Ecological perspective on ICT and education: The case of i-Saksham in Bihar, India

Completed Research

Gaurav Mishra
Development Management Institute
gmishra@dni.ac.in

Devinder Thapa
University of Agder
devinder.thapa@ui.no

Jaya Kritika Ojha
Desert Resource Centre
kritika.jaya@gmail.com

Abstract

In this paper, we present the result of a qualitative case study of i-Saksham project in Bihar, India. The project was introduced to provide access to education in a remote Naxalite area. The result shows that installing ICT in the classroom will not lead to sustainable education; however, it needs a well-functioning ecosystem of organization, community, teachers, students, technology, and training; even the geography matters. In doing so, we employed a theoretical lens of ecological model to analyze the case. One interesting finding of the study is the self-realization of the project members for the need of ecological approach in ICT for education; as they stated, "the focus of our project changed to ICT as a support rather than ICT as the solution."

Keywords
ICT and education, i-Saksham, Ecological model.

Introduction

John Dewey in his book democracy and education (1922), suggested the education system should take an ecological perspective to make it meaningful for the individuals and society. Ecological systems approach helps young people understand the complexity of the world around them and encourages them to think in terms of relationships, connectedness, and context. Dewey insisted on creating a free educational environment by making conducive sociocultural and political arrangement, so that everyone could be able to take part in the learning process. Furthermore, the learner should not be treated as a passive observer but an active agent. Unfortunately, even after more than 100 years, the dream of such ecological education systems is not yet realized; particularly in the context of developing countries, the dream seems to be falling apart.

The advancement of technology has also reconfigured the educational ecosystem; the focus is oriented towards making technology as a change agent, rather than realizing technology as one of the components among many others, or, in other words, the ecological perspective in ICT and education is missing; as Thapa & Sein (2018, p. 8) argued, “by looking at the interrelationships, interactions between the diverse species[entities] that make up an ecosystem, we can get an insight to how they coevolve and makes the system sustainable. We can also see how the system can fall apart if keystone species disappear or sustained interactions and interrelationships are disrupted.”

Information and Communication Technologies (ICTs) are being adopted in education for enhancing quality of learning through greater access to quality learning resources; enhancing learning environments; supplementing teacher’s instruction, improved assessment (Jhurree, 2005, Newhouse & Clarkson 2008); and increased student motivation and productivity by enabling them to collaborate, create knowledge and to interact with a broader range of content (Newhouse & Clarkson 2008, Bingimlas, 2009, Rossing et al.,
Some studies focused on the integration of ICT skills in school curriculums. For example, Grimus et al. (2012) advocated that teaching ICT skills in primary schools can prepare pupils to face future developments based on proper understanding. Hence, they emphasize the integration of mobile phones in the education system of Ghana. Similarly, Killilea (2012) argued that mobile devices present unique opportunities in asynchronous learning. Herselman (2003) has provided insight into the use of ICTs for uplifting rural education. The 'Learn-O-Vision,' ‘Biogas Project' and ‘SchoolNet' in South Africa, have influenced widespread use and implementation of the Internet and computers into schools (Herselman 2003).

However, Pouezevara et al. (2014) argued that implementing ICTs for education is challenging. They further added, choosing the right technology, training the right people to use it and maintain it, and adjusting classroom and school schedules to accommodate it are just a few issues while using ICT for education. In a similar strand, Kozma (2008) discussed the importance of ICT policy for education systems. He argued that without the guidance of national policies on ICT, it is less likely that individual school and classroom innovations can be sustained. Likewise, Pouezevara et al. (2014) discussed the sustainability issues of ICTs in education. They claimed unless technological sustainability is guaranteed, teachers will not be in a position to use or not use computers. In short, mere adoption and integration of ICT do not lead to sustainable education; as an African proverb says, "It takes a whole village to raise a child."

The existing studies on ICT and education, therefore, insist on taking a broader viewpoint, i.e. ecological perspective rather than an unbalanced view of ICT as the primary change agent. The question arises then why such studies are lacking? There might be two reasons: first, as Thapa & Sein (2018) stated, "it is complex," second, it is difficult to find the use of such ecological perspectives in practice. To address this issue, in this paper, on building upon the study of Thapa & Sein (2018), we conducted a qualitative case study of an educational project in Bihar, India called i-Saksham. Thapa & Sein (2018) applied ecological model to describe a success story of OLPC implementation by Open Learning Exchange (OLE), Nepal. The study shows how various entities of an ecosystem such as different non-governmental organizations (NGOs), governmental organization (GOs), teachers, students, content developers, software designers, and local communities came together to make OLPC intervention possible. However, in our study, we are applying the ecological model to reveal the challenges in the ecosystem of i-Saksham that changed the focus of the project from 'ICT as a solution' to 'ICT as a support' for quality education in the rural areas of Bihar. Rest of the paper is organized as follows. Next section set a context for the study; thereafter, the paper discusses the theoretical model ‘information ecology (IE),’ followed by the research method, findings, and conclusions.

**Research context**

We selected two sites Jamui and Munger for our case study. According to the Census of India (2011), Jamui and Munger have 1503 and 858 villages respectively. As shown in Figure 1, Jamui and Munger have 1503 and 858 villages respectively. Sex ratio (female/male) is 0.92 in Jamui and 0.87 in Munger. Around 8% of villages in Jamui and 15% in Munger are without primary education (including government and private schools). Approximately 76% of villages in Jamui and 73% in Munger have government primary schools. There are no pre-primary schools in Munger or Jamui. In Jamui, approximately 92% of villages have no schools. Children from Jamui need to travel more than 5 kilometers to reach the nearest school.

The statistics shows a grave educational situation in Jamui and Munger, which is also reflected in the quality of education. For example, in Bihar, in 2018 only 18% children in government schools in standard III can do subtraction. In 2016 it was 20%, a decrease of 2% since 2016. In 2008, 62.8% children of standard V in government schools of Bihar were able to read standard II level text. However, in 2018, it has decreased to 35.1% (ASER, 2018). Lack of skilled teachers is another challenge. Moreover, the educational system is also affected by political activities. Our study sites, Jamui and Munger, are affected by a proscribed Communist Party of India; Maoists in short. They are known as the Naxalites. Their main objective is to paralyze government systems through armed seizure or capture of political and state power (Ramana, 2011).
As depicted in the Figure 2, that is an instance of the situation due to the Government and Naxalites conflict in remote rural areas like Jamui and Munger.

In such critical situation, i-Saksham, a not-profit-organization, aims to address problems related to quality education in remote and rural areas of Bihar, India. The next section describes i-Saksham project in detail.

**i-Saksham**

i-Saksham is a Hindi word which means ‘capable’. The project emphasizes on building community edu-leaders, and provide them education support services with the help of ICT. The project implementers consider ‘technology as a solution’; they provide education and skill development services using digital technology (mobile tablets) in the isolated and remotest pockets of Bihar, India. In addition, the project focuses to create a new cadre of community tutors (is used synonymously with edu-leaders and Saksham Mitras) trained in using and handling digital technologies for imparting quality education. These edu-leaders reach out to children and youth in rural areas. The target edu-leaders are the local youth from the community, mainly females/differently abled pursing education; passionate and committed to teach for at least 3-5 years.

i-Saksham works on two operating models. In the first model, the edu-leaders have their learning centers and recruit children and charge a nominal $1 to $2 per child per month. They provide 2-2.5 hours of after-school supplementary education daily. i-Saksham monitors children’s learning until they achieve grade 5.
competencies. It manages the succession plan of an existing edu-leader. In the second model, community edu-leaders are placed in government schools in backward areas. They receive nominal payment for it.

These community tutors reach out to children and youth in rural areas. i-Saksham provides e-content (from class 1st to 5th based on the syllabus of Bihar board), whiteboard, and other supplementary materials for their classroom. Besides, i-Saksham spends 70% cost on training, and on-site handholding as well. The content, which relates to primary classes syllabus, is managed by the project officials. It is the tutors' responsibility to use the available content for teaching purpose. Mobile tablets enabled students to see and hear things which they were not able to do earlier. At present, National Skill Development Corporation (NSDC) is supporting with grants to train Saksham Mitras (capable friends) and providing a certificate course in basic tutorship. Ernst & Young (E&Y) foundation enriched the content by providing 'ToonMasti' (cartoons for fun-filled learning) videos to i-Saksham. Also, Pratham Education Foundation, an NGO in India focusing on quality education, is supporting i-Saksham with content and training. i-Saksham is an approved partner to implement the 'Intel Learn' course.

The project covers around 24 villages with 34 Saksham Mitras. The tutors are educated and unemployed youths with an average age of 21.8 years (N=24). There are 13 female tutors. In addition to teaching, tutors prepare for competitive exams, some are pursuing their higher studies, and some are looking for jobs. Through tuitions, they earn some money with which they support their families. The Saksham Mitras used to give Rs. 500 per month (1$= approx. Rs. 70 as on 22-04-2019) to i-Saksham as a contribution to expanding the project in 2015. i-Saksham does not ask for any input now. After setting the research context, in the next section, we describe the theoretical model that is used to analyze the case.

**Theoretical Model**

To guide our data analysis, we employ the ecological model proposed by Thapa & Sein (2018). The ecological model is based on the concept of ‘Information Ecology (IE).’ Information ecology is defined as “a system of people, practices, values, and technologies in a particular local environment (Nardi & O’Day, 1998, p. 49).” In information ecologies, the focus is not on technology, but on human activities that are served by technology (Nardi & O’Day 1998).

<table>
<thead>
<tr>
<th>Key Elements</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>System</td>
<td>Information ecology is marked by strong interrelationships and dependencies among its different parts. The parts of information ecology may differ from each other.</td>
</tr>
<tr>
<td>Diversity</td>
<td>In information ecology, there are different kinds of people and tools. In a well-functioning information ecology, they work together in a complementary way.</td>
</tr>
<tr>
<td>Coevolution</td>
<td>A well-functioning ecology is not static, even when it is in equilibrium. Similar dynamics are at work in evolving information ecologies. The pace of new technology development ensures that school, work, and home settings will continue to be offered more modern, faster, and different tools and services—not just once, but repeatedly. Information ecologies evolve as new ideas, tools, activities, and forms of expertise arise in them. It means that people must be prepared to participate in the ongoing development of their information ecologies. They need to acquire the capability of adapting to new constraints and possibilities, which, in turn, lead to further change. Information ecologies evolve as new ideas, tools and activities, and new forms of expertise rise up within them.</td>
</tr>
<tr>
<td>Keystone species</td>
<td>The presence of keystone species is crucial to the survival of the ecology itself, e.g., skilled people whose presence is necessary to support the effective use of technology.</td>
</tr>
<tr>
<td>Locality</td>
<td>The habitation of a local context is its location within a network of relationships. To whom does it belong? To what and to whom is it connected? Through what relations? The habitation of a local context is its set of family ties in the local information ecology.</td>
</tr>
</tbody>
</table>

Table 1. Key elements of information ecology [derived from ref. (Nardi & O'Day, 1999)]
At the core of this view is the premise that users can influence the design of technologies and technological systems through expressing their values, attitudes, and preferences. Information ecology (Nardi & O'Day, 1998) is comprised of five main elements as summarized in Table 1.

Thapa and Sein (2018) argued the advantage of using ecological model compared to other competing theories such as social capital (Nakagawa & Shaw, 2004), actor-network theory (Sabou & Videlov, 2016) and structuration (Stallings, 1997) is its analytical feasibility. The model visualizes the key elements separately, at the same time, shows the interdependency among them. It also explores how part and whole are interconnected and interdependent vis-à-vis coevolve in the process. The findings sections will describe in detail how the model is used for the case analysis.

**Research Method**

We conducted a qualitative case study to find answers to the current issues of i–Saksham project implementation. Initially, the genesis of i-Saksham was on the premise that ICT can replace teachers in rural areas. However, at present, i-Saksham's has its focus on skill development of tutors in rural areas. ICT is used for coordination, monitoring and peer to peer learning of tutors. In this study, a qualitative approach was helpful to understand such transformation, i.e., technology as a solution to technology as a support. The study was exploratory as there is an absence of conventional research methods and less availability of information related to the use of ICT in remote rural areas of India for education; particularly in Naxalites areas. According to Barkley (2006), exploratory study is suitable where little information exists regarding the workings and impacts of the programs.

The qualitative techniques of focus group discussion (FGD), observation, field notes, and in-depth interviews were used, which clarified ‘what,’ 'how' and 'why' of the research objectives. Content analysis is used to explore and conceptualize the core issues from the interviews and FGDs. We employed the ecological model to guide our data analysis. Furthermore, the thematic analysis (Braun et al., 2019) technique was used to categorize the data, creating distinct groupings that represented abstract concepts. The first phase of the study was done in May 2015 (just after the inception of the project) and then in December 2018. The different timeframes of the survey helped us to understand the organizational transition and its impact in the IE context.

**Findings**

We organized our results around the critical constituents of the ecological model, which are reflected in Table 2. We have identified various entities of i-Saksham, India, and their interaction, and its transition from 'technology as a solution' to 'technology as a support' for quality education. We discuss our findings below.

**System**

A system consists of interrelated components and has a specific purpose. i-Saksham, too, represents a system which has several interrelated components. In the beginning, ICT was perceived as the primary driver of education transformation in rural areas. In fact, at the beginning the focus of i-Saksham project was ICT; for instance, the following quote from a project staff:

“Tablet can be a good tool to provide quality education to children. It can be kept anywhere, used by anyone and requires less maintenance compared to computers. We only need to charge it for use. We can capitalize on tablets for better education. The community tutors can use the education content loaded tablets to impart education to children” [IS0215].

One of the founders of i-Saksham said:

“Tablet as a tool for imparting education in rural areas seemed plausible to us. Compared to a computer, tablet is cheaper, mobility is greater and is lighter. There are apps available for education which could be

---

1 Codes are used to maintain the anonymity of the respondents. The last two digits reflect the year of the interview.
used on tablets. Hence, tablets were our preferred choice for addressing lack of teachers, content, etc. in rural areas” [ISF0315].

The following quote reflects the nature of learning which can be accomplished through a tablet, importance of content, and, therefore, was perceived to change the education environment in rural areas.

“With help of video content, students can learn the correct pronunciation of words. For example, they can hear how the word ‘apple’ is pronounced. In addition, with the help of video contents, children learn faster. They can learn about various things like animals, flowers, colors, and numbers through video. In government schools, such pedagogy is not seen” [IST01315].

However, later they realized the importance of other stakeholders such as community tutors, content providers, local government teachers, funding organizations, children and their parents. The project officials, especially the field level workers, must be technically sound. They are the one who loads contents on tablets at regular intervals. Also, they train the community tutors in using tablets. Notably, the community tutors (known as edu-leaders or Saksham mitras) in i-Saksham play an essential role in imparting quality education. They have created an environment where village children come together and learn. According to one tutor:

“Because of the instructions on syllabus and content on the mobile tablet, I teach students in a scheduled way. I know what I have to teach and when” [IST01515].

The government plays an essential role in building the necessary infrastructure for education in rural areas, likewise formulating and implementing educational policies. For example, according to the founders of i-Saksham, selection of tablet posed a lot of challenges. Considering the financial constraints of the project, the tablet had to be of lesser cost, robust and functionally comprehensive based on the needs. Such economic challenges cannot be solved without government support. For example, a government school teacher said: “...the attendance of students in my school is poor. Parents don't send their children. Our school infrastructure is bad. There is no computer for our students. I understand the problems which our students face but I don't know what the solution is. Our government has to ensure that better students come and study” [ISS1218].

Diversity

According to the ecological model, different stakeholders and various types of tools work in a complementary way in a healthy information ecology. Therefore, all the components of i-Saksham have to work together to realize its objective.

It is often believed that poor rural people may not be in a position to spend money on education. Contrary to this belief, we observed that rural people are aware of the necessity of education and they are ready to pay for it. For example, a tutor said: “Even the poor villagers pay what they can pay to see their children get educated. Government schools do not charge any money, but parents are not hopeful of the education they get there. I teach in my village; parents are satisfied with our teaching” [IST0915].

Access to quality education is essential to parents. Most parents didn't know about the technology used by tutors for educating their kids. However, the local availability of trusted education has created a positive attitude in parents towards community tutors. With the involvement of local village youths, villagers believe that they are more considerate than government primary school teachers. There are challenges in using a tablet. She added: “Mobile tablet is good for teaching. However, instructions related to teaching and syllabus are necessary. Without syllabus and schedule, our teaching will be directionless; even lessons are available on the tablet” [IST082015].

Most tutors are not in a position to plan classroom activities on their own. The content which is loaded on tablets relates to primary class syllabus and is managed by i-Saksham team. It is the tutors' responsibility to use the available content for teaching purpose. Mobile tabled enabled students to see and hear things which they were not able to do earlier. The interaction with students revealed that they are enthusiastic about learning from a tablet. Most students said that they never saw a mobile tablet before and they enjoy learning from the tablet. Students perceive mobile tablet as a tool with which they can play, watch videos, take photos, make videos and listen to the audio. Tutors use a mobile tablet for their skill enhancement. They believe that with the tablet they can build their English language and computer skills. A tutor in Munger said:
“Tutorials on English grammar helped me to learn grammar. When I learned grammar, I could teach students also” [IST1515].

Most tutors believe that they can build their English language and computer skills using tablets and content provided by i-Saksham. As seen in the above discussion, various components of i-Saksham have diverse interaction with each other to meet the project objectives.

The diversity of roles played by different system components can be seen in the table below.

<table>
<thead>
<tr>
<th>Component</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content providers</td>
<td>Content providers for tablet-based education</td>
</tr>
<tr>
<td>Funding organizations/individuals</td>
<td>Organizations which can fund i-Saksham initiative</td>
</tr>
<tr>
<td>Tablet</td>
<td>Cheap (for sustainability) and robust tablet (for its use in rural areas)</td>
</tr>
<tr>
<td>Community tutors</td>
<td>Use tablets for educating students, build their capacity for using a tablet and by using tablets, motivate children and their parents towards education</td>
</tr>
<tr>
<td>Government school teachers</td>
<td>ICT to replace them or to supplement them</td>
</tr>
<tr>
<td>Project officials</td>
<td>ICT skilled (for example, can upload content on tablets), motivate children and their parents towards education, liaison with funders, government officials, private and NGOs, etc. for the smooth functioning of i-Saksham</td>
</tr>
<tr>
<td>Government</td>
<td>The overall infrastructure in villages for education, strengthen education system</td>
</tr>
<tr>
<td>Parents</td>
<td>Perceive ICT-based education to be more effective than government schools</td>
</tr>
<tr>
<td>Children</td>
<td>The overall objective of the project to educate rural children, increase the number of children going to schools, better education attainment, etc.</td>
</tr>
</tbody>
</table>

**Table 2: Components in i-Saksham system and their role**

**Coevolution**

Disturbances often influence any system, and a healthy ecology will withstand such disruptions and continue to work as a system. To overcome the disorders in the system, it has to dynamically adapt to the changes in the external and internal environment. i-Saksham, as a system, has struggled to keep it healthy. During its inception, tablet was the main component in the ecology of i-Saksham. All other parts tried to get on the bandwagon of using a tablet to meet the objectives of i-Saksham. One such example is given below:

One of the founder members said:

“...most of our resources were used to make tablet work for education. A lot of time was consumed in deleting, uploading or updating content. Misuse and repair issue became a perpetual issue. The designing content for tablets was an additional issue. In the duration of the last four years, we have realized that we can’t design content. The content available in the market can’t be customized for our needs” [ISF0218].

In another instance, a community tutor said:

“The use of tablets for educating students is a good idea. We enthusiastically started using tablets in the year 2015. But now, in 2018, we don’t use it as aggressively as we did earlier. There is no standardized content for students in different classes. We have a mix of students studying at our center and catering to their specific needs is difficult” [IST1718].
In the FGD with community tutors and i-Saksham team, we noted some other issues in using tablet-centered pedagogy in rural areas. The storage capacity of low-cost tablets is usually less, and therefore, old content has to be removed before adding any new content. Consequently, it was a challenging task to update the content of the tablets or memory cards from different villages; on the other hand, high-end tablets were costly. Once the tablets broke down it was not possible to reuse. Accessibility was another issue. Only 3-4 students were able to use tables conveniently; most of the students were just observers.

During FGDs, we observed that there was a need to address tutors’ pedagogy as different tutors used tablet differently. Some tutors gave tablets to students while some didn’t. For teaching, some tutors used tablets more when compared to books while some spent more time using books. Tutors need training in practical ways of using a tablet. Additionally, teachers told us that the contents were helpful in learning; however, it could be customized to reflect rural identity. For example, if the content is relevant to the immediate surrounding, children can use their learning for a positive change in their surroundings. Also, electricity issues in rural areas made it challenging to charge tablets as and when required. According to i-Saksham founders, the use of tablets didn’t seem to achieve the goals of education in rural areas. Hence, the above challenges influenced the ecology of i-Saksham. A greater emphasis on technology was derailing the objectives of i-Saksham. It was the point when the project started to re-think at their initiative.

**Keystone species**

As discussed in the above sections, the tablets were seen as an end in itself for education in rural areas. These were the keystone species at the beginning of the project in 2015. Because of perceiving tablets as a panacea for education in rural areas; the organization seems to deflect from their institutional objectives.

![Figure 3: Community edu-leaders-The new keystone species (Source: i-Saksham)](image)

With the progression of the project, the management decided to change its strategy of using tablets in rural areas. In their new approach, the community-tutor became the new keystone species. The role of tablets changed to supporting tool for community tutors. Furthermore, i-Saksham started a fellowship program for community tutors. The fellowship program aims to build the capacity of the community edu-leaders so that they can provide quality education to children; make institutional linkages by establishing interface with parents and existing village institutions so that the village community experiences and learn to demand quality education, engages and holds edu-leaders accountable; enhance leadership skills to selected high potential edu-leaders so that they become active social agents, and stay in the mainstream education ecosystem for long. The new focus of the organization is reflected in the image below, and the technology has taken a supportive role rather than the primary focus.

**Locality**

The context of the region where the project is implemented is vital as it helps us to understand where the network of relationships exists and how it is connected to the various ecological components. The need for
quality education in remote rural areas of Bihar sets the underlying context for the project implementation. The different actors of i-Saksham IE have the desire to provide better education in rural areas.

In some villages of Munger and Jamui, we observed that there is a lack of drinking water, less employment, no school, no doctor, no roads and food insecurity. In a remote hamlet called Rajarampur in Munger, a girl with tears in her eyes said: “I want to study to change my hamlet, but please tell me what I should do? I see no hopes, no rays. Would things ever change?” [ISV031].

There is a basic need for quality education in such remote rural areas. The community edu-leaders, parents, children perceive i-Saksham as a change agent for education in their villages. However, engagement of content providers, government school teachers, government agencies, etc. was weak in ecology. A government school teacher said:

“Government is providing free education for children and even free afternoon meals. Even then we don’t see a rise in the number of students in our school. I don’t know much about i-Saksham. I believe that if the government is not able to change the education scenario, how other organizations can do it” [IST1418].

One of the founder members further added:

“We are not able to create content which is localized. Bodhaguru does provide education content but aligning it to supplement the Bihar education system is difficult. The content providers have to design content by understanding our needs. General content may suffice some of our requirements but not all. And, we are not adept at creating content, our focus is different” [ISO0218].

Conclusion

In this paper, we argue it is essential to have an ecological perspective for using ICT in education. In so doing, we present a study of i-Saksham in which there was optimism towards ICT as a change agent. However, for i-Saksham, the community edu-leaders were the leading change agents and not the technology. Technology has become the supporting agent along with the other actors in the ecology. Mobile tablet for education has immense opportunities in the disadvantaged rural communities. However, to exploit the technology to its best, it is necessary that community edu-tutors, children, project implementers, parents, and other actors shared the vision of quality education. Besides, our study confirms that ICT for education projects must focus on the pedagogical use of technology on top of the IT infrastructure (Pouzevara et al., 2014). Local content generation through children and tutors should be encouraged. According to Topping (2005), peer learning mobilizes students as active participants in the learning process – this is true for teachers as well as students. Also, students learn the subject better and deeper and teach transferable skills in helping, cooperation, listening, and communication. The network relationships need to be strengthened with government, funding agencies, policy makers, content providers, non-government organizations for a healthy ecological education system. Through this study, we may not say whether i-Saksham is in the right or wrong direction. But, yes, technology has not worked and is not the panacea for education in rural areas. It is only a means and not an end. We conclude the paper with the following quote from the book Small is Beautiful by E. F. Schumacher (1973, p. 150), "Success cannot be obtained by some form of magic produced by scientists, technicians, or economic planners. It can come only through a process of growth involving the education, organization, and discipline of the whole population. Anything less than this must end in failure.”

REFERENCES


