

# Public-Private Partnership in a Minimally Invasive Education Approach

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*In developing countries like India, the onus of development lies mainly with the government, which faces the predicament of multiple demands and limited resources. This leads to a situation where even fundamental objectives such as basic literacy for all are not met. On the other hand, there exists a vibrant private sector, which has resources and the desire to undertake social responsibility. This sector is also coming up with innovative approaches to overcome barriers to education and is targeting the have-nots. This paper discusses results obtained from Madangir (New Delhi), one of the sites where Minimally Invasive Education learning stations were installed. Minimally Invasive Education (MIE) is one such endeavour. It encourages children to learn on their own, with minimal, or no intervention. Children are provided with free access to computers in an open outdoor location. The informal environment enables children to acquire computer literacy, enhance their academic levels and imbibe other life skills. This project is an illustration of a public-private partnership between the Government of NCT of Delhi and NIIT Ltd (India's leading private sector corporation offering IT education, training and global IT learning solutions) to overcome digital illiteracy.*

Public-private partnership, minimally invasive education, computing skills, social networking, academic achievement

## INTRODUCTION

The extent to which India is able to realise its goal of educating all and transforming itself as a knowledge based economy depends on the quality of education being imparted. In its education report for 2004, UNESCO ranks India at 105 (out of 127 countries) in its Education for All Development Index (EDI). The report doubts India's ability to achieve the Education for All (EFA) goals by 2015 ([www.infochangeindia.org](http://www.infochangeindia.org)) since "of every 100 children enrolled in Class I, only 47 reach class VIII, which is the terminal year of Elementary school" (<http://sify.com>). National sample survey (52<sup>nd</sup> round) indicates that the schools that are available for such children fail to attract and retain them or majority of dropouts are from the underprivileged sections that are "unable to cope with the academic failure and lack of interest in studies"(National Sample Survey Organization, 52<sup>nd</sup> round 1998). These out-of-school children have to work to support themselves or their families. For them, options and opportunities for self-advancement at the individual level are negligible.

In order to tackle the problem of high dropout rate and bring in out-of-school children, the government has taken a series of measures to make educational opportunity available to all children in the age range of 6-14 years. It has tried to make schooling more attractive by introducing policies like mid-day meals, school adoption programs (by better off private schools and non-governmental entities) and inviting private sector (particularly Information Technology

industry) to participate in such an endeavour. A public-private partnership has the potential of optimising existing resources, as the public sector plays the role of enabler and facilitator, and the private sector contributes its expertise, technology and management practices.

In India's capital, New Delhi, it has been estimated that more than a million children are living in slums and they have no access to school or education. Educating these children will require setting up 2000 new schools, providing them with basic infrastructure, appointing teachers and non-teaching staff (Phillip, 2001). The government may find it difficult to achieve this target alone; hence, it may have to depend on non-government, voluntary sector to supplement their efforts. The contribution of the private sector and particularly the participation of the IT sector in social development have increased recently. Literacy being the key area, focus is also on overcoming the digital divide.

India's emergence as a superpower in Information Technology (IT) has also led to an increase in inequalities in digital literacy within the country. While IT has improved the quality of life of the digitally literate population, it is still beyond the reach of the underprivileged. Efforts are being made to integrate new technology with the mainstream education and increase the penetration of IT; thus striving to become knowledge based economy.

It is in this context that in the year 2000, the Delhi government signed a MOU with NIIT Ltd. (Asia's leading IT education company) to spread computer literacy through Minimally Invasive Education (MIE hereafter) where children (between 8-14 years of age) learn to use computers on their own, in an informal and open environment. MIE pedagogy is an attempt to take IT the revolution to the economically disadvantaged children and provides free of cost access to computers.

MIE is defined (Mitra et al, 2005) as a “ pedagogic method that uses the learning environment to generate an adequate level of motivation to induce learning in groups of children, with minimal, or no, intervention by a teacher.”

The MIE learning stations have been designed on the basis of expertise gained from various experiments conducted by NIIT Ltd. Aspects such as climatic conditioning, anti theft and safety features, design to provide convenient access to a varying age group of users were taken into account while constructing MIE learning stations. For example, the architectural design incorporates features to maintain the temperature within the tolerance level without air-conditioning. These technical features enable MIE learning stations to be installed in open, outdoor locations, sometimes with extreme climatic conditions (Inamdar P, 2004). For example, learning stations have been installed in places like Leh (at an altitude of 12000 ft) in Himalayas, Jaisalmer (in Thar desert) and Pather Protima (Sunder ban Delta).

### **Minimally Invasive Education Experiments**

The first MIE experiment (in 1999, in Kalkaji, Delhi) was initiated with the objective to understand if economically disadvantaged children were able to operate computers without any instructions and also whether it was possible to operate computers placed outdoors (called learning stations) (Mitra & Rana, 2001; Cappelle et al, 2004).

This experiment was repeated in a small town of Shivpuri (Madhya Pradesh state) and Madantoosi (a remote village in Uttar Pradesh state). Evidence from these experiments indicated that both the objectives could be met by making a small change in the hardware and the design of the building (Mitra, 2000; Mitra and Rana, 2001)

A similar experiment was replicated in Madangir (a socio-economically disadvantaged area in New Delhi) in 2000, and six MIE learning stations (with five computers each) were installed. This was the first time that more than one learning station, with more than one computer were installed. The time frame for this project was for three years (i.e. from 2000 till 2003) and the exploratory research phase on MIE pedagogy began during this period. After three years, a project evaluation was conducted by the Centre for Educational Management and Development (CEMD, appointed

by Delhi Government) and an independent market research firm Quantum Market Research Private Ltd.

The post evaluation period was the second phase of the project and, the research focus shifted from a purely exploratory approach towards more directed attempts. During this phase an effort was made to examine whether exposure to MIE learning station has any so-called 'snowballing' effect on academic performance and collaborative learning along with the acquisition of computing skills.

This paper discusses the results from the Madangir project and its impact on the children between 8-14 years. Like earlier experiments, this project was implemented as a platform for self-directed learning for the slum children and the poorest of the poor. It was also expected to supplement their formal learning process by providing additional educational resources.

### **Profile of Madangir**

Madangir is, largely, a socially and economically disadvantaged locality in South of Delhi. The majority of the residents are migrants from various states of India and live in small rented rooms. Occupational structure varies from self-employed (vendors, carpenters, plumbers, stall owners, vegetable sellers etc) to those who work, at the lowest levels, in government and private organizations (sweepers, peons etc.).

The background data for 100 children revealed the following information.

1. Both of the children's parents have a very basic level of education and at the same time they aspire for their children to complete their schooling. In spite of the economic burden, they send their children for extra tuition so that the child performs well in school.
2. The majority of the children attend schools run by the Municipal Corporation of Delhi and government aided schools.
3. Girls attend schools in the morning shift and boys in the afternoon.
4. The medium of Instruction is Hindi, though now English is also taught from first standard onwards. But in the absence of regular guidance, either from teachers or parents, their command over English (reading, writing, speaking abilities) is poor.

Project evaluation, undertaken by an independent research organization, Quantum<sup>1</sup> (2003) estimated that approximately 6,365 children in the 8-14 years age group have interacted with these learning stations. In order to arrive at an estimated proportion, they conducted a dipstick in the project area in a matrix of 100 children, within the age group of 8 - 14 years. The dipstick revealed that 67 per cent of the children in the specified age group visited MIE learning stations.

### **Content that children accessed**

Content provided to these children varied from basic literacy modules<sup>2</sup>, Edutainment<sup>3</sup>, and IIK portal<sup>4</sup>. CDs were procured from two sources: (a) National Institute of Open Schooling<sup>5</sup> (NIOS, New Delhi), which uses these educational VCDs as part of its endeavour to "reach the unreached"

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<sup>1</sup> Quantum Market Research Pvt. Ltd

<sup>2</sup> Developed on the basis of outline provided by Jamia Milia Islamia University, Delhi (hyperlink given in IIK portal)

<sup>3</sup> Educational Games, Puzzle/Tricky Games, Musical Games, and Fun Games.

<sup>4</sup> A guided browsing system, with access to both the online and offline contents regarding Edutainment, News and information, Entertainment, Discover India, About Delhi, Education

<sup>5</sup> NIOS - An autonomous body to facilitate distance schooling.

through Distance Education Mode (DEM); (b) Headstart<sup>6</sup> Rajya Shiksha Mission (Bhopal, Madhya Pradesh, India) which develops educational software for use by teachers and students in elementary schools. These CDs were on various topics related to English, Science, Social Science and General Awareness.

### **Usage**

Usage of MIE learning stations by children averaged around two hours per day in the initial stages, but with an increase in the comfort levels and familiarity, the daily time spent averaged around 1 - 1.5 hours. Children tended to work and play at these stations before and after school and also whenever they happened to pass by the learning stations.

When internet connectivity existed, the children were interested in reading current news apart from sports news and downloading songs, and accessing games and cartoon sites. For example, they all had read and seen pictures of America vs. Taliban war in Afghanistan.

The children also accessed games at Indiatimes.com site and in the absence of internet connectivity MS Paint was the most preferred application. Children learned Windows Imaging, how to use the calculator, changing the display settings, playing quiz at IIK portal.

### **Evaluation Approach**

The initial observations indicated that children use the MIE learning station to acquire familiarity with computers. It was also observed that the children acquired collaborative behaviour by learning how to work together, by forming their own learning groups and by transferring knowledge from one child to another, from one group to another group and from present users to new ones. Their academic levels were also expected to show some improvements.

### **Evaluation Framework**

Tools and measurements for evaluation were developed and adapted according to the need to collect quantitative data, including:

- a) Icon Association Inventory to measure acquisition of computing skills;
- b) English, Math and Content Assimilation tests to measure influence on academic achievement;
- c) A sociometry technique based on the methodology, developed by Coi and Dodge in 1983 ([www.users.muohio.edu](http://www.users.muohio.edu)), was adapted after some modifications, to study collaborative learning, social networking and information flow; and
- d) qualitative data were collected through direct observation, diaries written by children to understand their perception.

These tools were developed, by taking into consideration that these underprivileged children were not well equipped to express their thoughts. Compared with the more privileged children of 8 –14 years of age, these children experienced difficulty in reading and writing.

### **Sample size:**

The groups selected for the study fell into two categories – frequent and infrequent users<sup>7</sup>.

1. The frequent users were those users, who came to learning stations regularly and worked, on an average, for two hours or more.

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<sup>6</sup> Head Start: Project for computer enabled education operational in elementary schools of Madhya Pradesh, India.  
<http://www.headstart-mp.org.in/>

<sup>7</sup> These two categories were formed on the basis of MIE learning station usage data.

2. The infrequent users were those, who visited the learning stations occasionally (once or twice a week) and worked for an hour per week.
3. The target population being transient, the composition of both the groups underwent changes over a period of time. Often infrequent users became frequent users and some of the older frequent users stopped using the learning stations regularly

The total sample size consisted of 100 children from all the five kiosks.

## **Results and Discussion**

The following discussion is based on the results obtained during the second stage, when efforts were made to study the impact of these learning stations on several aspects in addition to the acquisition of computing skills.

The positive benefits of providing, primary school children with computers have been studied in formal settings. These studies, namely Haughland (1992), have shown that the benefits derived are improvements in areas like intelligence, motor skills, mathematical abilities, critical thinking, problem solving, verbal skills and what Nastasi and Clements (1994) call effectance motivation (the belief that they can alter their environment).

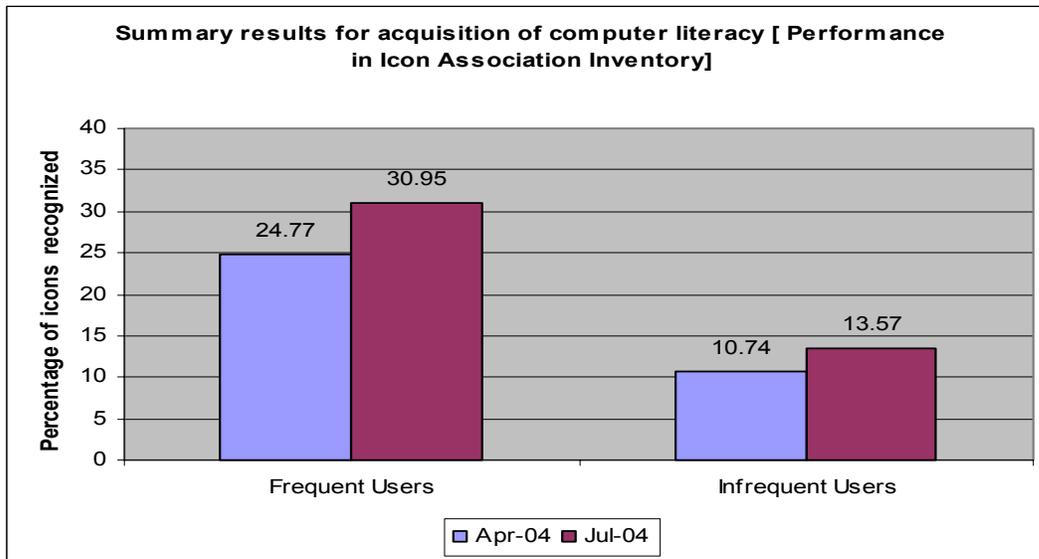
The degree, to which MIE learning stations impart these skills or abilities, may vary due to the environment in which these learning stations are located. A MIE learning station, itself provides an environment where stimulation is ever present but no direct guidance is available to the child. Children learn to share the knowledge gained and this influences their attitude towards the new technology.

### **Measuring Computing Skills – Results of Icon Association Inventory**

This project indicated that children were able to acquire familiarity with computers through MIE learning stations. Initial MIE experiments also (Mitra S, 2003) revealed that children associated Graphical Users Interface (GUI) icons with their functions and formed their own vocabulary to describe these icons. A study by Walton and Vukovic (2003) in South Africa suggested that with some experience of computers, users were able to understand Graphical Users Interface (GUI) environment. GUI used icons to represent various operations or functions, which were easily understood by the users. With basic or minimum of literacy, it is argued that, anyone can learn to work within the GUI environment.

Keeping this factor in mind the Icon Association Inventory (IAI hereafter) was developed and has been made independent of the name or the application associated with the icon.

It was observed that the some icons were specific (for e.g. sum in excel) to a particular application while most of them are general (cut, copy paste etc) in nature. The IAI consisted of 77 icons, clustered in six broad categories based on their functionality. These categories were: Desktop (7), Excel (4), Generic (15), Internet (11), Paint (18), and Text format (22). Figure 1 below, indicates that there is an improvement in performance, in IAI, of both frequent and infrequent users over time.



**Figure 1: Icon Association Inventory results**

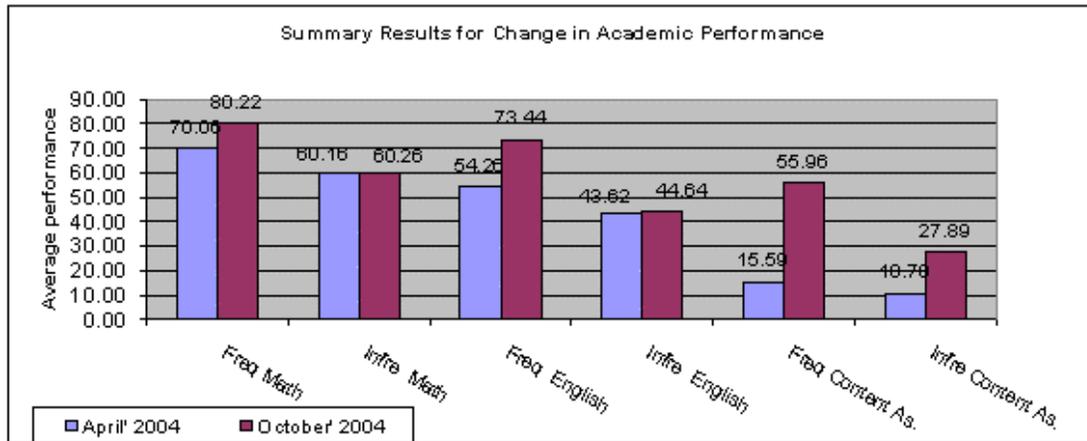
Children have been able to acquire familiarity with GUI environment due to trial and error and frequent interaction. One comment was “We have learnt by observing and trial and error...just kept hitting various buttons”. The following findings have been recorded:

1. In April 2004, a significant difference ( $p=0.000$  in both the cases) in performance in the icon association inventory was observed between frequent users and infrequent-users. The same held true for July 2004.
2. This indicated that frequent users performing significantly better than infrequent-users at both time points.
3. When the results were compared for frequent users over the four-month interval, there was an improvement in performance, though not statistically significant. The same held for the infrequent-users.

### Measuring Academic Performance

In the absence of proper guidance from parents or teachers, MIE learning stations were expected to fill in this void to a certain extent. In order to measure impact on the academic performance, tests were developed and administered. English and Math tests are based on the National Centre for Educational Research Training (NCERT)<sup>8</sup> syllabus for Class I to VIII. Assessment was also carried out on the basis of content (NIOS and Head Start educational material) provided to children. Figure 2 given below shows a comparison in academic performance between frequent and infrequent users when tested at two time points (i.e. in the month of April 2004 and October 2004).

<sup>8</sup> NCERT is the national institution in educational research and training.



**Figure 2: Summary Results for changes in Academic performance**

Figure 2 above suggests that both frequent and infrequent users have performed better in all subjects (i.e. HiWEL English, HiWEL Math and Content Assimilation) when tested in the month of October as compared to their performance in April, with the following specific findings.

1. For frequent users, results have been statistically significant ( $p=0.00$ ) for all the three subjects.
2. In the case of the infrequent users, only the content-assimilation result has been statistically significant ( $p=0.00$ )
3. This indicates that the learning through social networking might have influenced the child's performance irrespective of the categories they belonged to.

It was expected that longer exposure to this content and testing over a longer period of time might show even stronger results. These findings suggested that children found the content interesting and engaging. Not only did children play games at these learning stations, but they also learnt subjects directly related to the curriculum. Of course, the magnitude of gain was more for frequent users than for the infrequent users.

### Learning through Social Networking

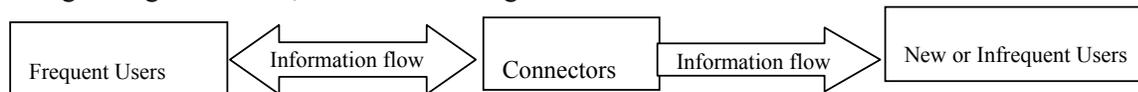
As discussed earlier that the learning at MIE learning stations is self-directed and participatory, in other words, children decide what they want to learn and with whom. This way the children, who are working or playing at the learning stations, form their own social network by connecting groups, directly or indirectly. They connect by assisting, cooperating and collaborating<sup>9</sup> within the groups and between individuals, at the learning stations. The information transmission took place within and from these groups.

<sup>9</sup> It may be noted here that a study by Bathla (2002) on collaborative learning indicated that levels of aspiration, social competence, and achievement along with general awareness, were enhanced among subjects exposed to peer group learning at the Madangir learning stations.

The primary benefit of social interaction or networking is that not only does the child learn from himself but also from his peers, through the process of communication. Thus the learning station becomes an invaluable tool in the entire learning process.

Social Networks, at MIE learning stations, may operate with certain inherent biases, for example, girls appear are hesitant to participate due to parental and social disapproval. The accessibility to the learning stations (i.e. the proximity of residence) also affects the learning and interaction with the other learners and users.

Sociometry methods were applied to frequent and infrequent user groups, to understand the dynamics in terms of emerging leaders in such an informal setting and their social status. The results obtained from Madangir showed that children learnt by approaching their friends, peers, siblings and also knowledgeable persons within the community. Other children approached some of these children and in this way the knowledge is transferred through networking, as represented in figure 3 given below, and the following observations were made.



**Figure 3: Information flow through social Networking**

1. It can be observed that the flow of information between connectors and frequent users is mutual.
2. Connectors are those children within the frequent user groups who facilitate the flow of information within and from the group. Therefore, the arrow between frequent users and connectors depicts the two-way flow of information.
3. However, the direction of information flow, between connectors and infrequent users is only one way because connectors are interacting with new or infrequent users.

Here connectors are perceived to be playing the key role in percolation of the information among other groups. They are expected to enrich the community and support the adoption of digital tools. Pentland (2003) also suggested that social networks facilitated flow of ideas and this flow or channel was influenced by the status of the individuals in the network.

An independent study (Bathla, 2002) was also undertaken to investigate how computer-learning strategies in a collaborative learning situation transformed into social learning system. After four months, it was found that there was no significant difference in the intellectual level but the aspirational level, social competence and achievement (along with general awareness) were all enhanced and these improvements might have been due to collaborative or peer group learning.

### **MIE learning Station - As Perceived by Children**

Children perceived MIE learning stations as a place, which gave them an opportunity to learn on their own, away from the authoritarian control of teachers or parents. For them it was a place for entertainment, enjoyment and exploration. Occasionally children were asked to write down what

and how they learned at the learning station. These data yielded valuable information regarding what children were learning and how. Given below is a sample response of a regular user: -

Name: Javed Age: 13, Gender: M, Grade: V

Q1. What do you think of the new learning stations?

Ans1: I feel very good.

Q2. How much time do you spend now at the learning stations?

Ans 2: I spend one hour at the learning stations.

Q3. Have you learnt anything different? If yes, then what, how and from whom?

Ans 3: I love playing games like Pinball and also the new content that has been put on solar system. I have learnt it all by myself. Nobody taught me.

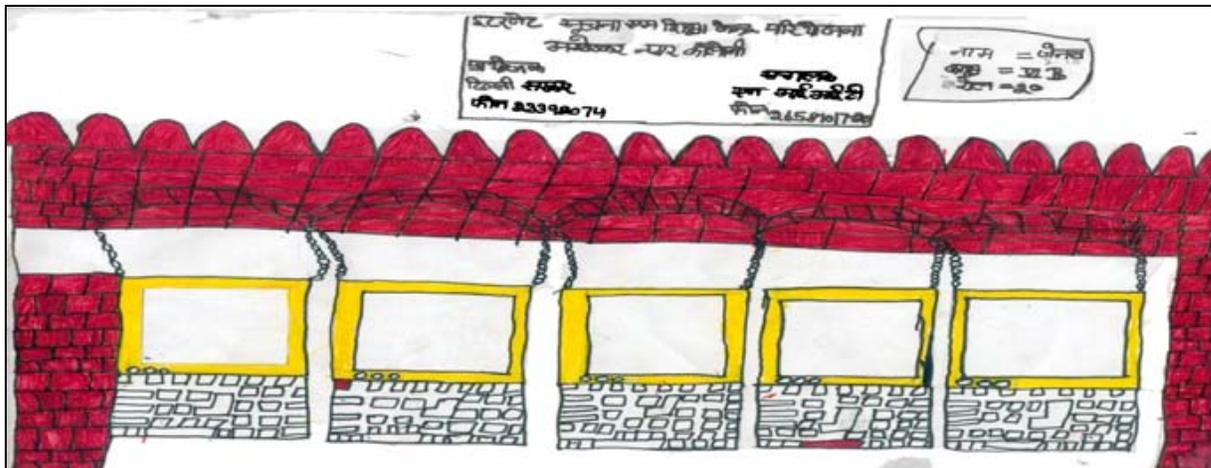
Q4. Which subject do you like the most?

Ans 4: I like English and have picked up from the learning stations.

Q5. Have you taught it to someone else? If yes, then please tell us the name(s).

Ans5: I have taught my younger brother Salman how to work at the computer.

The majority of children had never seen a computer earlier and they associated it with the learning station. When they were asked to draw a computer, they drew a picture of the entire learning station, with monitor screen and keyboard visible. A sample drawn by Zainab, a 10-year-old girl is shown in the Figure 4.



**Figure 4: Child's Perception of MIE learning Station**

Children referred to the computer learning station as a place where they went to play computer games "*computer game khelne jaate hai*". It is spontaneously associated as a play-station for small children (age group of 8 - 14 years).

Parents, on the other hand referred to these learning centres as "computer centres" or "learning centres", where their children were able to interact and learn more about computers. They viewed it as a viable place to send their children to - a free, accessible interface with the cyber-age.

Community members viewed these learning stations as facility for their children where they could acquire computer literacy, free of cost. Their perceptions regarding these learning stations were the outcome of attitudes towards the new technology.

Another interesting observation was the gradual change in the mindset of the adults within the community. Initially, they were sceptical about the idea of children learning without any teacher.

But over the last few years, as they saw the children picking up basic computer literacy on their own, the initial scepticism gave way to a more positive attitude towards the learning stations.

A limited section of parents felt that these learning stations offered restricted benefits; these parents appreciated ‘computer literacy’ that the learning stations imparted but feel that its utility does not stretch beyond this (Quantum, 2003). Their perceptions were affected by:

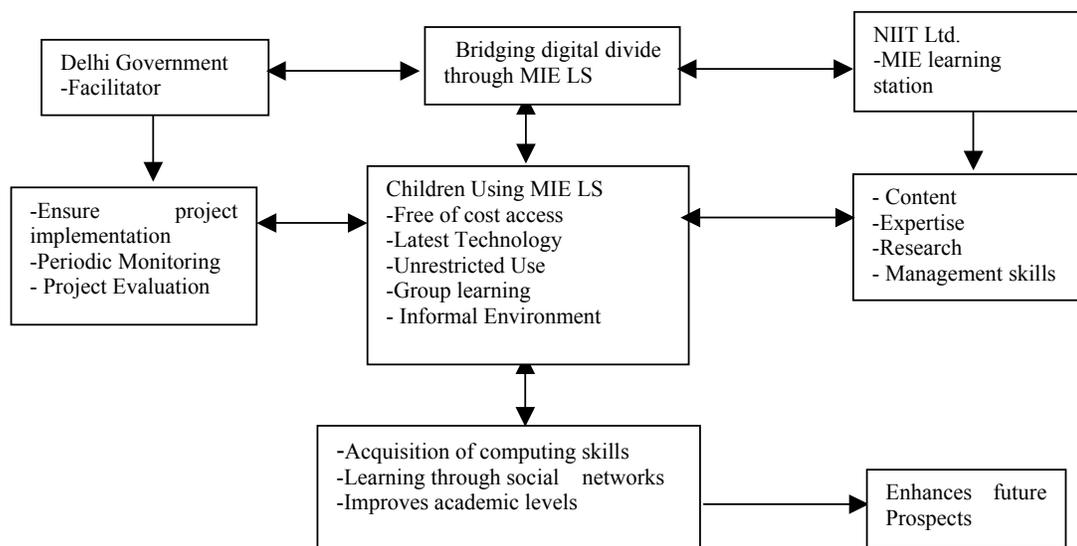
- a) Familiarity and loss of novelty
- b) Learning stations becoming a part of their habit and routine

Girls’ participation was an area of concern. Most of the older girls kept away from the learning stations due to social pressure. Some younger ones found ways learning of from the older boys who were willing to teach them. Given that a girl child in this community is burdened with a number of domestic responsibilities, in addition to schoolwork, the interest level among some of the girls is commendable.

### Conclusion

Madangir Project has been effective in providing access to computers to children who could not access them either at home or at school. By far the most important achievement was that children have learnt to operate computers on their own or purely by observing other children. James Tooley (2001) observed, “Underprivileged children, without any planned instructional intervention, could achieve a remarkable level of computer literacy”. He was of the opinion that “the delivery of education is an industry, not an office of the government” and this industry can deliver effectively by “harnessing the power of the private sector to reach the poorest through modern technology”.

Innovative approaches to bridge the digital divide have resulted in forward and backward linkages. Forward linkages have enabled spreading computer literacy and enhancing future prospects; and, backward linkages in terms of narrowing the gap between “Know” and “Know-nots” (Mitra and Rana, 2001). Figure 5 shows how public-private partnership resulted in the penetration of computer technology amongst the underprivileged, through MIE learning station.



**Figure 5: MIE learning Station – Bridging the digital divide**

The diagram given above illustrates how appropriate inputs from both the public and private sectors put enormous resources and opportunities at the disposal of the user. These resources enable the user to learn by doing or gaining hands-on experience, thereby reducing the digital gap

and improving future prospects. In the case of MIE learning station users, it is expected that not only do they acquire computing skills but also derive other positive benefits.

MIE approach can provide alternative avenues to the disadvantaged schools. It can be effective in supplementing existing resources of these schools by acting as one of the catalyst in the entire learning environment. It has the potential to initiate diffusion of technology at the grassroots' level.

### References:

- “India ranks 105 out of 127 countries in Unesco education report”, (n.d). Retrieved on March 7 2005. <http://www.infochangeindia.org/archives1.jsp?secno=5&monthname=December&year=2004&detail=T>
- “India must become fully literate: PM”. Monday, 21 February 2005. Retrieved on March 7 2005. <http://sify.com/news/fullstory.php?id=13675847>.
- Bathla, G (2002). Self-development through collaborative learning: A constructivist approach, an unpublished project report. D.R College, University of Delhi.
- Cappelle, Van F, Evers, V and Mitra S (2004). Investigating the effects of unsupervised computer use on educationally disadvantaged children's knowledge and understanding of computers. Proceedings of CATaC, Karlstad, Sweden. <http://www.it.Murdoch.edu.au//Catac/Catac04/indexo4.html>
- Evaluation of Madangir- A report (November 2003, An unpublished report). Quantum Market Research Private Ltd, New Delhi.
- Haugland, S. W. (1992). The effect of computer software on preschool children's developmental gains. *Journal of Computing in Childhood Education*, 3(1), 15-30. EJ 438 238.
- Haugland, S. W, and Wright, J. L. (1997). *Young children and technology: A world of discovery*. New York. Allyn and Bacon.
- Inamdar, P. (2004). Computer skills development by children using 'hole in the wall' facilities in rural India, *Australasian Journal of Educational Technology*, 20(3), 337-350. <http://www.ascilite.org.au/ajet/ajet20/inamdar.html> (verified on 7 March 2005)
- Mitra, S and Rana, V (2001): Children and the Internet: An Experiment with Minimally Invasive Education in India. *British Journal of Educational Technology*, (32), 221-232.
- Mitra, S (2000). Minimally invasive education for mass computer literacy, presented at CRIDALA 2000 Conference, Hong Kong, 21-25 June 2000.
- Mitra, S, (2003) Minimally Invasive Education: A progress report on the “Hole-in-the-wall” experiments, *The British Journal of Educational Technology*, 34, (3), pp367-371

- Mitra, S., Dangwal, R., Chatterjee, S., Jha, S., Bisht, R. S. and Kapur, P. (2005), Acquisition of computing literacy on shared public computers: Children and the "hole in the wall", *Australasian Journal of Educational Technology*, 21(3), 407-426.
- Nastasi, B. K, and Clements, D. H. (1994). Effectance motivation, perceived scholastic competence, and higher-order thinking in two cooperative computer environments, *journal of educational computing research*, 10(3), 249-275, EJ 486 806.
- National Sample Survey Organization (1998), “ Attending an educational institution in India- its level, nature and cost 1995-96”, Published by National Sample Survey Organization, Department of Statistics, Government of India, New Delhi.
- Pentland, A., (2003). “Role of digital technology in rural settings”, *i4d (Information for development)*, Volume I No. 3 September – October 2003 p (34-39).
- Phillip, A.J., Allow market forces in education (Dec 2001). Retrieved on March 7 2005.  
<http://www.indianexpress.com/columnists/phil/20011203.html>.
- Sociometry in the Classroom: How to do it (n.d), Retrieved on 5 April 2004.  
[http://www.users.muohio.edu/shermalw/sociometryfiles/socio\\_variation.htmlx](http://www.users.muohio.edu/shermalw/sociometryfiles/socio_variation.htmlx)
- Tooley, J. (September 2001). “ If India Can... Why Can't We?” *New Statesman* ,  
<http://www.ncl.ac.uk/egwest/people/james.tooley/India.html> (verified on 16 March 2005)
- Walton, M. Vukovic, V (2003). Cultures, Literacy and the Web: Dimensions of Information “Scent”, *Interactions Magazine*, 10(2). PP.64-71.