



Mastery Learning:



A measurements based approach to education

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We are crying hoarse about the emerging Knowledge economy and now the time has come when we must seriously start preparing for it. We should not repeat the story of a decade earlier, where we had signed the WTO agreement of which TRIPS is a major component, without adequate understanding and are still struggling to get the Patents bill passed after almost 10 years.

There has been a constitutional amendment to provide free and compulsory education to all children, but the implementation of the Sarva Shiksha is still going broadly the literacy mission way. No standards for content, processes or evaluation of achievement have been defined.

However those amongst us, who think of ourselves as responsible and concerned parents, must get on with the task of assuring that our children are equipped to face the challenges of globalization and to benefit from the opportunities that it provides. We are witness to the recent news items describing the more than \$150,000 dollars salaries that our premier Management Institute graduates are being offered.

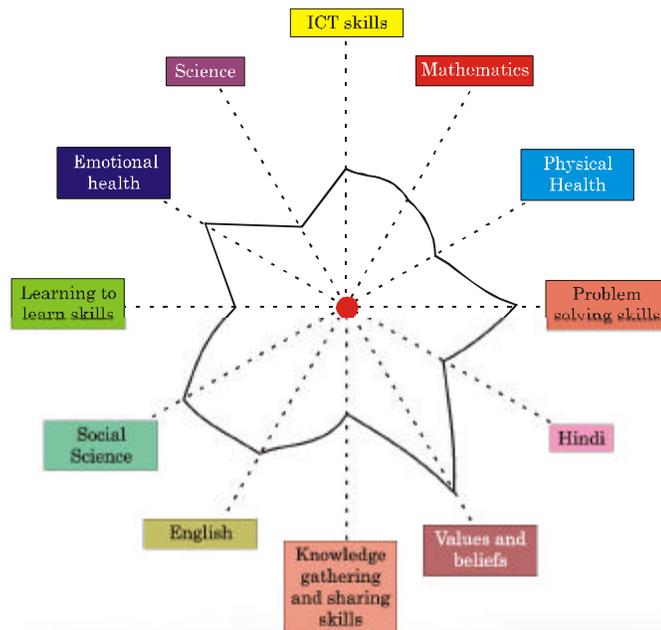
Realising that the USA is slipping behind in having adequate numbers of its population as high college achievers, it has fiercely (and in spite of significant criticism) launched an initiative of No Child Left Behind with the objective of raising the achievement levels of its school leaving students, especially in view of the high variability of the exit levels of children from different state systems of education.

In India we have according to the Constitution the responsibility of education with the States, and have a similar wide variation in the standards prevailing in different States.

When children are admitted to the first level in school, say class 1, Nursery or Prep they all have the capacity to display almost the same level of competence in alphabets and simple words and sentences. The group remains fairly homogeneous till class 3 or class 4, but then differences start appearing in the cohort, and by the time they do the Board exam at class 10, their performance is so far apart that they are then usually classified into Science, Commerce or Arts stream depending upon their differential abilities. And by the time they clear class 12, the variations are even higher, with the top making it to IIT's and other reputed Institutions and the bottom are condemned to study through correspondence, distance-learning or at private Universities of doubtful academic standing.

While educators have thought of achieving mastery learning for long, the inadequacy of technology and peer support mechanisms prevented its implementation. Keller did some experiments, which were followed up by some more at an individual level, but not really at a systems level because a mass scale implementation was not feasible. We are now at a time when there is both desirability and feasibility of the methods of mastery learning proposed by leading educators in the past.

To make progress on a desired learning path, we need to know where we are, be able to compare it with where we want to be and organise the learning intervention that



would lead to that direction. The existing evaluation and assessment instruments and the reporting methodology do not help. Even the recent global initiatives such as the TIMSS and other tests of International achievement emphasise relative rankings and percentiles rather than the achievement levels of students and defining learning paths for them. We need to create new instruments of assessment and measurement and implement them through a team of trained assessors and mentors.

Our first proposal is to use new parameters to indicate the development of a child in entirety, for which we have identified 12 attributes, listed below:

The Persona

- Physical health
- Emotional health
- Values and beliefs

Generic and Higher Order Skills

- Information and communication technology skills (ICT skills)
- Knowledge gathering and sharing skills
- Problem solving skills
- Learning to learn skills

Prescribed Curricular Subjects

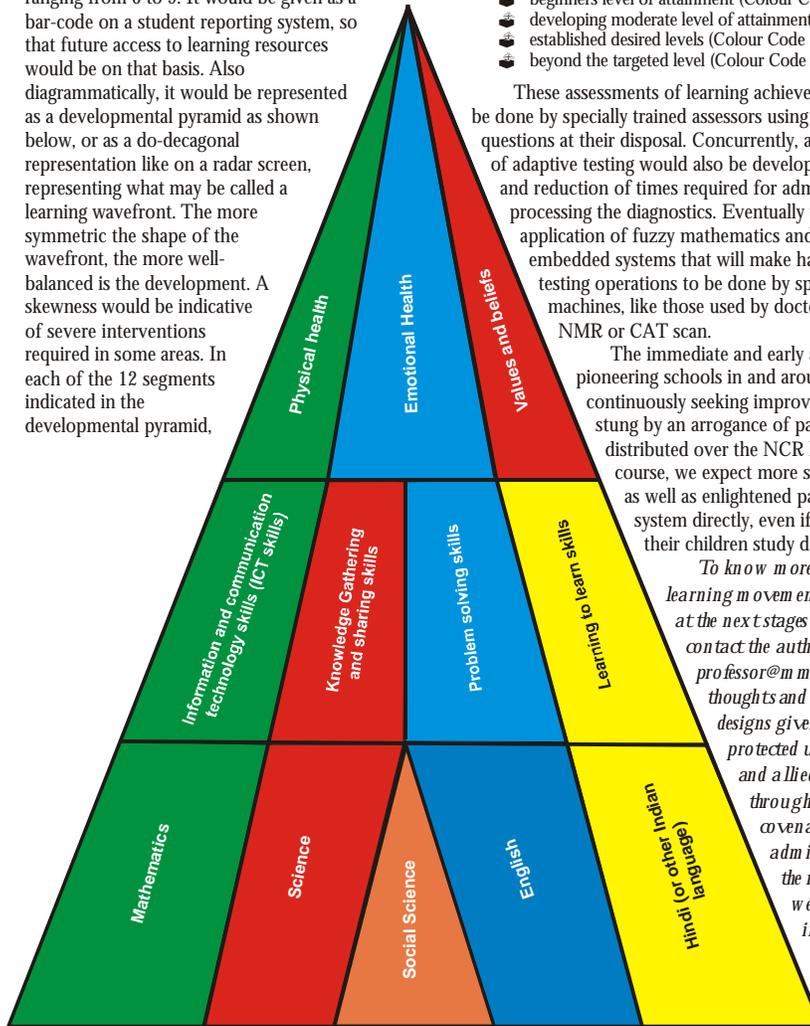
- Mathematics
- Science
- Social Science
- English
- Hindi (or other Indian language)

For each of these dimensions, standards of achievement are being developed primarily relying on International standards, where appropriate, such as for Mathematics, Science, English, ICT skills and using guidelines of our national bodies such as the NCERT/CBSE for Social Science, Hindi and other locally oriented domains, and developing new ones where existing standards are not available, such as in physical health, values and beliefs.

We propose to use this mainly till the pre-Board stage, that is up to class 9, because in class 10, the focus of most students is and probably ought to be to do their best in the external Board exams. We believe that having followed this methodology, they would all be ready to score the maximum marks in the Board exams, and also to do better in general having developed the other skills and competencies, whose development often suffers because of not having a set of standards and measuring instruments. Thus use of the numbers 1 to 9 in the reports

will reflect mastery level achievement against standards expected for classes 1 to 9 and 0 will reflect the need to achievement class 1 standards. Since the standards cannot precisely declare in advance the ability levels of all children studying in a given class, in practice learners achievement may be at a lower or higher stage in a given domain. The assessment process is therefore quite challenging.

In the above framework, each student's stage of development at any given time (not only once a year) would be represented by a 12 digit number, with values for each digit being ranging from 0 to 9. It would be given as a bar-code on a student reporting system, so that future access to learning resources would be on that basis. Also diagrammatically, it would be represented as a developmental pyramid as shown below, or as a do-decagonal representation like on a radar screen, representing what may be called a learning wavefront. The more symmetric the shape of the wavefront, the more well-balanced is the development. A skewness would be indicative of severe interventions required in some areas. In each of the 12 segments indicated in the developmental pyramid,



there would be a number ranging from 0 to 9 reflecting the level of attainment. There would also be a colour coding scheme to make this more visually communicative. This would be supplemented with identification of the best attainment, the least attainment, those where it is at par with expected levels, and where it is ahead or behind the expected levels. To summarise these, the standard deviation for these 12 parameters against the desired level would be also calculated. Another detailed report would actually indicate the strand-wise achievement indicators. For each strand, at each level outcomes achieved are measured on a 5 point scale as :

- very little evidence of attainment (Colour Code : Red)
- beginners level of attainment (Colour Code : Orange)
- developing moderate level of attainment (Colour Code : Yellow)
- established desired levels (Colour Code : Green)
- beyond the targeted level (Colour Code : Blue)

These assessments of learning achievement would initially be done by specially trained assessors using a data bank of questions at their disposal. Concurrently, a computerized system of adaptive testing would also be developed to allow scalability and reduction of times required for administering and processing the diagnostics. Eventually this will lead to the application of fuzzy mathematics and development of embedded systems that will make handling of these testing operations to be done by special purpose machines, like those used by doctors for ultra-sound, NMR or CAT scan.

The immediate and early adopters are a set of pioneering schools in and around Delhi, who are continuously seeking improvement and are not stung by an arrogance of past success, and are distributed over the NCR landscape. In due course, we expect more schools to participate, as well as enlightened parents to seek the system directly, even if the schools in which their children study do not adopt it.

To know more about the mastery learning movement and to participate at the next stages of this project, please contact the author, through e-mail at professor@mmpant.org. The thoughts and ideas, including the designs given here, are all protected under the copyright and allied laws of India and through the various covenants and conventions, administered by WIPO, in the rest of the world as well and all legal rights in them vest in the author.