EdK12

Testing the value proposition

The AGEM Team

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1 What do we propose to do

Indian education is stuck in an 18th century factory model rut at a time when society at large is beginning to see the connection between education and prosperity. The federal government has responded by bringing in the right to education and has introduced controversial mechanisms to ensure public private partnership in implementing it.

Within this context we propose a mechanism that will recognize the key problems in terms of the outcomes of the current education system and provide solutions that are scalable, affordable, measurable and effective.

1.1 The principal problems

There are two principal problems as we see them:

1.1.1 Visible problem - The disconnect between education and the needs of employers/tertiary education

Expressed with elegant brevity by the CEO of one of India's largest employers which is also a training company, Manish Sabharwal says:

> MANISH SABHARWAL - TEAM LEASE
>
> As a staffing firm, TeamLease sadly doesn't hire 95% of the youngsters who come to it for a job. As a training firm, it estimates that 40% of these job-interview rejects need more than a year of "repair" or "preparation" to make them truly job-ready.

1.1.2 The invisible problem - In a world that is changing rapidly - is there a requirement to ensure that we are preparing our children for a future where the only constant will be change.

The issue is that in a country that is developing at 6 to 8 percent can we truly say that our children are not being prepared for change.

The evidence lies in the first problem. Our children are not being prepared for the present, let alone the future.

1.2 The principal solutions

We see this as requiring three principal measures and try to present the rationale for these measures in the following paragraphs.

1.2.1 Imparting meaningful education

Currently there is a vicious cycle created by the examination boards which have to provide mechanisms for consistent marking across the length and breadth of a very diverse country. This focuses the examination system and thereby the school system into discrete data/info relationships rather than grey area issues. In other words, there is always a clear "right" answer even if the rationale behind it is not known by the student and often by the teacher.

We need to move beyond these confines to create in children the capacity for inference i.e. the ability to apply information to new circumstances and through dealing with real world problems being to acquire what Damasio and Yang have termed "skilled intuition"

1.2.2 Inculcating decision making skills

While an infant has all decisions made for it, the adult is supposed to have competent decision making skills. This transition occurs infrequently in the home and more infrequently in the classroom. It is only in the playground, particularly in team games, where children get to make decisions, sometimes have conflicts which they usually resolve harmoniously, and get immediate feedback on the quality of the decision. We need to extend these characteristics at least into the classroom. We have to remember the famous phrase variously attributed to some individual in the British nobility that the battle of Waterloo was won on the playing fields of Harrow and Eton. The mention of classrooms is conspicuously absent. Hence the origin of the problem is not necessarily in the immediate past.

1.2.3 Inculcating participative decision processes

PIDM or participation in decision making has been shown to produce increments in performance in various industries. There are three specific illustrations. Firstly, in the figure below, one can see the relationship between the TIMMSS test and the prosperity in the country concerned. One can see that in the lower right quadrant you have a strange phenomenon that high income correlates with bottom line TIMMSS test scores. These are also countries that are not known for invoking the opinions of their citizens into government decisions.

Similarly, if one looks at the United Nations Human Development Index, the top three countries are Norway, Australia and the Netherlands. None of the 200 people who have sat through the presentation have been able to name any individual or great leader who could have carried these countries to the top of the UN HDI. On the contrary these countries are known for the equality of citizens, participative government, and a focus on education and laws against child abuse. India, leaders exuding from every pore stands at the far end of the spectrum with a position of 134 on the UN HDI.

2 What is the value proposition

Our value proposition is that we would dilute the following two problems.

2.1 the gap between school education and the needs of the workplace and tertiary education

We will endeavor to establish the validity of this problem in two ways. The Hirsch Index is a measure of how India performs against other countries. The World Bank statement is culled from a report which includes initiatives by the Govt. of India and by the World Bank.

2.1.1 The Hirsch Index

The Hirsch index is a function of the number of citations academic papers receive. India ranks 24th on the list (Country Rankings by Hirsch Index) in spite of having the world's second largest population.

2.1.2 The World Bank Report

> "there can be no major expansion or improvement of higher education in India without first improving and expanding the secondary level."

2.2 the gap between current educational outcomes and the needs of the future.

To address this, we provide an incisive statement from a World Bank Report

> "Finally, India's gross enrollment rate (GER) at the secondary level of 40 percent is far inferior to the GERs of its global competitors in East Asia (average 70 percent) and Latin America (average 82 percent). Even countries such as Vietnam and Bangladesh, which have lower per capita incomes than India, have higher gross enrollment rates. The relative success of these countries suggests that India is underperforming at the secondary level, and has scope for significantly improving access and quality of secondary education given its current (and projected) GDP per capita. It also suggests that India needs to increase public investment in secondary education to remain globally competitive."

3 Testing the value proposition - Evaluating Perceptions and capacity

3.1 The objectives

As part of creating a wider awareness of educational system issues as well as to measure perceptions as well as audience capacity, we have been giving a presentation on educational reform to various academic groups. In the context of this document our intent is to try to understand estimation abilities of participants involving non-linear change, and also to understand the perception of participants in terms of their understanding of the flow of the development of learning relative to our own understanding of it.We also invited responses on the quality of the current education system and on the scope for change.

3.2 The method

Our presentation contains slides and videos as well as embedded questions which the audience answers using individual proprietary feedback devices. These resemble a keyboard without any display and permit all members of the audience to enter a response, a summary of which is displayed immediately after the responses are completed. There has never been any need to force a time limit on responses. All responses are recorded for later analysis. The video on our page shows a small part of one such presentation where the feedback devices are visible.

3.3 The audiences

The responses that have been analyzed have been from three audiences. The first comprised a group of final year students in a journalism course. The second was a group of teachers in a low resourced local school, and the third comprised teachers and the principal from a well resourced international school. The total number of respondents was 47.

3.3.1 The questions

There are four questions which we will try to analyze here.

3.3.1.1 The compound interest problem Not all change is linear. For instance, human perception of change of intensity of light or sound is a logarithmic function, and the growth of populations whether human or viral constitute compounded growth phenomena. As most people understand compounded growth in terms of interest on money deposits, we decided to pose a compound interest problem to understand how well students, teachers and principals estimate compounded growth.

The pages below depict how the questions are posed.

3.3.1.1.1 Page 1 Here the problem is explained to add to the written explanation of the task.

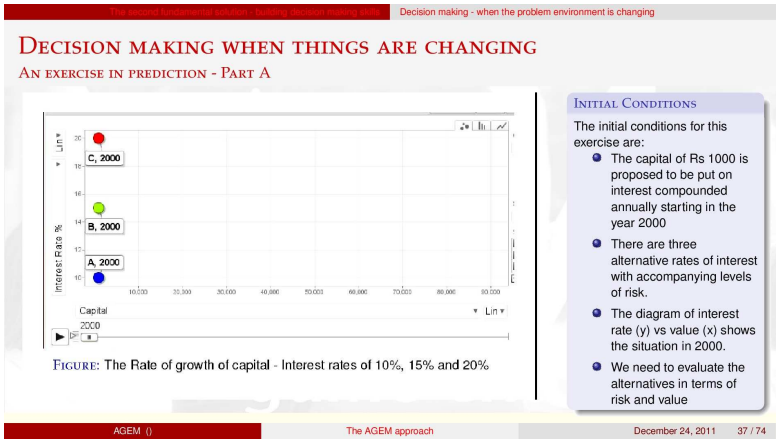


FIGURE: The Rate of growth of capital - Interest rates of 10%, 15% and 20%

3.3.1.1.2 Page 2 In order to make the task a little easier we show the growth of capital over the first 12.5 years i.e. in the middle of 2012. We then ask the participants to key in their estimate only for Option C for 2025 i.e. after another period of the same duration.

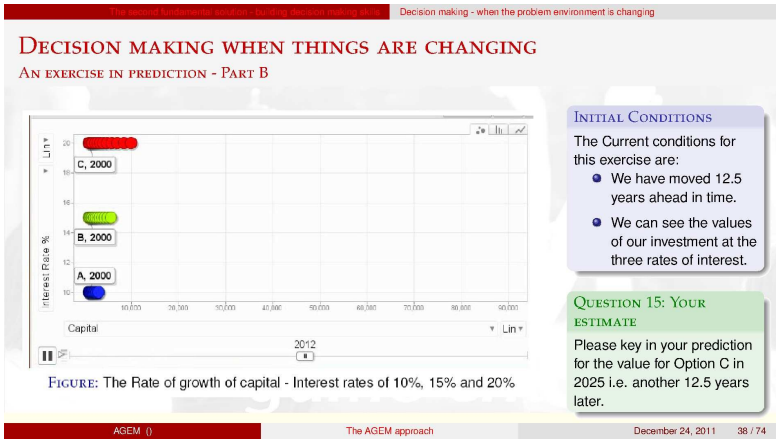
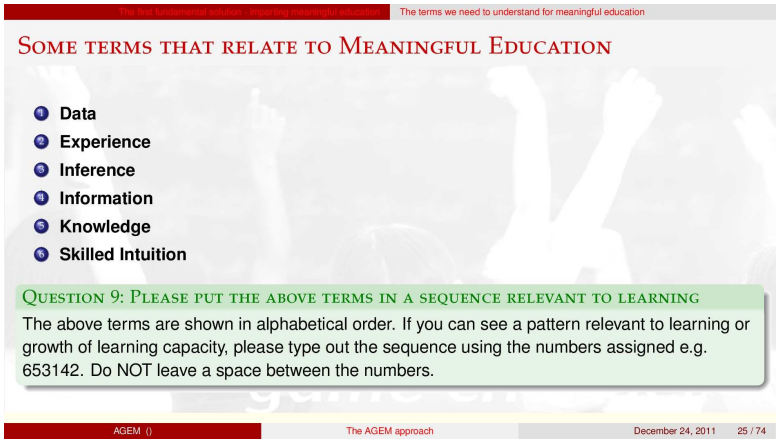


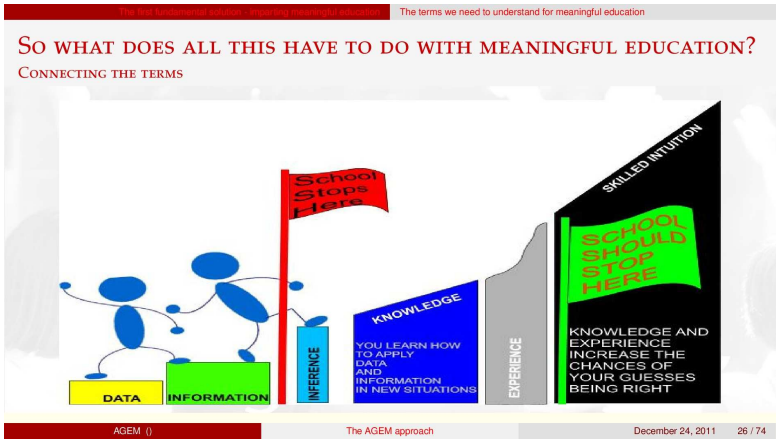
FIGURE: The Rate of growth of capital - Interest rates of 10%, 15% and 20%

The responses have been tabulated in a Parallel Coordinates diagram later in this article along with the responses to the second question.

3.3.1.2 The sequence of learning problem In this case we put 4 terms in alphabetical order, and the audience is invited to indicate their perceived order of linkage. The slides displayed are as shown.



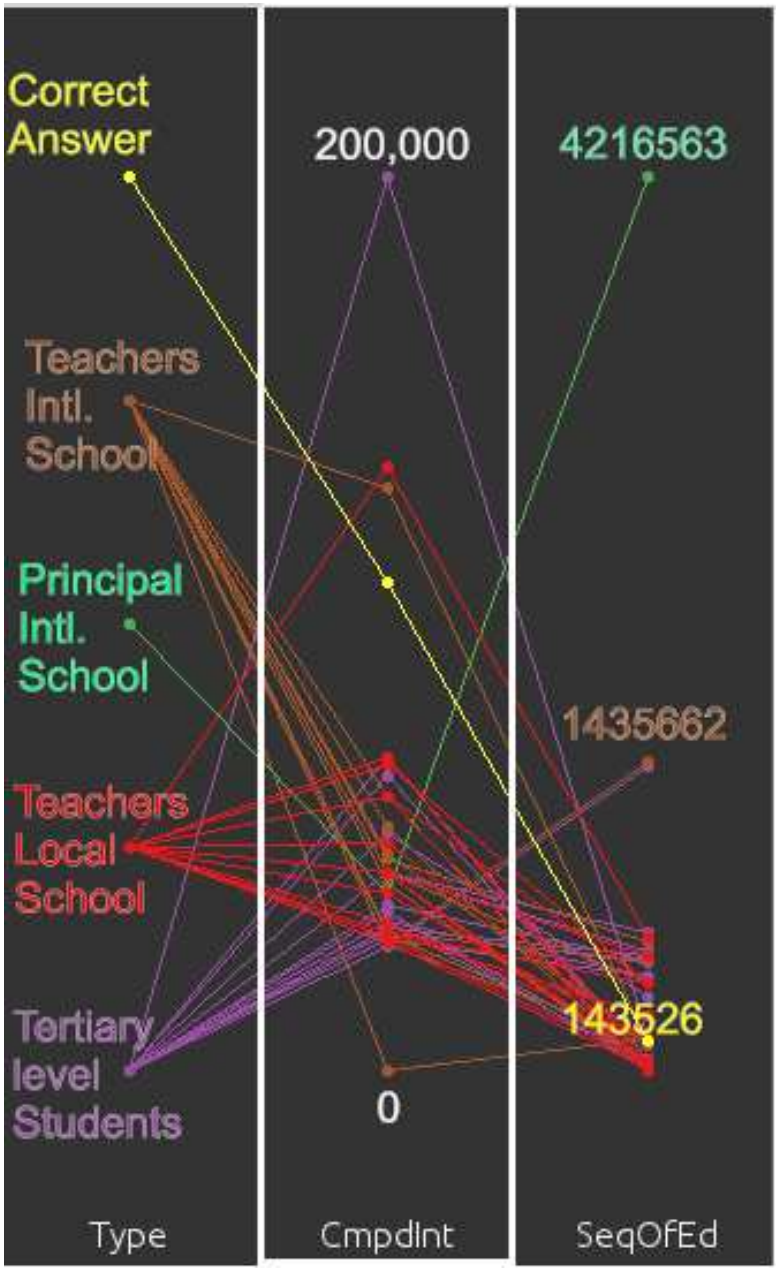
The audience is later shown the following slide



In Indian schools the examination system lays focus on the link between data and information so students tend to memorize sequences of data/information. Part of this leads to the popularity of quiz competitions which basically means remembering unstructured items of discrete information.

3.3.2 Analyzing the responses of the first two questions

This analysis uses Parallel Coordinate Display representation which is useful for seeing the connection between items of information and the type of respondent. In the figure below the middle column represents the respondents estimates in Indian Rupees and the last column represents the pattern of relationships seen which was the second question.



The principal observations here are that:

- In the middle column which represents the responses in Indian rupees, the correct answer is the yellow dot but the range of estimates for the compounded value are generally in a narrow band regardless of the type of respondent. This is consistent with expectations as there is an inbuilt human preference for linear estimation.
- only one respondent - a teacher from a low resourced local school - identified with the preferred pattern of relationship. There appears to be no intuitive understanding of the flow of learning in terms of that described above. Indeed our experience is that when we display the relationships based on the responses, every relationship entered is unique and but for one instance only in all presentations, does not correspond with the relationship whose validity we later explain. No questions have been raised on the validity of that relationship at any of the presentations. The variety of responses however indicates no coherent outlook on the issue.

3.3.2.1 Quality of education and scope for change In the next two questions we solicit the perception of respondents on the quality of the education system and on the scope for change.

3.3.2.1.1 The quality of education

QUESTION 5: YOUR OPINION ON THE EDUCATIONAL SYSTEM IN OUR COUNTRY?

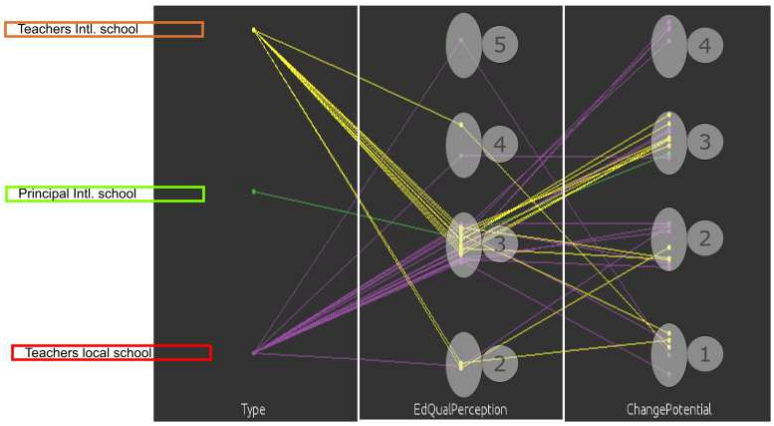
On a scale of 1 (very poor) to 5 (very good), please rate our education system. Type out a figure between 1 and 5 which indicates the rating that you have chosen.

3.3.2.1.2 The scope for change

QUESTION 6: YOUR OPINION ON THE POTENTIAL FOR CHANGING THE EDUCATIONAL SYSTEM IN OUR COUNTRY?

On a scale of 1 (very difficult to change) to 5 (very easy to change), please rate the potential for changing the educational system for the better. Type out a figure between 1 and 5 which indicates the rating that you have chosen.

3.3.2.2 The analysis of response In the Parallel Coordinates display below we show the three categories of respondents in the first column, the response on the issue of educational quality on a 1 to 5 scale in the second column, and the response to the issue of the scope for change in the third column. The values have been jittered vertically in columns 2 and 3 to allow a clearer understanding of the distribution.



Our analysis indicates that:

- the focus of teachers is generally toward giving a value of 3 to the issue of education quality and giving a 2 to 4 rating for the scope for change. It does appear teachers in the local school are more hopeful for the potential for change.
- There are few takers for the view that the quality is high and the scope for change is also high.

3.4 Findings from the 4 questions

The general tendency to assume linear change even in a commonly understood phenomenon such as compound interest which is dealt with quite universally in schools raises issues of whether such questions can only be understood by teachers in terms of calculation and not estimation. The failure to estimate may indicate that these topics are not studied in the context of their sensitivity to the various factors that impact them. One could argue that the ability to estimate is vital in real life problems.

Similarly for academic audiences to be unable to see a sequence in the terms describing the growth of learning raises questions about the ability of teachers to interpret and apply their experience to the teaching environment. Of greater significance was the fact that coherence was very low due to the spread of permutations. The low incidence of “Data” being at the beginning or the end, and “Skilled Intuition” being at the other end, is something that is difficult to understand. On only one occasion did a teacher ask what was meant by skilled intuition.

It is of course heartening that teachers and the odd principal see the system to be average or less than average but also see an average or slightly better than average scope for change.

In terms of the project we wish to undertake, this has several implications. From a positive standpoint, the existence of a void that our product can fill is heartening. From a negative standpoint, the absence of awareness is a vital factor in perceiving the need for the product.

The creation of awareness is therefore vital. In the three schools that we have given presentations at, the immediate response has been positive. However, over time this seems to dilute. It is also difficult to get circumstances where we are able to get an invitation to make the presentation. It is easier to get an invitation to an elite group at Microsoft Research (scheduled for 13 June, 2012) than in a poorly resourced school. The problem of awareness is a primary challenge.

4 The nature of the value proposition

Our initiative is characterized by the following:

- each student is provided a feedback device
- all material is pre-prepared for a projected display in the classroom and contains embedded questions designed to yield specific indicators of performance every few minutes.
- the response of the class is analysed and displayed on the projector within seconds of all students having answered.
- all responses are archived for ongoing analysis
- students are provided regular reports on how they can improve their performance
- no homework is provided and no textbooks are needed.
- project work usually with real world data is intrinsic to this method.

The following photograph depicts a classroom with 65 students undertaking a class in mathematics at Grade 6 in a school for disadvantaged children. The feedback devices are visible on their laps. The room was too small for the number of students and large areas at the front and the back were taken up with heavy school bags.

5 Testing the Value Proposition - Evaluating Performance

5.1 The outcomes of a pilot study to test the value proposition

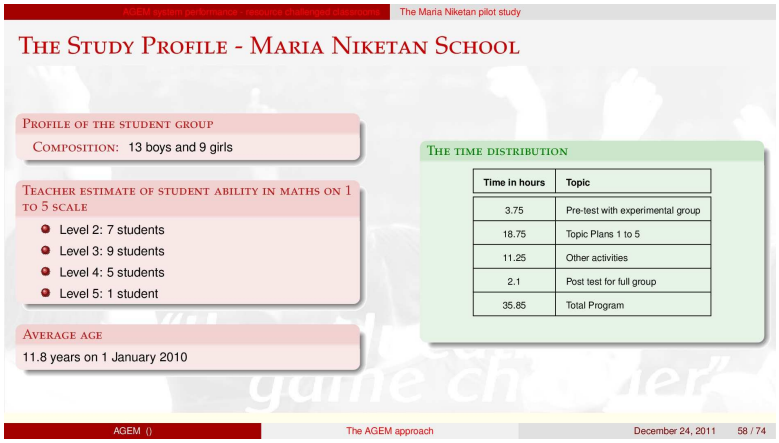
We asked for and received a set of students who were generally weak in mathematics as can be seen from the teacher estimate of student ability in maths in the figure below. We went through 5 topic plans with them of which the first was hopelessly optimistic and had been designed before we could give the children a pre-test. The remaining four assumed that little or no knowledge of mathematics and covered the following areas:

1. The concept of number
2. decimals
3. percentages
4. fractions

During the course of this effort we understood that the group of 22 was derived from a single class of about 75 students. Hence, a pre-test was not possible but all the children took the same post-test. This formed a basis for comparison.

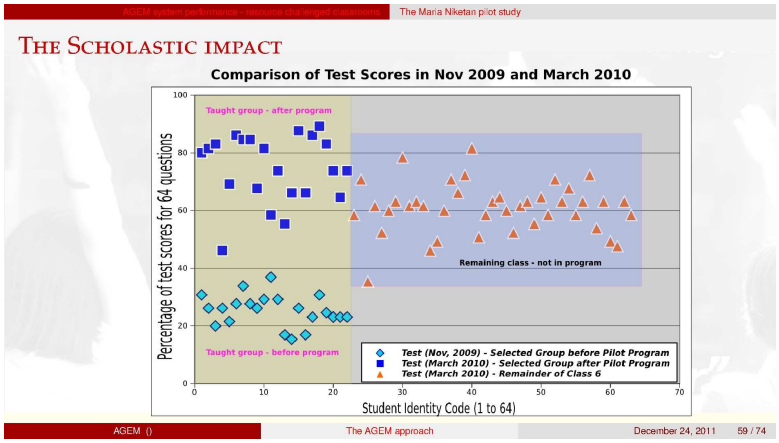
An alternative basis for comparison that was used was the change in performance between the end of term 1 i.e. before we commenced teaching and the end of term 2 when we had concluded teaching. Due to the unusually large difference between pre-test and post-test for our experimental group we decided to see if the changed motivation of children could have impacted not only mathematics but Science and English in the schools own examinations.

5.1.1 Profile of students



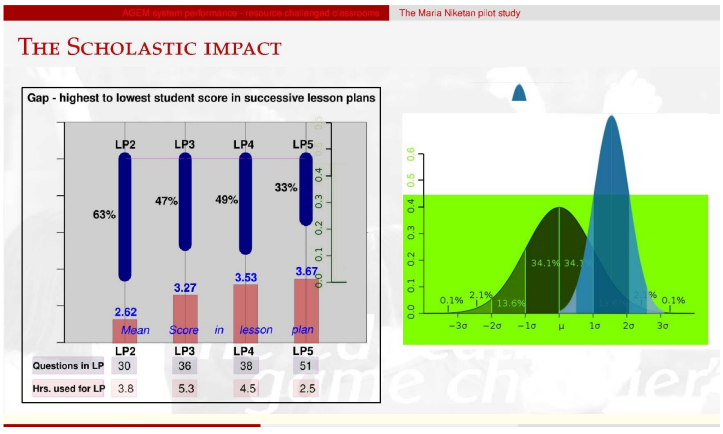
We can see here that the total teaching time for the 5 topic plans was 18.75 hours out of a total class time of less than 36 hours.

5.1.2 Performance in AGEM tests



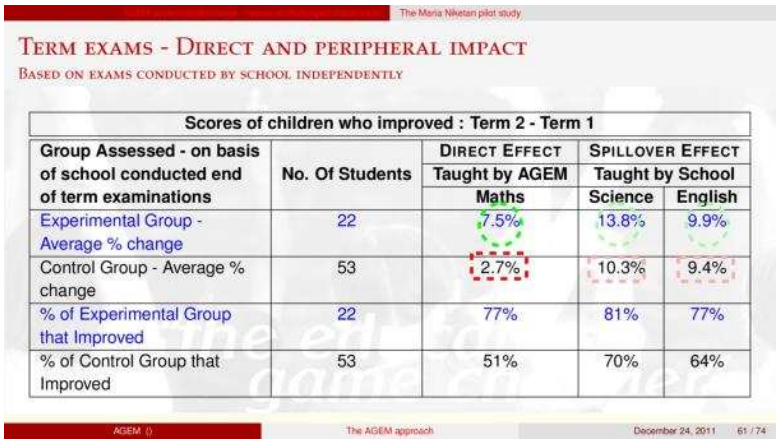
From this we observe that the taught group generally averaged less than 25% in the pre-test. As Prof. Hans Rosling of the Karolinska Institute has observed, this does not mean the children did not know, but implies they knew the wrong thing. However the change in performance was surprising even for an optimist. This led us eventually to the belief that this level of performance would have to reflect in overall school performace, if it were true as depicted in Section 5.1.4

5.1.3 Performance of the group per topic plan



The results show an improvement by the class in mean score with the topic plan but they also show a compression in performance of the class as a whole. In statistical terms this could be understood as a decrease in the variance as well as an increase in the mean score.

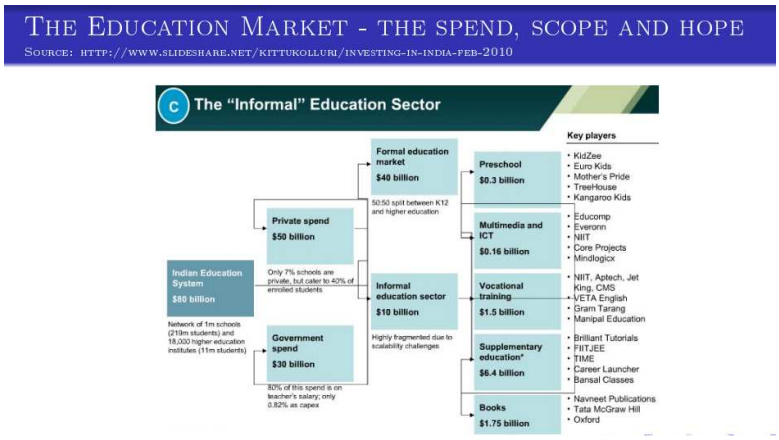
5.1.4 Performance in school end of term examinations



These results show an enhancement in the school end of term examinations which were in consonance with the school syllabus rather than what we had taught. The enhanced performance in maths continued for Science and English thereby possibly leading to the possibility of an increase in motivation and/or inference.

6 The market

Currently there are over 1 million schools in India catering to more than 219 million students. This represents a private spend of about 20 billion dollars for the K12 space. That has now been estimated to rise to about 45 billion dollars by 2015. No private company so far has even managed to address 1% of this market. The issue is not the size of the market but how to enter the market. We try to address that issue below. To successfully do that requires change in educational policy as well as educational methods. We tried to address education policy by meeting with the present Chairman and the past Chairman of the Central Board of Secondary Education (CBSE). We also tried to mount Harvard Graduate School of Education's Mind, Brain and Education Institute in India for educational policy makers, but the funding agency pulled out in the aftermath of the 2008 downturn in world economies. The nett outcome of meetings with Chairmen of the CBSE was that these individuals are mindful of the need for change but are deeply aware that rapid change can create a backlash. The recent introduction of the Continuous and Comprehensive Evaluation (CCE) scheme is well intended and interfaces well with the capabilities of our system.



6.1 First phase of operations

Operations are designed in phases. In the first phase, the market will be private schools in Bangalore. During this phase we will use current technology and our own staff to conduct sessions in 3 to 5 Bangalore schools for one hour each per week. We expect this phase to run for 6 months. At the end of this phase we expect to generate funding based on the performance increments recorded.

6.2 Second Phase of operations

Operations in the Academic Year commencing June 2013 will mark this phase of operations. In the six months preceding this we will use funding to manufacture the new generation of hardware and fine tune

software for the purpose. This will allow us to run operations in the four metropolitan areas viz. Mumbai, Delhi, Chennai, Calcutta and Bangalore. Our target would be to commence operations in about 20 private schools catering to about 1000 students in Grades 5 to 8. This represents a very small percentage of the market.

6.3 Third Phase of operations

In this phase, we would address the urban market in India which comprises about 30 percent of the total market of about USD 30 Billion in 2014. At this stage we would target government schools in at least one state. Our total expectation would be about 200 schools catering to 100,000 students. By this stage, cash flow should be positive and further growth will be funded from revenues. There are more than 600 towns and cities in India that cater to 30% of the population. We would look to charge Rs 1200 per student per year at this scale.

7 Conclusions

The hypothesis of the visible problem and the invisible problem seem to be supported by reasonable evidence and the failures that these could create are also visible in teachers, students and principal's responses to the questions posed on compounded growth as well as on learning sequences. The responses of MBA students in the Report FeedbackOfDemos.pdf seems to support the view of repairable fissures in the education system as do the responses of Class 9 and 10 students in the same report.

The pilot reported on here was based on the three solutions posed at the beginning of this article. The results of the pilot seem to give prima facie evidence of the impact of these solutions on student performance.