8th National conference

(Technology & Innovations in Math Education)

For Math Teachers at school level

December 7-10, 2017

Program and Abstracts

Convener and Founder

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Department of Mathematics
Indian Institute of Technology Bombay
Powai, Mumbai 400076

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Dr. P. B. Vinod Kumar, RSET, Kochi

Daily Program

Room occupancy chart

Date/Room	Room 1	Room 2	Room 3	Room 4	Room 5	Computer Lab	Computer Lab
Inauguration	9:30-10:30am						
December 7 Thursday	11:00-12:00 Key Note -IKR						
	12:30-1:00pm Invited Talk 1 A. Vijayakumar						
	2:00-3:00pm Invited Talk 2 Matjaz Kovse						
	3:15-5:00pm Workshop sessions	Workshop I Casio				14:30 -15:30 Workshop CW1 Geogebra	14:30 -15:30 Workshop CW2 Geogebra
	5:15-6:15pm Invited Talk 3 ??						
December 8 Friday	9:00-10:00am Invited Talk 4 E. Krishnan						
	10:15-11:45am Paper presentations	Paper presentation	Paper presentation	Paper presentation			
	12:00-1:00 Invited Talk 5 Shobha Baghi						
	2:00-3:15pm Workshop Sessions	Workshop II Casio	16:00 - 17:00 Workshop - Paper folding			16:00 -17:00 Workshop - Geogebra Intermediate	
	17:15-16:15 Special Talk 6						

Room	Room 1	Room 2	Room 3	Room 5	Computer Lab	Computer Lab
December 9 Saturday	9:00-10:00am Invited talk 7 Atmaraman					
	10:00-11:00am Invited Talk 8 Jonaki Ghosh					
	11:30-12:30pm Invited talk 9 Pravas K					

	1:30-3:30pm Workshop sessions	16:00 - 17:00 Workshop Paper folding			14:30 -15:30 Workshop Geogebra Advance	
	4:00pm-5:00pm **Invited talk 10 ??**					
December10 Sunday	Conference Tour					

December 7, Thursday

8:30-9:30am: Registration

9:30-10:30am: Inauguration

10:30am-11:00.am: Tea Break

11:00am-12:00: **Key note:** Inder K. Rana, *Teaching Math in the Google Age*

12:00-1:00pm: **Invited Talk 1**- A. Vijayakumar, What is happening in mathematical sciences?

Chair: Inder K. Rana

1:00pm-2:00pm: Lunch Break

2:00pm-3:00pm: **Invited Talk 2**- Mataz Kovse, *How to teach without becoming weary?*

Chair: Prof. A. Vijayakumar

3:00-3:15: Tea Break

3.15pm-5.00pm: **Workshop Sessions**:

- Computer Lab: Geogebra Basic
- Computer Lab 2: Geogebra Basic
- Room 1: Jitendra Pathak, *Casio Lab I*

5:00pm-6.00pm: **Invited Talk 3-** ???????

Chair: ??????????

7:30pm-9:30pm: Conference Dinner

December 8, Friday

9:00am-10:00am: **Invited Talk 4- E. Krishnan, Negative Numbers- History and Pedagogy**

  Chair: A. Vijayakumar

10:15am-11:45am: **Paper presentations**:

Room 1:

1) *Quantitative Reasoning: An integral component of foundation course*
   Asim Siddiqui, Proteep Mallik, Ramchander K., Richard F., Shomen M., Shantha B., Sri Ram, Rajaram, NSLS, Azim Premji University

2) *Experiments with tactile learning of mathematics*
   Shantha Bhushan, School of Liberal Studies, Azim Premji University

3) *Effect of of three step methodology in my school*
   Mr. Nitin Eknath Chaudhari, R. C. Patel Secondary School, Shirpur Dist. Dhule, Maharashtra

Room 2:

1) *Fractals Everywhere*
   Aba Antony, Teacher, Department of Mathematics, Vidyodaya School, Thevakkal

2) *The fourth dimension*

By Sangeetha S., Teacher, Department of Mathematics, Vidyodaya School, Thevakkal

3) *Use of Technology In The Mathematics Classroom*

Ashish Mittal, Indirapuram Public School, Pratap Vihar, Ghaziabad,

Room 3:

1) *Classroom Teaching of Mathematics in a More Meaningful way by Using Internet Technology*

Dr. Vipul R Shah, Mukesh T Joshi, G. H. Patel College of Engineering & Technology, Vallabh Vidyanagar, Gujarat

2) *Mathematics support for an undergraduate programme*

Proteep Mallik, Sri Ram, Shantha Bhushan, School of Liberal Studies, Azim Premji University

3) *Let us know the meaning first*

Avinash P. Kulkarni, M.G. High School and Junior College, Igatpuri

Room 4:

1) *Use of innovative teaching aids*

Mr. Yoganand Manohar Samant, Kudal Highschool, Kudal, Kudal, Dist. Sindhudurg, Maharashtra

2) *Global Positioning System (GPS)*

Manju Mahesh, The Choice School, Tripunithura

3) *Operations on Integers by tricky method and useful model circle to describe theorems of circle.*

Mrs. Devyani Gajendra Khedkar, Bharat Vidyalaya, Akola

Room 5:

1) *Improving participation of students in math learning*

Ishwar Mudakappa Rayannawar, G. D. K. Sainiki School, Tasgaon, Sangli

2) *Math: An insight into the latest Mathematics curriculum followed in the state of Kerala,*

Firoza Moidu, Calicut Girls High School, Calicut, Kerala.

11:45-12:00: Tea break

12:00-1.00pm **Invited Talk 5- Shobha Bagahi,** *Mathematical Drills to Thrill*

Chair: Jonaki Ghosh

1.00pm-2.00pm: Lunch Break

2.00-pm-3.15pm: **Workshop Session:**

- Computer lab: *" Geogebra Intermediate"*
- Room 1: Jitendra Pathak, *"Casio Lab-II"*

3.15pm-3.45pm: Tea Break

3.45pm-5.00pm: **Workshop Sessions**:

- Computer Lab: Pravas K., *Desmos"*
- Room 1: Sivashankara Sastry, *Paper Folding*

5:00-6.00pm: **Invited Talk 6:** *Dr. Anwar Sadat, topic??????????????*

Chair:??????????????

December 9, Saturday

9.00am-10.00am: **Invited Talk 7,** Atmaraman, *Investigations and Mathematics Laboratory*

Chair: ????????????

10.00am-11.00am: **Invited Talk 8, Jonaki Ghosh, Technology enabled explorations: A catalyst for developing students' Mathematical Thinking**
Chair: ?????????????

11:00-11:30am: Tea Break
11:30am-12:30: **Invited Talk 9, Pravas K., Desmos: A tool for Teachers and Students**

12:30-1:30 pm: Lunch break
1:30pm-3:30pm **Workshop Sessions**
- Computer Lab *Geogebra advance*
- Room 1: Sivashankara Sastry, *Paper Folding*

3:30pm-4:00pm: CONCLUDING FUNCTION
4:00pm: Tea

December 10 Sunday

9:00am-1:00pm: Conference Half day City Tour

Abstracts

7th December Thursday

11:00am-12:00 Key Note address
Teaching Mathematics in the Google Age
Prof. Inder K. Rana, Indian Institute of Technology Bombay, Mumbai
Teaching of learning of mathematics is an issue being debated over the years and will continue to be. For teachers it has become necessary to embrace technology to innovate in their classroom when the learners are becoming more and more tech-savvy in the Google age. We will share some illustrations on the use of technology to teach and innovate.

12:00-1:00pm: Invited Talk 2- *"Desmos: A tool for Teachers and Students"*
Pravas K., K.K.T.M. Govt. College, Pullut, Kerala
Desmos is a powerful, online graphing calculator designed to plot any equation, explore transformations, create complex tables, and more. Surely it is a useful tool for any teacher, student or math enthusiast. The classroom activity builder tool from Desmos helps teachers to create classroom activities, share with students and analyse their thoughts. This talk aims to give a quick introduction to Desmos and a tutorial on the classroom activity builder and its features.

1:00pm-2:00pm: Lunch Break

2:00pm-3:00pm: Invited Talk 3- *How to teach without becoming weary?*
Mataz Kovse, Visiting Associate Professor, School of Basic Sciences
Indian Institute of Technology Bhubaneswar, Bhubaneswar
Some old and new technologies for supporting the educational process will be presented. Among them also the Nonviolent violent communication (NVC), developed by Marshall B. Rosenberg, which

can empower educators to transform schools into life-serving, learning-rich environments that maximize the potential of every student, resolve and prevent conflicts peacefully, improve the quality of classroom and school relationships, and strengthen the classroom community.

3:00pm-3:15pm: Tea Break
3:15pm-5:00pm Workshop sessions
- **Room 1: Jitendra Pathak,** *Exploring concepts and applications of Mathematics using Casio teaching tools -I:*
  This workshop session will highlight the use of the CASIO CG - 20 graphics calculator as a teaching tool in the senior secondary mathematics classroom. The emphasis will be on developing conceptual understanding and also in enabling students to perform mathematical investigations. Participants will be given a hands-on experience on the calculator. Problems will be taken up from the topics of functions, calculus, matrices, simulation of experiments in probability and statistical inference.
- **Computer lab 1:** *Geogebra basics*
  Introduction Geogebra software with handson practice.

5:00pm-6:00pm: Invited Talk 3: ???????????
      Chair:?????????????????

8th December Friday

9:00am-10:00am: Invited Talk 4- E. Krishnan, *Negative Numbers- History and Pedagogy*
      Chair: ?????????????
      Teaching negative numbers and complex numbers is fraught with conceptual difficulties, since no motivation is given. For meaningful transaction of these concepts in the classroom, teachers should have an idea of the historical origin of these ideas, which is purely mathematical, and also their modern uses, which includes applications to other branches of science. In this talk, these ideas will be elaborated with emphasis on pedagogy.

10:15am-11:45am: Paper presentations:

Room 1:
1) *Quantitative Reasoning: An integral component of foundation course*
   Asim Siddiqui, Proteep Mallik, Ramchander K, Richard F, Shomen M, Shantha B, Sri Ram, Rajaram NSLS, Azim Premji University

   The school of liberal studies (Azim Premji University) started its undergraduate programme in July 2015. The goal of the programme is to create competent graduates who are socially committed, have deep knowledge in a broad spectrum of areas and come from diverse socio-economic backgrounds. We live in a world where numbers and quantitative evidence inform many decisions at the personal level and at the level of society and public policy. Therefore, it is important for all students to have an introduction to the possibilities and usefulness of quantitative reasoning. This necessitates that quantitative reasoning forms an integral part of the common curriculum for every student. Over the last decade several universities in India have started liberal arts/education undergraduate programs, many of which have made quantitative reasoning an integral part of the foundation course. Very broadly, quantitative reasoning might be described as the intersection of areas of critical reasoning, and mathematics within a disciplinary setting.

The challenges to developing such a course are many: how to handle the fear associated with math/quantitative thinking; how to make QR accessible and relatable to real life; what are the appropriate tools to making quantitative thinking a habit; finding a context to develop quantitative reasoning skills; finding the right level of abstraction; how to choose appropriate technology. This paper describes the process of visioning and implementing a quantitative reasoning course which caters to students with a spectrum of abilities and preparation. The innovation in this effort is in finding the right combination of content from a range of contexts where quantitative reasoning occurs, the appropriate pedagogical tools and assessment practices. We have chosen from a variety of themes such as game theory, epidemiology, cryptography, symmetry, statistics, creative computing etc. We have used GeoGebra, python, SNAP/ Scratch, experiments, games as pedagogical tools depending on the context. This QR course is supplemented by efforts of the academic resource center. We discuss some of our learnings and ongoing challenges in this effort. Preliminary assessment suggests that students are excited, engaged and are able to integrate the learnings from quantitative reasoning with other disciplines.

2) *Experiments with tactile learning of mathematics*
Shantha Bhushan, School of Liberal Studies, Azim Premji University

When students think of mathematics and learning mathematics, words such as celebration, joy, beauty, etc. are seldom associated with it. To quote Nathalie Sinclair, "A British study found that contemporary lower-secondary students find their mathematics classes to be "TIRED," that is, characterized by Tedium, Isolation, Rote Learning, Elitism, and Depersonalization". In the Indian context also, this is quite true both as the school and college level. One of the questions that we ask is how to make mathematics more engaging, relevant, accessible and most important joyful. Tactile mathematics is defined as recognizing deep mathematical concepts through engagement with physical objects. Having eagerly followed the work of Diana Taimina, Sarah Marie Belcastro, Carolyn Hackel and others, I wanted to see how college students might respond to tactile ways of learning mathematics. Diana Taimina talks about how non- Euclidean geometry was difficult to understand till she found crochet to visualize hyperbolic surfaces. She says "Lobachevsky called his geometry imaginary because it was so greatly in contrast with common sense: so, it remained for me also imaginary until I could experience straightness in the hyperbolic plane in a tactile way". This paper discusses the design and implementation of such activities into existing courses. How do college students perceive concepts such as symmetry, repetition, rhythm, and pattern, in a mathematical setting? In this paper we discuss two such experiments. The first one was a unit in a quantitative reasoning course, called symmetry. The second one was Pi day celebration where second year students engaged with a range of concepts which had strong experimental, tactile component.

3) *Effect of of three step methodology in my school*
Mr. Nitin Eknath Chaudhari, R. C. Patel Secondary School, Shirpur Dist. Dhule

The paper focuses on effect of 3 step methodology developed under "QIME Project "in my school. One argument is often place is that fear of Maths and misconceptions in mathematics are a result of ineffective teaching. May be the students have not had enough opportunity to reflect on discussion and mathematical reasoning to support the concept.
As we know that learners create their own meanings and structures for mathematics on the basis of their previous experiences researcher had tried a three step methodology developed

under QIME Project conducted by RMSA and I.I.T. Bombay in two different classes (standard 9th division A and Division C) in my school for comparative study with the traditional method.
Results:
It was found that the teaching method that I have adapted is:
1. Put students in real life situation and they understand why they are learning this topic.
2. Engage student and helpful in creating math's talk inside and outside the class that
Increase the confidence of students.
3. Students didn't miss the beauty of maths.
4. Enable the students to become 'Solution providers'
5. Keep the teacher away from black Board
And it is said that" If you are closer to black-Board, Then you are away from students. But
If you are away from black-board, Then you are closer to students" Because Whenever you reach to black-Board, You detect and detection is harmful to mathematics because math is created by human mind, not by nature, so every child can create mathematics. Thus, it was found that there was a remarkable difference in their understanding.

Room 2:
1) Fractals Everywhere
By Aba Antony, Teacher, Department of Mathematics, Vidyodaya School, Thevakkal

"Clouds are not spheres, mountains are not cones, coastlines are not circles and bark is not smooth, nor does lightning travel in a straight line" Dr. Benoit Mandelbrot.
In this presentation the basics of Fractal Geometry discovered by French/ American
Dr. Benoit Mandelbrot and its applications are highlighted. A fractal is a rough or fragmented geometric shape that can be split into parts, each of which is a reduced size copy of the whole. The word fractal is derived from a Latin word 'Fractus' means broken. A fractal is a quantity or object which exhibits self-similarity on all scales. Unlike Euclidian shapes, fractals have dimension which is non- integer or fractional. The places where we can find fractals include almost every part of Universe. The Cantor set, Mandelbrot set, Julia set, Sierpinski's triangle etc. is considered as examples of fractals. This paper intends to pick out the most important applications, trying to include them from as many areas of science and everyday life as possible. Fractals are in closed relationship with symmetry, proportion, measurement and fractions in elementary level and logarithms, compound functions, Pascal's triangle, geometrical series in secondary level, which will help our students in establishing a relationship between math and other disciplines. Here are the few activities which help our students to integrate fractals in school mathematics- Fractal Fractions, Calculating the area and perimeter of Koch Snowflake using geometric series and area of equilateral triangle, converting Pascal's triangle to Sierpinski triangle, Pythagorean tree. All these help our students to understand and explore this relatively brand new field of mathematics which in turn helps them to conquer greater heights in the field of mathematical research. Keywords: Fractal, Scales, Euclidian shapes, Non- integer, Fractional.

2) The fourth dimension
By Sangeetha S., Teacher, Department of Mathematics, Vidyodaya School, Thevakkal

"To see a world in a grain of sand and a heaven in a wild flower hold infinity in the palm of your hand and eternity in an hour" William Blake.
The Fourth Dimension or 4D opened a new dimension towards the development of technology and design through imagination and challenge. Mathematically 4D is an abstract concept derived by generalizing the rules of 3D. Algebraically it is generated by applying the rules of vectors and co-ordinate geometry to a space with four dimensions. A vector with four

elements (a four tuple) can be used to represent a position in 4D space. A 4D space is a simple space with four spatial dimensions that needs four parameters to specify a point within. Three dimensions are polyhedral made of 2D polygons, whereas in four dimensions there are four polytopes made of polyhedral. Four dimensional viewing is the process of projecting a 4D scene on to a 3D region. To understand the nature of 4D space, a device called dimensional analogy is employed. Dimensional Analogy can be easily defined by relating (n-1) dimensions to n dimensions and n dimensions to (n+1) dimensions. Few dynamic 4D products are Automatic Doors, Smart Focus of a Domestic Video Camera, 4D Ultrasound Scanner, , Aroma Space Technology, Technology used in Films to blow wind, shower rain, sprinkle water, leg and back ticklers, movement of air jets etc. All these provide a platform for us to experience the magic of fourth dimensions. This paper intends to bring out the concept of fourth dimension in to school level learning process. The use of interactive modules involving fourth dimension will become beneficial to students as they can easily relate the concepts. For example in a science class room, if we can show the blooming of flowers or the growth of a plant with the help of 4D, it will be helpful in learning the concepts effectively. Similar is the case of application of 4D in social science class rooms where we can present topics like volcanic eruptions and planetary motions. Even in literature class we can find the application of 4th dimension. Great writers like Edger Allan Poe, William Blake and H.G. Wells have presented the concept of 4th dimension in their works. In art classes, if we apply 4D technology the aesthetics concepts can be shown in a more concrete manner. In mathematics classes while dealing with polygons, there are five regular solids like tetrahedron, cube, octahedron, dodecahedron, icosahedrons etc. whose faces are composed of triangles, square and pentagons; whereas in 4D there are 6 regular solids which can be built based on the symmetries of the three dimensional solids. Mathematics is the language with which future discoveries depend on. Collaboration of different subjects and mathematics are bound to benefit each other. 4D acts as an excellent educational tool to train the new generation in the exciting journey of discoveries and to explore further frontiers of knowledge.

3) Use of Technology In The Mathematics' Classroom

Ashish Mittal, Indirapuram Public School, Pratap Vihar, Ghaziabad,

Education aims at making children capable of becoming responsible, productive and useful members of a society. Knowledge, skills and attitudes are built through learning experiences and opportunities created for learners in school. NCF (2005) also recommends on the position paper of teaching of Mathematics that to enrich the teachers with a variety of mathematical resources, Changing modes of assessment to examine students' mathematisation abilities rather than procedural knowledge, Engaging every student with a sense of success, while at the same time offering conceptual challenges to the emerging mathematician etc. Modern technology is therefore causing, and will increasingly cause educational aims to be rethought, making curriculum development a dynamic process. To a scanning eye, mathematics itself is being directly affected by the modern technology as new branches are developed in response to new technological needs, leaving some 'time-hallowed' techniques redundant. In addition, teaching of mathematics also gets affected in order to keep pace with new developments in technology. Our country is still keeping on reforming its education system year after year yet never found the right system which would be valuable to a student. If ordinary calculators can offer such possibilities, the potential of graphing calculators and computers for mathematical exploration is far higher. Teachers are simply satisfied with giving the mathematical rules to their students and having them memorize it. Their task is to transmit the knowledge to their students which has accumulated over the centuries. As per the today's requirement of system of education, it is strictly needed to make this teaching learning process so effective by using

technology in it. As National Council of Teachers of Mathematics (NCTM) (2000) highlights in its standards, technology can facilitate mathematical problem solving, communication, reasoning and proof; moreover technology can provide students with opportunities to explore different representations of mathematical ideas and support them in making connections both within and outside of mathematics (NRC, 2000). In a sense, all these are steps advocated by every mathematics educator over decades. The difference here is in emphasis, in achieving these actions by way of curricular choices. Perhaps the most compelling reason for the vision of mathematics education we have articulated is that our children will be better served by higher expectations, by curricula which go far beyond basic skills and include a variety of mathematical models, and by pedagogy which devotes a greater percentage of instructional time to problem solving and active learning.

Room 3:
1) ***Classroom Teaching of Mathematics in a More Meaningful way by Using Internet Technology***
   Dr. Vipul R Shah, Mukesh T Joshi, G. H. Patel College of Engineering & Technology, Vallabh Vidyanagar, Gujarat

   STEM is a curriculum based on the idea of educating students in four specific disciplines-Science, Technology, Engineering and Mathematics. One of the aims of STEM is to fostering of applying technology appropriately. In the state of the Union Address on January 31, 2006, President George W. Bush announced "The American Competitiveness Initiative". U.S. Department of Education website says that only 16% of high school students are interested in a STEM career and have proven proficiency in mathematics. As a result, The Obama Administration announced the 2009 "Educate to Innovate" campaign to motivate and inspire students to excel in STEM subjects. In India, State government as well as central government encourage use of technology under the scheme Computer Aided Learning (CAL) in rural as well as urban area by providing internet access and computers at every government school/colleges.
   This paper exhibits how teaching with technology can facilitate deeper, more meaningful, cognitive processing. We touched upon how some of the concepts of mathematics can be better understood during class room teaching using the power of technology. We can integrate the technology with chalk and duster approach to generate more interest among students. This hybrid approach will enable students to understand some of the concepts of mathematics easily. Moreover, they can access to global resources and materials that meets the student's appetite. We can use technology in such a way that students can develop power of conjecture.

2) ***Mathematics support for an undergraduate programme***
   Proteep Mallik, Sri Ram, Shantha Bhushan, School of Liberal Studies, Azim Premji University

   The Azim Premji University undergraduate programme in liberal studies was launched in July 2015. The goals of the programme are to create competent graduates who are socially committed, have deep knowledge in a broad spectrum of areas and who come from diverse socio-economic backgrounds. The faculty soon realised that some students did not have adequate foundation in mathematics to cope with their majors. The spectrum of student abilities is so vast that teachers have difficulty in pitching the course at the right level. In order to bridge this gap, it was felt that a summer program prior to the beginning of the academic session would really help the students get off to a good start. We decided to follow a two-pronged approach- one, a summer program and two, continuous support through the academic session. The summer program allows us to understand the abilities of students and

correct some common misconceptions. More importantly, it helps us design continuing support. The maths program in the summer is part of a larger summer program. This program is offered to students who are from socially and economically disadvantaged sections. We have conducted two summer programs so far.

We took the following steps: initial diagnostic test, identification of student needs, dividing students into groups with different abilities, choosing the appropriate pedagogical tools, and continuous assessment. At the end of the program, students took the same diagnostic test to identify the progress made. Following this student files were sent to faculty of respective majors so that faculty could design and continue the support. Our paper describes this experiment and our learnings from it.

The outcome of the summer program was multi-fold. Students gained confidence in being able to ask questions and to think critically. The students were able to self-reflect and understand their own weaknesses and strengths, which we believe is a first step to taking charge of one's own learning process. Students were also able to understand the needs of our program and grow accustomed to the ideas of liberal studies, continuous assessment, and self-directed and independent work. Finally, we feel that such a program is crucial for any undergraduate institution that is looking to create an inclusive environment and is at the same time attempting to design a rigorous and broad academic curriculum that will adequately prepare young graduates for further education and creative careers.

3) *Let us know the meaning first*
Avinash P. Kulkarni, M.G. High School and Junior College, Igatpuri

Mathematics, a subject with lots of different names, and different interest. Let us add one more name in list, i.e. ***Math is like a Court: Give Proof and make a decision***. Similarly justify your answer with proofs then and then only accept the concept. Usually the traditional teaching focuses on the mechanical/ procedural aspects, rather than the conceptual meaning. This leads following drawbacks:
1. Student takes the concept by a robotic way to their mind
2. Unable them to answer the question, "Why to do?".
3. Unable to build an Application Level in student's mind.
4. Unable to build mathematical thinking.
5. Directly jumps on procedural aspects.
6. Unable to correlate with other sub concept, unit, or subject.
7. The longest drawback occurs at Higher Secondary Level, where maximum concepts requires imagination instead of physical workout.
8. Its time being, after a long time it again need to learn.
9. Focuses only on instant outcomes and on bright students.

And many more, unfortunately time limitation does not allow another method in teaching learning process, brings an ignorance in Mathematics. This presentation focuses on the conceptual understanding, or helping students make meaning of the concept first, before jumping into the procedural aspects, which is different from traditional method. The presentation will demonstrate the strategy which overcomes the above drawbacks of traditional methods. I used the concept "Linear Equation in two variables" to demonstrate. The presentation is going to focus on the Meaning of Linearity of equation in two variables, which will be searched student by their self. There are lot of equations in two variables, but student will identify which are linear and which are not by comparing them graphically. This will also lead to differentiate the Linear equations in two variable and other equations in two variables by their definitions. The strategy will not only overcome all above drawbacks but also help students to start thinking a mathematical concept with its meaning, which tends to reach

to the root of a concept. Presentation includes material of students on which the strategy actually implemented. Strategy will build a capacity in student to answer a question -Why?.

Room 4:
1) ***Use of innovative teaching aids***
   Mr. Yoganand Manohar Samant, Kudal High school, Kudal, Dist. Sindhudurg, Maharashtra
2) ***Understanding Global Positioning System (GPS)***
   Manju Mahesh, The Choice School, Tripunithura.
3) ***Operations on integers by tricky method and useful model of circle to describe theorems of circle.***
   Mrs. Devyani Gajendra Khedkar, Bharat Vidyalaya, Akola

Mathematics is the queen of all sciences. Numbers in algebra and circle in geometry play an important role in our life. Teaching and learning can be made entertaining through various tricks. Plus (+) and minus (-) signs are made part of algebra. It is found that students usually make mistakes on operations of integers though it is well explained in text books. A single mistake of sign can make the entire problem wrong. My presentation includes 'tricks' to make students proficient in operation of integers. To develop skills needed to tackle operation of integers. I have also focused how to solve a quadratic equation and very few cubic equations by factorization method. Tricks are important in a competitive examination. It is expected that teacher should frame different practical as well as teaching aid of their own using available materials. In geometry, 'explaining proofs' is not sufficient or effective to understand the theorem. In my presentation, I have used 'teaching aid' on circle which explains properly and theorems of circles to get a clear idea. In my presentation, by using tricks and models, I tried to make mathematics interesting and time saving.

Room 5:
1) ***Meaningful Math: An insight into the latest Mathematics curriculum followed in the state of Kerala,***
   Firoza Moidu, Calicut Girls High School, Calicut, Kerala
2) ***Improving participation of students in math learning***
   Ishwar Mudakappa Rayannawar, G. D. K. Sainiki School, Tasgaon, Sangli

Creating interest and developing problem framing skill, which further helps in 'Game Making' by the students. Maths teaching has become a one way classroom bound activity. One way means: Problems framed by someone else and students solve. THEY NEVER GET A CHANCE TO FRAME THE QUESTION. While framing the question, students learn to think with multiple angles which help them while solving regular problems. The student's participation improves class communication. Also, the practical application of the theory is studied by them by indirect method. To illustrate the same, I would like to use some Geometry concepts.
Further, this activity develops the skills of 'game making' in mathematics. The joy of creating a game gives them encouragement and make mathematics learning a joyful journey.

11:45am-12:00: Tea break

12:00-1:00pm: Invited Talk 5- *Mathematical Drills to Thrill*
   Shobha Bagai, Cluster Innovation Centre, University of Delhi, Delhi
   Chair: ????
   Game based learning helps to develop an interest in Mathematics learning. It not only enhances the mathematical thinking, but also builds mathematical concepts among the

students. Game based learning empowers the learner to delve deep into the realm of mathematical concepts that later helps them to apply their mathematical knowledge to develop a feasible solution to a defined problem. The aim of the talk will be to introduce various concepts of mathematics – divisibility, alternate number systems, decision-making, geometry – through mathematical puzzles and activities. Starting from the simplest situation, the teachers will be initiated to the concept of generalization

1:00pm-2.00pm: Lunch break

2:00pm-3:15pm Workshop sessions:

- **Room 1: Jitendra Pathak**, *Exploring Concepts and Applications of Mathematics using Casio Teaching Tools -II:*
  This workshop session will highlight the use of the CASIO CG - 20 graphics calculator as a teaching tool in the senior secondary mathematics classroom. The emphasis will be on developing conceptual understanding and also in enabling students to perform mathematical investigations. Participants will be given a hands-on experience on the calculator. Problems will be taken up from the topics of functions, calculus, matrices, simulation of experiments in probability and statistical inference.

- **Room 2: Sivashankara Sastry,** *Paper Folding*

3:15pm-3.45pm: Tea break

3:45pm-5:00pm: Workshop sessions:

- **Computer lab 1:** *"Geogebra intermediate"*
  Intermediate level Geogebra software with handson practice.
- **Computer lab 2: Pravas K** Desmos, a hands on workshop.
- **Room 1: Yoganand Manohar Samant,** *Use of Innovative Teaching Aid – Goecircle*

5:15pm-6:00pm: Invited Talk 6- **???????????????**
     Chair:

9th December Saturday

9:00am-10:00am: Invited Talk 7- Atmaraman, *Investigations and Mathematics Laboratory*
Chair:?????????????
There was a lot of excitement when the concept of Mathematics Laboratory started to gain importance in the national curriculum. Unfortunately this notion has been defectively understood both at the implementation level and at the assessment level. Instead of being a dynamic forum for investigations, conjectures and mathematical communications, institutions turned the laboratories into places of costly display stalls and teachers into store-keepers who never opened their stores for fear of losing the expensive exhibits. With the advent of objective-oriented Technological tools that are easily available, schools and colleges can convert their mathematics laboratories into stunning entry points for enthusiastic mathematics adventurers and can also enhance the scope of teaching and learning process.This paper will aim to offer some suggestions for making our mathematics laboratories rich with purposeful and fascinating exercises.

10.00am-11.00am: Invited Talk 8- *Technology Enabled Explorations: A Catalyst for Developing Students' Mathematical Thinking*
Jonaki B. Ghosh, Lady Shri Ram College for Women, University of Delhi
Chair: VijayaKumar

The position paper on Teaching of Mathematics of the National Curriculum Framework 2005 identifies "Mathematisation of the child's thought processes" as one of the primary goals of mathematics education. David Wheeler defines mathematisation as "the ability to perceive relationships, to make transformations from actions to perceptions, from perceptions to images and from images to concepts", as well as "the capacity to internalise ideas and ask 'what if?' questions" – all of which are important ingredients for mathematical thinking. In this talk we shall highlight the role of technology in enabling the process of mathematisation and developing student's mathematical thinking with examples from studies conducted with senior secondary school students. In particular we shall reflect on the opportunities provided by the project – based approach to learning by citing examples of studies where students explored applications of mathematics to various topics such as genetics, fractals, queuing and cellular automata. We shall show how this approach lends itself well to the meaningful integration of technology. In some of these studies, students used different digital tools such as GeoGebra, Graphics Calculators, Spreadsheets and Mathematica to engage in processes such as exploring concepts, making and testing conjectures, looking for patterns, finding counter examples and dealing with multiple representations. The encouraging feedback and increased motivation level of students in these studies suggest that this approach is especially rewarding from the point of view of meaningful integration of technology in the teaching -learning process

11:00am-11:30am: Tea Break

11:30am-12:30: Invited Talk 6- A. Vijayakumar, What is happening in mathematical sciences?

12:00-1:30pm: Lunch Break

1:30pm-3:30pm Workshop Sessions:
- **Computer Lab:** *Geogebra advance*
- **Room 1: Sivashankara Sastry**, Paper Folding

3:30pm-4:00pm: Concluding Function

4:00pm: Tea

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