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The ICT Laboratory: An Analysis of Computers in Public High Schools in Rural India

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There has been a strong push towards e-literacy in India, particularly in the distribution and usage of information and communication technologies (ICT) in schools for economic and social growth. As a result, the Vidhya Vahini scheme was launched in Kuppam, a marginalized village constituency in Andhra Pradesh. This scheme strived to disseminate computers to all high schools by 2005 with the intention of scaling this pilot initiative nationwide. In this article, I argue that in spite of strong governmental initiative and multifarious private-public partnerships, there are considerable barriers in the implementation of computers in public high schools. To optimize these cost intensive resources, we need to address some of the chronic educational challenges prevalent in the school system. With the constant flux in participation by public and private actors in this process, the question of sustainability is critical in the transformation of schools as e-learning communities.

India as the IT Hub

Media gurus such as Thomas Friedman has drawn attention to the Indian information technology (IT) dynamism, attributing this in part to India's "technology determinism" in the global market economy (Pink, 2005). Given the current media coverage on India's' technology boom (Dudley, 2005), it is easy to attribute this "determinism" as a recent phenomenon. However, India's embrace of technology for development can be seen as stemming from as early as the 1970s (Girdner, 1987). India underwent a significant policy shift from an industrial approach to that which is more technological in nature in the 1970s. The author proposes that the concept of modernization amongst policy makers in the 1970s was synchronized with the idea of technological prowess for nationhood. Furthermore, the New Electronics Policy (NEP) initiated by the then prime minister Indira Gandhi in 1984 was seen as a key strategy to transfer technology from the west to an Indian setting in an effort to modernize India. In fact, the following prime minister and son of Indira Gandhi, Rajiv Gandhi took the view that poverty could only be removed through the embrace of better technology (Girdner, 1987). Today this momentum has been infused in almost every facet of Indian policy and practice, giving birth to the recent e-governance initiative.

According to Gujral (2005), the former prime minister of India (1997-1998), e-governance is meant to achieve democracy and transparency. Gujral perceived this initiative as not just an issue of access to technology but the allowances that technology provides where citizens can "communicate with governments, participate in policy making, and communicate with one another" (p. 2). Under this e-governance rubric has emerged the e-literacy movement, in part to address the growing concern of the digital divide, the gap between those who have access to technology from those who do not. Furthermore, the reputation of India as the IT hub has energized some of the state governments to promise e-literacy to its people by 2015 (Shrikanth, 2004). This is also being done to adhere to the Education For All (EFA) campaign initiated at the World education conference at Jomtien in 1990. In April 2000, the Dakar Framework for Action identified the use of new information and communication technologies as one of the main strategies for achieving the EFA goals. Here, e-literacy explicitly targets functional IT literacy training, creation of relevant local contents to benefit all the interest groups with the intention of generating massive economic growth (Shrikanth).

At the international level, the United Nations has generated the "Global e-school and Communities Initiative" (Gesci), a special campaign to promote the use of technology in education (UNESCO, 2005). India's "Silicon Valley," Bangalore, has been chosen as the headquarters for this United Nations campaign. The Gesci initiative was established by the UN ICT Task Force in 2003. The Gesci initiative has drawn attention to the fact that ICT in schools has impact that goes beyond the classroom, yielding enormous benefits to local communities in the form of employment, adult education, health, business services, communication, and e-governance. The Gesci initiative therefore seeks to build partnerships between the ICT, media, and entertainment industries in order to find ways to put existing technology to educational uses.

Hence, in recent years, there has been policy development in computer-enabled education instruction, particularly in secondary schools across the nation. In the last few years, several private and public partnerships (PPP) have been set up with the intention of scaling these initiatives nationwide. Unfortunately, according to recent World Development indicators (World Bank, 1997), less than 2% of the Indian population currently has access to the Internet, the majority being in the urban area. Accounting for determining factors including the availability of connectivity, maintenance technicians, trained users, end-user hardware, relevant and applicable content and the like, India falls short of these expectations (Press, Foster, & Goodman, 1999). This has posed a serious stumbling block in the ambitious scaling of e-literacy through computers across states. It has propelled governments, international think-tanks, and the private sector alike to seek for innovative solutions in computer distribution and utilization to best capitalize on these cost intensive resources.

The Vidya Vahini Scheme

As stated in the National Task Force on Information and Technology Development report (1999), the *Vidya Vahini* programme is meant to integrate ICT in the learning environment of the government/ government-aided schools in the country. Under this programme, a pilot project has been implemented in 140 schools in seven districts in the country, one being Kuppam, Andhra Pradesh. A teacher's training centre has been setup at each of these seven districts. All the principals of the 140 schools and more than

950 teachers will be trained. In each of the districts, 20 government/ government-aided schools have been selected in consultation with the state government. Under this scheme, each of the schools will have one computer lab consisting of a breadth of hardware and software. In terms of hardware, each of these schools are meant to have a server, a hard disk, network printer, 10 multimedia personal computers with a web camera, 29" flat screen color TV, with 15 minutes power back-up, uninterrupted power supply (UPS) and a constant voltage transformer. As for software, a multiplicity of tools are meant to have been supplied: MS-Office (full suite) with multi-lingual support, Visual studio, Encarta reference suite and online deluxe, and web hosting software.

A technology room is to be set up where a color TV and personal computer are connected to the Internet through the computer lab. The purpose of the technology classroom is to enable the teachers to access the education related material in the classroom and impart computer-aided instructions through the large screen color TV. Also, part of the *Vidya Vahini* scheme is the teacher's training lab. The purpose of setting up this lab is to bring the teachers from the same district and train them in computer applications, course development, and other technology related aspects. An arrangement has been made with Intel, Microsoft, and other corporate ICT providers to train the teachers in the use of computers, development of course curriculum material, internet access, and other related applications. Last, in addressing the issue of connectivity, given that most of the schools are in the semi-urban and rural areas, the terrestrial infrastructure at present is weak. Hence, the broadband facility has been used to provide intra and internet connectivity at all the 140 schools and 7 training labs covered in the pilot project. All the schools will have peer-to-peer connectivity. Therefore, the *Vidya Vahini* pilot project has been recorded as aiming to provide:

1. better quality of education at the school level;

2. good foundation at the school level;

3. IT training to the students;

4. world-class education at the level of senior secondary school;

5. promotion and implementation of e-governance;

6. exchange of skills, knowledge and sharing of resources among schools; and

7. linkages with schools all over the world.

In the following section, I will analyze how this initiative has translated at the ground level within Kuppam high schools based on my six months of ethnographic research.

ETHNOGRAPHIC FIELDWORK

Located at the confluence of Karnataka, Tamil Nadu, and Andhra Pradesh, Kuppam is strategically if not symbolically stationed amidst the three states. Ten years ago, Kuppam was reputed to be the prison encampment area of Andhra Pradesh. Today, Kuppam, due to the "progressive nature of its people1" has been chosen to be a "model" by Hewlett Packard for new technologies to be tried and tested within its vicinity. It is a rural Indian village, 105 kilometers from Bangalore city on the Bangalore-Chennai railway (Figure 1). Telugu is the official and most widely spoken language in the state. Other spoken languages in this area include Hindi, Urdu, English, Kannada, and Tamil. With a population of around 300,000 people across five districts or mandals, the area has experienced a transformation in health, education, agriculture and employment sectors. In the education setting, according to local government statistics (Kuppam Area Development Authority [KADA], 2003), impressive strides have been made in enrolments, retention, school facilities and passing rates (Table 1).

Figure 1. Kuppam: The wired village

Table 1: Kuppam Constituency Development Indicators 2003 (Statistics provided by KADA: Kuppam Area Development Authority)

	1989	1994	2003	% increase/decrease
Population		265922	317208	
Literacy Rate	26.40%	30.66%	68.49%	159.43%
School Age Children	27269	31769	73242	168.59%
School going children	16088	20332	71434	344.02%
Drop outs	11181	11437	1828	-83.65%
%age of enrolled	59%	64%	97.53%	65.31%
Teachers	311	396	1490	379.10%
Teacher-pupil ratio	1:51	1:55	1:48	
Class room: Pupil ratio	1:70	1:68	1:60	
Total Primary Schools	207	235	436	111%
Total Upper Primary Schools	18	27	74	311%
Total high Schools	9	14	53	489%
Junior colleges	1	1	6	500%
Total degree colleges	0	0	6	600%
Habitation having primary/upper primary schools	207	235	510	146%
School less habitations (beyond 1 km)	204	176	1 -	
10th Grade passing results	36%	43.70%	94.20%	
7th grade passing results	48%	54%	99.56%	
Computerization in Schools	-	-	20	
Access to print-total circulation of newspapers	163	518	4325	

Literacy rates jumped from 26% in 1989 to 68% in 2003. Within those years, dropout rates decreased by almost 84%. The statistics on access to schooling rivals the statistics in learning achievement. Passing rates amongst 7th and 10th grades have swung from a low of 36%-48% respectively in 1989 to 94%-99% in 2003. Through theVidhya Vahini Scheme, the government pledged to provide computers to all local high schools by the end of 2005. Further reforms included the establishment of a model residential school with the support of World Bank in 2003, targeting girls from the most marginalized scheduled castes and tribes (see Table 1).

Basics Are Not Sexy, Computers Are

A good portion of government schools persist in not having access to the basic facilities for children (Table 2)

Table2: Education System in Kuppam: Government High School District Statistics 2003 + Fieldwork	**%**
High Schools founded within last 5 years	70%
On students	
Female students in high schools	43%
Co-educational schools (M+F)	85%
Students from Backward Castes, Scheduled and Tribal Castes	90%
On Teachers	
Female teachers in schools	26%
Language in Schools	
Schools with Telugu as prime medium of instruction	100%
English as prime medium of instruction	0%
Teachers graduated from Telugu medium school	91%
Technology in Schools	
Schools with Computers	40%
Televisions in Schools	38%
Cable access	0%
Teachers claim computers main function to be that of a teaching aid	78%
Teachers claim that computers main function is to provide technical skills to students	17%
Students claim playing computer games to be their favorite usage of computers	47%
Students claim graphics & GK to be their favorite usage of computers	30%
Students claim internet to be their favorite usage of the computers	17%
Facilities	
Schools with access to drinking water	50%
Schools with libraries	15%
Schools with girls toilets	32%
Schools with Cultural activities/ Functions	57%
School perception on education	
Principals that claims instilling moral values to be the most important aspect of schooling	75%
Principals that claim schools main role is to prepare children with skills for jobs	17%
Principals that claim hiring more teachers to be their most urgent need	43%
Principals that claim their need for more facilities as most urgent	30%
Access to drinking water being the most predominant facility need	60%
Principals that claim reforming state mandated curriculum as their most urgent need	9%
Total	**n =23**

"We just need teachers," said the headmistress at a government high school in Gonugur. This had been a common plea professed by a majority of the public high school teachers and principals. Access to drinking water, infrastructure, curriculum change, science laboratories, and sports facilities were stated as the most urgent reforms needed within the education system (Table 2). Furthermore, the relentless poverty in this "model" community is illustrated by the "uniform" policy of the local schools. Several public high schools had instituted the "no-uniform" rule on Wednesdays and Thursdays. When asked the reason for this, we were informed that this rule gave the parents an opportunity to wash their child's uniform for that week. Safety is another key concern, especially in the education of girls. During our stay, a local school teacher had run away with a 13 year old girl student from his class. "That is why we don't want to send our older girls to schools. This is what happens," lamented a father of two girls. Also, there were several

complaints of corruption pertaining to the government education department. A well respected local teacher pleaded with us to come with him to see the open corruption in the education offices. “They ask you to sign for 20 textbooks and give you only 10. That is why you see clerks in “two lakh houses.” In spite of this sobering state of affairs, in speaking with parents, we learned that many strongly believed that English and computers were the most critical to their child’s education. As one of the mothers put it, she believed that it was the *only* way her children could succeed and do well. This is reflected in the fact that within the last 10 years, there has been a burgeoning of many private schools in Kuppam, all promising instruction in the English language medium as opposed to Telugu, the regional language medium taught in public schools (KADA, 2003). This parallels a national trend where poor parents in both rural and urban settings are opting for private schooling over the public, causing a national crisis in public education (Waldman, 2003).

Old and New ICT Within Kuppam Classrooms

The former government had pledged to provide computers to all government high schools by 2005. However, only 40% of the schools currently have computer facilities (see Table 2). Televisions had also been promised in addition to the computers for satellite TV education and other innovations in content access. Again, less than 40% of the schools have televisions (see Table 2). This is meant to enable children to watch educational programmes shown on TV and function as a temporary remedy to the shortage of competent teachers in rural settings. Also, schools can link computers to televisions for better viewing. This is an interesting phenomenon for it brings together the “old” ICT medium, the television, with the “new” ICT medium, the computer in a marriage that is conducive to large classes. With an average ratio of 10 pupils to 1 computer, more focus was given to group based activities. However, this put the onus on the teachers to facilitate participation among marginalized groups to maximize engagement.

Sitting Ducks

When we asked one of the teachers in Noolukunta if her school had a television, she replied in the affirmative, stating that they had got it recently

from the government. The word "recently" alluded to a two year period. In spite of this time lag, the government had not set up a power line for the television in her school. Meantime, the television had been locked away for the last two years. Power is perhaps the most critical factor in ICT access. A *shift-policy* system was in place where there was a planned power outage from 10 in the morning to 5 in the evening every alternate week. In terms of private-public partnerships, Hewlett Packard (HP) had provided Linux based PCs for a few schools. They applied the 4-for-1 strategy where four monitors are connected to one computer processing unit (CPU). According to *The Financial Express* HP has claimed that the schools could benefit from this novel facility where the cost of the system would be 40-60% cheaper compared to the regular PCs.[1] However, with no formal follow up and maintenance, much of this equipment could stay unused in these schools. If there is a problem with the computers, the principal would have to go to the district office, which is a good six hours away. "We have the equipment but with no power and no maintenance, there is no use. The children do not come here much," lamented a headmaster in Kangundi. In fact, in one of the schools, we noticed six computers sitting idly due to a fuse problem. Apparently a simple fix but due to the lack of support, these computers had been unused for months. "We are willing to pay from our own pockets, just tell us where to go," exclaimed the computer teacher at this school. Several other incidents pointed out the urgency of an ongoing support system in equipment maintenance and training, crucial for maximizing these cost-intensive resources.

The Language Barrier

As part of content provision, some educational software was provided to these schools as tools for learning. Some of the teachers were using these programs to instruct children by translating its English based material into Telugu, thereby converting it into a teaching aid. However, this was dependant on the teachers' grasp of English. This was a concern given that most of the public school teachers were graduates from a Telugu medium school (see Table 2). Although there were the occasional teachers who had the natural aptitude for computers, most teachers were nervous handling such expensive equipment. When it came to children directly interfacing with the computers, most of the children did not appear to understand the material.

When we watched the students in these schools demonstrate their knowledge of the computers, we noticed that they were comfortable handling the computers. They showed us their favorite programs on the computers: biology centered programs, programs on the Agra fort, and the solar system. Yet, in gauging their comprehension, we realized that they had not grasped the meaning of the content. They were still dependant on the teachers to translate this information to them. Also, a good percentage of students reported video games as their favorite usage of the computer with graphics software a close second (see Table 2). Yet, even when accounting for language accessibility, issues of content engagement, relevance and contextuality still persevere. As observed by the Educational Development Center (EDC), children centered educational content designed for ICT is unfortunately not readily available (EDC, 2004).

Changing Pedagogy, Changing Mindsets

Much of computer usage can be understood in light of the current pedagogical practices and beliefs within an existent system. According to the World Bank education sector report in 2001, a large number of teachers do not use the teaching kits provided. However, if teachers are involved in the process of creating the kits and if quality training is provided, the likelihood of usage is much higher. Interestingly though, teachers rely heavily on textbooks, often the only reading material in the schools in their day to day instruction (World Bank, 2001). In our interviews and observations of teachers using computers, similar patterns were observed. The majority of teachers, when asked about the main functionality of computers, stated computers to be teaching aids (see Table 2). The other most predominant usage of computers was in providing children with computer skills (see Table 2).

When it comes to curriculum, most teachers continue to guide student learning by information density, with an emphasis on rote learning (World Bank, 2001). Meta-cognitive learning is a rare occurrence in the classroom. “The significant amounts of class time spent on lecturing and copying from the blackboard reiterate the importance given to students mechanically appropriating syllabus content rather than developing higher order skills such as reasoning and problem solving” (p. 39). When it came time for students to interface with the computers, we noticed that most teachers appeared to function as poor catalysts to e-learning. In our observations of

classroom behavior, either the teachers abdicated responsibility to the "computer instructor" in charge who taught basic computer skills or would treat the computer medium as an e-textbook, making children copy down material being taught.

There were some teachers who were able to effectively use the medium to maximize learning. For example, in the Urdu school, the principal was able to combine various subjects within the same class and present it through multi-media facilities provided by the Urdu Foundation. In the government high school in Kothaindlu, the teachers had cultured a query-based learning within their classrooms which translated effectively in the usage of technologies for learning. This was evident through the high interactivity and sharing of the students in problem solving using computers. In Kangundi, the science teacher managed to design multi-media programs on physics and astronomy. He claimed he was self-taught. Yet for the most part, teachers did not display such a penchant to alternate pedagogical techniques. Another aspect, which is important to consider is the overall vision of education as espoused by the principals. Their leadership often determines to what extent computers get integrated within the classroom. Interestingly, most principals privileged the vision of schools as portals of values (see Table 2). While 75% stated moral education as their main goal to schooling, only 17% claimed their main aim was to impart skills to their students (see Table 2). Yet, most content for computers is designed as subject based, with little sensitivity towards value based instruction that can simultaneously be engaging and meaningful to children.

Therefore, in the rush to embrace technologies in the classroom, Selfe (1988) stated that teachers have acquired "professional amnesia" (p. 69) where they have lost perspective in what they already know of literacy and have succumbed to the impression of starting from scratch in the pursuit of technical knowledge. Traditionally, literacy concerns itself with reading and writing and how students make meaning from printed texts by interpreting content in light of their own needs and purposes. However, Selfe argued, computer literacy entails learning another grammar of technological interfacing, from hardware to software. These conflicting dualities appear to serve as an impediment to creating a common space for integrating educational technology with best practices in pedagogy. Hence, we should not just focus on the access to technology, but also on the usage of these technological tools to foster conducive learning spaces within and from without the classroom. In fact, Warschauer (2003a, 2003b) drew out similarities

between literacy and ICT access where both literacy and ICT access are closely connected to "human communication and the means of knowledge production" (Warschauer, 2003b, p. 38). Other parallels are where both tools function as prerequisites to full participation in the information stage of capitalism; they both necessitate a connection to a physical artifact (a book or a computer) and serve as a two way street in receiving and producing information. Lastly, he stated that both literacy and ICT access have spiraled the notion of societal divides, one being the literacy divide while the other is the digital divide. Attewell (2001) chose to see the latter as two waves, the first and second digital divides, where the first has been preoccupied with access issues while the second wave is concerned with usage and actual implementation of technology in learning. However, it needs to be noted that they cannot be looked upon as separate entities but rather as a webbed duality in the pursuit of enhanced learning.

Overall, the use of ethnographic grounded observations is critical to helps us illuminate the nature and worth of what students are learning about computers. Jungck, (1999) stated that, "What we know is linked to the way we come to know it" (p. 283). Hence, as students' interaction with computers shape what they know about them, researchers through conducting observations of technology access and use in schools will shape the understanding of teachers and students' experiences, their values and their needs in this teaching/ learning process. Thereby, voices from the ground level are endemic to shaping the effectiveness in policy and practice in technology in education.

CONCLUSION

Given that most of the high schools were created within the last few years in Kuppam, they were surprisingly not only functional but also managed to keep attendance rates high and drop out rates low. Also, having met some excellent and dedicated teachers within the public school system, it was apparent that leadership within this sector was a real possibility. Nor can we consider the ICT efforts completely wasted on these schools; there was a sense of pride created and interest generated among the teachers and students for gaining these privileges. Overall, at least in Kuppam, transformation was not just a concept or a subtle layer but a tangible reality. However, to sustain this, continued support is needed from the public and

private sector. In my interview with Mr. Naidu, the former chief minister of Andhra Pradesh, I asked about his computer-education schemes and its potential to be sustainable. He stated that Kuppam was a state laboratory, which housed smaller models of innovation. His main belief in sustainability was rooted in private-public partnerships (PPP) as a means for generating efficiency. Efficiency in turn was to produce wealth. "You need to create wealth in order to distribute it," he remarked. I shared my concern on projects like the *Vidya Vahini* scheme where due to its maintenance offices being closed, there was little continued support of the schools' computer facilities. He replied that governments could only jump start a project through initial subsidies. However, to really be an autonomous unit, certain corporate strategies were necessary for sustaining these projects. In the case of *Vidya Vahini*, the mobilization of local resources through user charges he stated was stringent to enable true sustainability. However, with Mr. Naidu not in power, HP transferring all responsibility to local non govermental organizations (NGOs) in 2005 and other computer training think-tanks potentially losing their funding, the idea of continuity is a looming concern.

I also met with the current secretary of education, Dr.Chellappa to help gauge the mindset of the current government towards ICT initiatives in education. Overall, he seemed supportive of the efforts. However, he explained that the department had been bombarded with educational content from several local and international sources, many targeting rural issues. I saw some samples, which were primarily documentaries on agriculture, environment, and other rural domains. He went on to explain that due to the high volume of ICT content, the department was in the midst of creating an ICT committee within the education department to screen through the material. He also expressed his personal frustration in dealing with the same topics over these years. "It's like to grind an already grounded floor," he said, quoting a Telugu saying. "In the 60s, we spoke of dowry, health, women's issues, agriculture and today we speak again of the same issues." He expressed the need for something fresh, something new, and less preachy to the public.

Sustaining Current Momentum

The Indian public school system needs to be responsive to the demands of its diverse public. Schools need to provide access to quality English and

appropriate computer instruction among other quality based schooling factors for their children to keep privatization at bay. However, this can be done in parallel to maintaining the regional language and culture within schools through investing in culturally appropriate educational software and adopting engaging multiple-language content software. Also, to prevent computers from becoming modern day artifacts in the classrooms, ongoing technical support and pedagogical e-training for teachers is key. Governments and nonprofits involved in training should harness the strengths of gifted teachers with a natural affinity towards creative applications of technology in the classroom. These teachers should be at the table when shaping computer content and e-curriculum. To make a genuine impact on learning outcomes, strong partnerships need to be developed between nonprofits, the private sector and the government to create meaningful and engaging content for the children. This can be achieved by broadening the parameters of PPP to encompass the teachers, students, and popular sociocultural bodies to help shape content. By engaging locals in their own learning process and development, it creates buy in, with a higher chance of the content being utilized. Overall, sustainability for computerization within the educational forum requires the long term investment of human, fiscal and institutional resources with a special emphasis on community participation.

References

Attewell, P. (2001). The first and second digital divides. *Sociology of Education*, *74*(3), 252-259.

Dudley, B. (2005, April 22). *India parlays education, timing into tech boom*. Retrieved November 13, 2006, from The Seattle Times, Business and Technology Web site: http://seattletimes.nwsource.com/html/businesstechnology/2002000235_india09.html

Education Development Center Report. (2004). *Digital libraries in India: A baseline survey*. Washington, DC: Author.

Girdner, J.E. (1987). Economic liberalization in India: The new electronics policy. *Asian Survey*, *27*(11), 1188-1204.

Gujral, K. I. (2005, June 27). *Digital democracy*. Retrieved November 13, 2006 from http://www.dqindia.com/content/egovernance/2005/105062701.asp

Jungck, S. (1990). Viewing computer literacy through a critical, ethnographic lens. *Theory into Practice*, *29*(4), 283-289.

Kuppam Area Development Authority. (2003). *Notes on developmental activities in Kuppam constituency*, Andhra Pradesh, India: State Government document.

National Task Force on Information and Technology Development. (1999). *Information technology action plan part III: Long term national IT policy*. Retrieved November 13, 2006, from http://it-taskforce.nic.in/actplan3/index.html

Pink, H. D. (2005, May 13). *Why the world is flat*. Retrieved November 13, 2006, from http://www.wired.com/wired/archive/13.05/friedman.html

Press, L., Foster, A. W., & Goodman, E. S. (1999). The Internet in India and China.*Proceedings of INET 1999*, Stockholm, Sweeden. Retrieved November 13, 2006, from http://www.isoc.org/inet99/proceedings/3a/3a_3.htm#s3

Selfe, C. (1988). Computers in the classroom: The humanization of computers: Forget technology, remember literacy. *The English Journal*, 77(6), 69-71.

Shrikanth, G. (2004, April 7). *From literacy to e-literacy*. Retrieved November 13, 2006, from http://www.dqindia.com/content/egovernance/104040701.asp

United Nations Educational Scientific and Cultural Organization (UNESCO, 2005). *Bangalore chosen as India headquarters for UN technology in education initiative*. Retrieved November 13, 2006, from http://portal.unesco.org/ci/en/ev.php-URL_ID=19610&URL_DO=DO_TOPIC&URL_SECTION=201.html

Waldman, A. (2003, November 15). *India's poor bet precious sums on private schools*. Retrieved November 13, 2006, from the New York Times Foreign Desk web site: http://www.cs.princeton.edu/~rywang/05s598/docs/031115-000938.india_school/

Warschauer, M. (2003a). Demystifying the digital divide. *Scientific American, 289*(2), 42-47.

Warschauer, M. (2003b). *Technology and social inclusion: Rethinking the digital divide*. Cambridge, MA: MIT Press.

World Bank (1997). *World development indicators*. Washington, DC: Author.

World Bank (2001). *India expanding and improving upper primary education in India* (Report No.20347-IN). Washington, DC: Author.

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Notes

1. Hewlett Packard website on the Kuppam i-community. Retrieved on November 13, 2006, from http://www.kupnet.org/

2. Hewlett Packard Press Site. Retrieved on November 13, 2006, from http://www.hp.com/hpinfo/newsroom/feature_stories/2005/05kuppam.html