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Effectiveness of Self-Organised Learning by Children: Gateshead Experiments

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Abstract

Children, working in groups and using the Internet, seem capable of learning content traditionally considered to be ahead of their time and comprehension levels. In this paper we describe four experiments to measure children's achievements in learning in Self Organised Learning Environments (SOLEs). We report the results that seem to suggest that, in Self Organised Learning Environments, children can learn ahead of their time, retain the learning over time and enjoy the process enough to explore further on their own. The results also suggest that children in groups can read and comprehend at higher levels than the comprehension levels of each individual in the group.

Keywords:cooperative/collaborative learning; elementary education; improving classroom teaching; pedagogical issues

1. Introduction

In this paper, we attempt to measure the effectiveness of self-organised learning environments (SOLEs) for children (Mitra,2010). The design of SOLEs in schools resulted from a series of experiments on unsupervised use of the Internet by groups of children. The context and conclusions from these experiments are described below.

Since 1999, a number of experiments seem to suggest the existence of a pedagogical method that is considerably different from the traditional methods used in schools in the last century.

Among the first of these are a set of experiments often referred to as the 'hole in the wall' experiments. Here, computers, connected to the Internet, were embedded into walls in villages and urban slums in India, much like public ATMs used by banks but with larger screens and placed at a height such that it was convenient for 8-13 year olds to use them. There was no specific learning software on these computers and no instructions given to the children about what they were and what they were for, except for a sign that said they are for free use by children. In 1999, poor children in India often did not know what a computer was and were quite unaware of the Internet. A study over 5 years (Mitra et al, 2005) showed that children were able to learn how to use the computers to play games, download media and search for information, among other things. Moreover, the locations were chosen such that, other than the fact that these machines were computers, the local adults had no other knowledge of how to use them. Also, these installations were designed such that it was nearly impossible for adults to use. Using a random sample of children in 17 locations all over India, and various tests, It was concluded that the children had learned to use the computers by themselves. This is, of course, no surprise today (2014).

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Photo 1: The Hole In The Wall experiments 1999-2005

These 'hole in the wall' computers remained in working condition for about two years after the experimental period, as there was no funding available to maintain them after that.

During this period, a number of experiments showed that children, working in groups, demonstrate educational achievements in these, unsupervised, environments. These achievements are described briefly in what follows. To describe each of the experiments that followed the original 'hole in the wall' study would be beyond the scope of this paper. The methods of data collection and analysis are all described in the publications referenced – all of which are internationally peer reviewed.

It is important to note that to reach educational objectives, children invariably worked in groups, interacting constantly with each other, in a somewhat chaotic manner. There was very little similarity with an orderly learning environment such as provided by a school classroom. Based on these observations, it was suspected that the learning was the outcome of a self organising system. The term 'self organising system' is used here in the same sense as it is used in the physical sciences or mathematics – a set of interconnected parts, each unpredictable, producing spontaneous order in an apparently chaotic situation.

To summarise the results from these experiments carried out between 1999 and 2013, we observe that groups of children (usually 8-13 year-olds), given access to the Internet and left unsupervised:

1. Can learn to use computers and the Internet by themselves, irrespective of whom or where they are and what language they know. (Mitra et al, 2005, De Boer, 2009)
2. Can achieve educational objectives by themselves. A number of studies were conducted to show this. Among them were studies that showed that children were able to complete standard school examinations in Computer Science and mathematics (Inamdar and Kulkarni 2007), they were able to improve their English pronunciation by themselves (Mitra et. al. 2003) and showed improvements in their school achievement (Dangwal and Thounoujam, 2011, , Dangwal et. al. 2014).
3. Show self-organising behaviour resulting in learning at 'Minimally invasive' environments (Dangwal and Kapur, 2009a, 2009b, 2008).
4. Understand content years ahead of their time (Mitra, 2012, Inamdar 2004).

In an experiment to find the limits to such self organised learning, it was found (Mitra and Dangwal, 2010) that groups of Tamil speaking children in a southern Indian village were able to understand (as established by pre and post testing described in the publication cited above) the basic concepts of bio-technology on their own in English. This, rather astounding, result seemed to indicate that children in groups were able to reach levels of learning years ahead of their time. However, their understanding was considerably less than that of a control group who were taught the same subject.

It was then found that an affectionate and admiring, but not knowledgeable, adult was able to equalise the levels of learning between the control and experimental groups. This was described as the 'grandmother's method' (a friendly, non threatening and admiring adult presence).

Current Experiments

Can these results be useful in a classroom context?

The experiments described below attempt to measure the effectiveness of learning in unsupervised environments created inside schools.

The experiments were conducted in St. Aidan's Church of England Primary School in Gateshead, England.

The school is of slightly below average size. It serves an area of considerable social and economic disadvantage and a high proportion of pupils are entitled to a free school meal. There are more pupils with learning difficulties and/or disabilities than in most schools. Most pupils are of white British heritage and very few do not have English as a home language. Children enter the Nursery with attainment well below expectations for their age.

We set up an environment simulating the conditions in the 'hole in the wall' experiments in a year 4 classroom in the school. We call this a Self Organised Learning Environment (SOLE).

A SOLE consists of a facility with one computer for every four children, approximately. Each computer is connected to the Internet. Children are given a question and asked to research the answer. Due to the number of available computers, they will need to work in groups, however they are not told to do so. They form their own groups, are allowed to talk within groups and also with other groups. They are allowed to move around, change groups and look at what other groups are doing. There is no adult intervention, from teachers or otherwise. In case of significant disorderly behaviour, the children's help is sought to sort things out. At the end of about 45 minutes, each group is asked to present their results briefly.

SOLE sessions in a classroom can be set up in the following ways:

- Timetabled usage: Each class should have at least one session of about 90 minutes in the SOLE, timetabled every week. During this time, a teacher will engage the children with a question that they answer using the SOLE. Examples of questions could be, "Who built the pyramids and why?" "What are fractals?" "Why is blood, red?" "Who is Gandhi and what did he do?" "Where is Botswana and what is it famous for?" Etc.

For each session, the children would form their own groups of around four each, of their own choice. Each group is allowed to use one computer with Internet access. Children are allowed to change groups, talk to each one another, talk to other groups and walk around looking at other's work. There are very few rules. The teacher's role is minimal, to observe the children and stay out of their way. About 30 minutes before the end of the session, the groups should produce a one-page report where they describe what they have found. The teacher can then expand on this in a later class.

- Curricular usage: This is similar to the above except that the driving question is one taken from the school- leaving examination (for example CBSE in India or GCSE/SAT in the UK).
- Aspirational usage: In these sessions, children listen to a short lecture from an interesting website on the Internet for example, TED talks (www.ted.com). They then research the talk in groups and present their findings.

- Free usage: The SOLE should be open for use by any child in the school before and after regular school hours. It should be made clear to the children that they can use this time to play games, chat or do whatever they wish. As usual, working in groups will happen due to the number of computers available. All screens in a SOLE needs to be large and clearly visible to all children and passing adults. SOLEs should, preferably be conducted in enclosures with transparent walls.

We set up several SOLE sessions to let the children get used to the new way of working. After their initial disbelief that we will let them do 'anything they like', the children reacted with great enthusiasm and declared the SOLE to be a great way to learn. The essences of their feelings are summed up in the following conversation:

After a SOLE session on a difficult topic on electricity:

Child: 'Aren't we going to do any work?'
Teacher: 'What were you doing so far?'
Child: 'Learning'
Teacher: 'And what is 'work'?'
Child: 'When you tell us things and we have to write them down'

2. Research Questions

We decided to investigate:

1. Can groups of children, using the Internet, answer test questions ahead of their time and obtain acceptable test scores?
2. What difficulty levels (ie, how far ahead of their time) can they obtain acceptable test scores when working in groups and using the Internet?
3. Do they retain what they have learnt in groups, individually?
4. Can children read and understand better in groups than individually?

It is important to mention that each question, after question 1, was formulated based on the results of the experiment designed to answer the previous question.

3. Experiments

We conducted 4 experiments over a three-year period from 2009 to 2011. After the first, each experiment was designed with the results of the previous in mind. In what follows, we will describe each experiment and its results in sequence before proceeding to a discussion on the findings.

3.1 Experiment 1 (July-October 2009)

We gave the year 4 class (8 year olds), 5 GCSE questions, that were eight years ahead of their time. They were asked to answer the questions in 45 minutes, using the SOLE method, which they were by then familiar with. We then waited for three months and tested the children individually with the same questions and without the use of the Internet. The results are shown in Figure 1. The questions related to how animals adapt to their environments. For example:

Give the main survival advantage of each of the following adaptations:

For example, a rabbit's large ears allow it to hear predators from far away.

a) A polar bear's white coat;
b) A hedgehog's spikes;
c) A cheetah's bendy spine;
d) An eagle's sharp claws;
e) A lion's powerful teeth.

When the groups handed in their answer papers, we graded them and assigned the same score to each member of the group.

We then waited three months and tested each individual for retention of learning by having them answer the same five questions in the traditional manner, that is, without using the Internet or discussing with each other.

During the three months there were no inputs related to the 5 questions in their regular school work.

The results are shown in figure 1.

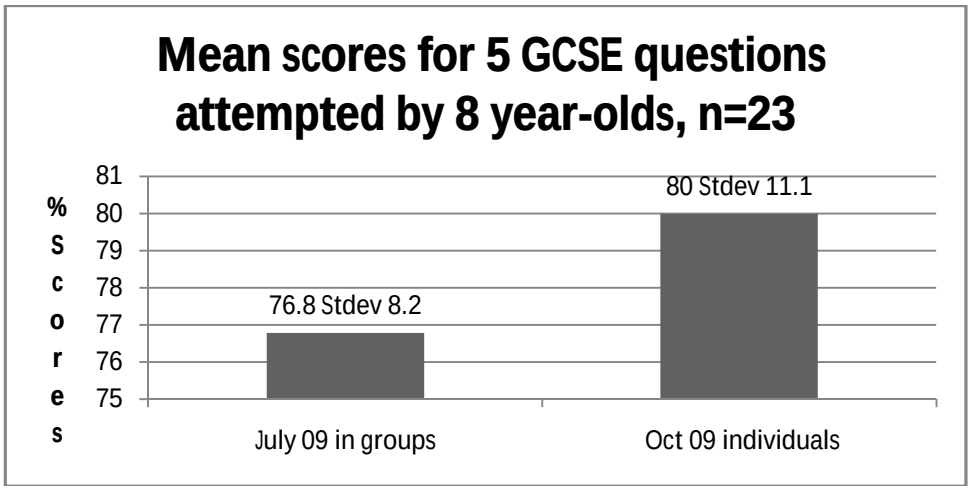

Figure 1: The Results of Experiment 1, on Animal Adaptation. July – Groups with Internet, Oct – Individual Recall

The results show that the children retained the answers three months later. The individual scores in the later test were actually higher than on the day they researched the questions. The children explained that they had researched further in their own time; some had discussed the topic with their parents and then discussed it with their classmates. This may explain the strange result of a test result improving over time with no formal inputs in the interim.

3.2 Experiment 2 (March – June 2010)

We decided to try more 'difficult' subjects. We assembled 3 tests on GCSE Physics and Biology.

Example:

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1. In which direction does friction act?

- ☐ In the same direction as the direction of movement
- ☐ In the opposite direction as the direction of movement
- ☐ At 90 degrees to the direction of movement

We then repeated the procedure of experiment 1. That is, the children answered the tests in groups with the help of the Internet and were retested three months later individually and without the use of the Internet. Once again we made sure that the children received no instruction in school related to the questions they had answered during the three month period between the two tests. The results are shown in Figure 2.

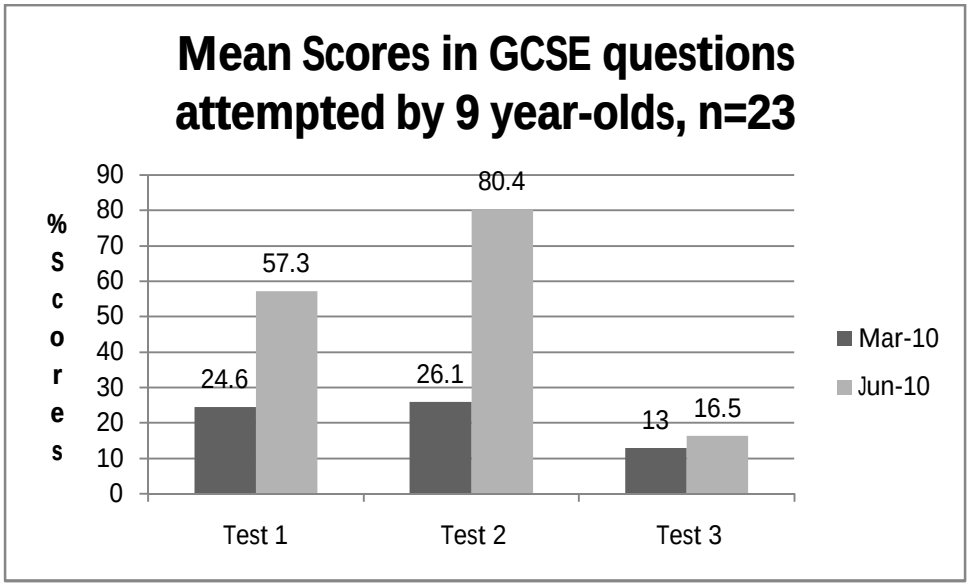

Figure 2: Results of Experiment2 on Physics and Biology, March in Groupswith the Internet, June – Individual Recall

While the children had no formal inputs during on the topics they were tested on, we notice that that their scores are significantly higher in the later test. The children's explanation was that the 45 minutes given to them to research and answer the tests was insufficient and they had continued the research at home and in school.

This is quite contrary to the belief that learners 'forget everything' after an examination and would do badly in the same examination at a later date unless they 'prepared' again for it. In our case, the children had no idea that they would be given the same test again three months later.

We decided to call this 'anomalous expansion of understanding'. Perhaps it is a characteristic of the age groups and the technology we were working with.

3.3 Experiment 3 (November 2010 – February 2011)

The results of the first two experiments were intriguing enough for us to work with more difficult subjects. We decided to use GCSE A Level questions for our experiment. The subjects chosen were topics from molecular structures, radiation and geography.

Example:

6. Compared to a body cell, a gamete contains:

- ☐ Half the genetic information.
- ☐ The same amount of genetic information.
- ☐ Twice the genetic information.

This time we also decided to check whether the children had any knowledge about these subjects to start with. The effects of television and other media on children are unpredictable and we decided to check if these were biasing our results. The children were from Year 4 and not the same as the children in the first two experiments, who had moved on to year 5.

The children were tested on questions from the three areas in groups and without the Internet to start with. They were then tested after they had worked on the questions in groups using the Internet. Finally, after three months we tested them individually and without the Internet. The results are shown in Figure 3.

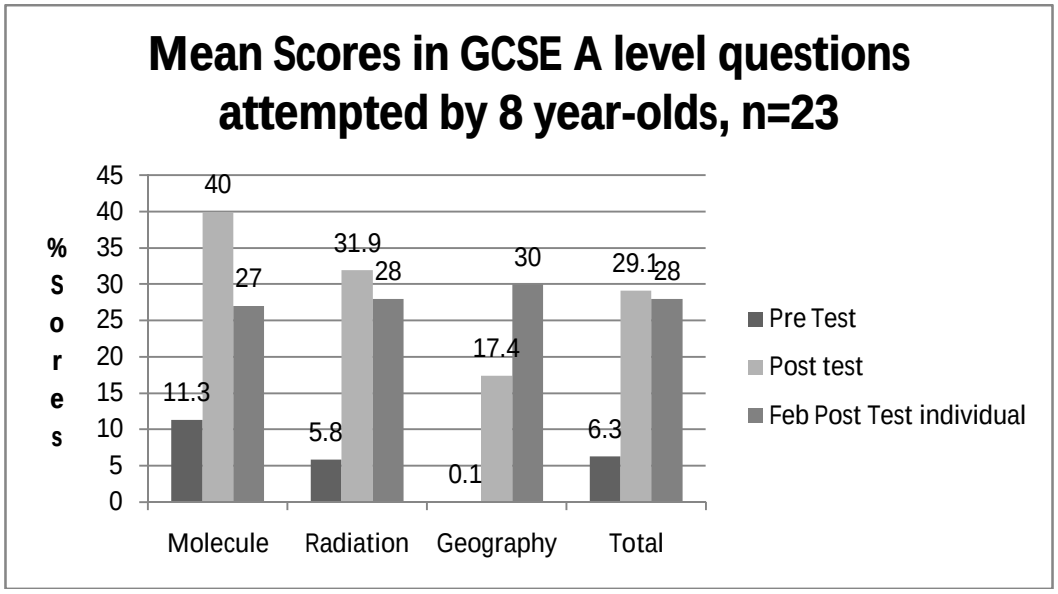

Figure 3: Results of Experiment 3 with Molecular Structure, Radiation and Geography. The Pre-Test is for Groups without Internet, Post-Test are for Groups with Internet and the February Post-Test is Individually Without Internet

We see from Figure 3 that the children's initial knowledge of the subjects was negligible. However, we do notice that when they are allowed to answer the questions in groups without the Internet, they still manage to guess a few correct answers. A child in a similar experiment in Uruguay (Mitra, S. and Quiroga, M. 2012) has told one of us, 'Four heads are better than one'.

The subject areas and questions we had chosen were meant to be answered by children nine years older than the children of year4. However, we notice that in groups and with the help of the Internet the children were able to make significant progress in 45 minutes. Strangely, the subject they knew the least about to begin with, Geography, and where they made the least progress with the SOLE method, was the one where they demonstrated the highest 'anomalous expansion of understanding'. We do not have data to explain this but we speculate that any help they may have sought after the SOLE, from parents or other teachers would have been available more easily in Geography that in the other areas. Indeed, in this experiment we, ourselves, did not know very much about the subjects the children were researching. The post test results from figure3 show good quality retention of learning.

3.4 Experiment 4 (June 2011)

The results of our first three experiments, along with the results of an earlier experiment in India (Mitra and Dangwal, 2010) indicate that groups of children, with the help of the Internet and without supervision, are capable of understanding topics that are traditionally considered many years ahead of their age level capabilities. How were they able to do this? We decided to test if children are capable of understanding text at levels that are ahead of their individual capabilities, if they are allowed to read in groups.

We divided a class of 17 year4 learners (different from the groups used in the previous experiments) into two sections of 8 and 9 children. One of the sectionswas told to form sub groups of 3 or 4 (of their own choice) while the others sat alone. They were then given a text suitable for 8 year olds (USA grade3 level), which was indeed the children's average age. The sub-groups were given one copy of the text to read together, while the individuals were given one copy each. They were to read the text and answer some questions at the end. Each group submitted one answer sheet while each individual handed in an individual answer sheet. After this exercise, we then interchanged the sections and repeated the process with another text.

That is, the children who had worked alone now worked in groups while the ones who had worked in groups were to now work alone. The text chosen was now a text meant to be read by 10 year olds (USA grade5 level). These reading comprehension worksheets were downloaded from http://www.superteacherworksheets.com/

Figure 4 shows the results of the reading exercise.

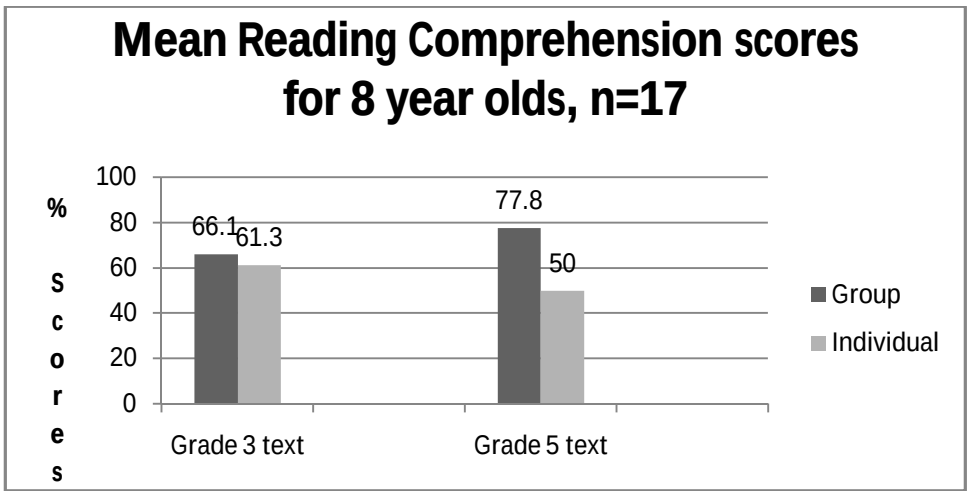

Figure4: Results of Experiment 4 on Reading Comprehension at 8 Year-Old and 10 Year-Old Level Texts

We notice that while the children read better in groups for both texts, the difference was significantly greater for the more difficult, grade 5 text.

Photo 2: A SOLE in progress in Hong Kong, China

4. Discussion

We decided to conduct these experiments based on several years of experience in conducting SOLEs in dozens of schools in England, as well as schools in Argentina, Australia, Brazil, Chile, China, India, Italy, Uruguay, and the USA.

Our observations in all these SOLE sessions was that groups of children seemed capable of dealing with questions several years ahead of their time when they worked in unsupervised groups and had access to the Internet. The quantitative results obtained from the experiments above seem to support our qualitative observations.

We should mention that these experiments were conducted in one school with small sample sizes. The validity of our conclusions needs considerably more rigorous measurements over larger samples in diverse schools. However, we feel that the suggestive conclusions from these experiments are sufficiently intriguing and require communication to other researchers as early as possible.

Children seem to enjoy working on a 'hard' question, when there is no competition and when they are in groups, using the Internet. There is some indication that the opposite is also true, namely, that children do better individually at easy things than they do in groups. However, this conjecture needs to be carefully researched.

We also notice that individual recall of the answers is consistently good over time. This seems to indicate that children in a group all learn quite uniformly although different children do different things. In a group one child operates the computer, another takes notes, a third directs the other two, while a fourth entertains, and often disturbs, the other three. They take turns at each of these roles. We also noticed 'flocking' behaviour when almost all the children will go over to another group to look at something important. Then the flock would disband and return to their groups. The facts that groups are organised by themselves and are changeable are very important to the children. The noise level in SOLEs can range from very high (chaotic) to very soft (ordered). Nothing needs to be done about this. In a SOLE conducted in London in 2013, a child said, ''I like the noise. When I hear the voices of my friends, it makes me feel….happy".

Most children seem to continue their discussions after a SOLE session, at home, in the playground or on their computers and phones.

The learning effects described above seem to work because of the ability of groups of children to read and understand material at a higher comprehension level than each individual in the group. This intellectual 'amplification' may lead us to an explanation of how the learning process in a SOLE works.

5. Conclusions

From these, small sample, studies, we conclude that groups of children, using the Internet, can answer test questions ahead of their time and obtain acceptable test scores. Moreover, the difficulty levels (ie, how far ahead of their time) they can obtain acceptable test scores when working in groups and using the Internet seems to be in excess of seven years.

Children who have attempted such questions in groups, seem to retain the answers individually for up to 3 months after the testing.

A related and intriguing result is that children seem to be capable of reading and understanding text that is, at least, 4 years ahead of their individual reading capabilities, if they are allowed to read in groups.

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