British Journal of Educational Technology *Vol 34 No 3 2003* 367–371

Colloquium

Minimally invasive education: a progress report on the "hole-in-the-wall" experiments

Sugata Mitra

Centre for Research in Cognitive Systems, NIIT Limited, Synergy Building IIT Campus, Haus Khas, New Delhi 110 016 India. Email SugataM@niit.com; Website:http://www.niitholeinthewall.com

Introduction

It has been observed that children are able to learn to use computers and the Internet on their own, irrespective of their social, cultural or economic backgrounds (Mitra and Rana, 2001). These experiments, first conducted in 1999 were labelled by the press as "hole-in-the-wall" experiments (see, for example, Padmakar and Porter, 2001), because the experimental arrangement consisted of computers built into openings in brick walls in public spaces. In what follows, we describe the work done subsequent to these initial experiments, the results obtained and some, possible, conclusions.

Initial experiments

The first experiment reported in our earlier publication was conducted in Kalkaji, a suburb of New Delhi, India. The experiment consisted of installing a computer connected to the Internet and embedded into a brick wall near a slum. We observed that most of the slum children were able to use the computer to browse, play games, create documents and paint pictures within a few days. The results have, since then, been reported in detail, elsewhere (see, for example, Mitra 2000 and Wullenweber 2001).

Subsequent experiments

Shivpuri

The Kalkaji experiment raised some doubts about whether the children had got inputs from computer literate adults in the vicinity. We repeated the experiment in the town of Shivpuri (state of Madhya Pradesh in central India) in May, 1999. Here we observed boys acquiring the skills required to do the tasks described above through an exploration, discovery and the peer tutoring process. The area was unsafe, no girls were observed to use the computer, and the experiment was closed after a few months.

Madantusi

So far, the experiments had been conducted in cities and towns. In June, 2000, we were able to repeat the process in the village of Madantusi (state of Uttar Pradesh, in north-

Published by Blackwell Publishing Ltd., 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

ern India). Here, a computer was built into the wall of the local school and left unattended. An Internet connection was not possible. After three months, we returned to observe that the children were using most features of the computer, including its CD drive and the keyboard. Certain behavioural changes were reported by adults of the area. The children were able to clearly articulate the pedagogy by which they taught each other. They were also observed using over 200 English words while talking about their experience.

Madangir

In 2001, funded by the government of Delhi, we set up six kiosks housing five computers each, in a sprawling resettlement colony in a south eastern suburb of New Delhi. The enclosures were designed to facilitate usage by children and discourage adult usage. ISDN connections to the Internet were provided on all computers.

Over 500 children have been observed to use these kiosks regularly. About 30 percent of the users are girls. They are familiar with all basic functions of the GUI-Windows environment. They browse and search the Internet regularly. Painting and games continue to be the favourites with younger children. Older children (12–13 year olds) read newspapers, browse cinema sites, and, occasionally, access educational material.

The first cases of vandalism in all our experiments to date (July, 2002) have been observed here. These are restricted to three computers that are not in full public view. The glass panes have been broken and the mice stolen by young adults of this area, with a history of drug abuse. This highlights the need to place public kiosks in highly visible and, therefore, safe, locations.

Sindhudurg

The largest of our rural experiments is located in the Sindhudurg district of the state of Maharashtra, on the western coast of India. Funded by the ICICI bank, the largest private bank in India, we have constructed five kiosks containing two computers each in five villages of the area, spread over an approximate area of 2000 square kilometres. The project has been operational since 2nd April, 2002. There is no Internet connection yet, although it is expected by the end of 2002.

In all locations, children were observed acquiring the basic skills required to use the computer (for playing games, painting, music, documents etc.) within a few hours. We have documented the entire process through video clips, interviews and machine log files. Approximately, 150 children use the computers regularly. There are an approximately equal numbers of boys and girls. A local teacher reported that about 10% of his work in teaching computing concepts had been already acquired by the children in one month. The results of experiments conducted up to July, 2002 are summarised in Table 1.

Table 1:

Place	*Location*	*Number of computers*	*Duration of study*	*Key observations*
Kalkaji	South east of Delhi, slum	1	January, 1999 –ongoing	First observations of self organised learning. Peer tutoring. Lack of correlation with social or economic factors as far as child learning is concerned.
Shivpuri	Madhya Pradesh, central India, small town	1	May, 1999– July, 1999	First observations of the actual process of discovery and peer tutoring among children. Kalkaji results successfully replicated.
Madantusi	Uttar Pradesh, north eastern India, village	1	June, 2000– ongoing	All results replicated. Self learning of English language observed. First comments from adults about the occurrence of desirable behavioural changes in children. Equal numbers of boys and girls.
Madangir	South east of Delhi, resettlement colonies	30	November, 2001– ongoing	First instances of adult vandalism at kiosks. Location and orientation as important factors for kiosk safety and usage. The need for remote monitoring technology.
Sindhudurg	Maharashtra, western coast of India, fishing and other villages	10	April 2002– ongoing	All results replicated rapidly. Sometimes more girls than boys. English is not a barrier. Games and painting dominate usage in the absence of the Internet. Local teacher reports 10% of the curriculum completed without assistance in one month.
Future plans	All over India	66	August 2002 –2004 planned	To provide final verification of all hypotheses of Minimally Invasive Education (MIE)

Hypotheses

We are testing the following hypotheses:

Hypothesis 1 (Prime): If given appropriate access and connectivity, groups of children can learn to operate and use computers and the Internet with none or minimal intervention from adults.

Hypothesis 2 (Supportive): It is possible to install a computer, connect it to the Internet, design it for use by children, and keep it in working condition in any external (outdoor) environment in India.

Corollary: It is possible to install a computer, connect it to the Internet, design it for use by children, and keep it in working condition in any external (outdoor) environment in the World.

Hypothesis 3 (Speculative): If given appropriate access, connectivity and content, groups of children can learn to operate and use computers and the Internet to achieve a specified set of the objectives of primary education, with none or minimal intervention from adults.

Technology

A design for kiosks meant for use by children in outdoor environments has been evolved and tested in our various experiments, and is considered robust.

We are able to remotely monitor the following:

1. The temperature, humidity and illumination levels in kiosks
2. Electrical conditions
3. Mouse movement history (when the mouse was moved last)
4. History of applications run on each computer
5. Screen images on each computer
6. Images of children using the computer
7. Voice recordings of children speaking
8. History of sites visited on the Internet.

Much of this technology is in a fledgling state at this time and many issues need to be resolved before reliable data is automatically obtained from each computer.

The icon test

Two of my colleagues (Ritu Dangwal and Parimala Inamdar) have devised a test to measure the progress of children in learning to use the computer. The test involves presenting the children with a list of icons as they exist on computers running the Microsoft Windows operating system. The children's description of icons is plotted against time and the number of correct descriptions used as a measure of learning. Detailed results are to be published shortly.

A new pedagogy?

Based on the observations above, we postulate that any curriculum can be divided into three parts in order for learners to acquire the necessary competence:

1. A part that needs a human teacher who is conversant with the subject matter and teaching methodology

2. A part that needs an assistant who is somewhat more knowledgeable than the learner
3. A part that needs resources and a peer group alone.

The second and third parts (of any curriculum) can be completed by children working in groups, with access to the Internet through an appropriate computing facility. None, or minimal, instructions are required to use such a facility, anywhere in the world. The distribution of curricula into the three parts would depend on the nature of the subject. In the authors opinion, concept acquisition would involve part 1 more than skill acquisition.

It is expected that such a distribution of curricula into "bands" and the consequent change in learning methodology would release significant amounts of teacher and institutional time.

Next steps

We intend to reproduce the experiments above under controlled conditions, all over rural India in the next three years. We expect that this will enable us to provide sufficient proof of validity of the three hypotheses above.

Acknowledgements

Financial assistance from NIIT Limited, the Government of Delhi, the ICICI bank and the International Finance Corporation is gratefully acknowledged.

References

Mitra S and Rana V (2001) Children and the Internet: experiments with minimally invasive education in India *The British Journal of Educational Technology* **32**, 2, 221–232.

Mitra S (2000) Minimally invasive education for mass computer literacy, presented at the CRIDALA 2000 conference in Hong Kong, June 21–25.

Padmakar P and Porter H (2001) The Hole in the Wall Machine *Time Magazine*, Asian edition September 3, 16.

Wullenweber W (2001) Das loch in der wand *Stern Magazine*. **42**, October 11, 97–102.