*British Journal of Educational Technology* *Vol 41 No 5 2010* 672–688
doi:10.1111/j.1467-8535.2010.01077.x

# *Limits to self-organising systems of learning—the Kalikuppam experiment*

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**Abstract**

What and how much can children learn without subject teachers? In an attempt to find a limit to self organized learning, we explored the capacity of 10–14 year old Tamil-speaking children in a remote Indian village to learn basic molecular biology, initially on their own with a Hole-in-the-Wall public computer facility, and later with the help of a mediator without knowledge of this subject. We then compared these learning outcomes with those of similarly-aged children at a nearby average-below average performing state government school who were not fluent in English but were taught this subject and another group of children at a high-performing private school in New Delhi who were fluent in English and had been taught this subject by qualified teachers. We found that the village children who only had access to computers and Internet-based resources in the Hole-in-the-Wall learning stations achieved test scores comparable with those at the local state school and, with the support of the mediator, equal to their peers in the privileged private urban school. Further experiments were conducted with unsupervised groups of 8–12 year-olds in several English schools using the Internet to study for GCSE questions they normally would be examined on at the age of 16. We conclude that, in spite of some limitations, there are opportunities for self-organised and mediated learning by children in settings where they would otherwise be denied opportunities for good, or indeed any, schooling. We also show that this approach can be enhanced by the use of local or online mediators.

## Introduction

The first 'Hole-in-the-Wall' experiments were carried out in 1999, when a computer with Internet connection was installed in a hole in the wall overlooking a slum area in New Delhi, the local children were allowed to explore and use the computer without supervision and their behaviours were recorded via a video camera (Mitra *et al.*, 2005). Within 1 month, it was evident that the children had taught themselves to use the computer and acquired some basic skills in English and mathematics. Encouraged by this finding, the researchers then trialled this approach in a number of remote and disadvantaged areas across India with almost identical results. These experiences gave credence to the belief that given the facilities, groups of children in such settings could learn to use computers and access and benefit from Internet resources on their own. Further investigations into such self-organising learning systems (Mitra and Rana, 2001, Mitra, 2003; Mitra *et al.*, 2005) confirmed that within a few months, given free and public access to computers and the Internet, irrespective of who or where they are or what language they spoke, children could:

1. Become computer literate on their own, that is to say, learn to use computers and the Internet for most of the tasks carried out by lay users;
2. Teach themselves sufficient English to use email, chat and search engines;
3. Learn to search the Internet for answers to their questions;
4. Improve their English pronunciation on their own (Mitra, Tooley, Inamdar & Dixon, 2003);
5. Improve their mathematics and science scores in school (Inamdar, 2006; Nicaud, Bittar, Chaachoua, Inamdar & Maffei, 2004);
6. Answer examination questions several years before they might normally be expected to be capable of doing so;
7. Develop their social interaction skills and value systems and
8. Form independent opinions and detect indoctrination.

The quality of education declines with remoteness and disadvantage (Mitra, Dangwal & Thadani, 2008). There are many places in the world, and especially in the developing world, where geographical, economic, social, political, religious and other factors limit the provision of good primary and secondary schools and good teachers will be unable or unwilling to go. If the possibilities and limits of self-organising learning without and with mediators can be evidenced and understood, children in such areas can gain enormous benefits. To establish the case for this, we needed to develop some research questions that could be answered in different educational environments and which would yield convincing evidence.

## The research questions

*Could Tamil- speaking children in a remote Indian village learn basic molecular biology in English on their own?*

We used this as one of our research questions because:

1. In order to check for self-organised learning, we needed an environment where there would be no possibility of any teaching from sources other than a connected computer. Hence, the choice of a village in a remote and underdeveloped area.
2. We chose to use material in the English language since this is the most common language in which children would find information on the Internet.
3. With the learning materials in English, the results obtained with children who knew very little English would provide a baseline for the learning to be achieved. We could safely assume that children who were more familiar with English would do better. If we had worked with children who were comfortable with English to start with, we would not have known what the results might have been with children who were not.
4. The choice of Tamil as the native language of the children to be studied was necessitated by the learning environment.
5. We chose molecular biology because it is part of the government curriculum in India and taught in all schools, but the village community members would be unfamiliar with it. Had we chosen mathematics or basic science, the risk of local learning inputs would have been greater.

*Could a friendly mediator with no knowledge of the subject improve the performance of these village children?*
We chose this research question because:

1. It is possible to find friendly mediators such as parents, grandparents or other adults in remote areas. Such mediators are not likely to be trained to teach, nor are they likely to have any specific subject knowledge. Indeed, in India and many other countries, they may even be illiterate.
2. If it could be shown that such mediators could help children improve the quality of their self-organised learning, we could have a replicable and sustainable solution. On the other hand, if we had studied the effects on the children's learning of a trained mediator who was knowledgeable in the subject, the results would not be replicable or sustainable. It was, after all, the non-availability of good teachers that was driving this study.

*How would the learning and test scores of these children in a remote village compare with those of children who were fluent in English and taught by subject teachers in a local state government school and those attending an affluent, private urban school?*
The purpose of this question was to establish to what extent such self-organising learning could 'level the playing field'. In the authors' view, equalising educational opportunities is the most efficient and effective means of improving the quality of human life on the planet. Education provides the route to economic and social progress and to people taking greater control of their own destinies.

## The research methods

The following research methods were adopted:

1. Identify a village in a remote location which has a primary school (Class 1–8 with children aged 5–15 years) in which English is taught where but English is neither the medium of instruction nor spoken in the community.

2. Identify a sample group of village children aged 10–14 years.
3. Identify instructional material on basic molecular biology on the Internet. Download the material into the local Hole-in-the-Wall computers for unsupervised use by the children.
4. Construct two equivalent tests on basic molecular biology based upon this material, one to be administered as a pre-test as well as a post-test with the sample group of village children, the other to be applied only as a post test. The reason for creating the second test is to check for any bias in the post-test results due to children's recall of questions from the first (pre) test.
5. Administer the pre-test with the sample group.
6. Enable these children to access the downloaded material on molecular biology for 75 days without any supervision or instruction using their two Hole-in-the-Wall computers.
7. Administer the two post-tests with this sample group.
8. Identify and appoint a local mediator—not a teacher, but an adult person favourably disposed towards the children and with no knowledge of molecular biology.
9. Enable the mediator to work with the sample group for a further 75 days.
10. Administer the pre- and post-tests with the sample group.
11. Administer the post-tests with pupils in the same age group and over at the local state government school where they had been taught the subject and had higher English language proficiency.
12. Administer the post-tests with pupils in the same age group and over at the private urban school where they had also been taught the subject and had higher English language proficiency.
13. Compare the test results.

*The settings for the research*

We selected the village of Kalikuppam for our study. Kalikuppam (village of the dark well) is located in the territory of Pondicherry in southern India. Pondicherry comprises four districts: Pondicherry, Karaikal, Yanam, and Mahe. Karaikal is on the eastern coast about 140 km south of Pondicherry and 300 km south of Chennai (Madras). There are 10 fishing villages spread along the coast, one of which is Kalikuppam, a small hamlet 10 km from Karaikal. There are 175 families in this hamlet. The language spoken is Tamil. There are around 120 children in the 5–15 age range. Their parents are mostly illiterate. The only occupation in Kalikuppam is fishing. All of the men go fishing and most of the women vend the fish. The village was destroyed in the 2004 Asian Tsunami and there were many deaths (Figures 1–3).

There is only one (primary) school in Kalikuppam, at the time (2007), teaching from 1st to 8th standards. The original building was destroyed by the Asian Tsunami of 2004 and the school was re-opened in a temporary shed built by an NGO in January, 2005. Ninety children attend the school. The medium of instruction is Tamil.

NIIT Limited, an education and training company and the originators of the 'Hole-in-the -Wall' experiments (Mitra and Rana, 2001), had constructed a public computer

*Figure 1: Kalikuppam village showing the signs of Tsunami damage. The Bay of Bengal is a few metres to the right of the photograph*

*Figure 2: Young and old using the Hole-in-the-Wall kiosks in Kalikuppam village*

facility for the children in Kalikuppam. This was established in January 2006 and the children used this regularly, having learnt to do so by themselves.

There is a state government secondary school in Thiruvettakudy, teaching from the 1st to 12th standard, 8 km from the Karaikal bus stand and 2 km from Kalikuppam. The medium of instruction in this school is also Tamil. Biotechnology is taught here from 10th standard onwards in accordance with the state government curriculum.

*Figure 3: Children at a Hole-in-the-Wall computer in Kalikuppam. The girl in the foreground is the 14-year old 'Amita' who became the 'teacher' of the other children*

There are several higher education colleges in the Karaikal region but none of these offer any courses in molecular biology, biotechnology or bioinformatics.

*Selection of Internet resources*

Drawing on the expertise of two biotechnologists, the following Internet resources were identified. The material varied from relatively simple to complex:

- http://tiki.oneworld.net/genetics/home.html (Lightspan Academic Excellence Award Winner)
- http://learn.genetics.utah.edu/units/basics/index.cfm (University of Utah)
- http://learn.genetics.utah.edu/units/biotech/index.cfm (a virtual Biotech Laboratory)

The experts then went on to construct two equivalent tests based on the identified Internet resources. One test to be used as a pre- as well as a post-test, the other test to be used only as a post test to check for any recall of the first test by learners since they are administered the first test twice.

It should be mentioned here that while the two tests seem to produce comparable results, the second test is possibly somewhat easier than the first and consistently produces better results. However, the difference is marginal and not considered important for the purposes of this study. The tests were administered in English.

*Work with the experimental sample group*

The experimental sample group of 34 children was drawn randomly from Kalikuppam village. Their ages ranged from 10 to 14 years (standards 5th, 6th, 7th and 8th). The children were told, 'There is some interesting new material on the computer, it is in English and it may be a bit hard to understand, but will you take a look at it?' The choice of words used was seen as important. 'Will you take a look at it?' is less formal than saying 'We want you to study the material'. The children were never directly asked to learn anything.

A pre-test and two post-tests, as described above, were administered with this group after 75 days. Each test consisted of 20 multiple-choice questions. A sample question is given below:

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12. There is a biological molecule given to you. The number of A + T = Number of G + C. Identify the most likely molecule:

a) RNA ☐
b) tRNA ☐
c) DNA ☐
d) MRNA ☐

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*Work with the other schools*
To carry out steps 11–13 described above: A state government school was identified in the nearby town of Thiruvettakudy. This is attended by lower and middle class children from the surrounding communities and its performance in the secondary education examinations is average-below average. The post-tests were administered with a random sample of 10 students in the same age group as the experimental group and 15 students 16 years and above.

A private urban school in New Delhi was also identified. This is considered an 'elite school' and is popular with high-income families in the city. Its results in the secondary education examinations are usually excellent. A random sample of 34 children in the same age group as the experimental group in Kalikuppam was selected for testing and another random sample group of 15 students 16 years and above. The same tests as above were used for this purpose.

*The use of mediation*
For steps 8–10 in the experimental design, we identified a young woman whom we will call 'Prerana' in a local NGO in Kalikuppam to act as mediator. She had no knowledge of molecular biology but she had a good manner with the children who knew her well and were friendly towards her. She was asked to make positive, encouraging remarks on what the children had learned and encourage them to further explore the information and ideas. She did so for a further 75 days. The sample group were again required to take the original pre-test (as one post-test) and the other post-test.

At the end of this period, 'Prerana' reported that all the children were able to pick up on words like:

- Neurons
- Parts of the body
- Heart
- Brain
- Virus
- Bacteria
- DNA
- RNA
- Heredity
- Chromosomes
- Living things
- Non-living things
- Yeast

It was even found that some of the children who were earlier in 4th standard and were now in 5th standard (approximately 8 years old) seemed to be capable of using these terms. While we did not test their understanding because they did not form a part of the experimental group, we assumed that children other than the experimental group had been examining the online material and discussing it with the others.

The question then arose, had the children simply memorised some facts about molecular biology without actually understanding the material or its ramifications? In answer to this, 'Prerana' was able to report that they:

- Had started relating what they had learned from the Internet to the TV advertisements they had seen. Seeing an advertisement for toothpaste, they showed that they understood how this prevented germs from affecting their dental health, and although they had never seen or used, disinfectants, they could explain that these products were meant to kill bad bacteria and viruses.
- Were able to classify the good and bad effects of bacteria, for example by explaining how milk turned into curd because of the bacteria.
- Had started using English terms in their day-to-day language and were attempting to read English.

It is necessary, at this point, to mention that while we seem to have found evidence of 'understanding', the relative importance of 'deep learning' in the context and location of this study needs elaboration. It has often been asked if self-organised 'Hole-in-the-Wall' learning really can be called 'deep learning' and whether the ability to answer multiple-choice questions can be treated as evidence of learning. In this study, we use the terms 'knowledge' and 'understanding' to mean the learner's ability to successfully answer such tests. We are describing a part of our planet where children, with nothing other than a street-side computer, are able to answer tests on their own. They have no teachers or educational support from their parents or anyone else in the community and they lack the healthcare, nutrition, sanitation and other conditions of modern living that we, in more developed parts of the world, can take for granted. To berate their efforts with comments about the lack of 'deep' learning is a sad reflection on our 'shallow' understanding of the problem. We would argue that what children achieve routinely in hundreds of 'Holes-in-the-Walls' in some of the remotest places on earth is nothing short of miraculous—a celebration of learning and the power of self-motivation. The strange, non-intuitive and unbelievable emergent phenomenon of self-organising systems is something that few social scientists are aware of, leave alone the possible ramifications.

The mediator's role was important to this study. 'Prerana' had no knowledge of biotechnology so she was initially reluctant to act as a mediator, believing that she could not be an effective 'teacher' for the subject. We then explained that all she had to do was simply commend the children for their efforts and encourage them to go further in their investigations, not actually instruct them. We suggested a 'grandparent' model of encouragement, using phrases such as 'I wish I could do that!', 'how on earth did you figure that out?', 'I could never have understood that' or 'please explain this in simple words to me, I am very scared of science'. What happened as a consequence of this was that the children taught her.

'Prerana' was also able to describe the learning methods used by the children in Kalikuppam. She reported that a 14-year-old girl whom we will call 'Amita' was arguably the most important factor in the children's learning. She took on the role of 'teacher' in the unsupervised part of the experiment, that is to say, the initial 75 days. The reasons for this were unclear, but 'Prerana' suggested that she was trying to establish peer superiority within the group, particularly in regard to the boys. At the start of the process, the boys had suggested that she would not be able to understand the subject and that they would 'work it out' for her. She then spent a lot of time and effort countering this attitude towards her and over time, transformed herself into a teacher of the subject.

While we do not have data on the nature, duration or frequency of usage by the children, we do know, anecdotally, that the children interacted with the computer in groups of four or more, daily, for about 2 hours or so. From the authors' experience, most of the time would be used for games and some time, say 20%, for 'looking at things'. The reason for spending two hours is probably because this is the time they could afford given their school times, household chores, homework and regular playtime. Since there were two computers and about 100 children in the village, the 2 hours were also shared between many children. It is an untested but intriguing possibility that the learning we observed and measured with our experimental group of children could well have spread to all or most of the children in the village.

## Results

Table 1 shows the consolidated data including all sample sizes, mean scores and standard deviations.

Figure 4 shows the results for first two phases of learning by the sample group in Kalikuppam, that is, unsupervised for 75 days and mediated for a further 75 days. On their own, the sample group surpassed the Government school and came close to the

*Table 1: Consolidated test results*

| The Kalikuppam Experiment—Consolidated Test Results | | | | | | |
|---|---|---|---|---|---|---|
| | | *Test 1* | *Test 1* | *Test 2* | *Test 1* | *Test 2* |
| Sample | | *Day 1* | *Day 75* | *Day 75* | *Day 150* | *Day 150* |
| Kalikuppam | | | | | | |
| 10–14 year olds | *n* | 34 | 34 | 34 | 34 | 34 |
| 7th standard | Mean | 7 | 27 | 30 | 52 | 51 |
| | SD | 8 | 11 | 9 | 17 | 16 |
| Government School | | | | | | |
| 10–14 year olds | *n* | | | | 10 | 10 |
| 7th standard | Mean | | | | 4 | 5 |
| | SD | | | | 2 | 1 |
| Urban elite private school | | | | | | |
| 10–14 year olds | *n* | | | | 34 | 34 |
| 7th standard | Mean | | | | 44 | 53 |
| | SD | | | | 13 | 18 |
| Government School | | | | | | |
| 16 year olds | *n* | | | | 15 | 15 |
| 10th standard | Mean | | | | 29 | 32 |
| | SD | | | | 15 | 11 |
| Urban elite private school | | | | | | |
| 16 year olds | *n* | | | | 15 | 15 |
| 11th standard | Mean | | | | 67 | 76 |
| | SD | | | | 13 | 12 |

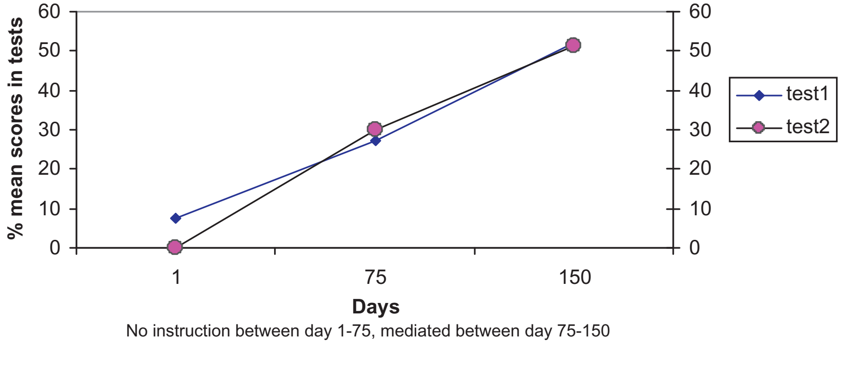


*Figure 4: Progress of unsupervised students followed by friendly but not knowledgeable mediation*

urban elite school in the first 75 days. In the next mediated 75 days they surpassed the 10th standard 16 year olds in the government school and reached the levels of the 7th standard learners in the urban elite private school. The progress made by the students alone was considerable and it was enhanced to the level of good formal schooling through encouraging, friendly but not knowledgeable mediation.

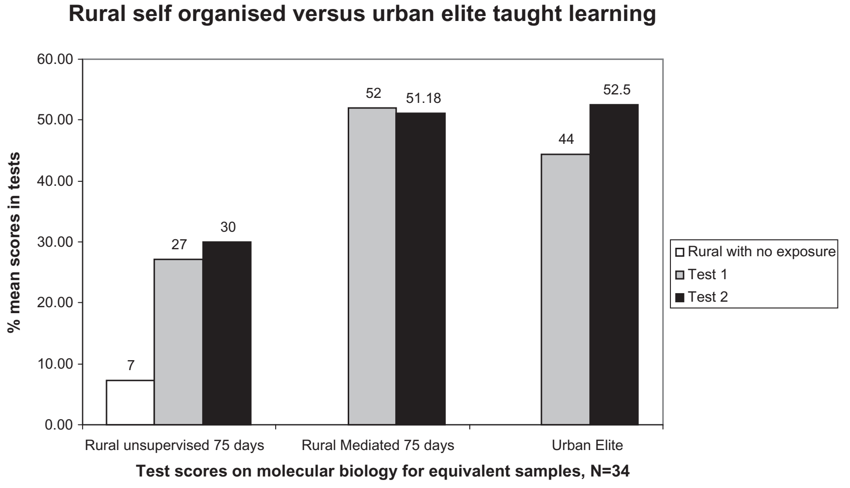


*Figure 5: Progress of unsupervised, then mediated learning, by the disadvantaged but self-organised rural children compared with urban, elite and taught children. The score 7 on the left is the baseline score in the Kalikuppam sample and is attributed to random guessing*

Figure 5 shows the progress made by the Kalikuppam sample group in the 150-day period compared with the random group of the same age group in the New Delhi school who were taught be a subject teacher. The two groups achieved the same test scores despite the rural group not having any access to a subject teacher.

Figure 6 shows the test performance of the random group of 10 children in the state government school in Thiruvettakudy. This compared unfavourably with the performance of the random sample in the New Delhi urban elite school, despite there being a molecular biology teacher in the rural school. These test scores would suggest that the subject was badly taught in the local secondary school and that 'Hole-in-the-Wall' type learning need in no way be inferior to the teaching and learning in some regular schools.

Figure 7 compares the mean scores of the random groups in the Thiruvettakudy state government school and the New Delhi elite private school. Our baseline scores (Figures 1 and 6) indicate that 10–14 year olds in the state government school in the rural area had little or no knowledge of molecular biology while similarly aged children in the New Delhi school had a mean score of 44 and 53%, indicating considerable knowledge of the subject. This is corroborated by Figure 6, where the urban senior children score 67 and 76% in the two tests as compared to 29 and 32% in the rural Government school. The curriculum of both schools is similar, since both follow government curricula, and both schools have teachers of molecular biology. This provides further indication of the yawning gap in quality of teaching and learning processes and outcomes between poor and rich and rural and urban schools.

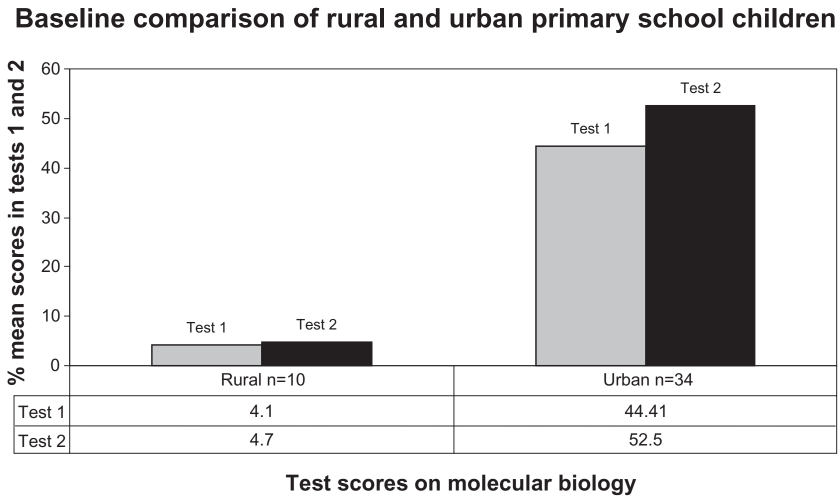


*Figure 6: Test scores on molecular biology in rural government and urban elite school children*

## Discussion

Given these findings, it becomes clear that to improve the learning outcomes in the rural schools, there is need to improve teaching quality or look for alternative pedagogy. Improving teacher quality through pre- and in-service teacher training does not necessarily address this problem because trained and competent teachers are always more likely to avoid working in, or keen to migrate away from, the remote areas and seek higher-paying jobs in the better-resourced urban schools. So appointing and retaining teachers will always be problematic in remote, disadvantaged and marginalised communities, in India as in elsewhere in the world. In this study, we have sought to show that this situation may be remedied, at least in part, by providing a self-organising system of learning using computers and the Internet. Further, we attempt to show that there can be advantages in augmenting purely unsupervised learning by the provision of a friendly, but not knowledgeable, mediator.

Figure 4 shows that the sample group performed well in a subject they knew nothing about and in a language with which they were unfamiliar. Other children in the area around Kalikuppam had virtually no knowledge of the subject and therefore could not have helped this sample group of learners. But even without any help from other children or adults, the children working in unsupervised groups around a Hole-in-the-Wall computer were able raise their test scores from 7% to about 30% in 75 days. A further period of 75 days with a mediator increased their scores to about 51%. These scores were comparable with those of children of the same age, taught by a trained and experienced teacher, in a privileged private school in the nation's capital.

## Conclusions

The original studies on Hole-in-the-Wall experiments (Dangwal, 2005; Dangwal & Kapur, 2008; Mitra and Rana, 2001; Mitra *et al.*, 2005) describe the process of self-

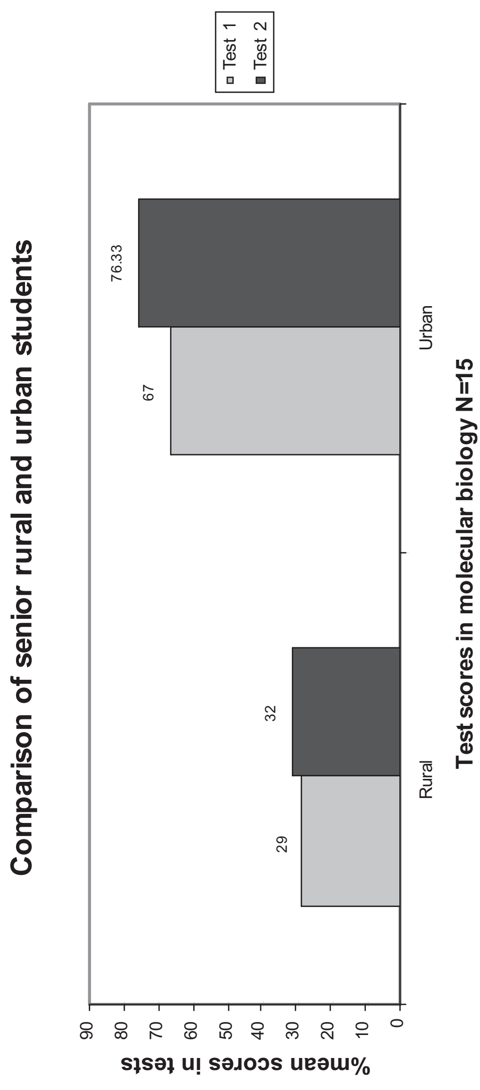


*Figure 7: Comparison of test scores of the senior, 16 year old, students in the rural government and urban elite schools*

learning as 'minimally invasive' (a term borrowed from modern surgical processes). However, these studies did not detail what the nature of such minimal invasion or minimal intervention should be.

A study with connected cellular automata by Mitra and Kumar (2006) shows that presented with a 'vision of the future', a self-organising system will retain this image as a fractal and reproduce it periodically. The human brain is a connected system of neurons and will, presumably, behave similarly. In other words, the introduction (intervention) of an image to a neural network will cause it to retain and reproduce this image periodically. It is tempting, albeit speculatively, to link this effect with human learning.

In the current study, an initial vision was presented to the village school children in the form of a short introduction that promised an interesting outcome but did not specify what the field of study or nature of the learning was to be. It was then shown that given unsupervised access to a computer with Internet-based instructional material the children were quite capable of organising themselves into self-learning groups and, without supervision and instruction, achieving the same levels as their peers in a nearby state government school but not those of similarly aged children in an affluent, urban school. So self-organised learning has its limits. In unsupervised environments such as the Hole-in-the-Wall, different children do what they like doing and therefore tend to excel in their particular areas of interest. Not everybody learns something about everything. Some individuals may benefit; others may not. Discussion on these matters is beyond the scope of this paper. But what this study has shown is that if pupils such as those in the village of Kalikuppam are then provided with a friendly mediator who provides supervision but exercises minimal intervention (encouraging rather than teaching), these issues are less likely to be a problem.

The problems of appointing and retaining well-qualified and highly motivated teachers are not limited to the rural areas. They also occur in schools in poorer or marginalised urban areas. Furthermore, while this research has implications for providing schooling in disadvantaged areas of India and elsewhere, it might also be hypothesised that the approach could be employed in conventional, well resourced and well-staffed schools to reinforce and enhance traditional teaching, for example where there are very large classes and/or where lesser qualified teachers' aides are employed. It may even be possible to develop a model for future schooling where children working in groups with access to the Internet and a friendly mediator, can complete large parts of the school curriculum through autonomous or semi-autonomous study. While this may appear to be a less random approach to the subject matter, it need not be so. In our experiment above, the children were unaware of the fact that what they were 'looking at' was curricular material. In the authors' opinion the curricular agenda can be kept at the planning level, while learning material can be designed to excite children's curiosity. However, a further discussion of this is beyond the scope of this paper. Also, it still needs to be shown whether such a model is replicable, sustainable and capable of providing all children with equal opportunity for quality education. However, this paper concerns pedagogical issues. Questions of sustainability and replication are beyond its scope and purpose.

## The follow-up

The question now was—would this approach apply in other educational and cultural settings? Based on the findings from Kalikuppam, one of the researchers proceeded to conduct a set of experiments in Northeast England. In these, with the help of the Internet, unsupervised groups of 8–12 year-olds attempted to answer GCSE questions that they would be examined on at the age of 16. The results were consistent with the Kalikuppam findings. Each group was shown to be able to consistently find the right answers, provided that:

1. They were allowed to form themselves into groups of about four.
2. Each group has access to its own computer.
3. The pupils were allowed to talk to each other and share information between the other groups.
4. There was no teacher present, only a minimally invasive mediator. Sometimes a teacher would sit quietly in a corner and not speak or be obtrusive.

## SOLE and SOME

Based on these as yet unpublished findings, we have established 12 'Self-organised Learning Environments' (SOLEs) in disadvantaged areas of India. These have been built in several locations to facilitate self-organised learning—to enable children to work in groups, access the internet and other software, follow up on class activities or project or take them wherever their interests may lead. Typically, a SOLE is a 'room' located in school premises which is clearly visible to all those who pass There are usually nine computers in clusters of three to facilitate the children's interaction across computer terminals as well within their groups. There are usually four children per computer working or playing together, but you will often find many more standing behind them, watching what's going on. Recently (March, 2010), a SOLE has also been set up in the Newcastle University.

While it is found that these children do not need adult supervision, this does not mean that they could not benefit from friendly mentors or mediators. To overcome the problem of finding such persons, various people across the world, most typically retired teachers, have volunteered to devote one hour a week to working with groups of children via Skype, the popular and free peer-to-peer Internet-based videoconferencing system. We call this a 'Self-organised Mediation Environment' (SOME). We intend to find out if the SOLE + SOME models can compensate for an absence or poor quality in conventional schooling. We are studying whether such interactions will improve the children's English, social interaction skills, value systems and school performance. We can imagine a world where thousands of such mentors/mediators are available to children over the Internet, providing a real face-to-face sense of presence, reading stories, conversing, singing and encouraging and supporting the children in their

*Figure 8: A mediator in Newcastle, UK, interacts with children in Hyderabad, India*

learning (see Mitra, 2009 and the website https://solesandsomes.wikispaces.com) (Figure 8).

**Acknowledgements**
We gratefully acknowledge funding from the Education Fund of Orient Global. We are grateful for the time, permissions and resources provided by Newcastle University and NIIT Limited.

This paper was improved immensely with the help of reviewers and editors of the BJET, particularly, we would like to thank Colin Latchem for his time and contributions.

The authors are grateful for stimulating discussions during the design phase of the experiment with Professor James Tooley of Newcastle University.

The village of Kalikuppam was identified as an appropriate location for the study by Arun Kapur, the Principal of the Vasant Valley School, New Delhi. Without his help, this experiment would not have been possible.

The authors are grateful to the Principal, the science teacher and Rekha Peter in the village of Kalikuppam.

The Kalikuppam Hole-in-the-Wall facility was constructed by Ravi Bisht who later went on to design and construct the SOLE facilities in India.

The existing SOLE facilities are managed and studied by Suneeta Kulkarni from India, while the SOME website is designed and maintained by Mabel Quiroga from Log & Learn, Argentina. Without their help, the latter part of this study would have been impossible.

The authors are grateful to head teachers and teachers at several schools in Northeastern England who are pioneering these methods in their schools. We would particularly acknowledge the interest and contributions of Emma Crawley.

Finally, we cannot thank enough the brave, often retired, teachers of Britain and elsewhere who, week after week and often struggling with the unfamiliar technology, 'beam' themselves into the slums and villages of India to interact with children who have so very little and who need their help so very much.

## References

Dangwal, R. (2005). Public computing, computer literacy and educational outcomes: children and computers in rural India. In C.-K. Looi, D. Jonassen & M. Ikeda (Eds), *Towards sustainable and scalable educational innovations informed by the learning sciences* (pp. 59–66). Amsterdam, Berlin, Oxford, Tokyo & Washington, DC: IOS Press.

Dangwal, R. & Kapur, P. (2008). Children's learning processes using unsupervised 'hole in the wall' computers in shared public spaces. *Australasian Journal of Educational Technology*, *24*, 3, 339–354.

Inamdar, P. (2006). Computer skills development by children using hole in the wall computers in rural India. *Australasian Journal of Educational Technology*, *20*, 3, 337–350.

Mitra, S. (2003). Minimally invasive education: a progress report on the 'Hole-in-the-wall' experiments. *The British Journal of Educational Technology*, *34*, 3, 367–371.

Mitra, S. (2009). Remote presence: 'beaming' teachers where they cannot go. *Journal of Emerging Technology and Web Intelligence*, *1*, 1, 55–59.

Mitra, S. & Kumar, S. (2006). Fractal replication in time manipulated one-dimensional cellular automata. *Complex Systems*, *16*, 3, 191–208.

Mitra, S. & 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., Tooley, J., Inamdar, P. & Dixon, P. (2003). Improving English pronunciation: an automated instructional approach. *Information Technologies & International Development.*, *1*, 1, 75–84.

Mitra, S., Dangwal, R., Chatterjee, S., Jha, S., Bisht, R. S. & Kapur, P. (2005). Acquisition of computer literacy on shared public computers: children and the 'Hole in the wall'. *Australasian Journal of Educational Technology*, *21*, 3, 407–426.

Mitra, S., Dangwal, R. & Thadani, L. (2008). Effects of remoteness on the quality of education: a case study from North Indian schools. *Australasian Journal of Educational Technology*, *24*, 2, 168–180.

Nicaud, J. F., Bittar, M., Chaachoua, H., Inamdar, P. & Maffei, L. (2004). Experiments of Aplusix in four countries. *International Journal for Technology in Mathematics Education*, *13*, 2, 79–88.