Proceedings of
One day Teachers' Conference on

Use of Information and Communication Technology (ICT) in Teaching-Learning Process

Saturday, 25th February 2017

Gujarat Bhavan, Vashi, Navi Mumbai - 400703

Science Utsav 2017

Organised Jointly by
Navi Mumbai Science Foundation, Vashi

In Association with
Shree Gujarati Samaj, Vashi
&
Maharashtra Academy Of Sciences (MC)

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Navi Mumbai Science Foundation
Teachers' Conference 2017
Program

Registration and Assembly (9:00 am to 9:30 am)		
Plenary Session		
9:30 – 9:35	Welcome and Introduction	Dr A. M. Bhagwat, NMSF
9:35 – 9:50	Opening Remarks by the Chief Guest	Dr. S. K. Malhotra, BARC
9:50 – 9:55	Remembering Prof. Chitra Natarajan	Dr. Aniket Sule, HBCSE
9:55 –10:25	Dr. Chitra Natarajan Memorial Lecture	Dr. Arindam Bose, TISS
10: 25 –10:30	Vote of Thanks	Dr D. A. R. Babu, NMSF
Tea Break (10:30 to 10:40)		
Session 1: ICT in Classrooms and Student Projects Session Chair: Dr. Paresh Joshi		
10:45 – 11:15	President's Awardee Lecture	Dr. Dolly Gavin Henry,
11:15 – 11:30	Using new technology in classroom	Ms. Tejashree Kadam
11:30 – 11:45	Using new technology in Classroom	Ms. Pinal Panchal
11:45 – 12:00	Using new technology in Classroom	Ms. Nirmal Milind Kasekar
Session II: Creating e-materials and Assessment Session Chair: Dr. Sanjay Chandrasekharan		
12:05 – 12:45 pm	**Invited talk:** Simulations and model based reasoning in School Curriculum	Durga Prasad and Prajakt Pandey, HBCSE
12:45 – 1:00	Computer Based Assessment	Ms. Vinaya Sambargi, Euro School
1:00 – 1:15	Khan Academy as a remediation tool for Mathematics class	Mr. Tejas Shah, Fr. Agnel
1:15 – 1:30	Teaching made tech savvy	Ms. Ankita Datta, New Horizon School
Lunch Break (1:30 to 2:10)		
Session 3: Social, cultural and equity issues in ICT Session Chair: Dr. Ankush Gupta		
2:15 – 2:45	**Invited talk:** ICT and equitable access in classroom instruction	Dr. Shweta Shripad Naik, HBCSE
2:45 – 3:00	Issues of equity and equal access in ICT	Ms. Preema Reego, Euro School
3:00 – 3:15	Article on Use ICT in teaching learning process	Ms. Mukta Khatavkar and Ms. Kavita Sandeep Chaphekar, Greefingers Global School, Kharghar
3:15 – 3:30	Foundation for establishing viable and sustainable ICT industry and its effect	Ms. Swaroopa Subhash and Ms. Uma Hotti, Vishwajyot Highschool
Tea Break (3:30 to 3:50)		
Feedback and Conclusion		
3:50 – 4:00	Feedback and suggestions	Ms. Mamta Aggarwal, NMSF
4:00 – 4:20	Closing remarks and conclusions	Dr. Aniket Sule, HBCSE
4:20 – 4:30	Vote of Thanks	Dr. A.K. Rajarajan, NMSF

Navi Mumbai Science Foundation

[Regn. No.: Maha /2592 / 10 / (Thane)]
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An NGO's portal for innovation in Education

Navi Mumbai Science Foundation (NMSF) is a science led NGO in India which is dedicated to development of "scientific temperament " in society in general & the student community in particular. This in turn will contribute towards the wholistic development of the nation & prepare it to face the challenges posed by a technologically advanced global environment without losing sight of its societal commitments.

VISION

- *Kindle and nurture scientific temperament in students;*
- *Enhance soft skills like problem-solving approach and communication skills;*
- *Promote 'Pupil-centric' approach in education;*
- *Create awareness in public about science and scientific issues;*

MISSION

- *To advance, popularize and promote the cause of science in Navi Mumbai.*

ACTION PLAN

- ***Develop a network*** *of professionals and personalities to share their knowledge;*
- ***Provide multi-disciplinary environment*** *to students to understand their inter linkages;*
- ***Provide a platform*** *for interaction between leading educationists, teachers and students;*
- ***Encourage participation in*** *scientific activities like:*

  i) Homi Bhabha Young Scientist Award (HBYSA) Examination

ii) ***ii) Regional Mathematics Olympiad, iii) National Childrens' Science Congress (NCSC) activity,***

  iv) World Nuclear Energy Day,

  v) Science Utsav: a) Teachers' Conference & b) Exhibition of Science Experiments

  vi) 'Fun with Science' activity, vii) Science Club activity, etc;

- ***Create links with national organizations*** *in the field of science and science education;*
- ***Arrange discussions*** *on scientific topics of current interest and publish scientific articles in local papers and magazines.*

ACHIEVEMENTS AT GROUND LEVEL

- *About 2500 students & 250 teachers are now being reached through these activities each year.*

IN SHORT, WE AT NMSF, ENDEAVOUR TO

- **Give meaning to** science in ways more than one, and
- **Erase the artificial barriers** that keep science away from the main stream of life.

OUR INDEBTEDNESS

We are indebted to several schools & colleges, a few institutions and a large number of individuals, who have been active partners in our activities year after year.

For more information, please visit our website at:

http://www.navimumbaisciencefoundation.org

MAHARASHTRA ACADEMY OF SCIENCES

[Regd.Soc.No.1020 Pune, Public Trust No.F-842 Pune]

[Mumbai Chapter]

{B-51,Gitanjali,Plot No.52,Sector-17,Vashi, Navi Mumbai-400703}

The Maharashtra Academy of Sciences is the premier scientific learned society of the state of Maharashtra. It was established in 1976 with the specific aim to highlight the scientific and technological issues confronting the state, and to recommend appropriate steps necessary to be under taken by the concerned authorities for the promotion of science and technology.

The academy has very wide spectrum of interests and has scientists of eminence as its fellows in all the major scientific disciplines. The list of fellows includes eminent scientists in Maharashtra and some outside the state who are interested in the promotion of science and technology and have in particular special attachment to Maharashtra. It has also fellows from industry who have made a name in their respective fields. The fellowship of the academy is conferred upon senior scientists after a peer-group assessment based on their scientific achievements as is practiced in the national academies of India and in the prestigious academies abroad. The first President of the academy was Dr. H. N. Sethna, the then Chairman of the Atomic Energy Commission, who guided the deliberations of the academy in its formative stages.

The academy besides promoting science and technology addresses various issues related to the development of Maharashtra in the areas of : Education, Industry, Communication, Mass Transportation, Agriculture, Natural Resources, Medical & Public Health Services, Demography, Urbanization, Rural Development, Human Resource Development. Management and Public Administration, Economics.

Some of the activities undertaken by the Academy so for include the following:

*****Presentation of recommendations for the education of groundwater resources of the state.

*Assessment of the impact of the Thal-Vaishet fertilizer complex on the Alibag Magnetic Observatory.

*Presentation of geological sites in the state. *National seminar on Biodiversity and sustainable developments. *Celebration of the century of the discovery of X-ray and of radioactivity at various places.

*Science education discussions from time to time and publication of detailed report in the book form by Dr. M. R. Bhiday.*Several seminars on important topics and lectures by eminent scientists. *Seminar on "Plastics: Bane or Benefactor"

Additional Activities of MASc (MC)

MASc(MC) is organizing several activities on a regular basis & some occasion-based as required. They are all in partnership with local colleges, schools & research organizations. Some important ones are listed below:

***An annual event "Science Utsav"** (having 2 parts: Sc. Exhibition for middle School Students & Teachers' Conf.)
***World Nuclear Energy Day : A novel annual event** (on Dec. 2, each year)
***Regional Mathematics Olympiad Guidance sessions.**
***Homi Bhabha Bal Vaidnyanik Competition Guidance Sessions.**
***National Children's Science Congress Activity for Navi Mumbai region.**
*****Throwing Light on Light on Feb. 12, 2016.**
*****Feeling the pulse of pulses now (Jan. 19. 2017)**
At present, there are more than 900 Fellows of the Academy covering the disciplines of Physical Sciences, Chemical Sciences, Earth Sciences, Life Sciences, Medical Sciences, Mathematical Sciences, Agricultural Sciences, Social and Educational Sciences, Engineering and Technology, Economic Sciences, Management Sciences, Computer and allied Sciences and Environmental Sciences. There is also a provision for making honorary fellows, patrons, associate members, young associates, donor members, corporate members and industrial members. The academy is now planning in a major way to welcome in its fold Indian scientists residing abroad, who are specially interested in the welfare of Maharashtra.
Young Associateship: An **Overview**
The MASc has introduced a new scheme for inducting "Young Associates" below the age of 40 from year 2006-2007. This scheme is mainly directed towards young, active and dynamic researchers and teachers as also individuals engaged in activities associated with popularizing and promoting various aspects of science covered by the Academy.
The main criteria for selecting individuals under this scheme are as follows:
1. Age: between 25 and 40 years.
2. The individual must be currently engaged in the activities such as research and development, setting up of new and novel facilities for conducting science and technology related projects, popularization of science, spreading scientific temperament by writing popular scientific articles and development of new and novel techniques for teaching science at various levels.
3. The candidate must have demonstrated his/her outstanding contributions to the above activities with proven records.
4. The candidate to be nominated must have a post-graduate degree from a recognized university in the faculties covered by the academy (or a bachelors degree in engineering with more than 10 years teaching experience).
At present, **there are ~ 75 Young Associates of the Academy covering various disciplines.**

Use of ICT in Teaching-Learning Process

Saturday, 25th Feb 2017 at Gujarat Bhavan, Vashi

With the convergence of technologies, it has become imperative to take a comprehensive look at all possible information and communication technologies for improving school education. The initiative of Information and Communication Technology (ICT) Policy in School Education (NCF, 2005) is inspired by the tremendous potential of ICT for enhancing outreach and improving quality of education. This policy endeavours to provide guidelines to assist the States in optimizing the use of ICT in school education within a national policy framework. Many teachers are ready to take up the challenge and encourage creativity and thinking in their classrooms through the use of ICT. This conference, organized by Navi Mumbai Science Foundation (NMSF), is aimed at sharing such experiences and ideas of how ICT is used in the process of teaching learning, and what challenges are faced while doing so.

We live in an age where ICT based tools are commonly encountered. Students and teachers use computers, Internet, cell phones, etc. almost every day. This changed environment has affected the teaching-learning processes, as students have multiple sources of information at their disposal apart from textbooks and teachers. The process learning no more relies only on classroom teaching. Learning theories have predicted different modes of learning, that include visual, imagination, construction, etc. and now, teachers have teaching aids that cater to such modes. Effective use of such ICT interventions can lead to overall improvement of teaching. Under this theme, we will explore influence of ICT in new age teaching and learning processes.

Sub themes:

1. Using new technology in classrooms
2. Creating e-materials / e-teaching aids
3. Using ICT in student projects
4. Computer based assessment
5. Social and Cultural aspects of using ICT in teaching learning
6. Issues of equity and equal access within ICT

Description of the sub-themes

1. Using new technology in classrooms

This sub-theme covers use of clickers or similar devices, use of tabs in classrooms, and scope and challenges (or advantages and limitations) of use of ICT in classrooms settings. Teachers can share experiences of using particular educational software to enhance students' learning, such as – database applications, analysis of data and problem solving, computing, design, and graphical and audio-visual communication. In your presentations and papers, please focus on how the software was used, with detailed descriptions of how actually it helped students learn specific concepts or skills.

2. Creating e-materials / e-teaching aids

This sub-theme covers creating audio/video material for students, creating customized applets / worksheets using existing software for specific use. Creating learning sequences online, e-learning courses etc. and manage content using a variety of software applications and digital devices; using web sites and search engines to locate, retrieve and manage content. While reporting under this theme, describe the process of e-material development, with examples of students' learning associated with the material.

3. Using ICT in student projects

This sub-theme covers added dimensions of project-based learning based on effective use of ICT tools. This includes work that entails, students undertaking research and carry out projects using web resources; use of ICT for documentation and presentation; creating and participating in web based networks for cooperative and collaborative learning; becoming aware of issues of cyber security, copyright and safe use of ICT and take necessary steps to protect oneself and ICT resources. Teachers who present their work under this theme, should include description of students' projects and with descriptions of how it actually exhibits use of ICT in their learning

4. Computer based assessment

Technologically assisted assessment provides an important overview of the education process. This sub-theme covers computer-based assessment in classes as well as in large-scale examinations, e.g., online competitive exams. While presenting under this theme, the teachers can describe the assessment developed using ICT and then provide insights on students' learning based on the data gathered through such tool.

5. Social and Cultural aspects of using ICT in teaching learning

This sub-theme would cover how ICT in teaching learning process is perceived by students, teachers and society and how it affects them. For example, is an ICT based method considered desirable over other methods even if it is not enhancing learning of students? In such cases, the teachers could discuss the reasons behind such attempts, such as poor implementation, lack of resources, incompatibility with the curriculum, etc. Are there cases in which an ICT method may alienate students from their immediate environment if its content is not situated in their own lives or due to reduced communication with their classmates?

6. Issues of equity and equal access with in ICT

Provision of equitable access through information communication technologies along with associated education and training is becoming an important goal worldwide. This theme seeks to stimulate discussion on many of the important aspects of ICT in relation to equity in education. Recognizing the interconnected nature of equity issues with ICT in education, teachers can provide evidence from the practice that brings forward issues of gender, caste

and other socioeconomic disparities from the classroom. Teachers presenting under this theme could share episodes of classroom teaching that demonstrate the relation between aspects of ICT that facilitates equity in the classroom.

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Science Utsav 2017

Table of Contents

Manipulable computer interfaces for teaching-learning school science and mathematics

Prajakt Pande & Durgaprasad Karnam

Homi Bhabha Centre for Science Education, TIFR, Mumbai.

At the Learning Sciences Research Lab, we conceptualize, develop and evaluate novel computer simulation interfaces to help the teaching-learning of certain concepts in science, mathematics and engineering. At the same time, we also try to understand how students learn by interacting with these simulations as knowing this helps us constantly revise our intervention designs. In this talk, we demonstrate two independent interfaces from different projects and discuss findings from the studies testing them.

The first interface, consisted of fully manipulable and interconnected multiple representations (such as graph, equation and a pendulum visualization) of the oscillation phenomenon. The interface was built to help secondary school students improve their representational competence (RC) around the concept of oscillation. RC refers to one's ability to 'integrate' multiple external representations (such as equations, graphs, diagrams, etc.) into a coherent understanding/imagination of scientific entities and phenomena. Grade VII students interacted with this interface in a semi-guided manner, while we tracked their behaviour using eye and mouse tracking. The students then answered a set of integration/imagination and transfer questions (the former explored if students could integrate the different representations and imagine the dynamic relationships between them in the absence of physical manipulation/dynamics, while the latter explored if the students could extend the oscillation analogy to other real life situations and representations). We wanted to understand (a) if and how the simulation interface supports improvement in student RC, and (b) what interaction as well as cognitive mechanisms support the development of RC. All the students did exceptionally well in the transfer questions as opposed to imagination questions where only a few students succeeded. Eye and mouse tracking (interaction analysis) revealed that the successful students employed no single strategy, suggesting that there are multiple ways of being good at imagination. Intriguingly, some of the poorly performing students exhibited similar interaction patterns to the successful imaginators, suggesting that interaction, and its nature do not guarantee imagination.

In this context, on the lines of the simulation used for the oscillation concept, we have designed an interactive platform for handling vectors. Usually in the high school or pre-college curricula, students are introduced to the concept of vectors and operations on it, and apply these across various contexts in physics (like the Newton's laws of motion, work-energy-power, torque,

electricity and magnetism etc). We have, for our purposes, looked specifically at the operations of resolution and addition and the notion of components. It was found from an analysis of textbooks (MH State Board) that the concepts required (properties of lines and angles, trigonometric ratios, unit circle etc.) are dealt with in a scattered way, spreading across 5-6 text books (Math and Physics textbooks for grades 10,11 & 12) and there is no way for the students to integrate this for themselves. Besides, the textbooks also promote an algorithmic way of solving problems, which could hamper the student's understanding/imagination of Science and scientific theories and models. There is a danger that students perceive the process of doing Science and Math to be more algorithmic, whereas experts agree that the process of doing Science and Math to be creating and using models. We have tested the tool with grade 11 for its ability to change the conceptual understanding related to vectors and the reasoning approach employed by the students. The preliminary analysis of the data, shows some promise in moving the students towards model-based reasoning (MBR) approach, which is a key thinking skill in science and engineering practice.

Thus these help us in both evaluating the novel possibilities of computer interfaces in learning of science and understanding the students' learning by interactions with these simulations.

TEACHING MADE TECH SAVVY

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Abstract

The increased use of technology in the field of education provides the new generation an unprecedented opportunity to improve the teaching learning process. This article explores the various technologies used in the present day and their effective uses. Traditional methods of teaching are fading day by day as technology has taken its place and the teacher acts as a facilitator and a guide in the modern day education. The present study also focuses on the barriers of using technology but they can be overcome.

Keywords: Technology, smart class, interactive whiteboards, tablets

Introduction

Technology has helped improve the way we work, the way we commute, the way we communicate, and even the way we teach. Living in the 21st century, the effect of technology is omnipresent in our lives. Technology is progressively being utilized for teaching in schools around the world. It is a belief that technology, thoughtfully assimilated into the course, can enhance learning and provides valuable life skills to the students. Since there is a tremendous support for technology incorporation from government and also the increase in the number of computers in the classrooms, it is expected that academicians increasingly integrate technology usage while delivering lectures.

Technology in Current Use

The introduction of smart class and interactive whiteboards brought revolution in the world of education. It was a paradigm shift that did what no one had thought of before: bring technology into the classroom. It empowered the teacher with well researched, mapped to curriculum digital modules which he/she could project right in the classrooms to elucidate and explain concepts. Classrooms came alive and the perennial tug of war between the teacher's challenge to explain and students' struggle to understand gave way to an inspired participation in the journey of discovering new concepts.

Interactive whiteboards (IWB) have replaced traditional whiteboards, blackboards and video/media systems such as a DVD player. Brief instructional blocks can be recorded for review by students which will show the exact presentation that occurred in the classroom with the teacher's audio input. This can help renovate learning and instruction. Classroom response systems are provided as an integrated part of their interactive whiteboard products. The Handheld 'clickers' operating via Infrared or Radio signals can offer basic multiple choice and polling options. Few complicated clickers offer

text and numeric responses which in turn can be a basis for the analysis of student's performance for subsequent review. By combining classroom response with an interactive whiteboard system, teachers can deliver the matter more effectively and receive feedback from students. IWB can be an effective tool because the notes and diagrams can be taken on the board and saved to be shared and distributed to students later.

Tablets have been introduced in many schools and colleges which avails many of the features like e-book, online assessments, camera, calculators and many more. Aakash or Ubislate 7+ is an Android-based tablet computer promoted by the Government of India as part of an initiative to link 25,000 colleges and 400 universities in an e-learning program. The Amplify Tablet enables a personalized learning experience for students and allows them to manage class work, access online resources, and interact with other students. Classpad is an Android-based educational tablet computer can help the teachers transfer class works to the students' tablets, share their own content instantly and conduct tests. Educational toys also simulate learning and help the student to develop a particular skill. Few of the beneficial educational toys are Euler's disk, Erector Set, Lego Mindstorms, Thames & Kosmos, GIANTmicrobes and many more which are designed for different subjects and age groups.

Campus ID card or hardware swiping device are used successfully to track the attendance of the students. Biometric methods like fingerprint recognition and retinal scanning are very effective as the students do not have to remember to carry a card with them to school.
The teachers, quite often, complain of sore throats, pharyngitis and laryngitis that come from talking for several hours a day. The use of microphones in the class can help raise student achievement, increase students' attention, decrease teachers' voice strain, and aid in classroom participation.
Few educational projects have been initiated in India by Intel Corporation in coordination with 12 state governments, the Kendriya Vidyalaya Sanghatan, and the Navodaya Vidyalaya Samiti and also Microsoft's Project Shiksha.

Barriers

Though technology is a boon to the modern education, there are few barriers to it. The lack of effective access to technological tools has acted as a great barrier towards the effective use of technology in education. Many schools and teachers have no accesses to technological tools like smart whiteboards and projectors. Some schools do not have enough computers and they even lack access to internet. Viruses and other malwares could be an impediment to using such technology in the classroom. The menace of rats is quite frequently reported as they cut the cables thus disconnecting the network.

My Experiences Using Technology

In my experience as an educator, I have been using educational software aids as a supporting tool to traditional teaching methods. Once a concept is taught

through a traditional method, educational software aids or other modern tools help reaffirm the concept through features such as audio-video presentations. Several other features like chapter wise keywords and worksheets help summarize the lesson effectively. Well organized lesson plans available before each chapter reduce the workload on a teacher that would have been spent in manually preparing it. Some of the features like puzzles, quiz and educational games help engage the students by making learning a fun activity.

Conclusion

The focus in the current study was on the new technology adopted in modern education. Mitra and Rana (2001) provided slum children in New Delhi with Internet access and observed that children seem to use the technology fluently in the first month of unsupervised and unguided access but language and formal education do not seem to make any significant difference. This points to the curious and inquisitive nature of the children, that even without guidance they explore new technology and becoming adept at handling it. The schools should be aware about the significance of ICT in learning and teaching and should overcome the barriers that hinder ICT usage among teachers and students. New technologies should be used effectively by the teachers and they should be updated from time to time. This will eventually make teaching learning process interactive, fun giving, interesting and highly competitive.

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2. C.S.M. Turney, D. Robinson, M. Lee and A. Soutar, Using technology to direct learning in higher education, Active Learning in Higher Education, 10 1, pp. 71-83, 2009.

Use of Information and Communication Technology in Teaching-Learning Process.

Mukta B. Khatavkar

Greenfingers Global school, Kharghar

ICT is defined as a diverse set of technological tools and resources used to communicate, disseminate, store and manage information. Technology is the necessity of 21st century with technological literacy at the centre of learning. Every educational institution should be adept to prepare global citizens who are technologically sound. India is the second largest market for education ,e-learning after US. Application of ICTs in form of e-learning is already changing teaching and learning processes. There are many pedagogical and socio-economic factors that have driven higher learning institutions to adopt e-learning. These include greater information access; greater communication via electronic facilities; synchronous learning; increased cooperation and collaboration, cost-effectiveness (e.g. by reaching different students and in greater numbers) and pedagogical improvement through simulations, virtual experiences, and graphic representations.
Higher education institutes - & - Corporate – need to provide opportunity for hybrid learning which is combination of online and classroom learning. Hybrid programs are providing very effective in some developing countries such as Malaysia, where most higher education institutions have switched to the flipped classroom model.

Using new technology in classroom:-
A Chinese philosopher and teacher used to say; "I hear and I forget, I see and I believe, and I do and I understand.
IT – enabled technologies to enhance classroom learning in school education are becoming widely available and costs are falling.

As we sail through the 21st century, **technology in the classroom** is becoming more and more predominant. Tablets are replacing our textbooks, and we can research just about anything that we want to on our smart phones. Social media has become commonplace, and the way we use technology has completely transformed the way we live or lives.

Educators, too, have seen firsthand the benefits of **technology in the classroom**. According to a **study by IT Trade Association CompTIA** just released this month, around 75 percent of educators think that technology has a positive impact in the education process. Educators also recognize the

importance of developing these technological skills in students so they will be prepared to enter the workforce once they complete their schooling.

The impact that technology has had on today's schools has been quite significant. This widespread adoption of technology has completely changed how teachers teach and students learn. Teachers are learning how to teach with emerging technologies (tablets, iPads, Smart Boards, digital cameras, computers), while students are using advanced technology to shape how they learn. By embracing and integrating technology in the classroom, we are setting our students up for a successful life outside of school. Here are a few benefits of using it.

- Makes learning more fun
- Technology prepares students for the future
- Improves retention rate
- Technology help students learn at their own pace
- Technology connects with students.

Types of technology used in the classrooms and its benefits:-

- Audio –Visual components like computers, white boards with projectors and speakers ensures effective learning and more meaningful in the classroom.
- Creating class websites and blogs which help teachers to post assignments or data to a blog.
- Use of digital microphones in the classrooms which helps teachers not to strain their voices.
- E-learning and video books which integrates textbooks, workbooks, videos, assessments, etc.
- M-learning for students and teachers to interact.
- Use of online media and online study tools.

USE OF TECHNOLOGY IN THE CLASSROOM, HOW IMPORTANT IS IT ?

The importance and use of technology in the classroom are self-explanatory terms, the implementation comes with usage of hi-tech teaching aids and modern tools for easier and faster understanding of educational concepts.

It is scientifically proven that we learn faster using multiple senses and if visual, auditory and demonstrative techniques are employed together, hardest subjects like mathematics and science become very convenient to absorb.

ISSUES OF EQUITY AND EQUAL ACCESS IN ICT:
Are We Giving Every Child What They Need?

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The twenty-first century will be remembered for the fast-paced technology development. Computers have been welcomed rapidly in schools, offices and homes. Teachers' and students have steadily increased their use of computers in academics. Information Communication Technology (ICT) has thus proved to be the driving force in all economies throughout the world. Education should make it their priority to educate children at a very early age on the use of computers in everyday life. Issues of equity are very important factors contributing to quality education and also to empower children in an equal and equitable manner to enable them to participate fully. Equity and access will also be very closely related to the community within which the school operates.

Equity therefore is the provision of resources to all in a manner that does not disadvantage others while Access can be defined as the ability to enjoy the benefits of resources that are being provided without any discrimination whatsoever. Equity in education means that personal or social circumstances such as gender, ethnic origin or family background, are not obstacles to achieving educational potential and that all individuals reach at least a basic minimum level of skills. There are several levels of equity to be observed in education, as equity can be addressed by assessing what causes the inequity and who is involved. Equity requires both that unequals are treated differently and that equals are treated similarly. We will look at the equity in Classroom level.

The classroom is a place where important learning and skill acquisition occurs. It plays a very important role in students' confidence and learning. Therefore it's a challenging task to provide every child the access to all the resources. Disparity between social composition in the forms of gender, socio-economic situation, disability, ethnicity, sexuality and such are unique to each classroom. Gender becomes an issue when it comes to who will use the resources. Both girl and boy child behave differently. Boys always run to the lab to take charge of the computers thus not letting the girl students to use it. Other than gender the top rankers or the scorers are also the issues that are been faced in such conditions. The high achievers are more often selected to participate in collaborative projects, as they will easily communicate with other learners. Teachers will at all cost avoid selecting learners who will need a lot of

assistance to participate in such projects. And therefore, the rest of the students spend endless periods of time at the windows peeping in to admire the computers and craving to put their hands on them. The computers are in this case reserved for the selected few, defeating the whole essence of equity. The girl child must be empowered equally in such cases but not overlooking the boy child. There should not be any differentiation among the two. Therefore equity and access should be defined within the context of each individual school so as to guide any policy developed. Monitoring and Evaluation method should be adopted to ensure that all the intended audience are reached.

USING NEW TECHNOLOGIES IN CLASSROOMS

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Abstract:

Technology today offers many new opportunities for innovation in educational system. Advances in computer technology continue to change the lives of instructors and students. ICT is becoming an integral part of everyday life. The technology is now an essential requirement in relation to our work, competence development and leisure-time activities. It is also increasingly essential for using various public and private services. Education system has given high priority to the use of ICT, both on and off campus. This has brought about new ways of organizing teaching, while research and the use of ICT have encouraged the academic staff to take an interest in flexible education. For some years, the implementation and use of ICT in education at all levels has been a major priority of educational policy. A number of studies (Erstad 2006, Krumsvik 2006) reveal high expectations and ambitions in regard to the role of ICT in future educational contexts. This has resulted in various research and development programmes at all levels of the educational system. Our present base of knowledge is insufficient and is tainted by investigations that are lacking in rigour and methodological quality.

Key words: Technology, ICT, education, research and development.

Introduction:

ICT (Information and Communication Technology) involves transfer and use of all kinds of information. ICT is the foundation of economy and a driving force of social changes in the 21st century. Distance is no longer an issue when it comes to accessing information; for example, working-from-home, distance learning, e-banking, and e-government are now possible from any place with an Internet connection and a computing device. ICT is an example of a technology that is a powerful change agent. ICTs possess all the potential to improve the teaching/learning process significantly and revolutionize the education enterprise.

Description:

Classrooms are constrained environments, and conventional instructional materials are static. If technology-enhanced education programs are taped classrooms, digital texts, and PowerPoint transparencies, then we are missing out on the tremendous potential of technologies that can animate, simulate, capture reality, add movement to static concepts, and extend our touch to the whole universe.

In recent years reference to 'digital technology in the classroom' (DTC) can be taken to mean digital processing systems that encourage active learning, knowledge construction, inquiry, and exploration on the part of the learners, and which allow for remote communication as well as data sharing to take place between teachers and/or learners in different physical classroom locations. This is an expanded notion of technologies that recognizes their development from mere information delivery systems and also clarifies their role in classrooms in contrast to their wider use across schools and learning centers.

Terms associated with digital technologies in the classroom:

Bring your own device (BYOD): Learners bring their own devices like mobile phones into the classroom. While this exposes greater range of technologies at lower cost to the institution, it is difficult to control and monitor the activities as the variety of technology – even that the teacher does not have an access to will be used.

E-portfolios: Learners and teachers create an electronic catalogue of work that tracks their learning journey. This is usually online and often uses multimedia files. For example a student portfolio of artwork could be presented online through an e-portfolio. While this provides a way of quickly and seamlessly presenting a wide variety of material in different formats including details of process, the data security and confidentiality lack of teacher understanding/ training may place the process at risk.

Flipped classroom: Learners discover new content before the lesson from online videos or resources, like Wikipedia and Youtube, and then apply this knowledge in more personalized work in the classroom. This process provides more time for activities that promote deeper understanding and reflection. The risk factor is the reliability of the resources. Learners do not understand or are not able to access the flipped material flipped learning is not appropriate misunderstandings arise that are not addressed in class lack of teacher understanding/ training ensuring resources are up-to-date.

Personal Learning Network (PLN): PLN is an individual's loose collection of links with other people or resources. The links can be through, for example, online interest groups like Twitter or online courses. While access to a wide range of perspectives and expertise beyond the confines of the physical institution is available, the data security and confidentiality becomes an issue. The accuracy of information, access to the network and lack of teacher understanding/ training may also pose problems.

Virtual Learning Environment (VLE): VLE is an e-learning education system that is web-based, but modelled on conventional face-to-face education like Moodle Blackboard. This is an easy way to collate and organise courses and information. Flexibility of access and software can limit course structure and requires high level of maintenance.

Equally important, research and experience have shown that ICTs, used well in classrooms, enhance the learning process, in many ways. For example, they have the potential to:

- ✓ allow materials to be presented in multiple media for multichannel learning;
- ✓ motivate and engage students in the learning process;
- ✓ bring abstract concepts to life;
- ✓ enhance critical thinking and other higher levels of cognitive skills and processes; provide opportunities for students to practice basic skills on their own time and at their own pace;
- ✓ allow students to use the information acquired to solve problems, formulate new problems, and explain the world around them;
- ✓ provide for access to worldwide information resources;
- ✓ be the most cost-effective (and in some cases the only) means for bringing the world into the classroom; and
- ✓ offer (via the Internet) teachers and students a platform through which they can communicate with colleagues from distant places, exchange work, develop research, and function as if there were no geographical boundaries.

CHALLENGES FOR ICT IN CLASSROOM:

- ✓ Educational Policy, Infrastructure, Contentware,
- ✓ Committed and Trained Personnel, Financial Resources etc.

CONCLUSION:

The challenge to integrate ICTs into education is enormous, but so are the potential benefits. With technology, the sky is the limit, but with educational technologies, the sky is not the limit. The limit is human imagination and societal creativity. Technologies have great potential for knowledge dissemination, effective learning, and efficient education services. Yet, if the educational policies strategies are not right, and if the prerequisite conditions for using these technologies are not met concurrently, this potential will not be realized. Very important, appropriate and effective use of technologies involves competent, committed interventions by people. The Dynamics of Technologies for Education commitment cannot be inserted into a project as an afterthought, but must be built into conception and design with participation of those concerned.

Practical exercises in pharmacology fulfill certain educational objectives. Handling an animal and dissecting it helps to build the psychomotor skill of a student. On the other hand it is not necessary that these experiments be carried out by the students “first-hand”, if the goal was to build the observational, analytical and interpretative skills of a student, as these objectives largely relate to the cognitive domain. It is possible for a faculty member to demonstrate these experiments and let the students observe the

results and interpret them. Computer Assisted Learning (CAL) can be very useful in such a setting. CAL also offers a stimulus- variation from the routine teaching methodologies. Attempts have been made by many teachers of pharmacology to improve teaching methods [1-3]. It is in this context that the CAIP software program was used as adjuvant in practical pharmacology classes.

The feedback shows that students appreciated this as a welcome change to practical sessions involving demonstrations, routinely conducted in the laboratory. Since these students have been exposed to both methods (faculty conducted demonstrations of certain experiments and also the CAIP software) their observations are valid and relevant.

Reduction in expenses involved for animal experiments is a definitive advantage of this method. Dependence on computers and technical problems arising during class are possible disadvantages of this method. It is to be noted that 99% of students who attended session 1 suggested that CAIP software should be used as an adjuvant to practical laboratory sessions. It is clear from this study that CAIP software can be used as an acceptable method of teaching practical pharmacology demonstrations to students. Many studies have highlighted the usefulness of CAL[4-6]. This underscores the need to develop software programs for CAL incorporating demonstration of drug actions. This can be achieved in the near future with the available expertise in our country.

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Khan Academy as a remediation tool for Mathematics class

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About Khan Academy

Khan Academy (http://www.khanacademy.org) is an online learning platform with the stated mission of "to provide a free world-class education for anyone, anywhere". Khan Academy offers instructional videos, practice exercises and a personalized learning dashboard on a wide array of subjects that empower students to study at their own pace in and outside of the classroom.

Khan Academy Features

The best-known feature of Khan Academy is the videos which the students can refer to at home or a teacher could use in the class. However, the focus of this essay is not the 13000+ videos but the practice exercises and learning dashboard especially in the context of remedial teaching in math.

All subject areas have some exercises. In case of math the site offers seemingly inexhaustible bank of online practice exercises by dynamically generating problems. But the best part is the site's ability to track the progress made by a student. Usually, a student needs to get five problems right in a row to attain the mastery level of 'Practiced' in that skill. A student can take the practice exercise multiple times to practice a particular skill. The student can level up by taking the 'Mastery Challenge' from the Math missions. The highest mastery level is 'Mastered' which means that a student knows this skill inside and out and is ready to build on this knowledge. The lowest is level is 'Struggling' which as the name indicates is assigned if a student is struggling to solve the problems of a topic. Students have access to step-by-step hints to help them solve the problem. Each page also links to a video related to the skill they are practicing.

The entire site is gamified and students earn points and badges for doing exercises and watching videos. Access to real-time and accumulated data allows a student to track the number of videos watched, number of exercises attempted, including which ones were correct and which were incorrect, the amount of time spent on each exercise or video, the wrong answers given, and the number of hints used.

The progress data is also available to a student's coach (teacher) who can then track progress of an individual student or a group of students. Data is color coded so that coaches can get a sense of progress quickly (e.g., red indicates the student is having difficulty while dark blue indicates topic mastery).

Khan Academy for Remedial Teaching

Using Khan Academy requires each student to have access to a computer. This can be an obstacle in adopting Khan Academy in regular classroom teaching. However, the school computer lab can be used while working with a small number (15-20) of students who are struggling in mathematics.

The first thing that a teacher needs to do is to create and add students to a class. There are multiple ways to add students to a class. The simplest way to type the name of the student and let the portal create a unique username for that student. The password can also be set while creating the login for the student.

The site has organized the topics by standard. The topics are mapped to the CBSE syllabus. Students and teachers from schools following other boards need to browse for the skills by subjects and pick the skills relevant to the syllabus.

A teacher can use the videos to cover a concept or do explain it in the traditional way in a classroom setting and use the portal only for exercises. The advantages of using the Khan Academy for math practice are:

- The teacher need not spend time making or writing practice sums on the board.
- Each student in the group can work at their own pace. If one student finishes a set of exercises, he/she could move ahead to the next one without waiting for the teacher.
- Real time data is available to see which students are struggling with which skill. A teacher could then work with that student on that particular skill while others can continue practicing.
- Students can access the site from home and their progress will be visible to the teacher. Also, when students are practicing on their own, if they get stuck, they can take advantage of the hints or watch the videos to clarify their doubts.
- Based on the progress of a student, the teacher can make a recommendation to watch some videos or do extra practice to the student.
- The awarding of points and badges creates an excitement amongst the students and encourages them to practice and master skills.

ICT IN TEACHING LEARNING PROCESS

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ABSTRACT: The paper discusses the foundations for establishing viable and sustainable Information and Communication Technology (ICT) industry and the opportunities it offers against the challenges faced by our education system. ICT is a tool for learning. ICT is a scientific, technological and engineering discipline in management technique used in handling information in application and association with social, economic and cultural aspects. The tools like interactive board, projectors, CBT, WBT, online website and videos are used in our school. The ICT enables self-paced learning through various tools as a result of this the teaching learning enterprise has become more productive and meaningful.

INTRODUCTION

According to Daniels (2002), Information & communication technology (ICT) within a very short time, has become one of the basic building blocks of modern society.ICT is a tool for learning. It helps to facilitate the transaction between producers and users by keeping the students updated and enhancing teacher's capacity and ability fostering a live contact between the teacher and the student through e-mail, chat sessions etc. Nowadays the role of Information and Communication Technology (ICT), *in* the education sector plays an important role. "*ICT in Education*" means "Teaching and Learning with ICT".ICT afford opportunity to the individual for self-paced learning, which caters to learner's abilities and aptitude. *The commonly used ICT tools in our school are:*

1. Computer in the science lab: With a computer in the cla**s**sroom, teachers are able to demonstrate a new lesson from required websites. For example: videos showing the insectivorous plants in action.

2. Interactive Whiteboards / Smart boards: An interactive whiteboard with the use of smart board software provides touch facility while explaining the concept. The various features can be selected by using a pen or a highlighting tool. In physics, teacher can draw ray diagrams. In biology, diagrams can be drawn with pencil tool. In maths, teacher can explain construction with more accuracy using virtual geometrical tools like compass & scale. These diagrams can be saved and further used in future.

3. HCL software: Digi-school's content is mapped to various curriculums (all Indian boards) & is packed with 2D/3D media elements. The features of the software are: 1.Equipped teaching. 2. User friendly interface. 3. Digi-slate reading template to enrich teaching. 4. Nuggets - small videos with

questionnaire. Eg: a) Cell division: It describes process of mitosis & meiosis. b) Sound – Explains progressive and transverse waves & its types. c) Chemical bonding: formation of different bonds.

4. Extra marks software: It includes ICSE curriculum which has learning modules, SLM, BBC gallery, animated videos, assessment sheets, etc. Eg: Explains the Excretory system in human, fractional distillation in petroleum refinery, etc.

***5.* Online study tools:** Tools that motivate studying by making studying more fun or individualized for the student.

Khan Academy*:* In this, the lesson is directly introduced through videos and concept clarity is evaluated through simple to complex questionnaire. How it help students: Collaborative learning, immediate feedback helps them to take corrective action. Apart from class activities and teaching, the audio visual caters all types of learners. Children are motivated as they get rewards at the end of each session.

Whiz juniors: It is an on-line technology learning platform for the students. Grade wise (1 to 12)courses are provided and students can learn latest technology & can apply in the irrespective subjects. Eg: Prezi presentations - This is an interactive presentation tool wherein small illustrations can be animated, zoomed in and out.

6. On-line virtual tutorial: This enables students to get clear idea and understanding about the concepts being taught. Eg: Virtual tour through the great pyramid. These ICT tools in the school help students for better retention and understanding. These help in eye-brain co-ordination. It saves materials and time. These are useful for abstract concept and as a simulation tool too, wherever things are hazardous and expensive. It also helps teacher for quick recap of the lesson, to make a well designed lesson plan, a customized question paper & for better communication with the students. In technology enhanced learning **(TEL)** teacher's role will be more challenging and definitely different from what is presently the traditional class room teaching.

LIMITATIONS:

- Affects the writing skill of the children.
- Doesn't cater to the kinaesthetic learners.
- The teacher-student gap is wider.

SUMMARY

ICT in classroom has changed the teaching – learning process. Education has been transformed from teacher centric to student centric. ICT is just a tool, not a substitute for a teacher.

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USING NEW TECHNOLOGY IN THE CLASSROOM

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As we are sailing through the 21st century, incorporating technology in the classroom is becoming more and more supreme. Everyone wants teachers to use technology in the classroom. But teachers are busy in meeting their standards, preparing students for tests and maybe teachers are not too fond of computers and technology.

The idea itself is a broad umbrella for numerous practices, education system should be ready for all the possible circumstances as technology tools changes rapidly and the outcomes vary depending on the style of implementation. We can search about almost everything and anything on our smart phones or tablets. It has become a common platform and the way we use the technology has almost transformed our lives.

The impact of using technology in today's era is quite significant. This widespread adoption has totally changed the teaching learning process. Teachers have started adopting the emerging technology and have started learning and finding ways to implement technologies in their teaching plans and children have started using the technology to mould their learning.

Few ways to incorporate new technology in the classrooms

- Using animated videos to deliver a lesson
- Flip Classroom-Assign a topic to every individual and ask them to prepare a presentation and present it to their classmates and have a question answer session to assess their learning.
- Can initiate a collaborative class blog.
- Video conferencing to connect beyond the classrooms.

By accepting and integrating technology wholeheartedly in the classroom, We can set the backdrop and platform for our children for the successful life outside the school, as using technology can have some benefits like as follows:

Learning is directly proportional to Technology

Technology has occupied an essential space in learner's life. Apart from the school premises everything around them is directly or indirectly is connected to the technology. Technology helps us to cater the needs of the learners and prepare them for the ever-changing era they live in.

A complete control over the pace of learning New technology empowers the learners to learn at their own pace. Learners have full control over the pace of learning according to their needs and abilities. Learners get more time to work independently on the things on which they are struggling on.

More Retention

It is believed that, if an individual encounters hands on experience for any concept, it is retained for a longer period of time and in an very effective way. In short, technology helps learners to remember what they learn.

Preparing Children for Life

Being Tech Savvy is one amongst the 21st century skills. This skill is very essential in order to be successful in today's age and day. Jobs are done easily using technology. Education is not just memorizing things and scoring good grades, its about having an ability to solve complex problems and being collaborative in the team work.

Fun way to learn

Learners believe that using technology makes everything interesting even the most challenging topic or any boring subject.

A Challenge for education sector-

Integration of technology with the school routine will be the most challenging task to implement.

Technology cannot replace a teacher. Using technology is an amazing tool for teaching, but technology alone doesn't facilitate learning completely. If computers, could replace teachers, all the school, colleges and universities would have computers as teachers. To overcome the challenges of an always evolving high -tech society, educators needs to develop multiple forms of computer and information literacy to upgrade education.

Technology shouldn't be replacing teachers instead technology should be a partner in the learning process.

Using new technology in classrooms

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Technology as a boon or a bane has often been questioned by us; however we neither cannot deny nor overlook the innumerable ways in which technology has helped us shape our lives.

From the invention of superfast cars and bikes in transport, emails and smart phones in the field of communication, to using microwaves for everyday cooking, technology has touched every sphere of life and changed the way we live.

The field of education thus is no exception. The Midas touch of technology has turned mundane boring classes to interesting interactive classrooms.

Replacing a single projector which would be simultaneously used by all the students to having the smart boards installed in each classroom, we have come a long way. Our classrooms have evolved and so have we as teachers- in our teaching methodology, thereby creating a different experience for the students and rendering a unique and distinct experience.

Howard Gardner's multiple intelligence gives us an insight into the various types of learners we come across in our classrooms. Teachers thus vary their teaching methodologies to meet the needs of these diverse groups of students.

Having technology enabled classrooms strengthens the quality of education. Facts are impressed and etched in their memory if the teaching methodology is an audio visual medium rather than a chalk and talk method.

ICT – information and communication technology also enables students to be a lot independent. With a click away to the world of information, students are more empowered than ever. The use of modern methods helps a student learn complex concepts with ease.

Some developed softwares used in a number of schools allow teachers to view and control computers in their labs and interact with students. Designated classroom blogs allows students to write and express their views freely. Assessments are also conducted in classes where students have a remote

control to click away at the screen – self- conscious, coy and demure students' benefit highly where such advanced processes are involved.

With the flaks ICT has received, from children falling prey to plagiarism to its continuous usage having a threat on the health of the children, it can be safely said that students are extraordinarily facilitated and benefitted through its use. Studies have shown increased motivation and self-esteem, development of technical skills and the accomplishment of more tasks in a given time. It thus definitely is a modern and revolutionary phenomenon in the field of education. And even with the advancement of technology and science making path breaking inventions, ICT cannot totally eliminate the importance of having a teacher in the classroom in an age when humaneness is slowly dwindling away.

It is time we embrace technology but only to support out teaching processes in the classrooms.

Computer Based Assessments

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Assessing someone's understanding has always been a challenge. From why the assessment is needed and through what it should be to how it should be done may differ in each person's point of view.

Believe me, when I say, assessments are dreaded by students, they are equally dreaded by us as teachers. It is so because we want our students to bring out and display the best of their understanding.

Any assessment can be categorised in two sections

1. The Actual Process of Assessment
2. The Analysis of an Assessment for further improvement in attaining of knowledge.

Revolutionary Intelligence Based Assessments

To achieve a successful evaluation we must know that individual will perform at their peak in the areas of their **Intelligence**. Howard Gardener in 1983 has described 9 types of intelligence.

- Spatial (Picture Smart)
- Linguistic (Word Smart)
- Kinesthetic (Body Smart)
- Logical-Mathematical (Number/Reasoning smart)
- Musical (sound smart)
- Interpersonal (People smart)
- Intra Personal (Self Smart)
- Life / Existential (Life Smart)
- Naturalist (Nature Smart)

All of us can possess one or many of these areas of intelligence in different proportions. We capture, understand, sort and store our knowledge pertaining to our strongest and dominant type of intelligence(s).

Considering this, computer based assessments can play pivotal role in a student's progress.

To achieve Intelligence supported evaluation, first step is to analyse the type of intelligence(s) that a student might possess/ develop. This test has to be taken periodically. Further a database of questions should be created which will include various versions of a typical question

- A traditional textual question
- A question which refers to an image or a visual
- An audio question
- An activity based question

- A situation based question

The question if selected for an assessment, will be given to the student according to their Intelligence type. The student will be most comfortable in understanding the question asked or information being assessed and perform at best of his/her abilities.

Adding more to this unique method, these tests can give students flexibility in time period of the exams, as well as the difficulty levels. We might have already learnt or experienced that some of the online assessments dynamically increase / decrease the difficulty level of their questions according to the answers that you have provided.

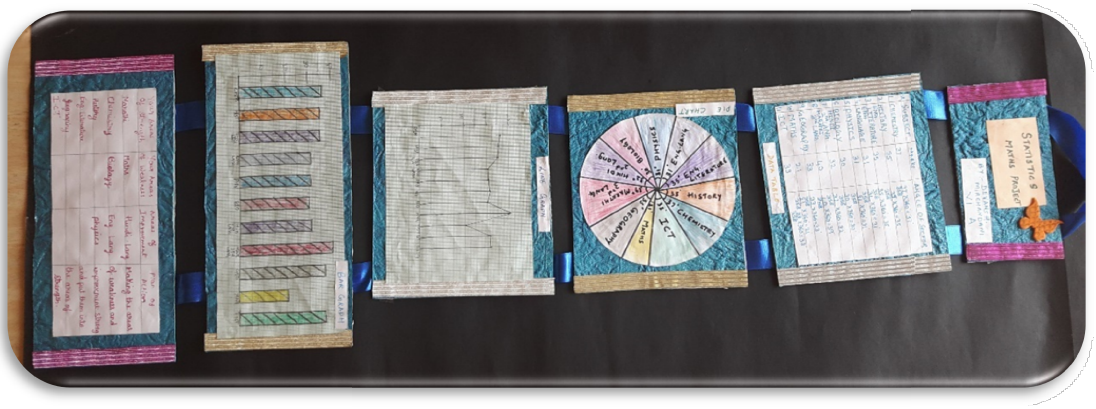
**Students really enjoy the work of other students because it connects them instantaneously. My Grade 10 Computer Application student Anjali has made an Quiz in Java as her project. The Quiz has three categories Football, Harry Potter and Famous Personalities and each category has three levels of questions Easy, Moderate and Hard. A user can select the Quiz category and choose between Easy, Moderate, Hard and Mixed Bag questions. Her peers totally enjoy giving the quiz again and again to find out what they have scored.*

To make these tests truly student friendly we can involve the students of higher grades to make a questionnaire for the lower grade students. They may provide a small software solution as a part of their ICT term project.

Analysis of an Assessment

**To depict the importance of presenting evaluation in other forms, I would like to share an experience with my Grade 6 Math students, I asked them to look at their Unit Test 1 score and describe their subject wise strength and weaknesses. Many could easily figure out which their strength areas are but most couldn't. Then they were introduced the Statistics concept where they learnt to represent a set of data in the form of graphs. Now majority of students could easily compare their performance and identify their strengths and weaknesses.*

Pic. below shows a project on the Graphical representation of the Unit Test 1 marks by a Grade 6 student Devansh.



Well the purpose of doing assessments is to analyse the understanding of the student and further provide remedy if required. The result of such an assessment is more than just number of right and wrong answers, it can be further micro analysed on

- Types of questions answered / left unanswered.
- Time spent on a particular / set of questions.
- Detailed SWOT (Strengths, Weaknesses, Opportunities, Threats) Analysis can be done student wise / class wise / subject wise.

All of the above information can be used for remedial purpose, thus achieving the ultimate goal of enabling the student with the knowledge and skills.

**We the Teachers in Euroschools are already using a software platform where the teacher gets a graphical subject wise and class wise comparison of the assessment results.*

So you can count on Computers for a friendly, precise, tireless, unbiased and an Intelligence based Assessment.

ISSUES OF EQUITY AND EQUAL ACCESS IN ICT

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For several decades, researchers have explored the potential of using technology based activities to facilitate learning at all levels. Certainly, since technology has a major impact on teaching and learning and on employment and everyday life, all students deserve equal access to its benefits. But one of major concerns that has remained since long is disproportionate access to ICT which arises from differential access and use by various groups within the population, particularly those differentiated by gender, ethnicity, region, social class/income level and ability.

Despite some successful policies targeted at low-income, minority, and rural schools, the "digital divide" is still apparent. An in-depth analysis of inequities in access and use of technology reveals gaps between poor and rich regions of country; ethnic disparities in access; inequitable distribution between schools and regions (relative minority enrolment, urban and rural schools vs. suburban); greater access to computers in school and at home for boys; more outdated, unreliable hardware or slower Internet connections in poorer schools.

Knowing what technology is available in a school does not tell us how often, in what manner, and by whom it is used. Research shows that available technology is often underused and poorly integrated into curricula.

Technology is much more than a physical resource; it is intertwined with social factors which differentially affect interactions. These include family computer cultures, "psychological access", social identities and exclusion from peer group culture encouragement from others, the setting (alone or with others) for technology use. These issues have a particular relationship with gender identity and are also connected with home access to technology. A rapid widening in home access is apparent; currently only a few homes have computers in our country. However, the distribution of home PCs and of Internet access has become increasingly skewed towards middle-class homes as many families are unable to purchase and constantly update equipment.

Differential values placed on specific types of computer expertise within family and peer cultures can influence children's ICT skills. The importance of parental guidance and encouragement for young learners cannot be questioned. However, many parents lack an understanding of the role that digital technology may play in their children's learning. The degree of integration into family life, prioritization as a support for children's learning, hardware and software available, and adult role modeling of computer use vary enormously, posing a subtle source of potential inequity within the group of students with home access.

Schools need a better approach for addressing unequal access to home computers. Students can be encouraged to make use of publicly available computers, such as those in libraries or community centers. Schools can also make laptops available on a check-out basis. Lack of access by some students to home computers should be viewed as a challenge to be overcome rather than a rationale for lowering expectations.