Use of Data in the Policy Making Process

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"If you learn how to look at data in the 'right' way, you can explain riddles that otherwise might have seemed impossible. Because there is nothing like the sheer power of numbers to scrub away layers of confusion and contradiction." – S. D. Levitt

Challenges…

o Ideology, Ignorance, Inertia, Instincts and **NOT data based** evidence the basis for most decision making (new *textbooks, teacher training*)

o Programmes implemented *enmasse* **without proof of concept** due to other compulsions (*vote banks, unions, ideology*)

o **Non-availability** of well collected data (*incomplete, non standard methods, non granular)*

o **Limited Accessibility** (searchable data repositories)

o System often **not skilled/trained to understand data** beyond the most basic data presentation (averages, percentages)

o **Absence of a culture of research**
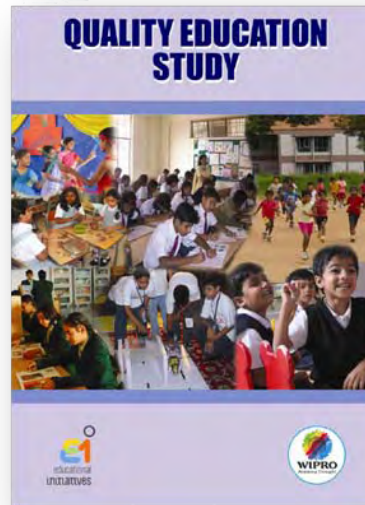
Data from Studies on Learning Outcomes…

Andhra Pradesh Randomised Evaluation Study

Bhutan ASSL, TNA, SATS

Gunotsav

School Excellence Programme

Purpose Determines.....

For selecting the best e.g. admissions, appointments

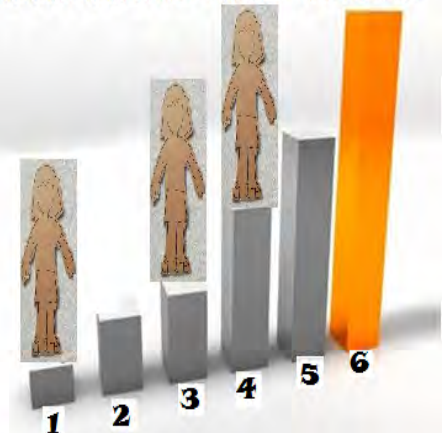For certification. eg., board exams

Focused on the Individual

Evidence: Showing What You Learned

STRENGTH AND WEAKNESS PROFILES

For diagnosis g., ASSET

For slotting as per their ability e.g. screening tests

APPROPRIATE GRADE LEVELS

1 2 3 4 5 6

Purpose Determines.....

**Whistle Blowing –
Calling Attention**
Short tests . eg.,
ASER

Benchmarks
Anchors and advanced analysis eg.,
SLS

Low Benchmark (students reaching 25th percentile)
25th Percentile IRT Scaled Score: 439
Students write the numeral form of 2 digit numbers when their number names are given. Students know 2 digit numbers less than 20 and can identify a number that is missing from a sequence of consecutive numbers.......

Focused on the System

**Detailed,
Granular
feedback**
Full Length Tests.
eg., MCGM

*bird's eye of performance of
every child on every competency
and question*

Evaluating Programme Impact
Similar Baseline and End line
Tests eg., Naandi
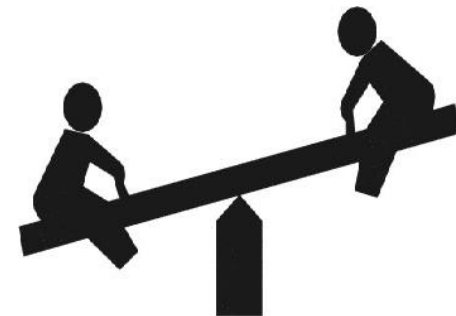
How can data be useful..

….to benchmark levels of learning

….to differentiate the types of learning

….to see patterns in performance

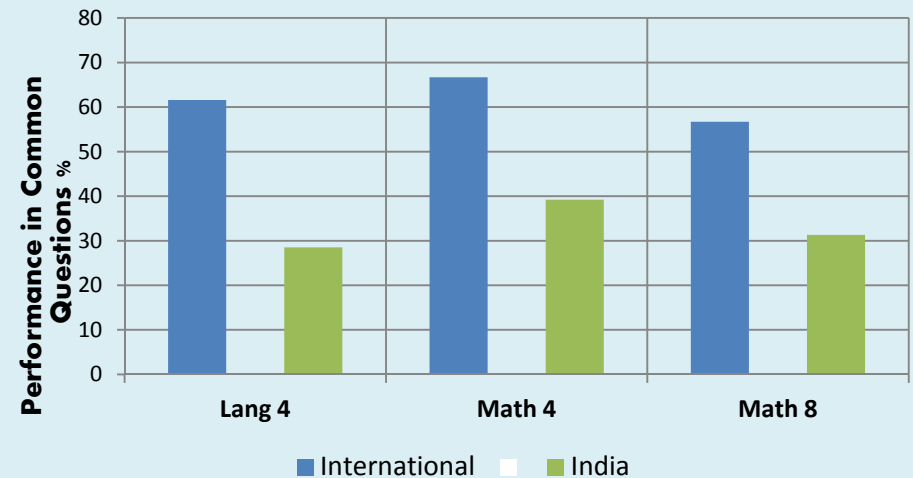…..to enable benchmarking at knowledge and ability level

…. leads to exploring student thinking

….leads to exploring teaching methods

Learning Level in Indian Govt. Schools

The levels of learning is much lower than the international average on questions used from TIMSS and PIRLS

International versus Indian Public School Students

A bar chart titled "International versus Indian Public School Students" with y-axis labeled "Performance in Common Questions %" (0 to 80). Categories: Lang 4, Math 4, Math 8. Legend: International (blue), India (green).

- Lang 4: International ~62, India ~28
- Math 4: International ~66, India ~39
- Math 8: International ~57, India ~31

Class 4   Language

Passage Excerpt:

When Lakhan discovered that he had mice in his house, it did not bother him much at first. But the mice multiplied. They began to bother him. They kept on multiplying and finally there came a time when even he could stand it no longer.

Why did Lakhan want to get rid of the mice?

A. He had always hated mice.
B. There were too many of them.
C. They laughed too loudly.
D. They ate all his cheese.

Question involves retrieving stated information in the text and making straight forward inferences from it.

Sample Question 3: Internationally, **79.0%** of students answered this correctly, while 41.8% of students from Indian schools could get this correct.

Types of Learning - Extent of rote…

Students when posed the same question in a slightly different form were found to perform differently

2 3
× 3
____

84.4% of students answered correctly

What is 3 times 23?
A. 323
B. 233
C. 69
D. 26

43.8% of students answered correctly

Is there Learning with Understanding..

Students when posed with questions that required understanding and application, fared much below international average when compared to procedural questions

Class 4 — **Maths**

One table can seat 4 people.

How would you find out how many tables are needed to seat 28 people?

A. Multiply 28 by 4.
B. Divide 28 by 4.
C. Subtract 4 from 28.
D. Add 4 to 28.

Sample Question: This is a question checking understanding of appropriate procedure/whole number operation that is to be applied to find the answer. 47.1% of Indian students answered this question correctly, compared to 57.0% of international students who got this correct.

Class 8 — **Maths**

Which shows a correct procedure for finding $\frac{1}{5} - \frac{1}{3}$?

A. $\frac{1}{5} - \frac{1}{3} = \frac{1-1}{5-3}$

B. $\frac{1}{5} - \frac{1}{3} = \frac{1}{5-3}$

C. $\frac{1}{5} - \frac{1}{3} = \frac{5-3}{5 \times 3}$

D. $\frac{1}{5} - \frac{1}{3} = \frac{3-5}{5 \times 3}$

Sample Question: This procedural question was answered correctly by 39.6% of Indian students compared to 29.8% of students internationally.

Patterns in a Topic

	Concept of a Fraction	
Low Benchmark (25th Percentile)	If a watermelon weighs 10 kg, how much will half the watermelon weigh? _____	Students understand fractional quantities such as half written in a word form as one out of 2 parts and apply them practically in their daily context.
Intermediate Benchmark (50th Percentile)	In which figure are one-half of the dots black? Tick (✓) the answer. A B C D	Students understand the concept of half as a number divided by 2, for example, in a group of same objects, they know that 3 out of 6 is half the number of that object.
High Benchmark (75th Percentile)	Which figure is divided into four EQUAL parts? Tick (✓) the answer. A B C D	Students understand parts of a whole and can visually identify equal parts.
Advanced Benchmark (90th Percentile)	Which figure is $\frac{1}{2}$ shaded? Tick (✓) the answer. A B C D	Students understands half represented as a fraction and understands it as one out of 2 _equal_ parts and is able to identify the correctly shaded figure based on this.

Patterns Across Groups

Misconceptions continues in higher classes
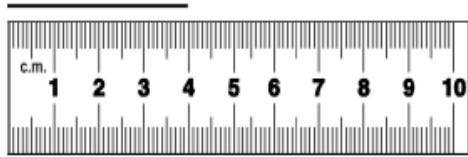
The length of the line in the figure above is 4 cm. How long is the pencil shown in the picture? (Use the ruler shown in the picture.)
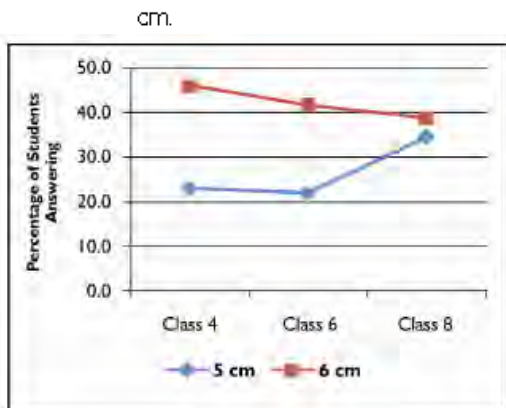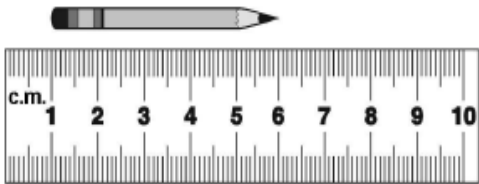
Class 4: 5 cm (23.0%), 6 cm (46.0%).
Class 6: 5 cm (22.1%), 6 cm (41.7%).
Class 8: 5 cm (34.7%), 6 cm (38.8%).

Homogeneity in the performance of the different mediums

Medium	Question	Performance
English	Which figure is $\frac{1}{3}$ shaded?	A. 3.4% ✓ D. 24.5% No. of students 1856 C. 2.4% B. 65.2%
Hindi	कौन-सी आकृति $\frac{1}{3}$ छायांकित की गई है?	A. 4.0% ✓ D. 33.8% No. of students 7926 C. 3.4% B. 54.8%
Marathi	कुटल्या आकृतीचा $\frac{1}{3}$ भाग छायांकित आहे?	A. 5.4% ✓ D. 27.9% No. of students 8588 C. 4.1% B. 59.0%
Urdu	کونسی شکل کا $\frac{1}{3}$ حصّہ سیاہ ہے؟	A. 5.1% ✓ D. 30.8% No. of students 6467 C. 2.6% B. 56.9%

Percentage of Students Reaching SLS 2009 National Benchmarks of Maths Achievement

SLS 2009 Maths — 4th Class

| State	Percentages of Students Reaching National Benchmarks	Advanced Benchmark	High Benchmark	Intermediate Benchmark	Low Benchmark
Delhi		22.1	51.7	80.8	95.3
Maharashtra		29.6	54.0	76.5	92.1
Karnataka		21.7	39.0	64.1	88.2
Kerala		21.4	41.4	67.4	88.0
Orissa		27.7	48.4	67.7	85.9
Tamil Nadu		8.8	22.8	53.9	84.8
Chandigarh*		9.9	24.6	55.3	81.8
Uttarakhand		11.1	26.7	55.6	78.9
National		12.0	27.0	52.0	77.0
Andhra Pradesh		4.1	15.6	43.0	76.1
Punjab		4.9	17.7	43.8	75.3
Haryana		6.7	20.2	46.4	74.5
Bihar		6.9	21.1	47.2	73.2
Chhattisgarh		4.0	14.6	42.9	72.7
Jharkhand		6.4	20.0	42.6	71.0
Gujarat		3.6	12.8	39.8	67.5
Assam		7.7	16.3	37.2	63.7
Rajasthan		6.3	14.6	33.2	57.0
Madhya Pradesh		4.6	14.3	32.4	56.5
Jammu and Kashmir		1.1	2.0	6.8	24.1

Delhi has highest number of students above Low Benchmark

Maharashtra has highest number of students in 90th percentile

Jammu and Kashmir has lowest number of students in 90th percentile

0   20   40   60   80   100

Note:- * Union Territory
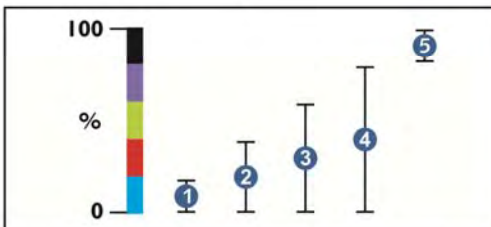
1. Percentage of students at or above **Advanced** Benchmark.
2. Percentage of students at or above **High** Benchmark.
3. Percentage of students at or above **Intermediate** Benchmark.
4. Percentage of students at or above **Low** Benchmark.
5. Percentage of students below **Low** Benchmark.

Graph above shows the cumulative percentage of students reaching each benchmark.

Low Benchmark *(students reaching 25th percentile)*

25th Percentile IRT Scaled Score: 439

Students write the numeral form of 2 digit numbers when their number names are given. Students know 2 digit numbers less than 20 and can identify a number that is missing from a sequence of consecutive numbers.......

Exploring Student Thinking

The concept of 'measuring length using a scale' is introduced in Class 3 and students of Class 4 are expected to be able to solve simple problems based on this concept.

The following question was tested in class 5.

Getting Stakeholders to Use Data…

o **No one report works** - Unpack in different formats/reports for different stakeholders – State policy, DEO, Teacher, Student

o **Provide as much explicit understanding** at item/concept level for the teacher – Teacher Sheets, Misconception Reports

o Have an **effective school support group** to train teachers to use data from studies to improve classroom methods

o Build online **searchable repositories/ tracking systems** that can be granular as well aggregate information as required

o **Train IAS officials** (early in their career) how well collected granular data assists them in objective decision making with examples of good learning tracking systems

o In the **teacher training syllabus Include** an understanding of data collection and analysis methods from granular data for classroom instruction

Thank you

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Basic Shapes — Class 4

Question
Which of these is a triangle?

Options

A   B   C   D

No. of students
3811

A. 10.46%
B. 19.20%
C. 27.88%
D. 41.30%

Only 41.3% answered correctly

● Right Answer
● Most Common Wrong Answer

1 Why was the question asked?

This question was framed to check if students could recognize a basic shape like a triangle, when presented in a somewhat different context from the "standard" presentation. This level of attainment is expected at this level.

2 What did students answer?

Only 41% of the students gave the correct answer (D). A and B were the most common wrong answers - with around 28% choosing A, and a similar number choosing B.

Possible reason for choosing A: As this shape has two slanting sides pointing upwards, students seem to be choosing this, ignoring the fact that a triangle should have 3 sides.

Possible reason for choosing B: Students are probably confused between a cone and a triangle and feel that it can become a triangle by turning it "upside down".

Possible reason for choosing C: Since this shape has two slanting sides, a sleeping line at the base, and "equal sides", it "looks like a triangle", to some children. They ignore the fact that this is not a closed shape and that there are many more line segments.

Interestingly, we have found that some students who answer D, do so only because they have to select an option. They feel that none of the options is a triangle and choose D, because they can "make it a triangle" by rotating it and making one of the sides the horizontal base.

3 Learnings

Some of the most common responses given by children are:

"D is very thin and so it cannot be a triangle."

"A triangle should have all the three sides equal and so C is a triangle."

"D looks like a triangle but it is not a triangle. If we rotate D, it will become a triangle."

"A triangle should have two slanting lines and a sleeping line at the base."

So what do these responses mean?

Research done by Dutch educators Pierre van Hiele and Dina van Hiele-Geldof has shown that there is a certain pattern in the development of geometric thought. A certain level of thought has to be mastered before the next level can be developed.

Level 0 (Visualization), begins with thinking about what shapes "look like", and making a mental model of that shape. It leads to a classification or grouping of shapes that "seem alike". This allows the person to progress to Level 1 (Analysis), where he can start thinking now in terms of groups of shapes rather than individual shapes. This leads to a progression towards thinking in terms of properties of shapes (even if it is only intuitively).

These are the two basic levels which if crossed by the child will allow her to think in a more organized way about the properties of the shapes, deduce relationships among properties of different shapes and then reach the highest level where she can actually analyse and deduce relationships among the founding principles of geometry. One interesting aspect of this research is that the kind of learning activities children are exposed to is far more important than the age of the child. Experiences of many educators around the world have validated these findings. (The references provide more details of this research.)

What we see from the student responses is that most of the students are stuck at the "Visualization" phase. They are unable to disregard irrelevant attributes of the shape like size and orientation and hence fail to analyse those shapes in terms of their properties.

4 How do we handle this?

- Try and give cardboard cut-outs of various shapes like circles, squares, triangles etc. to children, and let them feel those shapes first.
- Then give different sizes of a single shape. So for example, give triangles of different sizes or squares of different sizes and let them play with them and feel them.
- Try and get different types of triangles like scalene, isosceles, equilateral, right-angled, obtuse-angled, acute-angled etc (we don't have to use these names). Ask students to find out similarities among those different triangles. Then give a shape that is not really a triangle and ask them to check if it's a triangle.
- Conduct periodic assessments, using questions such as the above to find out at what level their thinking is, so that you can tailor instruction to the right level.

Used resources:

Books
John A. Van de Walle, Elementary and Middle School Mathematics: Teaching Developmentally, 4th ed. (New York: Addison Wesley Longman, 2001), pp. 306-11.

Websites:
http://www.learner.org/channel/courses/learningmath/geometry/pdfs/session1/vand.pdf
Online version of the chapter in Van de Walle's book mentioned above.

http://www.learner.org/channel/courses/learningmath/geometry/session10/part_b/index2.html
A good demonstration of the different levels of progression of geometric thought.

Educational INITIATIVES

Diagnostic Reports for Individual Schools

Overall Summary Of School Performance

Students' Score Table

Recommendations

Skill Performance Report & Questions Found Difficult/Easy

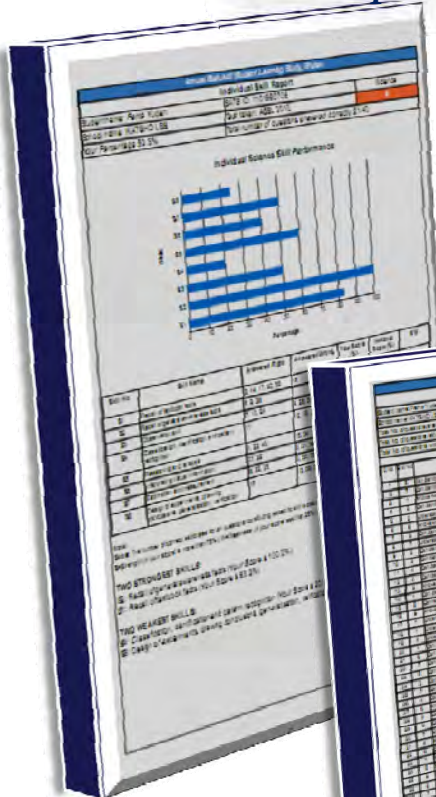Question Wise Comparison Of Your School Versus All Schools

Class Performance Table

Diagnostic Reports for Individual Students

Skill Report

Question Wise Performance

Recommendations for Improving Your Skills

Dzongkhag Level Summary Reports for DEOs

Skill Performance Chart
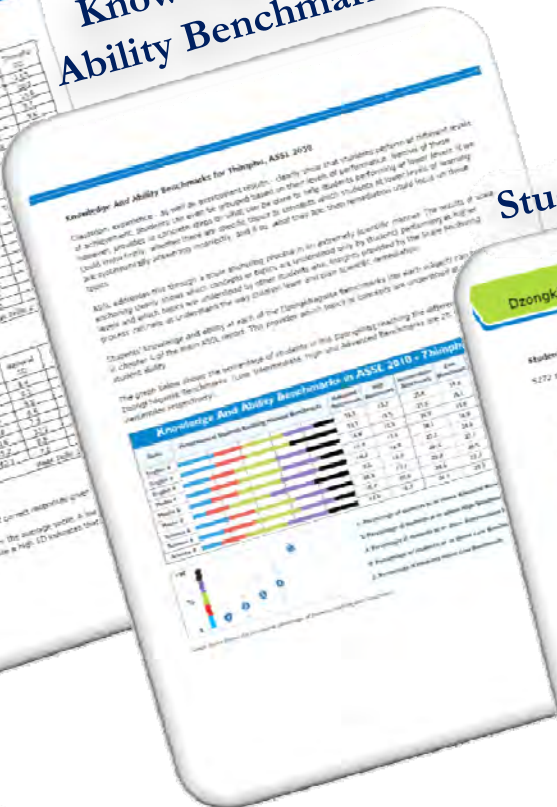
Knowledge And Ability Benchmarks

Student Performance

back