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Children and the Internet: experiments with minimally invasive education in India

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Abstract
Urban children all over the world seem to acquire computing skills without adult intervention. Indeed this form of self-instruction has produced hackers—children who can penetrate high tech security systems. Is this kind of learning dependent only on the availability of technology? We provided slum children in New Delhi with Internet access in their settlement. The paper describes the results obtained in the first month of unsupervised and unguided access. It is observed that children seem to understand and use the technology fluently. Language and formal education do not seem to make any significant difference.

Introduction

Use of the Internet is spreading rapidly in India, as it is in the rest of the world. While the users in India are, almost entirely, restricted to the affluent in metropolitan areas, it is more than likely that demand for the Internet will eventually arise throughout the entire country. In this context, there are many apprehensions from academicians and others that the ability to access and the quality of training provided will hinder the usage of Internet in the subcontinent.

We think this may not be true and report the results of some experiments in Internet and computer usage using a "minimally invasive" (we borrow the term from surgery!) approach to learning.

Background

The ability to access the Internet is one of the most important factors in the use of computers today. In many forums held on the subject in the Indian Subcontinental region, we have found people questioning the utility of schemes that rely on the Internet. The argument proposed is that there are too few people in the region who have access. In our opinion, this argument is not a good one for deciding on whether or not to start activities in this area. We base this opinion on the fact that resources have seldom affected the spread of a medium in this region. For example, India produces the largest

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number of films in the world. While it may be argued that in a country that is known for extreme poverty, people would rather spend on food than on films, in reality this is not the case. Films are watched in every corner of India by millions of people irrespective of their social or economic status. In fact one might argue that the virtual world that is offered by films is sometimes the only relief that the poor have from a harsh, and often unbearable, reality.

While telephone connections in India grew from zero to 4 million in 40 years (1950–1990), cable TV connections grew from zero to 16 million in just six (1990–1996). We would once again propose that this is due to the value perceived in entertainment over other "essential" items. In a study conducted by the Department of Electronics, Government of India, some years ago, it was found that many rural areas ranked a colour TV set as more essential than, say, clean drinking water. Such is the power of media.

Most lay users perceive the Internet as a source of information and entertainment. The cost of acquiring a PC and an Internet connection at home is about Rs.70,000 (US$ 1600). In addition there is a recurring cost of the phone bill of about Rs.10,000 (US$ 135) every year. In a country where the average annual income is about Rs. 6000, these amounts are not small. The fact that the home PC market is growing at 44% seems to indicate again that the economics of entertainment in the region are not clearly related to incomes.

We would expect that explosive growth in Internet usage would take place in the region, regardless of any other factor.

Previous hypotheses and experiments

One of us (SM) has been working in this area for the last two decades. The idea of unsupervised learning was first pointed out in a paper on the use of diagnostics (debugging) as a learning tool (Mitra and Pawar, 1982). Of the work done later in this period, two experiments are worth mentioning in the context of this paper. Both experiments were based on a paper (Mitra,1988) where it was suggested that unsupervised use of computers can lead to accelerated learning of skills in children. It is now widely felt that children are more adept at modern computing skills than most adults, although they seldom want or get formal education in this area.

The first experiment on the use of computers in rural India was conducted by Marmar Mukhopadhyay in the village of Udang in the state of West Bengal in India (Zielenziger, 1995). Here, a few computers were placed in a school and children allowed to use them after minimal instructions. Word processing, spreadsheets and database management systems were readily learned by both teachers and students who then went on to create a rural resources and healthcare database.

The second experiment was conducted as a set of courses for children in NIIT Limited, an Indian training company with over 150,000 students. These experiments were called LEDA (learning through exploration, discovery and adventure) and were based

on a publication (Ahuja *et al.*, 1995). The structured use of computer games for meeting learning objectives was the key strategy. Once again, it was observed over a period of four years that skill training would happen automatically in children given enough access and motivating content.

In what follows, we will define a computer literate child as one who can:

1. Turn a PC on
2. Use MS Paint to create a designated picture
3. Move objects using folders, shortcuts, cut-and-paste, drag-and-drop, copy and delete methods.
4. Move from one web page to another and back.
5. Send and receive e-mail through a PC that is pre-configured to do so.

We will then attempt to study the development of such literacy in learners with access to adequate resources.

Theoretical basis

The world of education is coming up with new movements, frameworks and theories to explain how learning occurs or how it should be conducted. Each has passionate supporters and detractors who debate on the effectiveness and inherent appropriateness of one over the other.

Broadly, however, almost all teaching-learning interactions can be classified as one of the following:

- Those where the teacher or external resource determines the learning content and methodology.
- Those where the teacher or external resource determines the learning, in consultation with the learners.
- Those where the learners determine their own learning outcomes and how they will go about it.

The last of these encompasses theories such as Piagetian, situated cognition and constructivism.

Constructivism theory talks about cognitive growth and learning. This theory has gained many adherents in recent years (cf. Forman and Pufall, 1988; Newman, Griffin, and Cole, 1989; Piaget, 1973; Resnick, 1989;Vygotsky, 1978).

One of the foundational premises is that children actively construct their knowledge rather than simply absorbing ideas spoken at them by teachers. It posits that children actually invent their ideas. They assimilate new information to simple, pre-existing notions, and modify their understanding in light of new data. In the process, their ideas gain in complexity and power, and with appropriate support they develop critical insight into how they think and what they know about the world.

The two specific features of this philosophy borrowed from research in child development, is that play and experimentation are valuable forms of learning (cf. Daiute, 1989; Garvey, 1977; Herron and Sutton-Smith, 1971). Play involves the consideration of novel combinations of ideas. It is a form of mental exploration in which children create, reflect on, and work out their understanding. Both play and exploration are self-structured and self-motivated processes of learning.

Another growing body of research on collaborative or cooperative learning has demonstrated the benefits of children working with other children in collective learning efforts (Rysavy and Sales, 1991). When children collaborate, they share the process of constructing their ideas, instead of simply labouring individually.

The educational application of the above theories lie in creating curricula that matches and also challenges children's understanding, fostering further growth and development of the mind.

Objectives of the present experiment

The present experiment was conducted to find out whether:

1. Potential users will use a PC based outdoor Internet kiosk in India without any instruction.
2. A PC based Internet kiosk can operate without supervision in an outdoor location in India.

Location and construction of an outdoor kiosk

An outdoor kiosk was constructed such that it could be accessed from outside the boundary wall of our office in New Delhi. The headquarters of NIIT Limited is situated in Kalkaji in the extreme south of the city. The office is bordered by a slum, as is the case in many Indian cities. The slum contains a large number of children of all ages (0–18), most of whom do not go to school. The few who do go to government schools of very poor quality (that is, low resources, low teacher or student motivation, poor curriculum and general lack of interest). None are particularly familiar with the English language.

The kiosk was constructed such that a monitor was visible through a glass plate built into a wall. A touch pad was also built into the wall (see figure 1). The PC driving the monitor was on the other side of the wall in a brick enclosure (see figure 2). The PC used was based on a Pentium, 266 Mhz chip with 64Mb of RAM, suitable hard disk, a true colour display and an Ethernet card. It was connected to NIIT's internal network of 1200 PC's using the Windows NT operating system. The kiosk had access to the Internet through a dedicated 2Mbps connection to a service provider.

Observations

The kiosk was made operational on the 26th of January, 1999. It was turned on without any announcement or instruction. A video camera was placed on a tree near the kiosk in order to record activity near the kiosk. Activity on the CPU was monitored from

Figure 1: Children examining the kiosk on the first day

Figure 2: Construction of the kiosk housing on the office side of the wall

another PC on the network. This enabled the kiosk to be monitored and, if necessary, controlled from within the office. One of us (VR) would monitor activity through the day and take notes or other actions when necessary. What follows is extracted from his diary, with comments added when necessary.

Jan 18th

In a meeting, the date for Implementing the Internet kiosk was decided—Jan 26th 1999 We would review the status of the project on Jan 25th.

This kiosk had to be made in the wall of NIIT—in such a place that the people can access the kiosk with out any fear/ hesitation. Therefore the wall (about 25 feet from the colony's first house) was chosen and the "brick kiosk" came into existence. Just before the construction started, we wanted to take the people of the colony into confidence—that a "kiosk" was being put up for their benefit.

I don't think they quite understood what we wanted to do. As long as it did not take up their space, they did not really care.

Jan 26th 1999

Installed the kiosk by 1:00 PM

Lot of enthusiasm in the people... as to what it is... why is it being put up here.

Most of the kids thought it was a video game being put up for free.

Few questions the kids asked.

- *Is it a video game?*
- *What is a computer?*
- *How will we benefit?*
- *...But we don't know how to operate the computer!!*
- *Who will take care of the computer (security etc.)? (Asked by the elders).*

None of the questions were answered with any instructional sentence. We gave general answers such as "It's a fun machine".

*The kiosk was turned on with www.altavista.com as the home site for them to play with and **"NO INSTRUCTION"** was the key instruction to us. As of now keyboard access was not given.*

The only instruction (not given deliberately) was the final testing of the system with the "Touch Pad"—the pointing device provided.

Among the first users were the little boys from the colony of the age 6–12.

Initial response to the system was to generally fiddle around with the touch pad... and since the pointer moves with that—they found it interesting.

The next thing that they learned (don't know how—may be accidentally) was to "click" from the touch pad itself.

Later they came to know what exactly is "Clickable" on the screen—as the pointer changes, from an arrow to a hand shape, when it is on some link.

The next thing they could relate to their knowledge was the "channels" icon on the browser. As overheard, "go to channels.. there must be TV", and similar expressions. Then someone simply tried and reached the channels icon and managed.

It is important to note that they learned to manipulate and click the mouse in a few hours.

Feb 1st
Launched the kiosk with WIN NT so that more security could be provided to the internal network.

The enthusiasm in the kids is still high and they are trying various things with the system.

Next 2–3days went the same way…. People trying to do various things—opening the "start menu", opening new windows, opening the "my computer" from the desktop—opening the other applications…

Figure 3: Children teaching each other

Feb 4th 1999
We found that one of the slum dwellers is computer literate—Sanjay Chowdhary is a BA 2nd year student from the Correspondence College of the University of Delhi. He has done a basic course on computers from IGNOU (The Indira Gandhi National Open University). Since he is the only one who knows computers in the colony , all kids give him great respect. He has been found teaching them how to operate the touch pad (the pointing device).

It must be realised that the "intervention" here is situational. The children found the best resource they could.

Feb 5th and 6th
People have tried and learned to "shut down" the PC. Most of my time went into rebooting the PC physically.

Tired of this I had to change the registry settings in order to stop them from shutting down the PC.

Feb 10th 1999
In the morning removed some 200 shortcuts from the desktop.

Later in the day removed some 850 shortcut objects from the desktop... this shows that someone is really finding it interesting to create them.

The most liked/ visited site are—disneyblast.com , MTVonline,

Applications—calculator, paint and chat (though they cannot do much with chat because they have not been provided with the keyboard.

But without any doubts the most liked is the "paint" application. They are trying to do things with it. There is no instruction given to them till date.

We spoke to the people of the colony today in order to find out their views about the Kiosk. In the day only the ladies are at home. They had some reservations about using the computer. "we don't know the language", "we don't know how to operate it", and an elderly woman said, "yeh daal roti dega kya" (will this give us food?). We tried to persuade them to use it. Asked them to try and use it in front of us. There seemed to be much hesitation in this too.

We have decided to keep it open 24 hours.

The adult women never went anywhere near the PC even until the writing of this article (March, 18, 1999).

Feb 11th 1999
The PC was shut down by the guards at around 11:00 PM as nobody was using it. So opening it 24 hours will not make much of difference!! The first thing in the morning we saw "clock.exe" running on the desktop. A number of other windows were also open.

At around 1:00 PM we again found lot of new folders on the desktop. This could be handiwork of a school student or a group of them, who have learned to create a new folder, and are enjoying it.!!

Feb 12th 1999
During the routine health check-up of the PC, I discovered that someone had changed the "WINNT256.bmp"—the startup screen for WINNT.

Though the Hindi paper site—www.naidunia.com invoked some interest as they wanted to see their horoscope for the day (these were kids of age 10–12 years), yet I notice that some of them were more keen on using the PAINT application.

12:00PM—just now observed—someone has actually learned maximizing and minimizing windows.

Figure 4: A picture created by the children

Feb 15th 1999
Noticed in the morning that someone had managed to change the Internet home page option, from www.naidunia.com to www.webevents.microsoft.com Also someone figured out to change the wallpaper setting, as one can change the wallpaper to any Internet picture.

Discussion
Our observations indicate that these underprivileged children, without any planned instructional intervention, achieved a certain level of computer literacy, as defined

previously. They were able to self-instruct and to obtain help from the environment when required. In the author's opinion, this is a common phenomenon among urban children. Indeed, most urban parents who have made a computer available to their children tend to marvel at the speed with which their children are able to master (in the parent's opinion) the "complexities" of computing. They often tend to wonder if their children are "gifted". The authors have had many occasions to interact with such parents and children. The present experiment seems to suggest that a similar phenomenon may happen in the case of underprivileged children with little or no formal education.

We realise that the work described above is not a controlled experiment. It is a set of qualitative observations about the changes in a societal group caused by a (controlled) change in the environment, namely, the introduction of an Internet kiosk. It is in this sense that we use the word "experiment" in what follows.

Our key observations from this experiment were as follows:

1. Once available, the kiosk was used immediately by children (about 5 to 16 years old). These children had a very limited understanding of the English alphabet and could not speak the language.
2. Children learnt basic operations of the PC for browsing and drawing within a few days.
3. Adults, both men and women did not make any attempt to learn or use the kiosk.
4. MS paint and Internet explorer were the most commonly used applications.
5. Children formed impromptu classes to teach one another.
6. Children invented their own vocabulary to define terms on the computer, for example, "sui" (needle) for the cursor, "channels" for websites and "damru" (Shiva's drum) for the hourglass (busy) symbol.
7. Within a month of interaction, children were able to discover and use features such as new folder creation, cutting and pasting, shortcuts, moving/resizing windows and using MS Word to create short messages even without a keyboard.
8. Children were strongly opposed to the idea of removing the kiosk.
9. Parents felt that while they could not learn the operation of the kiosk or did not see its need, they felt that it was very good for the children.

However, it is imperative to repeat such experiments in other locations before one can generalise from these observations or come to any conclusion regarding the educational benefits of such a minimally invasive method.

The Kalkaji kiosk continues to be operational (February, 2000) and about eighty children use it. We were able to evolve an engineering design for a kiosk that would operate with negligible maintenance and without air conditioning in tropical environments. Their usage varies from activities around painting and music, to browsing and attempting to build a web site.

We were able to repeat this experiment in two other locations in the period from May 1999 to February, 2000, when the final version of this paper was written.

An Internet kiosk identical to the one described above was constructed in the town of Shivpuri, state of Madhya Pradesh, in central India. Shivpuri is a rural town with very little computer usage in any segment of society. The kiosk was made operational for three months (May to July, 1999) with a dial-up Internet connection. Our observations were nearly identical to those obtained in the first experiment and are reported elsewhere (Mitra, 2000).

The third location was in the village of Madantusi, in the district called Harchandpur, about 60 kilometres from the city of Lucknow in northern India. This was a purely rural location with one small school containing about 70 children. There are no computers in the village and no one had seen one. One of us (SM) installed a notebook PC (working on batteries and without an Internet connection) running the Windows '98 operating system, in a classroom and left it there for an hour. The children were found looking at digital images of various places in the world, and playing music files, at the end of the period. A kiosk has been built into the school wall (June, 2000). The results, with children who know no english, are identical to our first experiment.

The learning process in a minimally invasive environment

Certain common observations from the experiments reported above suggest the following learning process when children self-instruct each other in computer usage:

1. One child explores randomly in the GUI (Graphical User Interface) environment, others watch until an accidental discovery is made. For example, when they find that the cursor changes to a hand shape at certain places on the screen.
2. Several children repeat the discovery for themselves by requesting the first child to let them do so.
3. While in step 2, one of more children make more accidental or incidental discoveries.
4. All the children repeat all the discoveries made and, in the process, make more discoveries and start to create a vocabulary to describe their experience.
5. The vocabulary encourages them to perceive generalisations ("when you right click on a hand shaped cursor, it changes to the hourglass shape for a while and a new page comes up").
6. They memorise entire procedures for doing something, for example, how to open a painting program and retrieve a saved picture. They teach each other shorter procedures for doing the same thing, whenever one of them finds a new, shorter, procedure.
7. The group divides itself into the "knows" and the "know nots", much as they did into "haves" and "have nots" in the past. However, they realise that a child that knows will part with that knowledge in return for friendship and exchange as opposed to ownership of physical things where they could use force to get what they did not have.
8. A stage is reached when no further discoveries are made and the children occupy themselves with practising what they have already learned. At this point intervention is required to introduce a new "seed" discovery ("did you know that computers can play music? Here let me play a song for you"). Usually, a spiral of discoveries follow and another self instructional cycle begins.

Conclusions

While it is difficult to draw specific conclusions from a few (observational) experiments of this nature, we felt that the following hypotheses and future action plans can be formulated from the observations reported above:

1. It is possible to design PC kiosks that can operate outdoors in tropical climates. Such kiosks would have to be protected against heat, temperature, dust, humidity and possible vandalism. Schemes for remote monitoring and maintenance of software would have to be designed.
2. Wireless connectivity with the Internet would need to be devised for kiosks in other areas that are not physically close to organisations with Internet access.
3. Several experiments need to be conducted in different areas to investigate whether self-learning will occur uniformly among disadvantaged children.
4. Other experiments will need to be designed to investigate the effects of instructional intervention at selected points of the learning cycle.

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