

APPENDIX Q
Mitra's unpublished experiments with
minimally invasive education
and the hole in the wall

Taken from Business Week, March 2, 2000

A Lesson in Computer Literacy from India's Poorest Kids

New Delhi physicist Sugata Mitra has a radical proposal for bringing his country's next generation into the Info Age

Sugata Mitra has a PhD in physics and heads research efforts at New Delhi's NIIT, a fast-growing software and education company with sales of more than \$200 million and a market cap over \$2 billion. But Mitra's passion is computer-based education, specifically for India's poor. He believes that children, even terribly poor kids with little education, can quickly teach themselves the rudiments of computer literacy. The key, he contends, is for teachers and other adults to give them free rein, so their natural curiosity takes over and they teach themselves. He calls the concept "minimally invasive education."

To test his ideas, Mitra 13 months ago launched something he calls "the hole in the wall experiment." He took a PC connected to a high-speed data connection and imbedded it in a concrete wall next to NIIT's headquarters in the south end of New Delhi. The wall separates the company's grounds from a garbage-strewn empty lot used by the poor as a public bathroom. Mitra simply left the computer on, connected to the Internet, and allowed any passerby to play with it. He monitored activity on the PC using a remote computer and a video camera mounted in a nearby tree.

What he discovered was that the most avid users of the machine were ghetto kids aged 6 to 12, most of whom have only the most rudimentary education and little knowledge of English. Yet within days, the kids had taught themselves to draw on the computer and to browse the Net. Some of the other things they learned, Mitra says, astonished him.

The physicist has since installed a computer in a rural neighborhood with similar results. He's convinced that 500 million children could achieve basic computer literacy over the next five years, if the Indian government put 100,000 Net-connected PCs in schools and trained teachers in some basic "noninvasive" teaching techniques for guiding children in using them. Total investment required, he figures: Around \$2 billion.

On Feb. 25, BW Online Contributing Editor Thane Peterson sat down with Mitra, a stocky 48-year-old with a mustache and a mop of graying black hair, in his tiny, triangular office at NIIT's R&D center on the campus of the Indian Institute of Technology in the south part of New Delhi. Here are edited excerpts of their conversation.

Q: What gave you the idea of giving slum kids access to the Internet?

A: It was a social observation rather than a scientific one. Any parent who had given his child a computer would invariably remark to me about it. I could hardly ever find an exception. Within a very short period of time, the parent would be claiming that the child

was a genius with a computer. When I poked a little further, I invariably found that the child was doing things with the computer that the parent didn't understand.

I asked myself whether the child was really doing something exceptional or if what we were seeing was adult incomprehension. If the adult was simply underestimating the child's ability to cope with a computer, then that should happen with any child. And I asked myself, "Why then would we want to use the same teaching methods for children as we use for teaching adults?"

At first, I tested my ideas with children who were easily available -- children at the company here, whose parents are in our executive group.... Then we tried this "hole in the wall" concept, where we put a high-powered Pentium computer with a fast Internet connection into a wall and let (slum) children have access to it with no explanation whatsoever. To be very brief on what happened, the results have been uniform every time we've done this experiment. You get base level computer literacy almost instantly. By computer literacy, I mean what we adults define as computer literacy: The ability to use the mouse, to point, to drag, to drop, to copy, and to browse the Internet.

The children create their own metaphors to do this. To give you an idea of what I mean, a journalist came up to one of these kids and asked him, "How do you know so much about computers?" The answer seemed very strange to her because the kid said, "What's a computer?" The terminology is not as important as the metaphor. If they've got the idea of how a mouse works and that the Internet is (like a wall they can paint on), who cares if they know that a computer is called a computer and a mouse is called a mouse? In most of our classes here at NIIT, we spend time teaching people the terminology and such. That seems irrelevant to me with these children.

But we also found that they would tend to plateau out. They would surf the Web -- Disney.com is very popular with them because they like games. And they would use (Microsoft) Paint. It's very, very popular with all of them. Because these are deprived children who do not have easy access to paper and paint. Every child likes to paint, so they would do it with that program. However, that's all they could do. So I intervened, and I played an MP3 (digital-music file) for them. They were astonished to hear music come out of the computer for the first time. They said, "Oh, does it work like a TV or radio?" I said, in keeping with my approach, "Well, I know how to get there but I don't know how it works." Then I (left).

As I would have expected, seven days later they could have taught me a few things about MP3. They had discovered what MP3 was, downloaded free players, and were playing their favorite songs. As usual, they didn't know what any of it was called. But they would say, "if you take this little box, and you drag this file into this box, it plays music." They had found out where all the Hindi music was on the Web and had pulled it out.

Q: What does it mean? What does it say for the potential of these slum kids? After all, being able to download music isn't enough to get them a job.

A: I don't wish to claim that this shows anything more or less than what it has shown, which is that curious kids in groups can train themselves to operate a computer at a basic level. In doing so, they also can get a generally good idea about the nature of browsing and the nature of the Internet.... And, therefore, if they view these things as worth learning, no formal infrastructure is needed (to teach them).

Now, that's a big deal, because everyone agrees that today's children must be computer-literate. If computer literacy is defined as turning a computer on and off and doing the basic functions, then this method allows that kind of computer literacy to be achieved with no formal instruction. Therefore, any formal instruction for that kind of education is a waste of time and money. You can use that time and money to have a teacher teach something else that children cannot learn on their own.

Q: What else have you learned?

A: Well, I tried another experiment. I went to a middle-class school and chose some ninth graders, two girls and two boys. I called their physics teacher in and asked him, "What are you going to teach these children next year at this time?" He mentioned viscosity. I asked him to write down five possible exam questions on the subject. I then took the four children and said, "Look here guys. I have a little problem for you." They read the questions and said they didn't understand them, it was Greek to them. So I said, "Here's a terminal. I'll give you two hours to find the answers." Then I did my usual thing: I closed the door and went off somewhere else.

They answered all five questions in two hours. The physics teacher checked the answers, and they were correct. That, of itself, doesn't mean much. But I said to him, "Talk to the children and find out if they really learned something about this subject." So he spent half an hour talking to them. He came out and said, "They don't know everything about this subject or everything I would teach them. But they do know one hell of a lot about it. And they know a couple of things about it I didn't know."

That's not a wow for the children, it's a wow for the Internet. It shows you what it's capable of. The slum children don't have physics teachers. But if I could make them curious enough, then all the content they need is out there. The greatest expert on earth on viscosity probably has his papers up there on the Web somewhere. Creating content is not what's important. What is important is infrastructure and access.... The teacher's job is very simple. It's to help the children ask the right questions.

Q: Are you saying that if we put computers in all the slums, slum kids could become literate on their own?

A: I'm saying that, in situations where we cannot intervene very frequently, you can multiply the effectiveness of 10 teachers by 100- or 1,000-fold if you give children access to the Internet.

Q: This is your concept of minimally invasive education?

A: Yes. It started out as a joke but I've kept using the term.... This is a system of education where you assume that children know how to put two and two together on their own. So you stand aside and intervene only if you see them going in a direction that might lead into a blind alley. That's just so that you don't waste time.... That would create teachers who are experts at composing questions.

Q: What are the business applications of all this?

A: I get asked this question all the time. It's kind of ironic that a company that makes (a big chunk of its sales from running computer-training institutes) should invent a method

where no teacher is required. The answer is that just because a method is economically viable, doesn't mean you shouldn't look for alternatives. A good business is one which provides more and more for less and less. The cost of your goods and services should spiral downwards.

The second point is that we are going to have an e-commerce boom. But what happens when an Indian businessman puts his shop up on the Web? Where's he going to get customers from? If someone lets me do this experiment for five years, with 100,000 kiosks, I reckon that I could get 500 million children computer-literate. It would cost \$2 billion. But if you had to pay to educate the same children using traditional methods, it would cost twice as much.

Q: If this were to become a business, would it require government funding?

A: Advertisers like Coca-Cola might be interested. But it would absolutely have to have government funding. I can't think of a company that would put \$2 billion into this. The governments will have to realize that the problem of the haves and have-nots is about to become) the problem of the knows and knows-not. Do we want to create another great big divide where the problem of illiteracy will come back in another context? In a very short period of time, adults who do not know how to deal with a (computer) mouse will have a very difficult time dealing with almost everything in life.

Q: But most of the information on the Internet is in English and the people you're talking about don't speak English.

A: We had some very surprising results there. We all have great misconceptions about what these children know and don't know. At first, I made a Hindi interface for the kids, which gave them links for hooking up with Web sites in their own language. I thought it would be a great hit. Guess what they did with it? They shut it down and went back to Internet Explorer. I realized that they may not understand the dictionary meaning of (English) words, but they have an operational understanding. They know what that word does. They don't know how to pronounce F-I-L-E, but they know that within it are options of saving and opening up files....

The fact that the Internet is in English will not stop them from accessing it. They invent their own terminology for what's going on. For example, they call the pointer of the mouse *sui*, which is Hindi for needle. More interesting is the hourglass that appears when something is happening. Most Indians have never heard of an hourglass. I asked them, "What does that mean?" They said, "It's a *damru*," which is Hindi for Shiva's drum. (The God) Shiva holds an hourglass-shaped drum in his hand that you can shake from side to side. So they said the *sui* became a *damru* when the "thing" (the computer) was doing something.

Q: Of all the things the children did and learned, what did you find the most surprising?

A: One day there was a document file on the desktop of the computer. It was called "untitled.doc" and it said in big colorful letters, "I Love India." I couldn't believe it for the simple reason that there was no keyboard on the computer (only a touch screen). I asked my main assistant -- a young boy, eight years old, the son of a local betel-nut seller -- and

I asked him, "How on earth did you do this?" He showed me the character map inside (Microsoft) Word. So he had gotten into the character map inside Word, and dragged and dropped the letters onto the screen, then increased the point size and painted the letters. I was stunned because I didn't know that the character map existed -- and I have a PhD.

Q: So what you're talking about is a different sort of literacy, a sort of functional literacy....

A: Yes, it's functional literacy. There are two examples I'd like to give you from the recent past. It's already happened in cable TV in India. There are 50 or 60 million cable-TV connections in India at this point in time. The guys who set up the meters, splice the coaxial cables, make the connection to the house, etc., are very similar to these kids. They don't know what they're doing. They only know that if you do these things, you'll get the cable channel. And they've managed to (install) 60 million cable connections so far.

Example No. 2 is the bicycle. I think we have the biggest bicycle-manufacturing industry in the world. The bicycle is ubiquitous here, and it's much the same in Malaysia, China, Africa. But you don't ask how the population became bicycle-literate. They just use it. So what I'd like to see is an India in which a large part (of the population) treats the computer that way.

The other thing is (how the Internet will change when most Indians gain access to it). We have the analogy of cable TV in India. Originally, it was all in English. It took exactly four years for all the programming to become Hindi. Star TV is now almost all in Hindi. If you go to Bangkok, they hate it.

Q: You're saying that a lot of Hindi content will appear as more Indians surf the Net?

A: Exactly. Let me go on record as saying it's not a question of what the Internet will do to India. It's a question of what India will do to the Internet.... If rural India goes onto the Internet, there will be an absolute flood of Indian-language content from people trying to sell to them.

Q: Has the Indian or any other government expressed interest in funding such a project?

A: Several government agencies, several state governments, and several world agencies have expressed an interest. Unfortunately, I don't want to name them because I need to get the funds first.

Q: You say that only the children used the computer, not adults. What does this mean for adult education?

A: I'm not even going to suggest that we use this (technique) for adults. The only reaction we got from adults was, "What on earth is this for? Why is there no one here to teach us something? How are we ever going to use this?" I contend that by the time we are 16, we are taught to want teachers, taught that we cannot learn anything without teachers.

There are two points I'd like to make about the adults. One is that the adults asked the children to do things for them. For example, to read their horoscopes on the Hindi news sites. The second thing is the reaction of the women. I would ask them why they didn't use (the computer), and they would say, "I don't have enough brains to understand all

this." I would say, "What about your daughters?" And the answer was, "They have lots of brains." So I said, "Do you think I should just remove this thing?" The answer was always, "No, no, no." I asked why not. And they said, "Because it's very good for the children."

Now, if the mothers have realized that, I'm happy. I don't care if they don't come (to use the computer). Because all we have to do is wait one generation. Not even that. In five years, a 13-year-old is going to be 18 and be an adult.

Q: Where do you go from here?

A: There is one experiment that scares me. These children don't know what e-mail is. If I gave them e-mail, I don't know what would happen. I'll probably try it anyway. But remember the stories one used to hear about people finding lost tribes and introducing them to Coca-Cola? I'm really seriously scared about what would happen if suddenly the whole wide world had access to these kids. I don't know who would talk to them for what purpose.

EDITED BY PAUL JUDGE

By December 2000 the Chief Operating Officer, P. Rajendran of the NIIT posted the following follow-up email on the developments of the experiment.

From Raju@NIIT.COM Fri Dec 15 19:00:17 2000
 Date: Mon, 11 Dec 2000 08:23:34 +0530
 From: P. Rajendran
 Subject: (GKD) Educational Experiment in India

Dear GKD Colleagues,

Many of you may recall the message I sent quite some time ago, about NIIT's experiment, which put a computer into a wall that separates NIIT's offices from a poor community, where many children play. The experiment was initiated by NIIT Senior Vice-president and Head of R&D, Dr. Sugata Mitra, to explore the effectiveness of an educational method NIIT developed, called Minimally Invasive Education (MIE). Specifically, the objective was to observe how poor children, who have never seen a computer, and without any help from a teacher, reacted to having one directly available. The results amazed everyone, as the children taught themselves to use the computer quite well. I thought you might like to hear about the latest follow-on to this experiment.

Responding to the success of the experiment, the State Govt. of Delhi, (capital of India), recently decided to invest in getting practical outputs from the experiment. They have approved a proposal submitted by NIIT to conduct a three-year project that will install six kiosks in poor areas of Delhi, with five computers at each site. The project will

make the computers available in poor communities, with software that helps guide users through the Internet. The computers will also provide information valuable to the local community, including relevant information on health, education, government programmes, etc. The systems can also be used to send email, and to run short videos on public information issues. They will use a sophisticated Web-based monitoring programme to gain information on users' computer use and offer insights into the ways children, and others, teach themselves to acquire computer skills to fulfill their own knowledge needs. NIIT is donating the hardware and remote sensing software, and has also contracted with the Government to ensure breakdown-free operation of the kiosk system. We intend this to be the first in a series of projects based on the "Minimally Invasive Education Pedagogy" to be undertaken in different economically and socially disadvantaged areas of Delhi.

Pioneer

IT to empower poor children

Gaurav Sinha/New Delhi

The Pioneer

If a small percentage of computer professionals can make the world sit up and take notice of India as an Information Technology superpower, imagine how much the nation will be strengthened if even illiterate children residing in slum clusters were to become computer-savvy.

"Everybody thought the solutions for all the misery in this third-world country will be provided by this IT revolution. Many, though, expressed doubts over this 'wishful thinking'," said NIIT senior vice-president Sugata Mitra as he pointed to scores of awed children making a beeline for a computer monitor installed hours ago at a JJ cluster in Madangir.

The afternoon proved, as Dr Mitra had been endeavouring to establish, that learning is not confined in the walls of the school and cannot be restricted to few in the privileged class. If proper initiatives are taken, even the weaker sections of the society can make progress and get counted in development process.

This was the foundation on which Dr Mitra had made a proposal to the Delhi Government. Principal Secretary (IT) S Reghunathan, evincing keen interest in the project, played a key role in getting the pilot project, "the first of its kind in the world", started.

In a way, Saturday was a historic occasion as the "world's first-ever computer learning programme in socially disadvantaged area" was inaugurated by Delhi Vidhan Sabha Speaker Ch Prem Singh. The 'heroes'

were the children of Madangir who had so far been deprived of modern educational facilities.

Even as the NIIT staff was busy preparing for the inaugural ceremony, some of the young whizzkids decided to have a dekho (look) of the 'dimaag wala machine' (machine with a brain) before assuming control.

Vicky became pro-active and started playing with the computer. To the amazement of the staff present there, he not only opened the computer successfully but closed the unit with equal ease. Vicky, 8, is a standard III student of Sarvodaya Vidyalaya who had never seen or heard of computer before.

Nine-year-old Sunita, who hasn't been to school, when got the opportunity worked her way around the pictorial page very convincingly.

Under this scheme, six kiosks having 30 computers will be opened across the city by next month where children will learn computer while playing with the machine "without any assistance from a teacher".

This "Minimally Invasive Education Pedagogy" is the first step in a series of similar projects to be undertaken in different economically and socially disadvantaged areas of Delhi.

If the kind of response the project generated the first day itself is anything to go by, one can safely assume that Delhi will be a "world-class cyber state" by 2003 and the dream of the chief minister would turn into reality.

Ananova

Slum children surf the net in internet kiosks Internet kiosks are to be installed on Delhi streets to introduce poor children to information technology. The government has launched a pilot scheme to set up 30 "hole in the wall" kiosks in six areas. The three-year project has been arranged in collaboration with NIIT. Known as the "hole in the wall" experiment, the main objective is to help children and adults acquire basic computer knowledge and improve literacy.

Information may also be provided at the kiosks on health, education and other schemes being launched by the government. The project is based on recent experiments by NIIT, which have proved that illiterate children living in slums can easily use the internet if they have access to it, says the India Express.

Hindustan Times

Delhi govt to take Internet to city slums
 HT Correspondent
 (New Delhi, November 17)

The Delhi Government is all set to "bridge the digital divide between the 'haves' and the 'have-nots' of the Capital" with its programme of taking computers to the under-privileged. With the help of NIIT and MTNL, Delhi plans to start a project where slum children would have access to computers with Internet. The project would first be launched tomorrow in the Ambedkar Nagar area. Thirty Internet kiosks will be set up at different locations in the area.

The NIIT's Centre for Research in Cognitive System had proved the effectiveness of the educational method of Minimally Invasive Education (MIE). NIIT studied the learning abilities of children and their interest in developing knowledge after giving them a computer. The present project, known worldwide as the 'Hole in the Wall' experiment, was set up on the basis of the experiments conducted by NIIT. The Delhi Government would fund the project, which aims to set up nine internet kiosks with five computers in an economically backward colony in Delhi, help children and adults acquire basic computer knowledge and to provide a platform for promoting basic literacy.

Hindu

Computer goes to the poor
 By Our Staff Reporter
 NEW DELHI, NOV. 18.

The Delhi Assembly Speaker, Chaudhary Prem Singh, today launched a pilot project in the slum clusters of Dr. Ambedkar Nagar and Madangir localities in South Delhi to spread computer literacy and basic literacy among the poor and bridge the digital divide between the have and have nots. The project has been launched in collaboration with NIIT's Centre for Research in Cognitive Systems and MTNL, Delhi. Under the project, the Government would set up 30 Internet kiosks at six locations in these two colonies. While the NIIT would provide the necessary technical expertise, the cost of this project would be borne by the State Government. The MTNL has also supported the project by providing free ISDN and internet connections for the project. The total cost is around Rs. 80-lakhs. The project will strive to provide computer, internet and basic literacy for poor children with minimal level of intervention. These kiosks would use Minimally Invasive Education (MIE) pedagogy to teach poor children and provide navigational guidance through the

informative and rich content of the internet. In addition, provisions would be made to provide local information pertaining to health, education, government circulars and other such documents. The system would have software applications for guided browsing, monitoring of users and a sophisticated web based maintenance system.

The objectives of the project are to provide the users with information about the important schemes launched by the Government for their welfare through these kiosks, provide the means by which local information can be uploaded, to help children and possibly adults to acquire basic computer knowledge, provide platform for promoting basic literacy, use the kiosks for appropriate guidance on issues such as health and sanitation and for sending messages during emergency and use them for showing short films on public awareness campaigns run by the Delhi Government in public interest. This pilot project would run for three years. A mid-term assessment of the project would be carried by the Government to determine whether the Project is going along the right direction or not and whether it is achieving the purpose laid down in the MoU signed with NIIT. Officials involved with the project said that if it succeeds substantially, it would be extended to more such colonies of Delhi. The Delhi Chief Minister, Ms. Sheila Dixit, who was the chief guest on the occasion, said that to tap the potential of the students in the IT sector, the Government had decided to open cyber cafes in all the colleges of the Capital. Cyber cafes would also be set up in residential areas, especially in the colonies inhabited by the middle class and the weaker sections.