A Study on the Permeation and Scope of ICT Intervention at the Indian Rural Primary School Level

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Abstract: The provision of education for all in India remains a distant dream, despite substantial amounts of government and state investment going into it. The objective of this study is to highlight an alternative learning model that makes use of the e-revolution that has proliferated into every aspect of our lives. Although there have been attempts to incorporate ICT into rural classrooms, most of the focus has been on video-based digitized learning and has not efficiently addressed the best ways in which learning can be achieved. Our aim is thus to design a model that not only makes e-learning effective, but replaces the under-qualified teachers in remote areas and allows for the free permeation of education in ways that might bridge the digital divide amongst students of various socio economic backgrounds. In this context our intervention focuses on a class of 16 students, 10 to 11 years of age (class 5) at Ma Sarada Shishu Tirtha, a school for tribal girls, located in Krishnanagar, West Bengal, India. The intervention involved a remote teacher delivering Math and English lessons in a class-room setting, (via the video conferencing software Skype, and PowerPoint Presentations) while also making the session interactive.

1. INTRODUCTION

Elementary education of underprivileged rural children residing in remote regions is the primary focus of the study, since only a robust elementary education system can solve chronic problems of low literacy and educational deprivation. Even though global demand tends to be focused on higher education and technical skills, there are backward linkages with elementary education in several ways. On the one hand, achieving universal elementary education is expected to raise productivity and incomes and strengthen the domestic market, seen as a condition for continued economic growth. On the other hand, the growing concern with basic education is seen as limited in the current economic scenario as it does not adequately consider the education and skill requirements needed to enhance productivity and incomes in a changing economy.

Development theory in recent years has taken note of the importance of education as an index of development of a nation, and with its myriad positive effects on the functioning of a society, the outreach of education to every stratum of society is a subject of great concern. The connection between universalisation of elementary education and human development is one of the most widely acknowledged issues in public discourse across the globe. Elementary education thus plays a pivotal role in reducing social inequalities by expanding human capabilities. (Sen, 1989)

Four features that have characterized India since Independence continue to characterize India's elementary education system: incomplete enrolment, inequalities, poor quality, and ineffective school performance. Further, despite aggregate improvements in education levels, glaring inequalities in basic education continue to persist. Disparities between regions (states) and across

gender, caste, class, religious groups; and other marginalized sections of society continue to present the biggest challenge for policy makers and educationists (Dreze & Sen 2002). For instance, about 53 % boys complete primary education compared to 34% girls. Recent interventions have helped in bridging the gender gap but the drop-out rate among girls, especially in primary classes, is still a cause for grave concern. This is reflected, for instance, in the differential in the median years of schooling which is 5.5 years for boys compared to 1.8 years for girls.

Marginalized groups such as the scheduled castes (SCs) and scheduled tribes (STs) (two groups of historically-disadvantaged people recognised in the Constitution of India) as well as religious minorities continue to fall out of the loop of schooling. In addition, there are striking gender differentials in school attendance among children 6–14 years belonging to SC, ST, and rest of India. The gender differential is most pronounced among the ST communities—a gap of almost 12 percentage points (Kumar, Rustagi, 2010).

School performance is often marked by absenteeism, inadequately trained teachers with indifferent attitudes, non-availability of teaching materials, inadequate supervision, and little support. Many poor families, having lost faith in government schools, are forced to send their children to private schools even when they have access to 'free' public schools. Several cases of discrimination are reported – against girls, against children belonging to socially disadvantaged and minority communities, and against the poor. Corporal punishment is common and many children are afraid of going to school for fear of being beaten, if not publicly ridiculed or rebuked by teachers and other students. (Kumar, Rustagi, 2010)

Although the proportion of GNP allocated to education (revenue and capital accounts together) has grown from a very low level of 0.67 % in 1951-52 to reach the all-time high of 4.4 % in 2001, mass illiteracy continues to flourish. Education is by far the largest capitalized space in India with $30bn of government expenditure (3.7% of GDP; at global average), and a large network of around one million schools and 18,000 higher education institutes. Yet, the public education system is 'insufficient' and 'inefficient'. A break-up of government expenditure shows that only a miniscule 0.82% component goes towards capital expenditure. A whopping 80% of the revenue expenditure on teachers' salaries leaves little to be spent on infrastructure creation, which eventually translates into 'ineffective' infrastructure/ quality of education. (Vora, Dewan, 2009). It indicates that a higher allocation of funds on education is not the only criterion to solve our literacy problems.

Although, various schemes and programmes have been started by the State Governments and the Ministry of Tribal Affairs to promote universal primary education among tribals such as- scheme for establishment of Ashram schools in tribal sub-plan areas, scheme for establishment of boys hostels for the Scheduled Tribes, scheme for construction of girls hostels for the Scheduled Tribes, and scheme for development of Primitive Tribal Groups (PTG), but in reality very few of them have percolated down to the tribal and benefited them. Many of the programmes did not benefit the tribal community because the programmes were not contextualized and localized considering regional, geographical and physical differences and barriers. (Kumar, 2008)

ICTs are a potentially powerful tool for extending educational opportunities, both formal and non-formal, to previously underserved constituencies—scattered and rural populations, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities, etc.(Roy, 2012)

ICT based distance education in India has primarily been confined to university-level education and is often considered being sub-par when compared to traditional courses. The long-term purpose of the present study is to develop a sustainable model of distance-learning that is cost-effective, and leads to a more fulfilling learning experience for the children.

The objective of this study is to highlight the importance of working with constrained resources, and proposes an alternative learning model that makes use of the e-revolution that has proliferated into every aspect of our lives. The study examines whether it can be utilised to overcome infrastructural bottlenecks in the provision of quality education in inaccessible rural areas, and thus bring about a concomitant increase in the population's educational levels. The internet-based social media revolution of the present age has the possibility of transforming education and knowledge as one knows it. By exploiting this, it may be possible, via a model that combines the correct elements of distance learning,

to bring forth a knowledge revolution and spread education to the remotest corners of the country. Our aim is thus to design a model that not only makes e-learning effective, but replaces the under-qualified teachers in remote areas and allows for the free permeation of education in ways that might bridge the digital divide amongst students of various socio economic backgrounds.

2. ICT BASED LEARNING

2.1 Computer-Assisted Learning

The wide use of Internet has affected the methods of education, giving us the concept of global classroom where any number of students can interact with each other at any time. ICT is currently widespread in schools and colleges of developed countries (DG Communications Networks Report, 2013). In the developing countries, it is being primarily used to support education in the form of "E-Learning" applications. There is still some amount of scepticism among the schools in adopting ICT because it is still a relatively new feature and its impact on student achievement is not known. Also such technological solutions are thought to be not very cost effective (Rajesh, 2003).

Although there are several studies that indicate how ICT can benefit various stakeholders, what is certain is that ICT is not the ultimate solution rather an aid to achieve the maximum that can be derived out of educational experiences at school. While the debate on the impact of ICT on learning outcomes still goes on, there seems to be a consensus that ICTs in education can increase access to information inside a classroom as well as increase motivation and efficiency throughout the system. (Haddad, Jurich, 2002) (InfoDev Report, 2010)

Government of India, as part of its 11th Five Year Plan, continues to support federally sponsored scheme, known as "Sarva Shiksha Abhiyan, (SSA)" with the objectives of providing school education to every child between the age of 6 and 14 years and improving the quality of school education in the country. Under this policy GOI aims at fostering ICT based Education in India. Under the Sarva Shiksha Abhiyan, several Computer Aided Learning (CAL) programmes have been created by developing multimedia content.[1]

[1] (www.ssa.tn.nic.in/Docu/CAL%202011-ss.pdf)

The objectives of CAL are as follows:

1. To facilitate effective delivery of curriculum content
2. To act as an effective supplement for teachers to improve learning levels in the school since it facilitates practical and experimental learning.
3. To serve as a means to attract children to schools with the multimedia i.e. audio-visual form of learning on various subjects of classroom teaching and thus hold their attention, hence tackling the challenge of dropouts and achievement of enrolment.

SSA has introduced many CAL projects across states in India. 27,289 schools with about 5.3 million students were beneficiaries of this program.[2] The two major ICT related projects in schools are Multimedia in K-12 (for *affluent* private schools) and ICT in public schools. The leading players are Educomp Solutions, Everonn and NIIT. Educomp which is the pioneer in this field has a product called "Smart Class". Smart class is a product offered under Multimedia in K-12. The objectives of this are as follows:

1. To use multimedia modules to effectively teach students across Kindergarten to 12^{th} grades.
2. Content delivery through multimedia i.e. digital content and LCD TVs/Projector assisted whiteboards. It has been universally accepted that this content delivery scheme improves teaching and learning experience.

However, the focus of these efforts was more towards computer-aided learning than Distance e-Learning . Distance E-Learning is the combination of Distance Education and e-Learning which is characterized by the extensive use of Internet enabled web technology in the delivery of education and instruction and the use of synchronous and asynchronous online communication in an interactive learning environment or virtual communities, in lieu of a physical classroom, to bridge the gap in temporal or spatial constraints (Garrison, 2011). A recent development in distance e-learning is Massive open online courses (MOOCs), aimed at large-scale interactive participation and open access via the web or other network technologies.

[2] mhrd.gov.in/ict_school

But, MOOC is usually non-interactive, i.e. the students will be viewing the recorded videos by the instructors, followed by off-line question-answering. Our focus in this study is to use Distance e-Learning in a synchronous mode, which implies real-time interaction with fixed-time-fixed-place virtual classroom over the Internet for primary students.

The McKinsey report (Madgavkar et al, 2012) states that there will be 330 million Indian users of the internet in 2015, thus making it the second largest connected population in the world. Rural access to education can be vastly improved by means of exploiting this revolution, and creating a networked virtual classroom system.

2.2 ICT Interventions in Rural Classroom

Some efforts in the sphere of remote learning already undertaken in rural India are summarised as follows:

Hole-in-the-Wall (HitW): Hole-in-the-Wall is a 'Shared Blackboard' which children in underprivileged communities can collectively own and access," to express them, to learn, and to explore together." In an experiment conducted first in 1999, a computer was placed in a kiosk created within a wall in a slum, and children were allowed to use it freely. The experiment aimed at proving that children could be taught by computers very easily without any formal training. Sugata Mitra, the inventor, termed this as Minimally Invasive Education (MIE). The experiment has since been repeated in many places, HIW has more than 23 kiosks in rural India. This work demonstrated that groups of children, irrespectively of who or where they are, can learn to use computers and the Internet on their own with public computers in open spaces such as roads and playgrounds, even without knowing English.

Pratham's Computer Aided Learning: This is a school based program which caters to school going children from 6-18 age groups with about 40% children in secondary school age. The objective of this program is: 1) To impact children's basic learning levels using IT and 2) to give them relevant IT knowledge and skills. Through its school based computer labs, this program reaches out to close to 90,000 children across 7 states. This program also tries to improve schools performance by encouraging them to adopt various IT solutions like MIS, Database etc and to get teachers to adopt technology through teacher training. The curriculum includes software developed by Pratham in local languages that helps build the reading and math skills of the children.

Some other interventions have been observed in the sphere of remote teaching and learning, though the focus of the following is not rural:

1. Board of Open Learning School: This was intended to be a medium for making distance learning easy for students who are unable to attend regular classes.[3]

2. iPerform: It is a web-based e-learning platform that works as an extension of the classroom and provides a personalised self-learning environment for students. It has been designed to meet differential learning styles, engaging students in activities like homework, revision and even help in preparation of exams.[4]

However, all these methods are mostly focusing on asynchronous learning based on preloaded course material and scope for real-time interaction are absent. As discussed, our focus is synchronous, i.e. virtual classroom over internet, where teacher should be present at remote location during teaching..

2.2 Critical Evaluation of ICT Intervention

A variety of constraints (Rajesh, 2003) dodge India's efforts to deploy technology in education:

1. Policy and Government commitment are existent but all is lost on the road to implementation. Educational projects, set up by conventional governments as part of a broad educational agenda, tend to reflect the conventionalism of existing institutions with their hierarchical and bureaucratic systems of administration when the need is for creative and innovative management.
2. Access and availability of technology is another issue as various implementing agencies that need to cooperate are not coordinating enough. Lack of stable electric power, non-existent or unreliable telecommunication lines and a mismatch between funding allocation and actual needs all add to the problems.

[3] www.bolsd.in
[4] www.iperform.classteacher.com

3. Sustainability is also a major obstacle, with many initiatives failing because Governments have not anticipated the cost of maintenance and upgrading of technology and services.
4. Geographic, Demographic and Climatic factors affect the access, reach and implementation of infrastructure
5. Ethnic and Cultural factors have an influence on the teaching or pedagogical methods. Language barriers are major obstacles as well.

Most importantly, however, the proper means for implementing an ICT-backed educational model has not been developed, with undue attention being paid simply on the process of setting up ICT labs. Our study tries to approach this issue in a manner that can solve these basic problems to bring about the complete benefits of an ICT intervention.

3. THE INTERVENTION AT A TRIBAL SCHOOL IN INDIA

The long-term purpose of the study would be to develop a sustainable model of distance-learning that is cost-effective, and leads to a more fulfilling learning experience for the children. The study focuses on a class of 16 students of class V and 28 students of Class I of Ma Sarada Shishu Tirtha, hailing from the tribal community in Krishnanagar, India. The undertaken intervention involved a remote teacher delivering Math and English lessons, (via the video conferencing software Skype, and PowerPoint Presentations shown during the video conference) while also making the session interactive and addressing individuals students directly by name, which brought the additional dimension of familiarity and added to the success of the intervention. The survey finds sufficient evidence to suggest that ICT intervention can significantly enhance and improve their academic attainment and leads to a more fulfilling learning experience for the children. Further, the present model is not one of distance learning in the conventional sense, in that it combines elements of traditional classroom teaching in a virtual form, enhancing it with tools as and when required. The main aim is to design a model that not only makes e-learning effective, but to replace the traditional model to save recurring expenses on local teachers and allow for the free permeation of education in ways that might bridge the digital divide amongst students of various socio economic and other geographical barriers.

For a preliminary understanding of the current level of the children, tools developed by Pratham, an NGO based in Mumbai, India were used. The ASER Centre of Pratham seeks to use simple yet rigorous methods to generate evidence on scale on the outcomes of social sector programs. (Vagh, 2009). We have also conducted written and oral examination to assess the effect of ITC intervention.

The before study comprised of usage of the ASER tools, a questionnaire to assess the academic achievement of the children. The children's past school results were also used to assess the baseline standard. Upon using the ASER tools, it was discovered that, while the children were fluent readers in Bengali, their mathematical ability was below average, with only 50% of the students being able to solve Class 2 level division problems. The questionnaire further revealed that English and Math remained a major concern for the students.

During the intervention, Math and English lessons were conducted for class V and English lessons were conducted for class I remotely, via the video conferencing software Skype, and PowerPoint Presentations shown during the video conference. (The intervention was preceded by a short introduction session to make the students feel at ease.) After the intervention, a follow-up questionnaire was used using some exercises covering the topics taught via ICT, to gauge their interest, retention and possible improvement.

Figure 1: Children Being Taught Remotely (Inset: The Remote Instructor)

3.1 Methodology

The research is Quasi-experimental in nature and has undertaken before after studies to evaluate the

impact of the intervention. The before study entailed the students being ranked on the basis of their performance in class (more specifically on the basis of school examination results). The ASER survey questionnaire for wellbeing assessment and educational assessment of English has been used. Next, the students have been ranked on the basis of their performance after the intervention in English through ICT. The impact analysis comprises of assessments and interactive observation with the students.

3.2 Evaluation

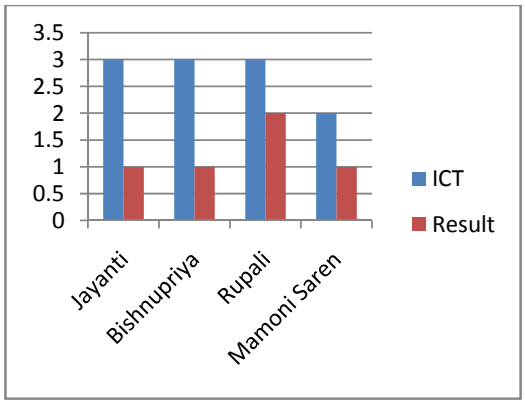

Figure 2: Relative performance of four students of Class-V based on Results of school exam. and evaluation done after ICT intervention

It can be seen that those who had been near the bottom of the class benefit the most from this intervention (fig.2). A majority of the others perform at the same level as their class performance. Among the five students of class V who have a normalized score of 1 in their school exams, three (i.e. 60%) achieve a normalized score of 3 in the evaluation conducted post-ICT intervention. Although the sample size is small, this is a significant finding.

Fig 3. shows the examination performance of 28 Class-I students in (i) the regular school examination before remote teaching, and (ii) an examination taken after a month-long remote teaching intervention in English (20 hours total). The students have been indexed on the basis of their rank in the school exam. The chart shows marked improvements in student performances. Specially, the students who received very poor marks in school examination (student number 24 to 28) have shown significant improvement in their English language skills. The classes were conducted using Google plus and the teaching learning materials were video based and PowerPoints. The method of teaching was interactive and it was made sure that the children interacted with the instructor.

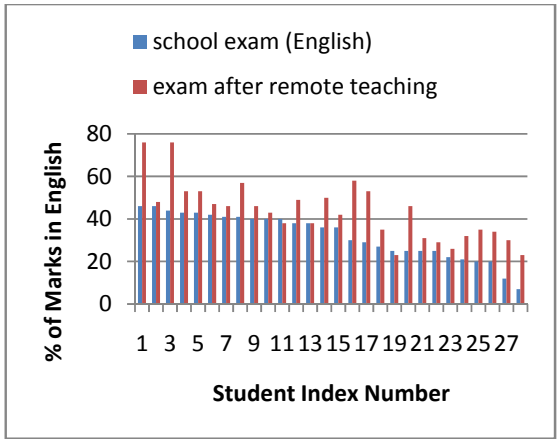

Fig. 3 Performance Improvement of Class-I Students after ICT-enabled Remote English Teaching

The intervention has generated positive results both in nature of change in attitude towards technology and learning outcomes. The children were aged between 6 to 11 years and it was earlier assumed that it would be difficult for them to cope with remote teaching due to their lack of attention span. However during the intervention it was observed that the children on the contrary did not lose their attention. The social difference that if often created between teacher and student due to several disparities was not observed in this context, the children were quite aware of the instructor's presence online but they did not have any hesitation in interaction. There was no fear of punishment although the instructor observed discipline in the class, but the children did not shy away from the instructor. Interactive sessions created a positive learning environment for them, leading to increased interest in the topics taught.

It can be deduced that technological aids, along to low/no teacher absenteeism and low social difference has lead to creation of a better learning environment. The teacher student ratio being comparatively low, and the regular interactions with the teacher also lead to faster learning of concepts. Video based teaching created better cognitive understanding of the topics taught. Children were able to freely interact amongst themselves, and this also created a positive interest in the topics taught.

Lastly the expectancy created in the children, increased interest for both instructor and the children in the classroom.

To summarize, one can make the following hypotheses about this intervention and, based on the data obtained, examine whether the nature of results for each has been positive or negative:

1. **The children enjoy the ICT-enabled classes more in comparison with their usual class:** We have received **positive response** from most of the students on the basis of the questionnaire and observations. 70% commented that they found the pictures/videos shown to be very engaging and interesting. This is natural, since an audio-visual presentation is more engaging for children and keeps children attentive longer than a routine class.

2. **An ICT-based remote teaching system serves to bring about higher teacher acceptability:** We have received **positive response** from most of the students on the basis of the questionnaire and observations. 89% students stated that they found the remote teacher to be highly acceptable. Further, since there is no physical threat from a "remote" teacher, the children feel more relaxed in presence of the teacher. 81 % students have stated they were mostly able to understand the remote teaching. There were no negative responses. Hence, acceptability is generally high during remote class.

3. **An ICT-based remote teaching system serves to bring about an improved performance in many, in comparison to school performance:** Although the data set is small, and time of intervention was short to draw any definitive conclusion about this, fig. 2 and fig.3 nonetheless shows marked improvements in student performances. Specially, the students who received very poor marks in school examination have shown significant improvement in their English language skills This could be because the ICT-aided material that was taught was better understood and retained by the children.

4. **The children will fear or be skeptical of new technology:** We have received **negative response** from most of the students on the basis of the questionnaire and observations. Rather, the children have shown a reasonably ready acceptance of it, and 81% interviewed have stated that they are open to change and would like to be taught in a different way.

5. **The children would offer some resistance in opening up to outsiders:** We have received **negative response** from most of the students on this. Being a close-knit tribal community at a remote village, with little interaction with the outer world, it was assumed that the children would not be open to the idea of complete strangers instructing or interacting with them. However, not only did the children show incredible openness to the idea, they also engaged very freely in all interactions and showed extreme enthusiasm.

6. DISCUSSION AND CONCLUSION

Teachers are expected to enrich a child's learning and schooling experience. But this is often not the case in rural India. Studies have shown that teachers frequently beat children, terrorize them, and humiliate them publicly. Many forms of discrimination and biases enter the classroom. A recent survey of rural schools, for example, carried out in West Bengal found disturbing evidence of primary school teachers showing much less regard for the interests of children belonging to Scheduled Castes. Teachers tended to perceive themselves as belonging to a different and higher class, often the result of earning much higher incomes than most parents. They rebuked children for not coming properly dressed to school, for being obviously dirty, for being stupid because they belonged to a certain community. Children were ridiculed for their eating habits. In some instances, they were made to sit separately. (Kumar, Rustagi, 2010)

Better-off sections belonging to higher castes are able to send their children to the fee-charging private school, which they can afford, for better quality of education. The poor belonging to lower castes, not being able to afford private school, are destined to send their children to inferior quality government schools. Studies indicate that first; most of the children enrolled in private schools are from general caste group, whereas most of the SC and ST children attend government schools (Aggarwal 2000; Kumar et al 2005; Mehta 2005; PROBE 1999).

ICT is a significant step in this direction, which eliminates barriers of regional and gender-based

discrimination by facilitating a high degree of permeability of education. Since this was a pilot study, the scope was limited by several constraints, but we certainly plan on using more sophisticated tools of e-learning for future interventions.

With regard to the survey conducted at Ma Sarada Shishu Tirtha, one probable reason for the ready acceptability of ICT, and the improvement in performance, could be that, if the teachers in a face to face teaching situation are from non-tribal background, a 'social distance' may be created which operates as a hindrance in learning. This is however more applicable with respect to weak students. ICT teaching being neutral to 'social distance' is more helpful for disadvantaged groups. It is clear that a long-term intervention is in order, and could prove to be immensely beneficial if implemented in a systematic manner.

While "digital inclusion" programs usually tend to focus on teaching people the usage of computers and the internet, the approach presented in this study takes a different perspective. According to this approach, the entire process of learning should be oriented towards developing abilities to connect to the global knowledge network of the cyber-world with a specific social context and purpose in mind. This makes it possible to improve the underdeveloped communities by obtaining social inclusion through digital inclusion, and creating self-sustainable forms of social development.

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