# MIDDLE SCHOOL MATHEMATICS CURRICULUM: AN EXPLORATION TOWARDS REFORM

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*"What to teach?" is the fundamental question one has to address before selecting or inventing the innovative pedagogies. The state or national frameworks mostly set the curriculum content. Our educational efforts & classroom processes are there so that this curriculum content can be covered in the span of prescribed academic hours.*

## OBJECTIVE OF THE PAPER

The concern of this paper is to present the middle school mathematics curriculum [Classes IV-VII][1] being developed at iDiscoveri Education. The effort aims at bringing out more than a list of content or behavioral learning outcomes.

This is a step to take forward the NCERT's guidelines into specific learning outcomes[2] for four years of middle school that:

-involve concepts, skills & processes.

-show a vertical & a linear progression

-are classified on the basis of skills[3] &

-do not prescribe the use of a particular textbook.

This curriculum is an attempt to overcome the four inhibitors of a dynamic curriculum, as Steven Levy says in his book, Starting from Scratch (1996). These are; the fragmentation of subject matter; the abstraction of knowledge; our reliance on prepared textbooks & learning kits; & the expectation that we will cover vast areas of content.

## CURRICULUM DRAWN FROM THE LEARNER

The curriculum is based on the understanding of learners' previous knowledge and their readiness to learn. The learners enter middle school mathematics with a basic number sense: counting, sorting & reading number; computational skills with reference to simple calculations & problem solving; considerable experience of exploration with respect to shape, size & measurement using manipulative; familiarity of story problems; knowledge of simple mathematics language and an eye for pattern observation.

In middle school, learners start building up their own conjectures. They try to gain mastery of basic skills and enhance the understanding of key concepts. The exploration is geared towards reaching the final product. They work on facts and start building the rules and require challenging situations to work on. Based on this understanding of children, the Middle School Mathematics Curriculum

[1] The classes IV-VII are being selected based upon the understanding of child development and the specific skills the learners of this age group show. The existing educational frameworks of India like NCERT, Educational Initiatives & of other countries like USA (NCTM), Singapore, Sasketchwan & UK were analyzed & compared.

[2] Learning outcome is a statement of one of the several specific performances, the attainment of which contributes to the attainment of curriculum goal.

[3] This is done keeping Bloom's taxonomy of cognitive domains as a background.

has learning outcomes that emerge out of an integrated curriculum map of the four years of middle school.

## IMPLICATIONS

Based on the understanding of child development & child-centered curriculum, these learning outcomes help both, the facilitators and the learners, in the following ways:

a) The learning outcomes are being presented to achieve three broad content areas. This clearly shows the links between the concepts & makes generalization of them easier. These areas are as follows:

### Number & Operations:

The learners will be able to enhance their number sense and extend the understanding of whole numbers further to fractions and decimals. A foundation in integers will also be in place. They will be able to infer the relationships between different operations and they use the basic operations in problem solving with effective computational fluency. The learners will be able to make generalizations based on pattern observation.

### Space, Shape & Measurements*:*

The learners will be able to use visualization and spatial reasoning to describe relationships and solve problems [e.g. using observation/ tracing, sketching/building/manipulating/ creating poems/stories, etc.]. The learners will know measurable attributes of objects and process of measurement. They will be able to choose and apply appropriate techniques, tools and formulae to determine measurement.

### Data & Chance:

The learners will be able to collect, organize, and display a range of relevant data to deal with a problem situation. They will be able to select and use appropriate statistical methods to analyze data. They will be able to make assumptions on the data and to evaluate these predictions based on statistical methods. They will be able to know and apply basic concepts of probability.

b) The learning outcomes show both **horizontal as well as vertical progression** of the skills for the content level i.e. they are arranged in an order to show continuous progression of the concepts in a grade as well as across grades.

c) The attainment of learning outcomes will clearly show whether the learner has attained **the factual knowledge or the higher order applicative skill**. This is because the learning outcomes have been coded & presented in such a way that they indicate whether a skill attained is knowledge /understanding/application based 3. They can also be used as an assessment tool by facilitators and learners. Facilitators can diagnose levels of learning and thus, plan a classroom transaction based on differentiated instruction and multiple- intelligence.

d) The entire middle school mathematics curriculum will focus on the following **skills**:

### Problem Solving:

The learners will be working on the engaging tasks across all content areas, in various contexts, using their own strategies. They will be checking, verifying and reflecting back on their solutions and analyzing their errors. They will be encouraged to create their own problem situations.

*Reasoning:* The learners will be able to make and check assumptions. They will be able to make logical inferences.

*Connections:* The learners will be able to draw out connections between mathematical ideas. They will be able to observe mathematics in a context.

*Communication:* The learners will be able to work on the problems with classmates. They will be able to express their ideas, pose questions to others and evaluate others' strategies.

*Representation & Visualization:* The learners will be able to use technological tools along with the traditional ways to represent their ideas & learning. They will be encouraged to use visual tools to represent & solve problems.

*Generalization:* The learners will be encouraged to seek relations & create patterns of figures, symmetry, tessellation, numbers, etc. around us to make generalizations about mathematical ideas. This will further support them in handling with abstractions.

*Sequential approach:* The learners will be able to handle the problem situation in step-by-step manner i.e. systematically addressing the problem.

*Computation & Estimation:* While solving problems, the learners will be regularly promoted to mentally compute the calculations & estimate the result/solutions.

e) The learning outcomes do not prescribe any specific textbook/s but mention **examples of instructional strategies** at various levels, which can be further developed for a dynamic classroom transaction.

f) The **facilitator-learner interaction** plays critical role in achieving the goals of middle school mathematics curriculum. Hence, it is crucial that the interaction builds upon the following strategies:

-Connecting Mathematics with learners' experiences & previous knowledge.

-Providing a non-threatening environment, where learners commit mistakes and learn from their mistakes i.e. providing supportive environment where both failures & successes are valued.

-Self-analysis (comparing with the correct solution and self correction) & providing scope for mathematical discussions driven by learners.

-Shift from a solution oriented approach to process oriented approach.

-Using variety of examples & strategies & let the children reach the generalizations. Let the children use their own strategies and then decide which strategy is better/best.

-Using deductive approach i.e. let the students struggle with the problems & come out with their own solutions/ strategies rather than teachers providing correct solutions. This requires scope of open-ended problems that can be approached through different ways.

-Regular experience (formal or informal) of the concepts once introduced, in variety of situations.

-Linking conceptual and procedural knowledge i.e. providing scope for observation & application of the connections of learning in real life & with other subjects.

-Continuous feedback to & from the learners.

-Use of appropriate and friendly language (specifically in word problems).

-Use of school campus, manipulative & visual tools.

-Flexible seating arrangement, which gives scope for participating in variety of group dynamics i.e. individual, pair, small group & large group.

-Working on own beliefs about the subject and children.

## Note:

iDiscoveri : Founded in 1996, it is a learning, teaching & research organization that works at transforming education & enterprise.

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