Role of ICT for Better Mathematics Teaching

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OPEN ACCESS

Volume: 7

Issue: 4

Month: September

Year: 2019

P-ISSN: 2320-2653

E-ISSN: 2582-1334

Received: 10.08.2019

Accepted: 17.08.2019

Published: 01.09.2019

Citation:
Das, Kaushik. "Role of ICT for Better Mathematics Teaching." *Shanlax International Journal of Education*, vol. 7, no. 4, 2019, pp. 19-28.

DOI:
https://doi.org/10.34293/education.v7i4.641

Abstract
The objective of this study is to explore the role of the application of ICT tools in Mathematics teaching. Learning and conversation technologies (ICT) are an integral part of daily life, including the teaching-learning process. Mathematics is considered the queen of all sciences. For a long time, the role of mathematics was reduced to the purely academic domain. But at present, the role of mathematics is not limited to the purely academic domain. It has entered the field of technology and industry. This paper will highlight the importance of the integration of knowledge and communication technologies (ICT) into the teaching and learning of mathematics in Teacher-Training College and School level. The methodology of the research is a different type involving an interpretative, conversation, observation and study secondary sources, like books, articles, journals, thesis, university news, expert opinion, and websites, etc. Finally, meaningful suggestions are given.

Keywords: Information and Communication Technologies, ICT Integration, ICT in Mathematics, Mathematical Education, Teacher-Training, Teaching.

Introduction

The study is especially crucial in Teacher-Training Colleges because it presents a period of preparation for the students' future courses before making decisions about the student less scientifically or scientifically that mathematics is essential and even essential. Mathematics as a science-based course or discipline is known as a queen of all subjects. Sometimes the teacher of mathematics does not have sufficient knowledge, but it is necessary to read into concepts that contradict what the theory of mathematics says or implies. However, mathematics is a unique subject, which encourages the acquisition of specialized science skills and knowledge, which explains the natural phenomena of life in society. It is something that grows in civilization as the quantity demand of people increases. It originated from a practical problem, and the men needed to solve these problems. It has contributed to the development of civilization and other disciplines and the development of culture. Despite the abstract nature of mathematics, its teaching is the scientific thinking among students; A mental set that requires students to take the exam through tests. Globalization and technological change have created a new global economy driven by technology, data-driven, and knowledge-driven (Tinio, 2009). It has been proposed that the development of ICT has become a vital issue to meet the needs of the education system (Chao, 2015). ICT is a tool that supports the learning process and holds the promise of new solutions to all the challenges that education is facing (Oduma & Ile, 2014). Jef Peeraer (2005) highlighting the factors affecting the integration of ICT into teaching practice in Vietnam's higher education teachers (Jef Peeraer, 2005).

Thus the interaction is a strategy to engage teachers & students through a hierarchy of tasks beginning at the necessary level of navigation and ending in more dynamic interactions that create real-life stimulations (Aldrich, 2005; Roy, 2006). Externally the active participation of the student through e-learning is impossible, and it helps the e-learner to learn for a lifetime (Kumbhar, 2009). There is a positive relationship within students' learning and the use of ICT (Harrison et al., 2002) Both NCTM (The National Council of Teachers of Mathematics) and BECTA (British Educational Communications and Technology Agency) focused on the technology as enabling, as well as encouraging the learner to focus on reflection, verification, decisions making and problem-solving (NCTM, 2000., BECTA, 2003). The prospect of ICT is a promising practice in the mathematics classroom, but the success of this exercise is mainly dependent on several issues, including teachers' perceptions of ICT skills, teachers' attitudes toward ICT contribution to mathematics teaching, and teachers' attitudes toward ICT contribution to students' mathematics learning. Teacher Passion of ICT in the classroom mathematics, mathematics teacher in the presence of ICT in the classroom self-esteem and sense of control, and teachers aim to mobilize ICT in their education (Baya'a, 2013). These possibilities of ICT integrate a proposed practice into the mathematics classroom. Although the above description of the factors affecting ICT convergence at the school is involved, this exercise will result only if certain conditions exist met. ICT in the classroom, especially in the incorporation of a positive outcome will depend on the following factors: teachers 'attitudes to the contribution of ICT for teaching mathematics, mathematics education of students and teachers attitudes towards the role of ICT, arithmetic teachers to use ICT in the classroom sense, that presence of ICT in the classroom mathematics teachers' self-esteem and classroom administration ability to integrate ICT in education for teachers and attractions. While pre-service teachers solve math problems, they focus on the social and socio-mathematical norms that are installed during the interactions of pre-service teachers (Tatsis, 2008). It is the speech of the pre-service teachers to identify the regulated rules when solving a task related to the definition of mathematics (Sánchez, 2014).

From time immemorial education has become a symbol of civilization and development — Tripoli's concept of education as a whole point to teachers, students, and the environment. Not only mathematics teachers but the quality of all teachers in the teacher education department also must be met (Das et al., 2019). In the contemporary era, education depends on the physical and more importantly, the science of science for technological improvement. Therefore, psychological principles carry significant importance in the learning process. Thus, the policy of student-centered education has gained momentum over the past few decades. As such, all the achievements that are agreed upon in different subjects or more clearly marked by students are synonymous with their cognitive development. Mathematics is considered a difficult question. Mathematics theoretically provides a simple restoration of logical reasoning and knowledge. It makes it as a specific subject compared to others and shows an easy way to learn other things. Development is a continuous process, which is continuously underway. Providing and acquiring an education is one of the characteristics that set human beings apart from other living things. For advanced knowledge, people are continually improving their teaching-learning tools and strategies. Information Communication Technology (ICT) is an engine of innovation in education, and we can see in the 21st century, the psychological, socio-economic, and technological changes it brings to school. It has changed the role of information professionals and is becoming popular in the library.

Objectives of the Study

The present research is directed at achieving the following purposes:

1. To find out the attitude of Mathematics teachers towards the use of ICT.
2. To find out the attitude of Mathematics background teachers towards the use of ICT.
3. To find out the teachers of various levels of experience on their attitude towards ICT.
4. To study Mathematics teaching towards the use of ICT.

5. To study classroom teaching with a combination of Mathematics & ICT.
6. To find out the ICT tools used in Mathematics teaching and learning at Teacher-Training Colleges.

The Methodology of the Study

This study applies an interpretative approach where qualitative data were gathered and analyzed by a document study of the research papers from journals, books, edited books, reports, online documents. The methodology of the proposed research is based on the document-based analysis.

Methodology Employed

1. It is based on qualitative research.
2. It is also a document-based analytical study.
3. It has the chief characteristics of recent document-based analytical research.

Research Materials

1. Government documents,
2. Peer-reviewed Journals,
3. Books,
4. Magazines,
5. On-line reports from some relevant and reliable internet sources.

Data Collection Process

Multiple procedures consisting of studying international and national journals, library consultation, online journals, periodical, newspapers, and monographs have remained employed.

Data Analysis

The study employs current document-based analytical approach. To examine the obtained data, the research also adopts historical and sociological strategies.

What are ICTs?

The term ICT is described as the information dissemination, storage, and management of various sets of technical tools and resources that are accepted and for information and communication technologies. ICT has become one of the primary building blocks of our modern society. The level progress, which is likely to limit the ICT barrier. This causes problems at a low rate of education in a country - it can be utilized as a tool to overcome expenses, teacher shortages, as well as time and distance barriers, along with lower-level education.

Meaning of ICT

ICT stands for Information and Communication Technology. It is the combination of two terms, i.e., Information Technology and Communication Technology.

"Information Technology is a scientific, technological, and engineering discipline and management technique used in handing the information; it's application and association with social, economic, and cultural matters."- UNESCO (2002).

According to Prytherch (2000), "ICTs are networks that provide new opportunities for teaching, learning, and training through the delivery of digital content." According to Blurton, C. (2002), ICTs stand for information and communication technologies and are labeled as a "diverse set of technological tools and devices used to communicate, and to create, distribute, store, and manage information."

ICT Tools

ICT is changing processes of Mathematics teaching and learning by adding elements of vitality to classroom education environments, including virtual environments for the purpose. The new digital ICT is not a single technology; it is a combination of hardware, software, multimedia, and delivery systems. Today, ICT in education encompasses a vast range of rapidly evolving technologies such as Desktop, NoteBook, and Handheld Computers, Digital Cameras, the Internet, Cloud Computing, the World Wide Web, Spread Sheets, Tutorials, Simulations, email, Local Area Networking, Bluetooth, Streaming, and DVDs; and applications such as word processors, Virtual Environment, Simulator, Digital libraries, Computer-Mediated Conferencing, videoconferencing, Emulator etc. ICT allows for the production of digital resources such as digital libraries, where students, teachers, and professionals can access study material and course material from anywhere at any time.

Classroom Management

Education enables people to adapt to changes in complex societies. Knowledge helps to create perspectives that address current and future challenges so that people can adapt to changing circumstances. The concept of classroom management and its narrow reference, discipline is so important that in many aspects, it becomes an indicator of teacher quality. Classroom management is a prerequisite for teaching.

Managing Classroom Instruction

1. Work on improving the Mathematics-teaching style.
2. Establish a unique characteristic of the Mathematics-teaching strategy.
3. I am making the Mathematics-Education curriculum worthwhile or meaningful.
4. Continually strive to motivate the students.
5. Co-operative Learning should be encouraged.

The Mathematics Teaching and Learning Situation

Two-year B.Ed. Program: West Bengal Scenario.

Two-year B.Ed. The syllabus is split into four semesters. This four semesters we will look at how a trained math teacher is learning about mathematics and how ICT can be combined with this teaching method.

Semester-I

Topics for the first-semester exam include Mathematics in the fourth unit under Course Five. Now the main objective is how to do this through technology. Connecting to computer-based learning in a slightly different way than reading so-called reading is a novelty in the learning process. Topics for the first-semester exam include Mathematics in the fourth unit under Course Five. Now the main objective is how to do this through technology. Connecting to computer-based learning in a slightly different way than reading so-called reading is a novelty in the learning process. The effectiveness of different teaching styles (Wentzel, 2002; Grasha, 2002) and the potential of ICT usage (Higgins & Moseley, 2001, Tall & Ramos, 2004) in teaching mathematics has explored on the other hand. So, in addition to math learning, the teaching techniques that make use of ICT can be significantly enhanced by the use of ICT. Combining ICT with teaching in mathematics can make math easier to explain.

Semester-II

The second semester consists of a separate mathematics course, along with other pedagogical subjects. Students have to do a Practical work of Pedagogical Analysis on Mathematics. Also, the practical work on a Micro-Teaching is compulsory for the students. Here students can quickly learn mathematics teaching methods. That is, pre-service or in-service or fresher students have the opportunity to learn the practical field of teaching mathematics in first-time in this semester. Pre-service teachers needed additional planning and preparation for technology integration, as they had no previous knowledge or experience about the design of ICT-supported teaching activities (Inan, 2010). The mathematics teaching methodology will be more exciting and exciting if students are involved in the same way as the students are learning first.

Semester-III

The third semester is completely based on practice teaching. That is, pre-service or in-service or fresher students will go to school and perform their duties as teachers. Students of mathematics will teach mathematics in the right schools. The teachers will teach mathematics in the school from the sixth to the twelfth grade. This is a practical task that is very important for students to become teachers. While in school, students must associate ICT with mathematics, and if possible, the math subject to the school will take many innovations from the traditional method and their love for mathematics. Exciting experiences in this type of technology lead to pre-service teachers' better understanding of the link between theory and teaching practice (Sang et al., 2010). It will be easy to explain in mathematics, and more specifically, who will be able to address the matter to sixth, seventh, eighth, ninth, tenth, eleventh and twelfth-grade students. Practicing Teaching Mathematics Students must learn from their institution what training they should take on mathematics (Das & Chowdhury, 2019).

Semester-IV

In the fourth semester, mathematics can be easily applied to other subjects, even though there is no specific mathematics subject. There is an ICT based course this semester. Underlying this course is a practical task of creating ICT dependent learning designs. Pre-service teachers have the opportunity to share, develop, and critique learning resources to help integrate technology into their lessons and it can help them see the utility, value, and potential of using a particular technology and teaching strategy (Dorner, 2016). Through this, students will be able to create ICT based learning designs and learn to use ICT properly in mathematics learning in the coming days.

Use of ICTs in Mathematics Teaching and Learning in School

The teachers of the school are urgently guided. In this case, the important thing is that if the trained teachers are taught to connect with ICT in mathematics, they will be able to apply it in future school courses. As illustrated, various mathematical images of geometry can be presented to the students using a projector. The use of ICT in two-dimensional and three-dimensional imagery will give an obvious idea to the students. With the help of the Internet, new information and data are always available to the students. With different theories of trigonometry, it is possible to make ICT dependent on practical applications. Self-Regulated students are aware of their academic strengths and weaknesses and are well versed in the strategies they use to address the day-to-day challenges of academic work (Dweck & Leggett, 1988).

Challenges in Learning both Mathematics Content and Computer Technology

Difficulties in using ICT and math software are related to the weakness of any mathematics teacher's knowledge of what technology is available and how to use them when learning math. Mathematics teachers will have to take considerable challenges in both math content and computer technology.

Environment Factors Affecting Students' Learning towards Mathematics

Multiple studies have attempted to explain the impact of mathematics education on a variety of factors. Recently, many researchers have demonstrated that students' learning is influenced by elements of their learning environment such as course curriculum, teacher support, assessment methodology, parenting influence, teaching facilities, and so on. The concept of function concept in mathematics plays a vital role in the learning of students and affects the whole mathematics curriculum, and students of all grades have learned the function concept that through formal perspectives, standards of relevance, materials understanding/ learning standards, etc. (Yüksel Dede, 2006).

Students' Factors towards Mathematics Learning

According to many, students' factors with environmental factors can affect their mathematics learning effectiveness. Studies show that teaching methods in mathematics should be developed in terms of students' reasons. The students' attitude towards mathematics is the main factor influencing the learning outcomes of mathematics.

The Use of ICT in the Mathematics Classroom

The use of ICT in the mathematics classroom has primarily held of particular concern to mathematics educators. Some examples of the use of ICT in maths are portable, graphic calculators, computerized graphing, specialized software, spreadsheets, and databases, etc. By using ICT as a tool for learning, those teachers can maximize the impact of ICT in mathematics education (Becta, 2003). Students are taught to work in collaborative groups or apply the problem-solving process when using a computer to solve a problem, and then ICT is involved in developing the solution. Higher-order thinking of math students consists of the transformation of information and concepts. This transformation occurs when students combine information ideas, synthesize, generate, interpret, estimate, or reach a conclusion or interpretation. Managing data and thoughts through these processes enable students to solve problems, gain understanding, and discover new meaning. ICTs are the most powerful when

used as a tool for problem-solving, conceptual development, and critical thinking in mathematics. Using ICT as a tool, students spend productive time developing strategies for solving complex problems and develop a deep understanding of the various mathematics topics.

Mathematics & ICT

Students can use ICT as a tool to perform calculations, draw graphs, and help solve problems. The most obvious example of using ICT in this way is when students use a calculator or something like that to perform more challenging numbers. However, spreadsheets, computer algebra systems, or graphical calculators can be used to solve problems by tests and improvement or retrieval methods. Students of mathematics can use graphical calculators or graph plotters instead of algebra to graphically solve an equation.

Students can smoothly perform a statistical analysis of the data they collect using the extensive statistical features of the graphical calculator. Creating an image in a dynamic geometry package can help a student understand, solve, and then prove a geometric problem. When students use ICT as a tool to help them search things out, solve problems, or understand what's going on, it often helps them develop their skills in the use and application of mathematics. ICT can be an extensive and efficient tool, but students need to learn the technical skills they need if they are to use the opportunities provided to them constructively and efficiently.

For Example

1. By using a calculator or spreadsheet for a straightforward, single Calculation.
2. The graphical calculator helps us to draw a graph when a sketch would be more appropriate.
3. To solve the quadratic equations like as X2+X=20 by using a spreadsheet or graphical calculator.
4. General geometric & trigonometric applications:
5. Drawing a triangle, cube, etc.
6. Measure a distance in real life.
7. I am using excel tools.

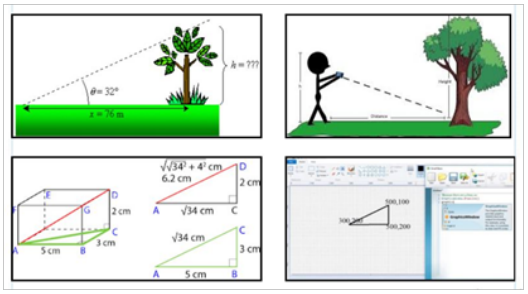

Figure 1 The picture above shows the height of a tree in daily life and the diagram of the triangle cube, and its calculation is defined, and another image shows the use of Excel

Use of ICT in Various Areas of Mathematics

ICT can be used advantageously in most areas of mathematics, but the following regions particularly benefit from the opportunities it offers.

1. Applying mathematics and solving problems.
2. Position value, order, and rounding.
3. Equations, formulae, and identities.
4. Sequences, functions, and graphs.
5. Geometrical argumentation: lines, angles, and shapes.
6. Transformations.
7. Coordinates. (coordinate-geometric)
8. Construction and loci.
9. I am handling data.
10. Probability.
11. Statistical applications and so on.

Pedagogy

Decisions about when and how to help teach ICT to depend on whether scientific information, skills, or concepts support the effective teaching of ICT curriculum objectives. The use of ICT should allow teachers or students to do something that helps them become more proficient.

Use of ICT Tools in Mathematics

Maxima is an algebra solver software. The program is based on Computer Lisp and works with all POSIX principles such as Linux, Unix, OS X, and BSD. For drawing it uses Gnuplot.

Geogebra is a math software that is useful for both teachers and students alike. It is a robust platform that helps preschoolers learn math effectively and

solve math problems on different topics that include vectors, calculus, linear programming, algebra, complex numbers, statistics, and more.

SymPy is a Python archive for symbolic mathematics. It aims to become a full-featured computer algebra system (CAS) while keeping the code as simple as possible to be comprehensible and easily extensible.

Discussions

Lack of Professional Development Opportunities

Lack of adequate opportunities for teachers to receive ICT based training. Sufficient time for the teachers to train the subjects related to the practice. ICT and basic ICT training require curricular training about the curriculum. Providing educational training to teachers is more important than simple training for teachers about the use of ICT equipment (Johns, 2004). Teachers taking part in ICT-related professional development courses are not confident enough with their lessons regarding ICT. These courses were mainly about necessary ICT skills and did not teach teachers how to associate these ICT tools with their experiences. Training content should be blended with educational content technology in training courses for teachers to train using ICT resources in their respective subjects. Some parameters related to the technical knowledge and skills, the educational skills supported by the technology, the management of the classroom, the knowledge and skills required by the teachers regarding the use of technology.

Lack of Technical Support

When working with ICT tools, teachers face technical problems, so teachers try to avoid using ICT. Therefore, timely assurances of technical support can help teachers provide appropriate lessons and provide lessons. Technical constraints include Internet connection failure and ICT equipment malfunction. In some cases, teachers argued that the fear of breaking the ICT equipment during the experience might discourage them from using ICT during their teaching practice. ICT training is useful enough for teachers, but the lack of technical support concerns teachers. Therefore, to encourage the use of technology, teachers should have proper arrangements to provide technical support.

Benefits of Using ICT in Education

1. Assist seniors in accessing digital information efficiently and effectively.
2. Support undergraduate-centered and self-directed learning.
3. Produce a creative learning environment.
4. Promote collaborative learning in a distance-learning situation.
5. Offer more opportunities to advance critical (higher-order) thinking skills.
6. Better education, including collecting quality.
7. Support teaching by facilitating entrance to course content.
8. Most of the teachers have a favorable attitude towards ICT.
9. Science/Mathematics background teachers have a more favorable attitude than Arts/Social Science background teachers towards Information and Communication Technology (ICT).

Educational Implications

1. The use of ICT in education helps in developing critical and scientific thinking among the students and the teachers. It motivates the learner to participate in learning activities at any time and from anywhere.
2. It helps in exchange and shares ideas among teachers for professional growth.
3. ICT has also used to improve access and the quality of teacher training. ICT tools enhance teaching, and facilitate learning using multi-modal courseware, Integrate ICT using pedagogical innovations to develop higher-order thinking skills among learners.
4. ICT tools such as radio, T.V., Internet, computer, laptop, tablets, and many other hardware and software applications can be appropriated in the teaching-learning process. These tools can give benefits in the areas of content, curriculum, instruction, and assessment.
5. In India, mainly education has three levels that are primary or elementary level, secondary and senior secondary level, and higher level. The quality of all these levels can be adjusted by the use of ICT tools and techniques.

From a Student's Point of View, Drawbacks are

1. Poor ICT infrastructure in classrooms and the library.
2. Poor internet service during the teaching-learning activities, projects & assignments.
3. Reduced internet speed because of old computers and old operating systems and low internet access packages.
4. Teachers lay more emphasis on PPT creativity rather than the topic content.
5. College website not updated for accessing college information.

From the Teacher's Point of View, Drawbacks are

1. Technical Skills: Teachers don't have sufficient skill to develop digital Mathematics contents.
2. Time aspects of digital content making: Powerpoint presentation (PPT) making is not an easy task which requires excellent technical skills and patience.
3. Making lessons more difficult: Making electronic content on mathematics education is a time and money consuming process.
4. ICT restricts the scope of explanation: Some subject contents may require more proof and discussions like problem-solving, drawing mathematical figures, geometrical shapes, drawing curves and graphs, etc.
5. Poor ICT accessibility: Poor ICT infrastructure in classrooms like computers, laptops, and overhead projectors. Poor coordination with ICT centers for day to day arrangements.
6. Time constraints to use ICT: Teachers are very busy due to credit-based syllabus system college activities, personal researches, and ongoing examinations.
7. The applicability of all subject's content: ICT is not easy to apply to the Mathematics, application of Mathematics, etc.
8. ICT Education is an incomplete transformation of knowledge as it possesses fewer face-to-face interaction, warmth, empathy, and rapport with learners.

Recommendations

1. Teacher training program (B.Ed.) should be based on the use of ICT for all subjects.
2. To reduce the cost of infrastructure can be adopting measures such as locally assembled hardware/software to avoid reliance on imported one.
3. Education policy and curricula should be revised periodically to meet the demand of the present situations.
4. Teachers' attitude towards the use of ICT and lack of confidence can be overwhelmed by professional development courses conducted regularly.

Conclusions

This study shows that ICT integration in Mathematics. From literature displayed several problems to utility ICT in mathematics. ICT integration in Mathematics-education has a positive impact on both the teaching and learning process. The study was conducted out to determine the impediments to integration of ICT in mathematics teaching and learning in Teacher-Training colleges & secondary school levels. There are some barriers to integrate ICT in teaching and learning mathematics in various branches of mathematics. In the future, we shall extend my study to the higher education level for professional development.

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