Appendix 7

Developing middle school mathematics curriculum

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Mathematics at the middle school (class VI to VIII) level deals with the following themes:

1) Fractions, ratios, proportions and percentages
2) Negative number
3) Algebra
4) Measurement
5) Geometry
6) Number Sense
7) Graphs
8) Data arrangement and elementary statistics

Of these themes fractions, measurement, geometry and factor and multiples are already introduced to students at the upper primary level.

Elementary school mathematics in M.P Board

The M.P board for example basically handles all of fractions- from introduction of fractions to working with all the four operations on fractions – at the upper primary level, ratio, proportion and percentages are dealt with in class 6. The class 7 syllabus deals with 'rational numbers', which includes numbers like (-5/7)- i.e. the numerator and/or the denominator could be negative numbers- and focuses on properties of rational numbers from a point of view more relevant to those who would specialize later in mathematics.

Measurement in the upper primary level deals with finding area of squares and rectangles and perimeter of different polygons. At the middle school level students graduate to finding area of different rectilinear figures, area and circumference of circles and surface area and volume of cubes and cuboids.

Geometry at the upper primary level deals with recognizing shapes and symmetry but also deals with the notion of angle. At the middle school level geometry proper starts. One deals with points, line, line segments, parallel and perpendicular lines, angles of various kind, properties of triangles, circles, properties of circles and so on.

In what I would call number sense at the upper primary level children are introduced to factor, multiples, LCM and HCF. These along with prime numbers, divisibility tests, radicals and exponents are dealt with at the middle school level.

Negative numbers, algebra, graphs and statistics are themes introduced for the first time at the middle school level.

Themes I have explored

Geometry: From my continued interaction with middle school children (in the three WATIS schools for two years) and an occasional interaction with high school children (in a workshop organized by Sudhar for children from police quarters, Bhopal) I find that measuring lengths and angles pose problems for

children. Most of the children do not know how to use a protractor. In fact, I think the notion of 'angle' itself is quite unclear to a large number of students. I need to spend quite a bit of time thinking and reading about geometry before I will have anything to say about what should or should not be taught.

Negative numbers: It is not clear if negative numbers and operations on them could be introduced to middle school children in a meaningful way and if yes, how. It is also not clear how to teach something as outlandish as negative numbers to children whose understanding of counting numbers itself is quite shaky. I have attempted a certain approach and have done some classroom documentation. It would be good to spend sometime in developing this theme and a small module that one can try out. I believe that we must spread out negative numbers over a period of two years- class VI and VII rather than covering the whole thing in one year.

Fractions: This is an area on which I have spent time at both the middle school and the upper primary level. It remains a difficult topic at the middle school level in spite of the fact that children have been taught, at the upper primary level itself, all possible algorithms that one could learn for handling them. From my limited reading, I find that themes like fractions start at the upper primary level in most places.

HBCSE has developed a sequence for teaching fractions, which is something one could try out. It appears that Muskan would be willing to try it out and we might begin the trials soon. Teachers from Sahamat, Kesla have shown a keen interest in learning and teaching fractions. So the schools they work with could be another site where we could try out the HBCSE curriculum. There is a slightly different line of approach taken by Streefland, which could be fully developed and explored as an alternative. The material I developed needs to be reviewed too and is probably better suited for teacher training than for teaching children.

One of the most crucial things that we need to do in fractions is to investigate what can be taught at the upper primary level and what will have to be taken up at the middle school level. As far I know HBCSE curriculum does not spell this out clearly- though the team might have a clear idea about it.

Measurement: I have spent a small amount of time with class VI children on finding area and perimeter. I need to work on this.

Number sense: This is again another area I have dabbled in for a short time with class VI children. But I do think this is one of the most creative domains and should provide a lot of fun with mathematics. We should collect a lot of interesting puzzles and problems that would help children play around with numbers.

Algebra, graphs and data arrangements are themes I have not touched so far. HBCSE has dome some work on Algebra. I am not sure if they have a complete module yet, but I know for a fact that they have a new approach.

Developing a middle school math curriculum

It seems a huge task and would call for more people. I would need your comments and suggestions about how to proceed. At the moment it appears to me that I must consolidate the work on fractions and negative numbers and bring out something that one can try implementing and comment on, and explore geometry.