STUDENT Learning in the Metros 2006

EXECUTIVE SUMMARY

Educational INITIATIVES

WIPRO

Prologue

"In regard to education in Brazil, I had a very strange experience. I once attended a lecture which went like this, translated into English: "Two bodies… are considered equivalent… if equal torques… will produce… equal acceleration. Two bodies are considered equivalent if equal torques will produce equal acceleration." The students were all sitting there taking dictation, and when the professor repeated it, they checked it to make sure they wrote it down all right. Then they took down the next sentence and so on and on. I was the only one who knew the professor was talking about objects with the same moment of inertia and it was hard to figure out.

I didn't see how they were going to learn anything from that. Here he was talking about moment of inertia but there was no discussion about how hard it is to push a door open when you put heavy weights on the outside, compared to when you put them near the hinge - nothing!

After the lecture I talked to a student: "You take all these notes - what do you do with them?"

"Oh, we study them," he says. "We'll have an exam."

"What will the exam be like?"

"Very easy. I can tell you now one of the questions." He looks at his notebook and says," 'When are two bodies equivalent?' And the answer is, 'Two bodies are considered equivalent if equal torques will produce equal acceleration.'" So, you see, they could pass the examinations, and "learn" all this stuff, and not know anything at all, except what they had memorized.

After a lot of investigation, I finally figured out that the students had memorized everything, but they didn't know what anything meant. When they heard "when light passes through a medium", they didn't know that it meant a material such as water. Everything was entirely memorized, yet nothing had been translated into meaningful words. So if I asked, "When are two bodies equivalent?" I'm going into the computer with the right keywords. But if I say, "Look at the water," nothing happens - they don't have anything under "Look at the water!"

Surely You're Joking, Mr. Feynman, Richard Feynman, Unwin Paperbacks, 1986

Executive Summary

Public debate in India bemoans the lot of government schools in the country. The implicit assumption is that all's well (or at least almost well) with private schools. In this research study, an attempt has been made to verify that assumption. And instead of looking at private schools in general (which come in a wide variety), an attempt has been made to measure how well students are learning in the 'top' English medium schools (as per public perception) in 5 metros - Mumbai, Kolkata, New Delhi, Chennai and Bangalore.

Over 32,000 students of classes 4, 6 and 8 participated in this study. An analysis of their performance suggests that even in our 'top' schools, students are not learning well and with understanding. Schools seem to be laying disproportionate emphasis on rote and procedural learning and not surprisingly, students tend to be strong in those. To a certain extent this is good - for one, it builds habits of rigour and hard work. But when it starts replacing original thinking and creativity, over-reliance on rote can be extremely counter-productive. This is happening, and we need to be alarmed.

DESIGN OF THE STUDY

An expert panel of educationists and principals guided the survey. About 200 people from different walks of life were surveyed in each metro to identify the best schools in the country. Based on their responses, a list of 50 top schools was drawn for each city. These schools were then invited to participate in the study. Students of classes 4, 6 and 8 of each school were tested for their learning achievement with a special test tailored to their age and ability. The test tried to measure how well students of these classes *understand* the key concepts in English, Mathematics and Science. Apart from the multiple-choice questions, students were also required to write a small paragraph or essay, which would help study their writing competencies.

A *secondary study* was also conducted to understand the progression of learning achievement across the classes. In this study, a *common test* was administered to students of classes 4, 6 and 8, to gather insights on the retention and development of knowledge, as students move to higher classes. Additionally, about 25% of the questions in this paper were taken from an international assessment study (the Trends in International Maths and Science Studies - TIMSS, *http://www.timss.org*) for which performance data of students from over 40 countries is available.

TEST ADMINISTRATION AND DATA ANALYSIS

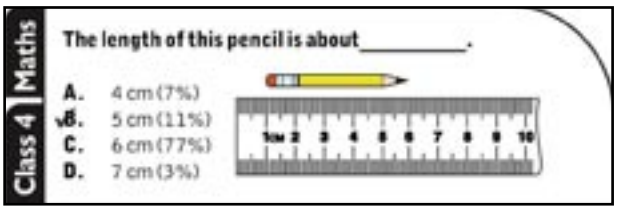
About 32,000 students from 142 schools participated in the tests which were conducted between February and April 2006. Trained invigilators from Educational Initiatives supervised every test. The participation ranged from 23 schools in Kolkata to 37 schools in Chennai. Some background information on issues like class size, fees and school facilities were also collected through a questionnaire from the participating schools to look for any influence of these factors on student achievement. 89 out of the 142 schools filled and returned the background questionnaire.

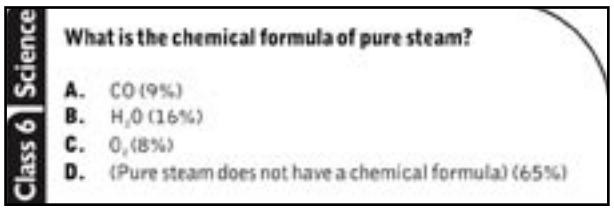
THE FINDINGS

The results do not present a happy picture of the state of student learning even in the 'top' schools of the metros. Students seem to be learning mechanically, and are able to answer questions based on recall or standard procedures quite well. However, their performance on questions testing understanding or application is far below what we consider to be acceptable levels.

The student performance suggests that they are unable to tackle questions that appear to be a little different from what they typically find in textbooks or in the class. Their ability to apply what they have learnt to new, unfamiliar problems - so important in today's world - is not very high.

The results also show that students tend to slot learning into artificial compartments. They may learn something, but are able to answer it only in the same context, in which the learning first occurred. They





Students seem to falter when questions are asked in even a slightly unfamiliar form. The question on the left suggests that practical competencies like measurement are not being developed well. In the question on the right students know the formula of water and about physical and chemical changes but are unable to link the two facts. (Figures in brackets indicate the percentage of students who chose that option.)

may be using an aspect of what they have learnt in their day-to-day lives, but be completely unaware of that connection. Another finding is that students tend to be weak in certain real-life competencies like practical measurements and problem solving, which can and should be developed through the formal school curriculum.

Many of these findings were corroborated through the secondary study in which learning levels across classes were compared. While learning clearly improved from class 4 to 6 to 8, a number of students seem to be learning class 3 and 4 concepts only around class 6 or later.

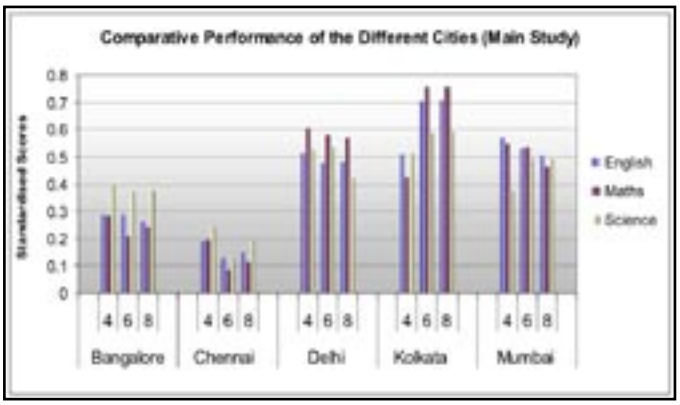


Exhibit 1 *- Surprisingly, a statistically significant difference was found in the performance of students in the different cities.*

A number of specific misconceptions in English, Mathematics and Science were also identified, and these are illustrated with a large number of examples in the detailed report.

COMPARATIVE ANALYSIS

One of the most significant findings of the study was the poor performance of the students compared with the average performance of students from 43 countries. Across the sample of 11 questions in Maths and Science, our class 4 students performed *below international average on all of them* (***Exhibit 2).***

A comparative analysis of the performance of the 5 metros again threw up a surprise. It was found that the performance of the cities fell into two categories, with Kolkata, Mumbai and Delhi clearly outperforming Bangalore and Chennai (***Exhibit 1).*** It was also found that schools affiliated to the CISCE (ICSE) board out-performed the CBSE board which in turn out-performed the state boards.

Boys outperformed girls by a margin that was statistically significant in Mathematics (in all classes) and Science in class 8. In Mathematics, the gap widens even more among better-performing students and in the case of difficult questions. We believe that these differences are not because boys are inherently better in Mathematics than girls, but due to social messages encouraging boys to do better in Mathematics and probably discouraging girls.

As stated earlier the exhibit 2 shows that the average performance of the student in the metro schools was below the international average on all the common questions taken from the TIMSS.

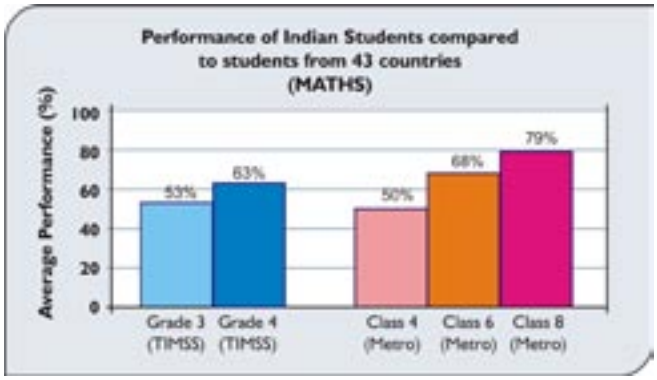


Exhibit 2 *- Some of the questions used in the study were taken from TIMSS, an international study across 43 countries. TIMSS tested students of classes 3 and 4, while students of 4, 6 and 8 were tested in this study. As the graph shows, students representing the 'top' schools of our metros scored lower than the international average.*

None of the factors like class size or school facilities seemed to be strongly and clearly correlated to the student performances in the tests. Our hypothesis is that the teaching-learning processes and the quality of leadership play an important part in determining the effectiveness of student learning.

NEXT STEPS

All the data, including the question papers and detailed analysis will be made available in the public domain. This should allow the issue of quality of learning to be more widely debated on a foundation of hard data, rather than subjective "opinions". It is planned to expand this study to more cities in the coming year, and also enhance the study in other ways. It seems clear that it is in our power to improve the quality of learning in our schools, but that will happen only if we choose to make that commitment to the next generation, by way of focusing on real learning. The current focus on valuing high scores in the board exams or fancy facilities in our schools is unlikely to take us far, as far as real learning is concerned. Our tests should be such that they measure real learning.

Many of the questions asked in the study test understanding of concepts covered in textbooks and classrooms of a lower class. Of course, the questions are of a form that are slightly different from what is typically done in the class. In many such questions, it was found that basic understanding seemed to be weak among a significant proportion of the students.

Textbook case study - 1

A non-zero decimal number lies between two whole numbers.

The concept of non-zero decimal fractions is treated in a fair amount of detail in classes 4 and 5 of different states. Excerpts from 3 textbooks are presented here.

What the textbooks of classes 4 & 5 says...

Board	Class	What's in the textbook
NCERT	Class 5 *Page 96,* *Example 1,*	Example 1: Write the following decimals in the place value table: 27.45, 9.07, 76.305 Solution: The given decimals can be written in the place value table as shown below: Hundreds (100) | Tens (10) | Ones (1) | Tenths (1/10) | Hundredths (1/100) | Thousandths (1/1000) 27.45 → 2 | 7 | 4 | 5 9.07 → 9 | 0 | 7 76.305 → 7 | 6 | 3 | 0 | 5
Maharashtra state board	'Decimals' Class 4 *Page 67, section 3,* *'Decimal fractions'* Class 5 *Page 35,* *sum number 4.5.14*	In a fill-up, "As you go from left to right, the place value of each digit ____ part of its place value in the preceding place." Arrange the following decimals in the ascending and descending order: (i) 3.700, 3.701, 5.731, 7.214, 4.120 (ii) 4.125, 4.205, 4.025, 4.502
Karnataka state board	Class 4 *Page 31,* *'The place value of decimal digits'*	For the number 754.32, the value of each place is described. i.e. place value of 7 is 700, 5 is 50, 2 is 23 is 3/10 and so on.

We asked Class 6...

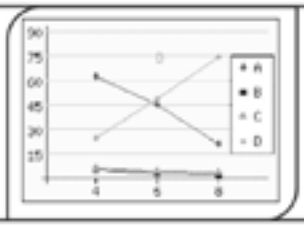
...Which number is closest to '423.1'.

Class 4 & 6

Maths

Which of these numbers is ALMOST equal to 423.1?

	Class 4	Class 6	Class 8
A. 4231	61.5%	44.3%	20.6%
B. 4.23	5.0%	2.4%	1.8%
C. 42.3	5.3%	4.1%	3.1%
✓ D. 423	24.4%	48%	73.5%



Option A (the most incorrect option in the sense that 4231 is the farthest from 423.1!) is chosen by a signficant percentage of class 4 and 6 students! They are probably misguided by the fact that 4231 has all the digits of the original number in the same order. Students simply seem to ignore the decimal point. Even in class 8, a fourth of the students answer wrongly.