**11.1 TEACHING OF MATHEMATICS**

Unfortunately, So far Mathematics has been an elusive bird, which we hope will one day take off and fly. The prevalent conventional and formal teaching has enough scope for a change to an objective, organized and strategic planned education. The focus should be on the achievement of teaching and teaching environment as a whole. The teacher should be well equipped with the innovative teaching concepts and visions to achieve desirable, smooth and sustainable transitions.

* It is known to one and all that Mathematics plays an important role in our daily lives. We cannot move an inch without mathematics.
* Not all students like mathematics, but a good math teacher has the power to change that dis-affection.
* For the students who have a bad taste for the subject, a good math teacher can breathe new life into the subject.
* A successful math teacher has an extensive knowledge of mathematics.
* This knowledge allows him to confidently explain concepts and processes to his students.
* This confidence boosts his credibility and helps students trust in his ability to teach them what they need to know.
* Math teachers use many methods when teaching.
* Their job when instructing is to develop methods, or ways of teaching, that will benefit the students and make them successful.
* Methods of quality math instruction include using visuals, making connections, using formative assessments, and teaching strategic thinking.

**Teaching strategies**

* Students learn in different ways, and a good math teacher understands that.
* He keeps up with the best practices in the math education and regularly incorporates them into his instructions to help all of his students learn.
* His lesson plans engage students and help them feel confident in their mathematical abilities.

**A personal approach**

* In the class-room a talented math teacher serves as a facilitator of learning, providing students with the knowledge and tools to solve problems and then encouraging the students to solve them on their own.
* When students answer incorrectly, he does not allow them to quit, instead figure out where they went wrong and keep working at the problem until they get the correct answer, providing support and guidance where needed.

**Class-room leadership**

* A skilled math teacher is seen as a leader in his class-room and in the school.
* His students respect him, not only for his knowledge of the subject but for his overall attitude and actions.
* He has control over the class-room, laying out clear rules and expectations for students to follow.
* When students misbehave, discipline is consistent and fair.

**Care and concern**

* A good math teacher cares about his students.
* While he holds his students to high expectations, he recognizes that occasionally life gets in the way of home-work and that studying sometimes take a back-seat to family obligations.
* Therefore he offers student second chance when warranted and takes time out of his own schedule to help student catch up.

**Math teacher is required to have skills in a variety of topics**

* He should be patient as some students take long time to comprehend a concept.
* He should be creative in finding ways to convey concepts to somewhat resistant students.
* He goes beyond teaching the basics of counting, adding, and subtracting to installing a love of Math and its usefulness into students.
* He is usually well versed in both his understanding of the basics of Mathematics and how to share the knowledge in various ways.
* A Math teacher must have the ability to communicate effectively with students, parents, and fellow teachers in order to work towards the common goal of providing education to youth.
* He is required to create lesson plans to keep students engage in the learning process while sharing math concepts that can often be confusing.

**Teaching Math at Primary level**

* Math teachers who teach math at Primary level are usually certified in elementary education and teach all topics.
* Help students develop the skills and strategies for mathematical problem solving.
* Assist students develop the skills and strategies for mathematical problem solving.
* Assist students in understanding math as a natural language that is able to be manipulated by human mind.
* Teach students how to build more advanced skills as they progress.
* Show students how to check work, revise, and evaluate mathematical process.
* Teach students to reread and restate the problem using different languages.
* Teach students how to relate the problem to other similar problems.
* Empower students to consider various problem-solving strategies.
* Teach children to do the necessary calculations.
* Teach children to communicate answers using pictures, manipulative and words.
* Teach children fundamental concepts like “reasonableness” and “approximate”.
* Model math reasoning by thinking aloud.
* Encourage talk at each state of the problem solving process.
* Encourage positive attitude for approaching mathematics.
* Teach children how to measure using a variety of tools.
* Connect mathematical concepts and procedures to everyday situations.
* Communicate mathematical thinking and inquiry through visuals, written work, and speaking.
* Commit to becoming a role model for students in the community.
* Set rigorous, concrete and individualized goals for student to achieve.
* Engage in professional development on a regular basis.
* Use a variety of teaching aids manipulative to reinforce concepts.
* Understand money, time and measurement.
* Acknowledge students in meaningful ways in regard to their academic development and achievements.
* Collaborate with other teachers to support the school’s mission, statement and values.
* Develop positive and meaningful relationships with students and their families.
* Conduct all teaching practices and related work activities with a manner of professionalism.

**At middle and higher classes**

* Math teachers are responsible for refining students’ developing mathematical experiences and greater understanding of math in the world, and directing them towards a study and appreciation of mathematics in both the practical and theoretical spheres.

**With that goal in mind, secondary math teachers**

* Teach students about the focus and goal of math in the real world.
* Assist students become more confident mathematicians
* Assist students select and apply a variety of problem solving strategies.
* Create a variety of retranslations of mathematical concepts.
* Help student determine area, volume and parameter etc.
* Help students reflect on their thinking.
* Help students make connections among math concepts.
* Become familiar with mathematical terminology.
* Use analysis to verify problems and solutions.
* Be passionate about the mission and vision of the school.
* Set academic goals for students to achieve.
* Commit professional development to increase depth and skill of teaching practice.
* Commit to becoming a part of the students’ community as a teacher.
* Be flexible to meet needs of students that vary from day today.
* Support the school’s culture and practices with confidence.
* Make appropriate connections with students to acknowledge their academic development and achievements.
* Work collaboratively with students and their families to achieve best outcomes.
* Conduct all work activities in a professional manner.

**Math Lab for improvement of teaching of Mathematics**

* Mathematics is more than the rules and operations that we were taught in school.
* Mathematics has always been the very important subject to understand the physical phenomena in everything around us.
* So, Mathematics as a tool is indispensable in our daily life. Unfortunately the phobia for this subject is very prominent amongst our learners.

***The present education system has made a 360 degree shift from learning Mathematics by obedience to learning by applied reasoning.***

* This means children learn best when they are interested and even excited about what they are doing.
* We should therefore give children many opportunities to see and hear different things, and to move about and play with things they can touch.
* Let them connect things, and show and demonstrate concepts in their own way.
* National Curriculum Framework (NCF) developed by NCERT, the Central Board of Secondary Education has initiated a number of steps to make teaching and learning of Mathematics at schools activity-based and experimentation oriented.

**The guidelines are:**

* Learning concepts using concrete objects.
* Foster Mathematical awareness, skill building, positive attitudes and learning by doing.
* Verify Math facts and properties using models, measurement and activities.
* Teachers to explain and demonstrate many concepts using charts, models, aids and activities.
* **Math Lab--**will enable school students to learn and explore mathematical concepts and verify mathematical facts and theorems using technology tools.
* **Math Lab--**will offer Multiple Teaching and Learning Aids comprising of Technology Applications, Videos, Manipulative, Measuring Instruments, Tables and Charts based on the three pillars of *'Imagination, Investigation and Interaction'*.
* **Math Lab--**provides an opportunity to students to understand, internalize, discover and verify the basic mathematical and geometrical concepts through concrete objects and situations, thus building interest and confidence in students learning the subject. The laboratory also allows and encourages the students to think, discuss amongst themselves as well as with the teacher, and assimilate concepts.

**Methodology**

* Mathematics is not about isolated skills and procedures.
* It needs to be seen as a tool which helps us in the process of estimation, communication, analyzing data patterns, connections, relationships and spatial sense.
* Children need mathematics education that is alive, vibrant, relevant and meaningful; an education that paves the way to seek and understand the world around them in the stance of numerical.
* At present students may be able to solve various mathematical problems but not able to relate to subjects like science, art, computers and appreciate the interconnectedness.

**Mathematics club**

* Mathematics club for motivation and better understanding of the subject.
* Participation in various inter-school competitions.
* Mathematics made easy through practical Math work.
* Other activities as suggested by Math teacher.
* Mathematics coaching during summer vacations and after regular classes during the year.
* Representation and participation in various inter-school competitions of mathematics and various other activities

**Merits**

* The method is based on the principle of learning by doing.
* This method is psychological as we proceed from known to unknown.
* It is based on student’s self pacing.
* It helps in making clear certain fundamental concepts, ideas etc.
* If develops the self confidence and teaches the students the dignity of labour.
* Children learn the use of different equipments, which are used in laboratory.
* It develops in the child a habit of scientific enquiry and investigation.
* This method presents mathematics as a practical subject.
* It stimulates the interest of students to work with concrete material.
* It provides opportunities for interaction and co-operation among the students.
* It is child centered and therefore it is psychological method.
* It helps the students to actively participate in the learning process and therefore the learning becomes more meaningful and interesting.

**Demerits of math lab**

* This method can be used for a small class only.
* It requires a lot of planning and organization.
* This method is suitable only for certain topics.
* By this method, it is not possible to make progress quickly.
* This method requires laboratory equipped with different apparatus.
* All math teachers cannot use this method effectively.
* It is an expensive method. All schools are not able to adopt this method.
* This method has very little of theoretical part in it.
* While in science, experiments provide evidence for hypothesis or theories, this is not so in mathematics.
* Mathematical truths are accepted only on the basis of proofs, and not through experiments.

**Conclusion**

* We can say that this method is suitable for teaching mathematics to lower classes as at this stage teaching is done with the help of concrete things and examples.

***”Pure Mathematics is the world’s best game. It is more absorbing than chess, more of a gamble than poker, and lasts longer than Monopoly. It’s free. It can be played anywhere. Archimedes did it in a bathtub”. (R.Trudeau)***