

TECHNOLOGY IN TEACHING MATHEMATICS

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ABSTRACT

21st century skills refer to the abilities to think critically, to collaborate, to create, to manage information, to apply technology and to continue to learn. According to National Council of Teachers Mathematics (NCTM), (2000), “technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances student’s learning. Teacher’s attitude plays an important role in using technology in teaching and learning mathematics”. Teaching mathematics can no longer focus just on teaching procedures, students need to know why they are doing and what they are doing? They need to understand the process of math. The teacher must start to realize that “Attitude, Skill, Knowledge & Creativity” are the four essential component that work separately, but together like the four legs of the horse or four wheels of car.

Technology may be defined as redefining, reshaping, representing, recycling, renewing the process of learning and teaching. In today’s world, technology is fast penetrating, engulfing and reconfiguring the whole education system. For students, the process of problem solving has adopted more practical and factual approach. Now they are developing attitude of reason with information and expecting the same from their educator. Technology empowers students to deal with multiple representations, enhances ability to visualize, increases opportunity to construct knowledge, and enhances opportunity for individualized evaluation. Teaching mathematics with advanced tools enables one to perform rapidly, easily reliably, yielding better results. Technical representation of mathematical ideas impacts students’ minds to build their conceptual understanding of the problem solving practices to a greater extent.

Keywords: *Computer algebra system (CAS), GeoGebra, Geometer sketchpad, Graphic calculator, Maple, Auto graph, e-transformation, tele-teaching, tele-conferencing,*

INTRODUCTION

Teacher and technology happen to be the perfect combination of guide and resources required to steer the tender minds of students. Technology may be defined as the "systematic application of scientific or other organized knowledge to practical tasks".

Student, teacher and mathematics form a didactic triangle, whereas introducing technology into this system transforms the learning ecology so that the triangle becomes a tetrahedron, with the four vertices of student, teacher, task/content and technology creating a space within which new mathematics knowledge and practices may emerge. Technology can be used as servant, partner or master depending on task assigned. It is a servant if used by students or teacher only as a fast, reliable replacement for paper or pen without changing the nature of classroom. It can be a master if students and teacher knowledge and competence are limited to a narrow range of operations and It is a partner when it provides access to new ways of approaching existing tasks to develop understanding, explore different perspectives. Mathematics involves the processes of analysis, interpolations, and probabilities for finding the solutions. Word processors, calculator and spread sheets have contributed to the computational and analysis capabilities of teachers Computer algebras systems (CAS) are used for modeling and providing examples to students for verification, demonstration and drill practice. Geometer’s sketchpad and applets tools provide students with ranging opportunity for mathematical exploration and sense making. Students can prepare mathematical conjectures and use the dynamics capability to visualize on idea under a wide variety of situations. Using such tools mathematical reasoning and problem solving skills can be enhanced among students by indulging them with examples from the day to day lives. Since mathematics is the science of problem solving, these tools have enabled teachers to exert students for applying their minds to find out the new solutions rather than providing already known conventional solutions

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In the 19th century; the teacher happened to be the gatekeeper of knowledge hub available to the students because they didn't have easy access to learning material. They were totally dependent on teacher from whom they could acquire knowledge. But with the advancement in technology the information gateways are now wide open in the form of internet and video conferencing services. Using e-learning, tele-teaching and tele-conferencing, virtual platforms are now available to the students for group discussions and other collaborative activities.

In teaching and learning of mathematics, technology can serve in the following fields:

- **Mathematical Concept & Skill Development:-** Technology has enabled students to obtain multiple representations, to construct mathematical knowledge, and to build individualized and customized diagnosis. Computer and/or calculator programs can simulate sequences of random events for the study of probability and statistics.
- **Mathematical Problem Solving:-** Technology provides students with enhanced ability to focus on the process of problem solving instead of the computational aspect and increased opportunity to develop mathematical modeling skills.
- **Mathematical Reasoning:-**Technology can motivate students to think logically in the context of programming a calculator or computer to perform a desired task
- **Mathematical Communication:** Technology helps communicate mathematics precisely and present mathematical ideas both orally and in writing. Presentations become quite easy when students use word processors and presentation software to write and present reports which include mathematical symbols, tables, graphs etc.
- **Mathematical Awareness:** Project mathematics through Video clips, Photo clips, Auto clips that explore basic topic in high school/college mathematics in ways that cannot be done at the chalkboard or in a textbook. This activity will attract young people/student to mathematics through high-quality instructions that shows mathematics to be understandable, exciting and eminently worthwhile.
- Each institution must publish newsletter featuring math activities, puzzle and fun games of numbers. It inculcate interest among students in mathematics.
- Teacher must include application of each topic to co-relate the mathematics with daily life. With this act, students are engaged in mathematics reasoning, problem solving and communicating about mathematics.
- Form math club in institution and it will provide extracurricular mathematics for young learners. Such clubs make way for interest in mathematics.
- Use e-mail math in order to exchange math story/problem with other math classes around the world.

IMPACT ON STUDENTS' LEARNING

- **Communicate Effectively:** Students can have a range of skills to express themselves not only through paper & pen, but also through video, audio, animation, design software as well as a heart of new environments (e-mail, websites, messages, boards, wikis, blogs, digital photo sharing, social networking, video conferencing etc.)
- **Analyze and Interpret Data:** Students can have the ability to crunch, compare, and choose among the glut of data now available Web-based and other electronic formats.
- **Understand Computational Modeling:** Students can pose on Understanding of the power, limitations and underlying assumptions of various data representations systems, such as computational models and simulations, which are increasingly during a wide-range of discipline.
- **Engage in Problem Solving:** Students can have an understanding of how to apply what they know and can do to new situations.
- **Manage and Prioritize Tasks:** Students can be able to manage the multi-tasking, selection and prioritizing across technology applications that allow them to move fluidly among teams, assignments and community of practice.

- **Ensure Security and Safety:** Students can know and use strategies to acknowledge identify and negotiate 21st century risks.

ROLE OF TEACHER

SMART: Teacher should be SMART inhabiting the qualities

S – Specific
M – Methodology
A – Approach
R – Reasonable
T – Time Bound

- **Subject Master:** One of the invigorating things about teaching is mastering in the subject to be taught. Students believe that the teacher is a source of all knowledge. The belief of the students must be kept alive by their constant learning.
- **Role model:** Students get easily influenced by their character, commitment, regularity, punctuality, morals and ethics. The teacher is responsible for social behaviour of students. So they must be at their best in front of students. The good teaching is about caring greedily, nurturing, evaluating and giving feedback to the students. Good teaching is about listening, questioning, interacting and remembering each student as an individual. Teacher should be able to win the heart of the learners.
- **Motivator:** For motivation, there must be co-operation between the teacher and learner. A good teacher is one who in short span of time can turn the dullest and the most disliked subject into your all time favourite and interesting subject. Inculcate the habit of Practice makes a man Perfect among students.
- **From spoon-feeding to self learning:** Teacher should inspire young minds, encourage thinking and motivates self-learning instead of giving spoon-feeding.
- **Towards Professional Development:** From being a person that just impart bookish knowledge, he should be actively involved in all staff meeting, educational workshops/seminars.
- **Teach Mathematics as a skill:** Learning mathematics is a habit formation process. Habits are formed through repetition continuous practice and drill work is needed for it. So the learner will have to repeat and revise things in order to have mastery over mathematics.
- **Pleasant voice:** Good voice projection is one of required feature of good teaching. As you speak articulate, clearly and be loud enough so that your teaching can heard by every student in the classroom. Our voice fuels the purpose of our actions.
- **3D's:** Teacher must possess 3D's – Design, Develop and Demonstrate.

Various technologies deliver different kinds of content and serve different purposes in the classroom. For example, word processing and e-mail promote communication skills, database and spread sheets program promote organizational skill and modeling software promote the understanding of math and science concepts .even the cell phones that many students now carry with them can be used to learn. The single most important factor for proper use of technology is to have teachers who are competent and knowledgeable about appropriate and effective use of technology to improve student learning.

TECHNICAL TOOLS FOR MATHEMATICS

With the advancement of technology in education mathematics can also be taught with digital technology like other sciences. Technology can be used in variety of ways to improve and enhance learning of mathematics For example advanced graphical calculators can be used for efficiently generating visuals of graphs useful for demonstrating mathematical ideas such as slope and y-intercepts for linear functions point of intersection of multiple function and pictorial view.

- **e-transformation** helps in Reflection, Rotation, Translation, Resizing of objects. Reflections – flip, Rotation – turn, Translation – slide the figure.
- **Maple:** Maple can be used to algebra, plot graphs, solve equations. It can also compute derivative, integrals, solve differential equations and manipulate vectors and matrices.

- **Graphic Calculator:** It is hand held mathematics calculator that can draw and analysis graphs, compute the values of mathematical expressions, solve equations, perform symbolic manipulation and perform statistical analysis
- **Auto Graph:** It is dynamic software for teaching calculus, algebra and co-ordinate geometry. It can be used for 2D &3D graphing in transformations conic sections, vectors, slope and derivatives, Transforming shapes and drawing statistical graph, animate and change graphs and shapes.
- **GeoGebra** combines geometry and algebra into single easy-to-use package for teaching and learning of mathematics
- **Geometer's Sketch Pad** Geometer sketch pad was created by Nicholas Jackiw. The geometer sketch pad is a popular commercial interactive geometry software programme for exploring Euclidean geometry, algebra, calculus and other areas of mathematics. It includes the traditional Euclidean tools of classical geometrics construction. It helps to deepen students understanding of slope, geometer transformation and arithmetic on integers. Sketchpad allows to measure length of segment, measure of angles, area, perimeter, midpoint and mid segments of objects etc object can also animated.
- **Computer Algebra System (CAS)** Computer algebra system (CAS) is a Technological tool equipped with numerical, graphical and symbolic capabilities which can appear as computer software programme such as mathematic (wolfram Research 2009) maple (water maple 2009) or graphing calculator interfaces such as the TI-92, VOYAGE 200, or TI-N spire (Texas instruments 2009). Apart from standard graphing calculator which possess only numerical and graphical functionality. It is the symbolic capacity of CAS and its connectivity with numerical and graphical functionalities that has captured the attention of research and teacher. The potential of CAS rests in freeing students for mundane drill so that increased energy may be connected into thinking and reflecting on the mathematics learned. This powerful technological tool has important place in our class room. Its distinct uses will be:-
- **Black Box** was introduced by Buchberges (1989) in CAS. The black Box usages is the spark of curiosity it instill in some students but otherwise one must be careful not to cultivate on anxiety- inducing view of a subjects already conceived as mysterious. Finally the black box can serve the purpose of solving problem those literally stretch human capacities to their limit i.e. CAS can handle exceptionally intricate problems.
- **White Box** was introduced by (Buchberg, Child and MC Challw). White Box can be used to solve linear equations. White Box CAS has ability to give instantaneous non judgmental feedback those open doors for novices who are struggling with concepts.
- **Amplifier** metaphor stands to be particularly well suited to student's generalization in graphing environments.CAS can serve the role amplifier to intellectual activity .It can also serve as general experimental tool as one delves into the unknown world of mathematics such as relegate "manual labour" e.g plotting points, repetitive multiplication. This intrinsic attribute "outsourcing procedure" to CAS is often equated with the amplifier role.
- **Discussion Tool-** In computer lab students get together as groups and something new or different will happens on one machine. CAS presence is a catalyst in initiating discussion of what appears on screen. CAS can be fertile in promoting and orchestrating meaning discourse and even in care when the teacher is sole user of CAS

Reform in education might be defined as any movement that result in a nontraditional approach to learning a subject, irrespective of whether change is channeled through teaching or student's activity. It is interesting to investigate how learner interprets the influence of these uses on their knowledge of mathematics as well as specifics of instrumental genesis in adaptation of success.

Technology provides functions to solve mathematical problem like integration. This may prompt students not to learn skill of finding integrals. It is for the teacher to investigate how calculator may be used as a tool to think with rather than a tool to replace thinking. Incidentally the role of a teacher in the students' lives has been remarkably affected. He should be a knowledge disseminator, informer, counselor, mentor, coach, assessor, feedback provider and user of modern educational devices. No doubt the techniques and tools available to the teacher for imparting education have been improved in terms of time management and effective teaching but his responsibility has also been increased manifold. Technical skills and efficiency can go in vain if the educator is unable to provide proper direction of innovation to the students.

CONCLUSION

No doubt technical tools provide opportunity for independent learning to students. If not checked technology can also make negative contribution to the process of teaching, it may weaken students' understandings of the basic concepts. They may think that the only thing they need to learn is efficient use of technology. Resultantly teaching and learning effectiveness is not enhanced but damaged. But the purpose is to enrich student's mathematical capabilities with the use of technical tools and prompt them to follow the approach of experimentation in mathematical science also.

Only mathematics teacher not technological tools are the key change agents to bringing about reform in mathematics teaching with technology. Although preparing mathematics teachers to use technology appropriately is a complex task for teacher educators. The use of technology cannot replace conceptual understanding, computational fluency or problem solving skills. In a balance mathematical progress the strategic use of technology enhance mathematics teaching and learning. Therefore, by taking technical support, we the teachers should try to meet the 21st century trends and enable the students get ready for the better technical world ahead.

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