRN) program of the CIE (Central Institute of Education), Delhi University, teachers and teacher educators from government, aided and private institutions exchange ideas and resources[32], which is another example of decentralized program based on non-hierarchical networking of teachers. In this program, hardware or software was not provided to the teachers, who used their personal computers. Teachers were enabled to collaborate and create curricular resources. As per our research study, we conducted on the program in 2010,

> *"The project has been able to make significant contribution to the academic resources, especially in the Hindi language. There is a critical need for foundational resources to be available in Hindi and the project has made a good beginning by making 25 translations available. The website is seen as an important resource portal which can support discussions amongst teachers, teacher educators."*[33]

10.3 Subject Teacher Forum

Similarly, in the Subject Teacher Forum[34] of Department of State Education Research and Training (DSERT) and Rashtriya Madhyamika Shiksha Abhiyan (RMSA), Karnataka, teachers share lesson plans, assessment questions, semantic maps etc. in video and text formats over virtual networks[35]. The program is premised on the idea that teachers need to leverage technology by connecting and creating for self learning and peer learning. In this program, the focus has been on teacher capacity building to access educational resources, as well as create open educational resources (OERs) using different free and open source editors and educational applications.

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31 Kasinathan (2010), op.cit., pp.13.

32 Kasinathan, G., Thirumalai, B. and Vishwanath, K. (2010). *Impact assessment study on the 'Regional resource centre for elementary education',* http://www.itforchange.net/RRCE

33 Ibid, pp.25.

34 See http://karnatakaeducation.org.in/KOER/en/index.php/Subject_Teacher_Forum

35 Disclosure – the author is the director of ITfC, which partners with DSERT and RMSA Karnataka in the STF program design and implementation

Teachers have also been connected through public mailing lists to one another. The program has not supplied any hardware to the teachers or schools, who use existing hardware, many teachers have been encouraged to purchase personal computers after participating in the program. The program has emphasized a free and open environment and the creation of a collaborative resource platform, and focused on building teacher capabilities for evaluating technology choices.

A case study on the Subject-Teacher Forum throws up significant insights on teacher engagement and agency:

> *"The training has included a hands-on introduction to digital literacy and ICT basics; accessing, creating and curating digital resources.."*[36].

The program design has enabled individual and collective agency, bringing teachers together to participate in debates on educational and larger socio-political issues. A large volume of OERs are also being created by the teachers and shared on the mailing-lists. A study[37] of a sample of emails in the maths and science mailing list revealed that around 50% of the emails have a resource attached, for sharing and feedback. Thus

10.4 Free and open digital environment

The Subject Teacher Forum program design consciously works with and for a free and open digital environment. The teachers learn free and open source educational applications and editors. They interact on a public mailing list, with no moderation. They share resources which are licensed as "Open Educational Resources" (OER) and made available on a web portal, created using the Mediawiki software[38]. The use of FOSS tools has enabled an application rich environment for teachers , encouraging them to engage with these resources, create their own and share them with their peers. Thus the teachers are using free and open tools to create open educational resources, aligning the choice of means (digital applications to create resources) and ends (digital content created in the form of OERs)[39].

The Open Educational Resources (OER) movement is becoming increasingly popular and is premised on offering educational content on a decentralized and public basis. Programs[40], such as Khan Academy, TESSA, Open Courseware use ICTs to create curricular resources and allow teachers to use, re-use, retain, revise, re-mix and re-distribute these (the 5 R's). By allowing sharing and modifying, OER processes support teacher collaboration, which enhances teacher agency at both individual and collective levels.

While FOSS applications are in the nature of 'digital tools', OERs are in the digital outputs. When both are free and open, the technology environment can have positive implications for teacher agency[41].

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36 Sharma, R. (2015). *Subject Teacher Forums and the Karnataka Open Educational Resources program, a case study*. To be published by Wawasan Open University, Penang.

37 This study was a part of the 'Research on OERs for Development' research project, being conducted across countries in Asia, Africa and South America, to explore the role of OERs in higher education in the global south. See http://roer4d.org

38 Mediawiki software has been created for supporting collaborative editing and is used by Wikipedia, the largest encyclopedia.

39See Kasinathan, G. (2015). "'The means are the ends': The alignment between OER and FOSS". ROER4D blog.

40 Atkins, D.F., Brown, J.S. and Hammond, A.L. (2007). *A Review of the Open Educational Resources (OER) Movement: Achievements, Challenges, and New Opportunities*. Report to the William and Flora Hewlett Foundation, http://www.hewlett.org/uploads/files/ReviewoftheOERMovement.pdf

41 Kasinathan 2015. "The means are the ends": The alignment between OER and FOSS on http://roer4d.org/1570

10.5 Public and decentralized, necessary but not sufficient

However, public and decentralized implementation by itself will not ensure program effectiveness. For e.g. the Computer Aided Learning Program (CALP) of SSA has in most states largely involved providing computers to the schools with little or no teacher capacity building. Studies of the CALP suggest that the absence of teachers' capacity building and networking for mutual support has led to program failure. In one study, a teacher from a CALC school said,

> *"They have given us all this expensive equipment but not told us how to use it. We feel it is such a waste and feel bad that is lying around like this!"*[42]

Another study of the CALC program reinforces the need for building teacher capabilities.

> *The second point of concern relates to teacher training or the lack of it. Finding optimal ways to use technology for students will take time, exploration and experimentation on the part of teachers. They are simply not getting the time or wherewithal for this. Training programs need to veer around practical and pedagogical issues instead of only ICT applications. These programs have to encourage teachers to reflect on and make decisions about ICT use. Training must adapt to teachers needs if we expect them in turn to adapt to their students' needs. Also, teachers need to be empowered to recreate content, collaboratively. There is no scope for teachers to adapt IT to suit their classroom requirements", radio/CAL/EDUSAT are viewed as programs rather than as resources and due to the top-down approach that is adopted, they are unable to visualize an integration of all these resources.*[43]

Likewise, in the CALP in which Azim Premji Foundation participated and provided digital resources as well as a school coordinator, the lack of teacher capacity building and integration into the regular teaching learning processes proved to be a reason for failure, as per Behar:

> *"Over a four-year period, we at the Azim Premji Foundation produced the largest single library of digital learning resources (DLR) in India for children... We worked with various state governments to use these DLRs in thousands of schools. But they did not run well everywhere... After 5 years, when we took stock at a fundamental level, we realized that the whole thing was at best a qualified failure."*[44]

Decentralized implementation and public ownership can enable teacher ownership over the program and support teacher engagement, provided teacher capacities are developed to understand ICTs and learn the possibilities for integrating ICTs for their own professional development and for teaching-learning, and secondly a support mechanism is created and sustained at local and peer levels.

11 Internet

The Internet which has now become the primary medium for sharing information blurs the categories of the centralised and decentralised programs. The Internet can be used in broadcast mode, without any requirement for specialized receivers, since the general purpose computer (or phone) with connectivity can receive content. Hence, even in case of "broadcast" models, the receiver can receive (download and use) the content as per their own preferences. For instance the NPTEL program[45] which has a similar 'make once, share everywhere'

42 Kasinathan and Viswanath (2010), op.cit., pp.11.

43 Mythili, R. (2010). *Nature and Extent of use of ICT in classrooms: Draft Report*. Bangalore: R.V. Educational Consortium, pp. 75.

44 Behar, A. (2010). "Limits of ICT in education". *Livemint*, December 16, http://www.livemint.com/Opinion/Y3Rhb5CXMkGuUIyg4nrc3I/Limits-of-ICT-in-education.html

45 See http://nptel.ac.in/faq.php

approach, makes all the resources available on its website, for download and use.

With the emergence of the Internet, peer networking has become possible, at the same time, it has become easier for 'providers' to reach out and disseminate their offerings. The Internet thus has created possibilities for both centralized and decentralized program designs. The recent emergence of Massive open on line course[46] (MOOC) as a model of learning (for both students and teachers), is a pointer to this hybridization. MOOC has both centralized (core course content, assessment) and decentralized elements (discussions, peer assessments). MOOC is only one implementation of new models of learning enabled through ICTs, which combine physical and virtual interactions, centralized and decentralized designs in different ways.

12 What's ahead?

The paper has drawn on data available on ICT in education projects, to suggest that ICT enabled education programs that support public (local) ownership and have decentralized implementation seem to be more effective in eliciting the support and participation of teachers. Centralized implementation and private ownership approaches seem to limit teacher engagement, which is associated with program ineffectiveness. Allowing teachers space to learn and design programs appropriate to their contexts appear to be more effective.

Yet, strong forces will continue to push for centralized models and privatized models of ICT programs in education. To elaborate this, I will move beyond the empirical data presented, and make some inferences and observations, these are based on the work done by ITfC in understanding movements in the digital technologies and their impact and implications across sectors.

The centralized design of the ICT programs is perhaps, only reflective of the larger need for control, of the education system, over teachers and schools. With ICTs, it is even easier to treat the teachers as minor technicians, since every aspect of curriculum and now, even transaction can be attempted to be controlled. The 'ideal' of being able to 'monitor' *every action of every teacher in every school* can become a reality with ICTs. In namma Bengaluru, for instance, all schools are already required to install CCTV cameras[47] to record and monitor activities. CCTV cameras in classrooms[48] to monitor teacher and student are already seen, and it is a matter of time for them to become commonplace. Education bureaucracies will find reasons to justify these, even on the grounds that these are for teacher support.

Similarly, private businesses will justify their offerings on grounds of 'quality'; their sleek packaging and efficient performance will be seductive, difficult to resist[49]. Freedom, autonomy can potentially be sacrificed on the grounds of 'quality' of content and 'impact on learning'. Their proprietary platforms will be much more constraining on teacher agency than earlier digital applications. Every act (click) will be recorded[50] and monitored by the digital structures and the '*big data*' generated will be used to 'predict' learning styles and processes, this is the emerging field of 'learning analytics'. Predictions from big data will be used to define teaching paths and this can only mean unimaginable restrictions on teacher agency. Also, the big data platforms will be proprietary and will allow their vendors perennial rent seeking.

On the other hand, if teachers learn and understand ICTs as resources for them to use, adapt, interpret and as

46 See https://en.wikipedia.org/wiki/Massive_open_online_course

47 http://www.deccanherald.com/content/422090/cctv-mandatory-schools-buses.html

48 *The Great Indian School Show*. Dir. Avinash Deshpande. Poona Cinema, 2005. Documentary. http://www.cultureunplugged.com/filmedia/play/245/The-Great-Indian-School-Show

49 On a lighter note, many progressive educators happily sport macs and iphones, proprietary products from Apple

50 Clickstreams, see https://en.wikipedia.org/wiki/Clickstream

methods to create, share, co-own and for collaborate with their peers, this can create rich learning environments.

We will thus need to watch these two diverging trends; on the one hand, the bureaucrats and market forces will have their compulsions to promote proprietary cloud approaches for ICT programs, on the other, decentralized public models which appear most complex, will offer the maximum promise in terms of supporting teacher agency, participation and school autonomy. These two opposite approaches are distinguished in the table below. The design of the program, across the elements of hardware and software, content and pedagogy, based on empirical evidence, can be seen to be co-related with possibilities for teacher agency and autonomy. These two extremes are discussed for sharp juxtaposition.

Program elements	**Private centralized**	**Public decentralized**
Hardware	Sophisticated, specialized, reliance on external support for maintenance	Generic and common. Open hardware Teachers need to be and can be trained for maintenance and support
Software	Proprietary platforms and applications	Public, free and open platforms and applications
Content	Can only use. re-vision, retaining and re-distributing can be restricted	Dynamic; free to re-use, re-vise, re-mix, retain and re-distribute (the 5 Rs of OERs)
Pedagogy	Learner has limited agency in learning; content dissemination is the key pedagogic focus One-way bypassing the teacher though direct or outsourced delivery of content	Learners can interpret content; teacher is the arbiter of the learning process; Multiple paths of communication and information sharing Teacher interprets the curriculum for the student

13 Policy

Technology is unlikely to move us away from these gloomy scenarios, policy could. In its 2012 review of ICT program in education, a sub-committee of Central Advisory Board of Education (CABE) had this to say,

> *"Given the enormous pace with which newer ICT technologies are spreading, their appropriateness in terms of pedagogy, equity and larger public interest becomes a vital question, more so because information about these technologies is mostly spread by their vendors, whose major concern, understandably, is to sell them more and more. It becomes imperative therefore that for the benefit of governmental agencies working in education, and for larger public interest, the government lays down yardsticks and benchmarks through a public policy in the choice and use of ICT technologies, that can act as a guide for central and state government agencies and for the* ***larger public purpose****. This is particularly so since the governments are now spending significant amount of funds in bringing these technologies into education, particularly in schools"*[51].

51 Central Advisory Board of Education. (2012). *Report of the Sub-Committee of Central Advisory Board of Education (CABE) on ICT in School Education,* http://www.itforchange.net/sites/default/files/ITfC/Final Report of CABE Sub-

That was the report of the CABE sub-committee on 'ICTs and Education'. The National Policy on ICT in school education, informed by this report was released in June 2012. This report is still to be internalized by decision makers. It is only the political (policy) that can assert the supremacy of the people over technology, and direct technological processes and energies to work for public interest and for education as emancipation.

14 Annexure A – Abbreviations used

Becta	British Educational Communications and Technology Agency
BOOT	Build-Own-Operate-Transfer
CABE	Central Advisory Board of Education
CAL	Computer Aided Learning
CALC	Computer Aided Learning Centres
CALP	Computer Aided Learning Program
CCTV	Closed-Circuit Television
CD	Compact Disc
CIE	Central Institute of Education
CIET	Central Institute of Education Technology
CLASS	Computer Literacy and Studies in Schools
CLPS	Computer Learning programs in Schools
DLR	Digital Learning Resources
EDUSAT	Educational Satellite
FOSS	Free and Open Source Software
GHS	Government High School
HM	Headmaster
ICT	Information and Communication Technology
ISRO	Indian Space Research Organisation
IT	Information Technology
MNC	Multinational Corporation
MOOC	Massive Open On line Course

Committee on ICT in SE .pdf

MOU	Memorandum of Understanding
NIAS	National Institute of Advanced Studies
NPTEL	National program on Technology Enhanced Learning
OER	Open Educational Resources
RMSA	Rashtriya Madhyamika Shiksha Abhiyan
SCERT	State Council Educational Research and Training
SSA	Sarva Shiksha Abhiyan
STF	Subject Teacher Forum
TESSA	Teacher Education in Sub-Saharan Africa
USRN	University School Resource Network