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PERSPECTIVES ON TECHNOLOGY ENHANCED LEARNING AND TEACHING FOR AN EXCITING LEARNING EXPERIENCE

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Abstract. The scope for learning subjects in our own way via flexible learning module is relevant in this age of tablets to capture the excitement of science. The paradigm shift in globalized learning using multiple sources is reflected in the recent trends, practices and techniques among learners/facilitators changing the very nature of human relations and social life. The present situation of slightly lower academic performance from an educational perspective needs some specific and alternate methods to discuss a subject, impart knowledge, instill basic values and for well-rounded educational experience. The PowerPoint presentations, open source articles, lateral and supplementary learning materials, problem based learning, multimedia learning and miscellaneous methods discussed in this paper stir the imagination to influence the thoughts and deeds of the future generation and have implications on health, education and prosperity with the advantage of subject areas, supplementary reading material and value addition. The disciplined learners can use visualization technique as a primary method of learning to gain knowledge and understanding to increase confidence levels by adapting divergent thinking approach in the changing times. Learning can be facilitated by maintaining learner-sensitive environment to gain a more positive understanding, appreciation, perspectives of the important contributions that science and technology makes in the real world at large and to generate new ideas, products, processes and jobs. The whole perspective of creating that exclusive experience for learners not only elevate learning to the next level but also speaks volumes about the facilitators passion for teaching to create a mental picture.

Keywords: interdisciplinary learning, content design, skill development, quality education, open source articles

Introductory perspectives

A change in narrative styles and patterns of presentation is the essence of any high impact teaching and teaching-learning interaction can be made more exciting by being creative and experimenting. There is a shift from instruction to learning paradigm and the facilitator acts as a guide by the side rather than a sage on stage in a learner centered approach. After understanding the importance of high-impact teaching-learning methods

in higher education, it is essential to drastically change the thought processes of people by proper educational sensitization. Today, there is a greater understanding and appreciation of the needs of younger generation learners and participatory educational experiences. The internet resources or learning resource centers (LRC) on supplementary materials act as a support structure to build a successful and healthy lifestyle to independent learners to experience joyful learning. The quality of the materials must be more sophisticated to activate the brain cells and improve the control of stimulating agents towards rational thought process. This is particularly relevant as we move from agricultural to industrial to the emerging knowledge economy as the role of human capital becomes more important and multiple factors are at play at any time. The emphasis on interdisciplinary, transdisciplinary and multidisciplinary approach to education rather than conventional disciplinary approach will help the learners to develop a mind programmed to react differently under different problem situations and to get more exposure to the other subjects. A different approach involves the cross-fertilization of different disciplines and production of fruitful ideas different from the standpoint of each discipline, taken separately. An attempt has been made to draw the attention of readers to educational, engaging and enjoyable teaching-learning materials including author's own examples. The basic knowledge content design with certain additional enhanced learning features incorporated will have huge impact on the learner as a world citizen. There is a growing interest in recent times about using power points in the context of education to have superior learning outcomes. The free and open source learning materials help in disseminating information related to teaching-learning interactions. The stakeholders, teaching/research communities, can come together to work towards common and larger development goals for forward-looking education on diverse platforms including Free and Open Source Software (FOSS) and Content Management Systems (CMS) (Feller et al., 2005; Mauthe & Thomas, 2004). The enhanced educational value of such materials within the context of educational transformation would increase the investigative spirit, ability to question and sense of scientific and technological potential. Major transformations are required in science education around the world by using right approaches if future generations are to be made adequately interested in basic and applied science subjects and to substantially enhance the gross enrolment ratio (GER) in higher education. The solution needs to address a wide range of issues relevant to modern education for an enriching and an invaluable experience involving imagination and inspiration including change in teaching methods to produce educational dynamism and good socioeconomic outcomes based on sound conceptual foundation and understanding of abstract principles.

Today, it is very essential to draw on theoretical and practical knowledge from a wide range of subject areas to address the complexity of real-world problems and to promote learning across boundaries as the compartmental attitude is detrimental to

learning, practice and research. The combination of educational concepts of pedagogy, andragogy and heutagogy with a focus on the principles of teacher-directed, self-directed, self-organized to totally self-determined learning as a part of life-long learning process is more practical in the present day situation in problem solving. Learning the subject matter, unlearning in the face of superior learning and relearning after having forgotten is necessary to become more disciplined and focused to achieve long-term sustainable development goals (SDGs). It is better to follow the revised Bloom's taxonomy for effective knowledge transfer, from the six levels of thinking in the order, remembering, understanding, applying, analyzing, evaluating and creating and the theory of multiple intelligences of Howard Gardner including universally applicable verbal-linguistic, logical-mathematical, spatial-visual, bodily-kinesthetic, musical, interpersonal, intrapersonal, and naturalist intelligences (Anderson & Krathwohl, 2001; Gardner, 2004). The learners want to learn skills beyond regular classrooms and examinations and expose themselves to higher orders of thinking skills, training and practice. In this context, combining different learning levels and theory of multiple intelligences has implications in strengthening and motivating learners by alternative teaching techniques to involve them actively in the learning process. The proper structural design, appropriate content and delivery mechanism affect the desired level of impact on the knowledge, skills and attitude in the cognitive, psychomotor and affective learning domains. Therefore, cognitive educational objectives (CEO) to enhance an individual's knowledge, affective educational objectives (AEO) to transform an individual's attitude and psychomotor educational objectives (PEO) to build a physical skill must be defined clearly. The participation in extracurricular activities like community service, clubs (science, robotics, photography, aero-modeling, theater & sports), hobbies, music and sports and co-curricular activities like interactive workshops and student seminars help them in overall development process and make learning exciting. How much of these activities to be promoted and encouraged is a matter of crucial importance with measurable bottom-line impact in scientific quarters. Today there is a need of objective and balanced viewpoints to make mature individual to derive one's sense of identity from various aspects of education. An integrated and a more systematic approach is required to bring about changes in vibrant educational industry where the websites could offer a special learner with a specific need at his convenience, free of cost and catholic choice of study materials so that large population will be impacted.

As the good practice uses active learning techniques, the content designer has an important role to play in the comprehension of a topic so that one can understand and remember new information via different interactive learning experience (Prince, 2004). This may be a discussion on connecting a topic to be studied to more interesting one in day to day life, learning about the latest advances, trends and techniques in the field

of science, technology and medicine, integrating old and new knowledge and to learn about smart solutions or innovative approaches from the professionals. The point-wise representation in power point presentations symbolizes convergence of a big banyan tree into small mustard sized seed. It is great to see visual display interspersed with images in such presentations along with the memorable/unusual word combinations and apart from enhanced educational value it lifts our spirits. It would be practical to prepare each slide carefully on specific themes in a power point presentation with a purpose to inspire, influence, inform and educate. The representations of concepts via appropriate flowcharts/models/matrices/animated pictures/newspaper clips will help and motivate learners to focus in the concept-building process and understand the topics in proper scientific context. As a part of continuous quality improvement, existing public domain power point presentations can be redesigned to create a new level of experience and excellent exposure. It is premature to judge the impact of such teaching-learning materials on web on education. From a scientific perspective some are at an entry level while others enjoy good online popularity with the visual appeal of the successful presentation. An interesting point about memory of subject matter is the continuous flow of a series of sensual influences along the pathway that creates a lasting impression. An interesting content and explicit expression makes a great first impression in creating registration, recording, revision and recall stages of memory process. The field trips, educational tours, industrial visits, workshops, conferences, symposia and specialized training provide practical exposure to real life situations and help learning beyond regular academic curriculum. For high impact education to achieve its purpose, adoption of high-impact methods, creation of stimulating environment, a drastic and basic change in attitude towards higher education in general and science education in particular is essential. The establishment of more and more collaborative research programs, faculty/student exchange programs, twinning and dual degree programs, quality improvement programs and distance/vocational education programs will highlight the best practices in training, teaching, learning, research and knowledge transfer. The improved educational mechanisms and processes will have the environmental, social, cultural and economic impacts and slowly metamorphose into educationally and economically forward society with progressive and productive members.

The main emphasis is given to a general discussion of several viewpoints on the importance of various aspects of higher education and the perspectives are presented to provide rich possibilities for blended learning with a special sense of excitement and development of positive attitude towards life. The specialized ingredients to promote active learning and to gain knowledge to create specialist solutions for problems are also stressed. The body of the paper is divided into six subsections containing different aspects viz. PowerPoint presentations, open source articles, lateral learning materials,

supplementary materials, problem-based learning, multimedia learning and miscellaneous methods. This paper presents a qualitative overview of relevant technology enhanced aspects to encourage readers to delve deeper into specific learning methods and the treatment attempts to cover the subject matter for perspective and breadth rather than great depth and a detailed discussion of all these methods is clearly beyond the scope of this paper. We hope that this paper proves useful for learners/facilitators interested in the impact of science/engineering on modern society, those dedicated to the promotion of innovation and educational excellence in several academic disciplines and those who have vision to bring about dramatic improvements in our lives by real change in perspective towards life. The specific literature references and the science education-oriented journals serve as a work of reference for the researcher and for the general reader in understanding the present day learning pattern and effective learning tools.

PowerPoint presentations

The power point slide show involving sights and sounds on a variety of science, engineering and technology topics offers significantly more visually stimulating experience than traditional teaching tactics. There are several possibilities of presenting the subject matter and self-explanatory PowerPoint slides provide more meaningful information for better learning outcome and intellectual growth. We have to deliver information in crisp bullet points that makes it effective and it is necessary to encapsulate the meaning, concept and application aspects to obtain phenomenal response from the entire audience. It is possible to project the existing topics from different perspectives by using appropriate domain expertise and experience of content designers, scientific specialists, engineers, inventors, regular researchers, academicians and other scholars to provide new learning experiences. Incorporation of certain related funny cartoons or instances may set the learner to a joyful mood with a sense of humor and increase the attention span. Sometimes only a passing mention and tangential references to related aspects influence an intensely visual presentation. More importantly, each slide should be extremely informative and innovative as well as thought-provoking with illustrations, diagrams, schemes, animated pictures, screenshots, snapshots, interactive exercises and video-clips to ensure a ripple effect on the mind of learner and to have a more fulfilling learning experience. The better quality images that complement our thoughts and better words that reflect our thoughts provide intellectual stimulation that act as a vehicle to integrative understanding of specialized science subjects and appreciate the importance and relevancy in the modern day context from the learner's approach. The power point slide show that incorporates the soft or rock instrumental music playing in the background enhances specific cerebral electrical activity in the brain and acts as the great bonding factor. The supplementary exposure to music brings refinement, inspiration,

enthusiasm and form an essential part of holistic presentation. Increasing availability of sophisticated music can be used for sensory stimulation in different parts of the brain by specific notes, scales and melodies. The quality of sound has an impact in providing improved audio-experience as part of well-rounded experience. We have to take special care to insert close-up images, graphic art works, aesthetics and intellectual depth along with philosophical and lyrical aspects to capture the public imagination and keep the audience marching inspired by perfection. The adaption of learner-friendly features to encourage the sense of curiosity and purpose about the slide design makes a difference in changing perceptions. The computer-generated ball-and- stick or space-filling models of complex molecules provides learner a greater sense of molecular architecture and increase their conceptual understanding. The exclusive latest collection of high quality and free PPT/PDF products in the form of repository provides an opportunity of learning appropriate domain knowledge at their own pace and huge mass of academic materials accessible to a global audience already exist in the public domain. It is easier to access the PDF or PPT files, update the content with recent advancements or fresh interpretations and to correct the errors when required for a learning journey. The extra ingredients are added to create the perfect formula to bring the presentation alive and provide a perception and learning experience that is both inspiring and engaging. A subtle play of advanced animated images combined with dramatic dialogue presentation can create sensory richness in specific segments and this technology enhanced learning and teaching techniques make the audience more active to enhance the learning experience creating lasting impressions.

Open source articles

The papers published in open source journals incorporating quality teaching-learning content by specialists in subjects with a significant involvement in subject information provide an alternative source of knowledge. Reading activates and forces the mind to discriminate which in turn pushes us to extend our imagination to learn descriptive skills. This visually guided thinking make us more creatively inclined and help us to improve our knowledge and skills consistently and constantly. Writing clear, lucid explanations of scientific concepts, elaborate discussions and detailed accounts of the subject presented in papers published in open source journals reflect a manifestation of the small seed that springs live banyan tree. It would be feasible to focus on the papers specifically designed to improve continuous learning outcome incorporating detailed explanatory and interactive textual material tinged with humor in small doses. There are several articles that are thought provoking and provide an insight into different topics and the goal is to produce the most effective teaching text possible (Bar & Tag, 1995; Weimer, 2002). It all boils down to a particularly interesting stories well told with es-

sential idioms and patterns, eye-catching images, finer aspects to have a better feel for ground reality and getting stimulated by the subject of the presentation. A new twist in the tale could have wide-ranging implications to inspire learning by manipulating certain neuro-chemical pathways and by increasing or inhibiting certain chemicals in the brain to open the windows of mind. It is important to make stories interesting involving recent advances including descriptive, inference and evaluation aspects to get a sense of learner satisfaction. Exemplary/cautionary case studies with clear-cut background information or an analysis of particular simulations of processes or products can certainly help to interact with the subject in a better fashion. One can use analogies, illustrations, simulated demonstrations, stimulating discussions, facts and figures and future focus to make complex scientific material simple and understandable. The average retention of material presented in audiovisual representation and reading texts is roughly estimated to be about 30%. One would be able to download open source teaching learning materials, papers or PowerPoint presentations anywhere, round-the-clock at the click of a mouse because of global high speed internet connectivity. It is well established that the low level anxiety ensures learning by enhanced creativity and critical thinking and leave a positive lasting impression. The MIT open source courseware are the most popular ones in use today and the peer-reviewed articles in open access journals are increasingly being cited and enhanced readership is an obvious plus point for content producers. There are about 1300 scientific journals available in the open source directory.[1)] Importance of digital resources is evident by the fact that there are more than five lakhs available on various websites. These electronic resources have inherently positive implications to gain vital experience while learning about rare topics touching educational aspect of life and explore possibilities of change for the better to boost academic development. There are people who create unusual learning materials, books/question banks/e-books/e-readers and they can reignite love for books and maintain concentration to equip learners to face a highly competitive world with confidence. The content developers have to take initiatives to redesign introductory, intermediate and advanced level resources that could put the readers, domain experts and other stakeholders beyond those useful in limited academic circles and update the content with the growth of new knowledge and information to establish a link in the continuous development chain. These papers with a good eye for detail are more engaging which could be used for self -education with mental mobility leading to innovative thoughts/ ideas and alternative perceptions rather than traditional dull march through the topics.

The specialists who have more than a decade long experience in the field should also analyze some multimedia products, video-conferences, panel discussions, tele-presence solutions, online advisory level consultancy in scientific problems, webcasting seminars, conferences, and many other interesting events on the internet as part of the next wave

of transformation of the education and society. Education is vital for every society and it is important to catalyze it to promote and motivate the existing and future learners by high impact mental activities to strengthen their mind in today's highly knowledge intensive environment. The government (GOs) and non-governmental organizations (NGOs) from several countries need to accelerate progress in basic and higher education by taking strong and action-oriented steps and in healthcare, economic and construction sectors that impacts wider society altering socioeconomic indicators. The proper and immediate implementation of social sector programs is necessary to make sure that the younger generation developed a keen interest in specialized education involving science, engineering and technology, medicine, and management subjects and dedicate their life to research involving science teaching and learning. The structured and disciplined methods using modern information technology results in significant improvements in learning outcomes. The observable, measurable and the result of the action in terms of particular knowledge domain (develop ability to understand, analyze, evaluate, apply and create), affective aspects (exhibition of true team spirit, positive attitude) and psychomotor skills (proper use of precision instruments, surgical tools) must be stated clearly. The change of method and style of presentation always has certain effects on learning outcome, thus differentiating between normal and high impact learning. We need to create question banks, knowledge banks and co-operative banks on various specialized platforms to share thoughts, voice concerns, discuss delivery of solutions, advice implementation aspects, post ideas, express opinions, exchange expertise and access information about specific topics. This type of bonding and meaningful relationship in scientific community broadens the scope of productivity and efficiency to the next level. The co-curricular activities such as debate, quiz, educational excursions, industry visits and extracurricular activities like sports, games, corporate interactions, interactive workshops and intercollegiate competitions (quiz, debate, storytelling and drawing) assist in well-rounded personality development and overall emotional maturity. The public-private partnership initiatives to deliver affordable education to all will also contribute to the need to provide quality education and offer concepts-to-creation services using teaching philosophies or ideas developed earlier rather than those provided by knowledge-centric professional services companies.

Lateral learning materials

Teaching science using appropriate and substantial laboratory work help learners to develop scientific reasoning, to understand the nature of science, to enhance the mastery of selected topics, to learn a set of laboratory skills, to develop collaborative skills and to cultivate the interest and motivation in learning science subject matter. The lateral learning materials (LLM) displayed in notice boards inside the laboratory,

preferably the power point slide printed version, will draw the attention of facilitators and learners. This could include definitions of scientific terms, classifications and basic principles, schematic diagrams of instruments, advantages, disadvantages, standard data, safety checklist, graphs, tables, flowcharts, illustrations, photographs and uses of the laboratory experiments. This additional visual material is an integral part of learner centric education (LCE) in their development and help facilitators to enhance effective demonstration practices to create additional academic interest in committed students by stimulation of thought with its trajectory of images, photographs and illustrations. These act as complements and supplements that provide a sense of reality, illustrate how science is related to the outside world and take an informed decision with forward thinking at the right time. Thus, the instruction can be enriched to encourage the critical thinking process for learners to develop the required skill sets including analytical thinking skills, application of concepts and inner strength to present in a more positive manner. Broad focus rather than narrow course provide much better experience, connectivity and tangible outcome to face the real world problems. We stress the importance of concept-oriented learning and the basic concepts relevant to each of the laboratory experiments have to be introduced to provide the necessary background for the experiment. We have observed the positive feedback from the regular students in connecting, reconnecting and interacting with the facilitator regarding the subject matter making the laboratory session more vibrant and create an effect of overall attraction. Alternatively, we could experiment with the art of telling tales of science and highlight the broad outlook of the application of established works of science to make it more alive. This would underline the impact of the new pedagogic technique in obtaining focused attention of youngsters and reveal the real picture to create tremendous impact on the way we think. Judicious mix of several elements such as light humor, strong emotions help the learners to be more involved with content and to generate curiosity on training and skill development process, progressing on the development path to extend the breadth and knowledge of the learner. We can produce tears using a lachrymator like benzyl chloride without the feeling of sadness and make people laugh using nitrous oxide gas without the feeling of happiness. Similarly, conversational or cosmetic listening in contrast to active listening on the part of the learner has much less impact to develop experiential learning. It is not just enough if we increase the alternate teaching-learning content and we need to learn to distinguish between the looking versus seeing, listening versus hearing, boredom vs. excitement, mediocrity vs excellence to make a meaningful contribution to educational development as a long-term solution to societal problems. The inclusion of short-answer and essay type questions promote the development of scientific writing skills while exploratory questions help to develop a lasting conceptual understanding, analytical thinking and problem solving skills. The comprehension, logical reasoning, critical thinking

and problem solving abilities in certain specialized subjects play an active and integral role in teaching-learning interactions. These lateral learning techniques help students to process raw data to generate insights or useful information, to provide perspectives by proper interpretation, to deduce patterns and trends in certain parameters and to draw conclusions based on evidences.

Supplementary materials

There is growing need for supplementary reading materials across the globe in engineering education to develop an integrative understanding and an evolved sense of refinement in students. In the context of inculcating the scientific temper, it is important to develop the habit of self-questioning on the part of the learner. A questionnaire designed with specific theme is useful in this direction to develop creative thinking by answering questions. For instance, the article entitled 'Metal based Questionnaire' that is related to wide-ranging applications or several special properties of metals in the periodic table or the "Scientific Instrument based Questionnaire" involving questions related to various instruments (Thimmappa, 2007; 2011). These articles mainly consist of informal learning resource in the form of questions and answers and the process of learning to answer typical questions as additional practice helps in understanding the subject matter. They are effective as reflected in the access count of the article and the statistical access count for the first article has crossed the 8000 mark. The statistics of access to the www server for CEJ by editorial board indicates the usefulness of such flexible question-answer learning formats in an open classroom concept. The second paper contains set of questions related to instruments that are regularly required for our day-to-day applications and those with diverse applications in different branches of technology. The additional advantages that will be of continuing assistance include increased self-directed learning process, enhanced problem solving efficacy and enriched pedagogical content knowledge. This may be useful as supplemental content in continuing education workshops and value-added onsite training modules with participatory interaction. The unique aspect about the paper is that it has the potential to bring about positive changes in some students by including examples from many different areas of science and technology.

The power point slide show on "Incredible Contributions of Chemistry with a Human Touch-An Overview" during the National Symposium on Chemistry and Humanity (NSCH-2011) held in Manipal, was appreciated very much as observed by the tremendous feedback by the audience and focused attention.[2)] The potential of decreased energy consumption reduced overall cost and decreased environmental pollution level can be realized through unique virtual reality activities. For instance, virtualized chemistry laboratory courses can be conducted instead of regular physical experimentation involving large number of students in a class as the virtual world is an extension of the

real world. This would help the more tech-savvy students to learn the importance of certain concepts, principles, definitions, laws, processes and applications. This change would also help to reduce the pollution level to some extent contributing to eco-friendly practices, environmental and social impacts. Alternatively, we could experiment with the art of telling tales of science and highlight the broad outlook of the application of established works of science to make it more alive. Both contribute to increase the confidence level and take learning to the next level. Several industries have extended their corporate social responsibility (CSR) initiatives on the back-to-nature theme to establish green educational initiatives and to promote eco-friendly universities.

The design and development of a new graduate course, laboratory resource materials and self-learning educational materials on certain current topics act as supplemental sources of learning and add to the learning potential that specific types of articles can bring (Thimmappa, 2006a; 2006b; 2008). One article on novel course serve the needs of chemical education professionals in a format immediately usable in their classrooms while another serves as general guidelines for chemical laboratory practice emphasizing safety aspects. The last article consists mainly of educational content on the topic of nitrogen fixation and dinitrogen complexes. It should be relatively easy for a teacher to generate notes from this article and is accessible anytime as it is published in an open source journal. Some of these papers have been well cited in important books and have been followed up in furtherance of teaching. The following teaching material with active learning techniques on 'Introduction to Battery technology' and 'Lead acid battery' published at Mission 10X portal help the learners to be more involved with the content.[3,4)] It is also essential to create awareness among the members of teaching-learning community on evaluation aspects that are necessary components of education. The formative and summative assessments as well as objective and subjective evaluations of learning outcomes have to be balanced on a continuous evaluation scheme with appropriate grading on a scale to bring various perspectives on assessment practices together in a comprehensive assessment program. The teaching efficiency is reflected at least in part in the assessment of learners and the feedback from regular students at the end of each semester. The design of good question papers including intellectually challenging problems and a sincere effort to work out solutions also contribute to effective study of any subject by allowing us to test our understanding. The integrated learning involving life skills, scientific concepts and applications of knowledge in an engaging environment equip the learners to face the real-world challenges.

Problem based learning

Another trend in the wake of electronic books/papers/ppts contributed by various science and technology professionals in academic institutions and research laboratories, industrialists, medical/clinical practitioners and management consultants is the growth of

the open learning model. The electronic repositories on special topics have been growing at a faster rate and important part of the storage is to save files in an organized fashion under different categories for easy access. The electronic version of many academic books, magazines, journals, maps, special monographs, treatises, review articles, plays, films and paintings on different topics are already available across the path of change useful for people in pedagogy and literature, environmental analysts, doctors, engineers, technologists, industrialists and managers. These changes in the learning mode would add up to focused activation and effective presentation so that it becomes an enjoyable experience. Today, specialization is increasingly important to educate youngsters and each specialization is associated with information sharing, mutual support and coordination of professional activities. Information from product/process patents, general/specialized review articles, research and development papers, commentaries, internet images and technical reports can be distilled into a meaningful active learning form to enhance imagination and facilitate positive interactions amongst facilitators and learners. Careful attention to accuracy, objectivity, balance, detail, narration that would provide a whole new meaning is essential to create superb content and it should be such that the resource becomes a great educational statement to provide a unique positive experience and add another dimension to learning process. The academic format with added aspects to acquire a greater sophistication and making the learner more thought-provoking enhances the intrinsic value. This activity help people to obtain valuable academic content for free, allow the contributors to meet or connect like- minded professionals, to showcase the workshop/symposium/conference content and to establish or improve academic collaborations and research consultancy relationships. Active learning techniques including brainstorming (individual or group), demonstration (logical, pictorial, designing), game (individual, team), group discussion, case study discussion (real or constructed), cognitive analogies, impersonation, mnemonics, quiz, games and puzzles, role-play, simulations and debate, problem-based learning (PBL), innovative introduction/conclusion help the learners to be more involved with the content. The high impact teaching-learning techniques can be considered to contribute substantially to modern educational reforms to influence the thoughts and deeds of the future generation. It does make a difference to the lives of many youngsters and we have to recognize this educational dimension and connectivity to social conscience. The recent developments in education sector reflect the changes in the educational system to obtain finest educational outcome and the learners will be able to apply knowledge, expertise and skills in real-world situations. The other forms of learning include project based learning, learning by lecture/seminar, collaborative learning and discovery learning also have immense long term benefits in the overall development and finding a possible practical solutions/patches to a wide variety of real-world problems. The different approaches to learning including problem based

learning (learning a subject through realistic, complex and multi-faceted problems), project based learning (learning through rigorous classroom projects), inquiry based learning (confirmation, structured, guided and open inquiry levels) and action learning (learning experience through actual action and practice) could be blended to provide an overall action learning tool.

In today's scenario, the facilitator/teacher has a larger role of overall development of student community by taking concrete steps and active attempts towards various curricular, co-curricular and extracurricular activities to empower them to reach their full potential. The important roles of a modern day teacher include that of facilitator (learning facilitator and mentor), role model (teaching and on-the-job), information provider (lecturer, practical teacher), resource developer (resource material creator, study guide producer), planner (curriculum planner, course organizer) and assessor (student assessor, curriculum evaluator). The impressive features such as superior graphics, glossy page display, innovative backgrounds and creative story telling make the presentation more attractive, inspiring and interesting. The multimedia educational products, videoconference, telemedicine, webinar, online advisory level consultancy and training courses are symbolic of a wider trend. The key elements like reality check and accurate information based on their scientific value are easily accessible via net connectivity and emerging trend in less explored areas like computational neuroscience, synthetic biology help in thought process evolution and creative process development. It is better to incorporate universal principles, human values, ethical guidelines and academic discipline to inculcate right intent, approach and message as an integral part of the academic program. There will be slow change of thought process at individual, group/institutional, national and global levels to improve long-term results. The creativity skill and technical expertise can offer a learner a novel experience while sensitizing the youth about educational values help them to distinguish superficial versus core values. The whole process of education should create awareness about the conservation and optimum use of a wide variety of natural resources such as land, forests, oil, gas, coal, metals, water and cause minimum damage to the environment to have sufficient impact on sustainable development. The principle of preventing waste formation and recycling, using safer solvents and reagents, productions using efficient processes and minimum expenditure of energy have to be practiced as greener alternatives to conventional techniques. As we have to learn from the past, enjoy the present and plan the future, it is essential that the different variables and other fine points of the subjects help in self-renewal processes. The different flavors and styles of stimulating discussions are necessary to build the capacity for linear and non-linear thinking patterns in a phased manner and develop a thorough understanding of the scientific concepts as a part of invaluable learning experience. The reforms in continuous evaluation process and accreditation aspects as well as their

strict implementation in letter and spirit also form a part of the next wave of transformation of the education. As variety is the essence of life, specific activities like science photography exhibition, theme-based workshops, lecture demonstrations, panel discussions, research consultancy, academic collaboration, short writing and active learning projects, multimedia presentations, refresher courses, crash courses, tutorial questions, computer assisted instruction (CAI), quality improvement programs, best practices and experience reports and science model exhibitions also provide a stimulus that is more pro-active and exciting to nurture and develop the new learning mode and get more exposure to the other subjects to develop their scientific thinking and the spirit to serve society. The employer look for education, aptitude, soft skills (communication, articulation and teamwork), experience and training while recruiting. Further, quality teachers, proper infrastructure, appropriate pupil-teacher ratio, learning resource centre and finally change in our hearts and minds are essential to trigger off positive chemical reactions in the brain. Another issue regarding the inclusive growth is to make concerted efforts to integrate the weaker students into the mainstream by involving them in additional essential activities specifically designed to stretch imagination and feature enhancement to provide enough motivation to move further in developing scientific thought process, enhance conceptual understanding, and improve problem-solving skills.

Multimedia solutions

The life-long learning (LLL) concept include learning skills such as life skills, teamwork skills, soft skills, organizational skills, computer skills, sketching skills, lab skills and domain skills continuously throughout our active life period. The television also plays a crucial role in educating the masses and a judicious use of TV to display scientific information, educational developments and to watch science popularization programs to develop inclination to use scientific knowledge for betterment of society by finding tangible solutions to various real problems including environmental protection and eco-development. The journey involves exposure to imagery and concepts that make a dramatic statement, cinematic aesthetics and an attention grabbing model projects are extremely educating with absorbing stories. The creative thought and expression over the national and international electronic channels energize and excite the audience. They provide an opportunity to think and engage the imagination of the audience with their special effects, brilliant performances, graphic detailing and emotional involvement to encourage, educate, enrich and inspire to ignite their scientific temper. Some educational programs on radio offer a distinct flavor to cater to the selected segment of society that has great practical significance for getting free education and in updating their knowledge in several fields to some extent and develop interest in a wide range of scientific activities. The changing perceptions in a society reflect an increasing awareness of the

health dangers of bad habits like smoking and drinking and the AIDS awareness activities may help people to prevent the spread of the human immunodeficiency virus. In these programs, well-written descriptions help one better appreciate the developments in science and add a new dimension to learning. The continuous broadcasting from radio station delivering the information, education, literature and instruction provide good experience and deep thought which in turn increase people's confidence level to work on their own potential and strengths. The broadcast media content is becoming more specialized to appeal to audience providing an in-depth knowledge on all aspects of the subject. Some selected interesting programs attract audience by crystal clear voice that add flavor to sounds of positive reinforcement and mind stimulation under relaxed atmosphere to provide a nostalgic experience. Another advantage is the multitasking possibility while listening to the clear signal broadcast.

Recently, the innovative audio product, multimedia instructional materials, iPods have become more popular in educational use particularly about sharing ideas, thoughts and perspectives and the specific details when fine-tuned invariably helps raise the bar[5)] (Moreno & Mayer, 1999). Yet another resource point the internet voice service also helps in the learning process and develop cooperation between different nations. These extra bits act as a catalyst to put learners at ease, helps establish a connection between the subject and the learner and assist shaping the minds of how youngsters think. The learning by these aids help the open source community to reach to a higher level and this is also a step in the overall development involving inspiration, imagination, ideation, invention, innovation and incubation so that a product, process, design or device could result that will be beneficial to the mankind. Finally, the establishment of educational hubs at different places in the global village is an important step in the right direction in encouraging youngsters to enroll in higher education seriously. Though the fundamental features and values of education remains the same the conductance of events like literature and art festivals, book exhibitions would go a long way to inculcate the love for reading and writing in people with an open mind and an urge to learn new things. Thus the television, radio and iPods provide an opportunity to achieve the four broadly accepted purposes of education viz. intellectual attainment (knowledge, skills), political participation (patriotism, law and order, socialization), economic empowerment (productive work-force) and social responsibility (values of society, personal development) in the wide-ranging career options. These media can help construct knowledge representations to correctly understand the context and underlying meaning with a scope for the overall development of the learners and provide out-of-the-box solutions. Heavy-duty multi-tasker mobile phones are used creating for mass awareness on certain societal problems and local solutions such as using eco-friendly alternatives to the polybags or energy-efficient and pollution-free technologies including the improvement of existing

products or processes. The positive reinforcement by e-textbooks, iPads and tablets as learning tools not only help learn mathematical concepts, expose learners to landscapes, art materials and graphs but also enhance the efficacy of our learning. The current trend in digital education is to use these electronic gadgets integrating audio and video snippets to make the learning process more effective and the learning potential that specific types of media can bring adds to the interest quotient.

Miscellaneous methods

Learning method has to involve the means to discuss, reflect upon, evaluate and validate the procedure to have positive learning outcomes and the basic subjects can be taught through research projects, case studies and practice of science to have more concrete experiences establishing connections to abstract scientific ideas (Renkl et al., 2002; Barron, 1998). The REACT methodology involving the five interrelated elements, relating to life experiences, experiencing the thrill of exploration/invention, applying knowledge/information, cooperating by communicating/responding and transferring knowledge in new contexts has been applied effectively with good response from the students (Rinard & Whitney, 2010). Inquiry learning is something that happens while investigating concepts and processes within a discipline and is characterized by the extent to which the problem/procedure was developed by the learner (Hannafin et al., 1999). The scientific teaching model where the learners are typically engaged in 4Ls of learning viz. lecture, laboratory, library and life require the students to listen (reasoning, inquiry), perform experiments (observation, measurement), engage in research (knowledge, critical thinking) and connect to life (examples in nature, broad applicability). This provides a platform through which instructors can connect with young learners and engage them in meaningful opportunities to develop a sense of diversity of fields, laboratory work, productive thinking and scientific relevance. Alternative approaches to the enhancement of science instruction include process-oriented guided inquiry learning (POGIL) and peer-led team learning (PLTL) (Eberlin et al., 2008; Farrell et al., 1999). Another method is to introduce seminar courses on current topics that encourage cooperative learning, inquiry-based activities, interdisciplinary approach, theoretical/practical modeling and global perspectives to sustain the learners' scientific interest. Excellent education encapsulates the concept that knowledge is power and thus key to high quality life and the current trend of blending different educational techniques and philosophy of enhanced effect instill a sense of life-long learning including the skills of survival in today's world.

The rapidly advancing knowledge base and volumes of information make it difficult to deliver and the decreasing number of learners attracted to academic science careers is a matter of concern. In addition to providing supportive, stimulating and engaging learning environments, it is essential to consider potential advantages of joint applica-

tion of several methods mentioned to increase learner interest, change the perception and learning outcome. The use of forceful language, providing specific perspectives, enough practical exposure, poster presentations, tutorial and assignments, interactive discussions and specialized education counseling designed to evoke intense passion for the higher education provide additional support. The educational organizations and the methods of teaching should be modernized and the basic attitude/motivational behavior of the learner should change. These methods help learners to develop skills to analyze and evaluate information, to apply scientific concepts to new situations, to follow the inductive (specific to general) or deductive (general to specific) logic to express ideas and to draw conclusions based on concrete evidences. This could lead to the establishment of an interdisciplinary network to tackle current global problems such as greenhouse gases, global climate change, acid rain, ozone layer, industrial pollution, solid and e-waste management, recycling of plastic/paper/glass and a host of health care management issues. The use of interactive websites and electronic response systems (clickers) can serve as media in science education that help learners to cultivate cognitive skills and interact with the subject material to improve their understanding (Donovan & Nakleh, 2001). Similarly, videos (documentary movies about the topics), animations (2-D and 3-D animations to highlight certain concepts), a verbatim transcript of video and the list of references/uniform resource locators (URLs) can act as vehicles for enhanced understanding of specific topics. The published material relevant to this topic is widely scattered in educational research articles and specialist books. A list of selected science education journals provided at the end of the article provides a ready reference and help learners reading material for more detailed study to enhance the learning experience that lead to academic achievement and formulate strategies to create tangible solutions to practical problems in the context of the real world via integrated approach of the utilization of science and technology. Another e-learning initiative currently practiced in certain universities is to provide access to offline video lectures from eminent professors of premier institutions to broaden the learners' horizons. The open courseware of MIT, active learning materials of Mission 10X and NPTEL video lectures by eminent persons provide a balanced perspective and cover a whole gamut of topics relevant to several academic disciplines.[6-8] It is better to adapt progressive and pragmatic approach to self-learning, hands-on learning, classroom learning, open courseware, new learning resources and online courses to increase the rate of generation of ideas, discoveries, inventions and innovations in the modern world. The quality effort required to create, transfer and adopt new knowledge and creative, workable and affordable solutions to increasingly complex technical and business problems depends on our perception, vision, drive and enterprise. The reforms, methods and approaches to empower learners/facilitators needs a paradigm shift leading to change in the quality of learning/teaching,

standard of examination, technology innovation, intellectual growth and up gradation in knowledge about recent scientific developments. The specific queries and specific response using World Wide Web (WWW) source or mobile platform for information and education would certainly inspire several individuals and put things in perspective.

Concluding comments

Thus the technology can extend learning to reach the highest level by raising the curiosity level of people across the globe and to stimulate and energize mind to improve mental fitness and quality of life of the younger generation on the earth. The combination of traditional knowledge that comes from lineage in every society, the curricular one that is taught in educational institutions and the knowledge gained by invited lectures by eminent speakers creates that curiosity to learn. A well-developed combination of several learning techniques using technology creates maximum stimulating effect so that learning process becomes more spontaneous, free-flowing and beyond imagination. In conclusion, preparing teaching materials on a particular discipline or interdisciplinary topics for wider distribution than one's own classroom is certainly a worthwhile activity to practice as it is a way to contribute and serve society in a path to progress and prosperity by healthy educational approach to life. It is like conventional teaching sprinkled with a little bit of the spices for enhanced taste/ to create more impact contributing to intellectual growth and rapid socio-economic development through better quality life with a set of sustainable development goals. But the material has to be carefully selected and the explanations cautiously prepared to have a learning process that is more engaging and mind stimulating to support excitement in science education throughout the world. We have to look at education in teaching-learning perspective with an objective of quality education to all through vibrant, free and open resources that are essential elements of modern education to capture undivided attention. The current trend in the education sector with design of innovative and improved presentation techniques will continue to provide many interesting insights and enable exciting experiences through technology based interactive approach including interactive smart classrooms. The experts in their respective fields act as a significant source of specialized knowledge within the context of educational transformation and networking allow the scientific community to produce quality learning content to provide an intellectually exciting experience. It may be worthwhile to establish 'expert advisory committees', 'world innovation commission', 'global knowledge network', 'global educational association', 'global education development initiative', 'world education research initiative' and 'international leadership mission' to gain valuable insights from experts regarding global educational outlook and to bring about drastic change in approach towards the future of higher education. These innovative initiatives have important consequences to achieve significant performance improvement and efficiency to capture the color and

flavor of the topic concerned to deliver to open source community and to create a learning environment that can meet the needs of a knowledge society. It is crucial to set up high level expert group (HLEG) for universal education coverage (UEC) and to eventually establish a healthy and strengthened public education system while the domain experts contribute to create strong educational content with coherent narrative that brings a perspective to scientific outlook. Alternatively, the establishment of Teaching Resources Support Systems (TRSS) and Scientific Information Systems (SIS) would enable the researchers, professionals and industrial practitioners to share and gain more knowledge on different topics and maximize their potential to succeed. Educational research activity must be rooted in sound science and the local solutions to local problems may very well prove to be more effective than global solutions and the learners are interested in the various ways in which science and technology impacts everyday life including the negative impact of technology and genetic engineering.

It is important to build the innovative resource materials available to all the consumers of knowledge contributing to a noble cause of meeting social and industrial needs of the 21st century. The learners' attitude towards education has changed immensely in the past few years and the idea is to expose and engage the learners creatively for mental, physical, spiritual and emotional development to become thinkers, explorers and achievers. A multipronged approach to ensure extraordinary resources to enhance the learning outcomes and proper development of specialized skill sets like presentation skills, coordination and communication skills is necessary. We have to maintain a high level of rigor so that the learners achieve long term retention of facts, concepts and models used in a particular discipline and how to apply them in a broad range of other disciplines. There is enough scope to nourishing and nurturing young talents to become responsible citizens and thought leaders of tomorrow and the methods mentioned help learning become more meaningful and citizens will be able to face global challenges in different fields of work. The audiences can expect more such presentation materials in the power point segment or visual collaboration with remote academicians, multidisciplinary collaborations and stay ahead in the learning curve with a capacity to conceptualize and to apply the concepts to problem solving. We have highlighted some modifications to power point presentations and future content development that provides rich educational information along with flexible learning module to make it exciting. Investing in promoting healthy holistic brain-food is a more sensible approach especially when fine-tuned to individual needs and to create a renewed vibrancy in education to impart scientific insight. An action plan must be followed to educate the public about the importance of high-impact teaching-learning methods so that significant socioeconomic benefits in the long run and significant contribution towards improving the overall quality of life results. The initial capital investment in education development may trigger a

rapid growth of teaching-learning materials which in turn further intensify the demand for better quality materials as the learners develop a passionate relationship with such improved knowledge expansion lessons to boost their confidence. The educational institutions offering programs in engineering, pharmacy, physiotherapy, medical, dental, nursing, management and law can adopt techniques that makes the entire experience at these organizations an enriching and exciting one by following a disciplined approach for green future. It is important to maintain and sustain the standard in all the aspects of education in an integrated manner to develop higher order thinking skills and create wisdom of the highest order. The best way is to encourage learners to develop a very strong academic background with abundant intellectual resources, superb infrastructure, premier institutions, tons of science literature and adequate training facilities in a planned cohesive approach. Learning allows us to find meaningful relationships between abstract scientific ideas and practical real world applications and sometimes storytelling technique capturing the essence of the subject blending the humor or artwork provide a detailed picture of the concept concerned. A judicious combination of traditional approach involving transmission of knowledge, transaction method involving more interaction between learner and the facilitator and transformational learning strategy involving physical, emotional and spiritual growth is a holistic approach for overall development. The flow of talent, capital and ideas will result in innovators, lateral thinkers, wealth generators and future leaders as the excellence becomes a habit. At the same time, it is essential to make youngsters understand the need for higher education in different science streams and effect a change in their attitudes to be successful in the long run. To put everything in high-impact higher education into three words is quite simple: vision (climate of professionalism), values (focus on academic standards) and vitality (teaching and research culture). In a rapidly evolving educational scenario reforms like these can act as a dose of educational Viagra to add sparkle to their lives to achieve excellence in their careers and lives and to inspire others in the future contributing to social development.

NOTES

1. http://www.opensciencedirectory.net/
2. Thimmappa, B.H.S. Power point slide show on "incredible contributions of chemistry with a human touch" (unpublished work).
3. Introduction to battery technology, www.mission 10X.com Portal, S1 (Thimmappa, B.H.S.).
4. Lead acid battery, www.mission 10X.com Portal, S2 (Thimmappa, B.H.S.)
5. http://www.unm.edu/~moreno/PDFS/chi.pdf
6. http://nptel.iitm.ac.in
7. www.ocw.mit.edu
8. www.mission10X.com

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