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HIGHER EDUCATION PERSPECTIVES FOR AN EXCITING EDUCATIONAL EXPERIENCE – PART V: AN INDIAN CONTEXT

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Abstract. The universities and the higher educational institutions, being embodiment of their strengths and collective aspirations, help reshape the idea of developed India. The diversity of the higher education-trained workforce is of concern, as the economy needs scientists and innovators who can work with diverse collaborators in an increasingly open marketplace. Best practices for developing national interest, education revolution, change challenges, and random perspectives are presented. The challenge of changing higher education landscape is huge, and a significant shift in mindset and a disciplined lifestyle are necessary to have sufficient number of high quality skilled workers available on a consistent basis in the decades to come. India can emerge as a global platform for higher education and high quality research with a policy environment which is predictable, transparent and fair. We have to make concerted efforts and investment to achieve progress in certain key areas of education, energy, science and technology. The new developments must make existing education process and delivery systems more efficient and effective. The fundamental reform agenda for higher education will be to improve the quality and competitiveness of higher education and research, and empower individuals and society committed to the progress of the nation.

Keywords: higher education reforms, Indian perspectives, quality of education, education processes, teaching and scholarship, learning society, execution issues

The aims of the paper are to excite young people about higher education and the positive impact it can have, and to enable them to critically engage with ideas and solutions. This manuscript is an attempt towards reaching the target audience of young people with an educational message of hope, change and growth. One of the purposes is to introduce the readers to different perspectives and inspire them to think beyond the curricula. This eventually brings about significant change in the current higher educational scenario. It makes a lot of educational sense to publish such articles and this is the fifth in the series that emphasizes high quality higher education. In our previous four articles, we have discussed about the technology-enhanced teaching-learning, inspiration by books,

human resource development, learning beyond boundaries, policy matters, high-impact teaching-learning interactions, contemporary concerns, strength, weakness, opportunities and challenges analysis, and additional perspectives (Thimmappa, 2013a, 2013b, 2014a, 2014b). In this paper, the subject matter is organized into sections on national interest, education revolution, change challenges, random perspectives and elevated thinking. Focusing on the Indian experience, the paper captures a broad perspective of a country of shifting educational landscape through a particular prism of higher education. The different perspectives presented offer some pointers to the way forward for higher education reforms to restore its quality and catalyze excellence and innovation in science education.

National interest-make a mark

Many higher education related issues that matters to us today have their origins in the past, and hence lessons from the history of higher education in India could throw an interesting light on several such matters. The essence of philosophy of past holistic education coupled with new ideas, developments, experiments and experiences provides a model of education. It is important to harness traditional wisdom and contemporary scientific knowledge to achieve prosperity and strength. The continuing imperative toward providing a marked quality improvement in all areas of higher education presents numerous challenges for scientists, educationists and engineers. These challenges range from the framing of new policies to professional development, content creation to administrative aspects. A formal commitment and process is central to have a targeted educational change to be integrated into the fabric of Indian life. Considerable research is needed to analyze the current situation and to examine the consequences of reforms to arrive at meaningful educational reforms and a fair distribution of financial, human, technological and administrative resources. The response of learners to the changes is also a matter of growing interest and building models based on learner experiences or specific educational backgrounds add an interesting dimension to improve the whole learning experience. It is important to establish a balance between the requirements of growing economy and the protection of the environment, institution building and ecological sensitivity, theory and practice, professional and personal life. Similarly, we have to strike a balance amidst intense competition leading to excellence and collaboration, leading to specialized solutions. The outcome of the discussions, debates, conversations conducted in classrooms, seminars, workshops and conferences help enhance education standards. They have to be clearly designed to inform and stimulate the exchange of views rather than with a clear commercial undertone.

The country's journey to rapid growth and modernity requires us to inculcate the spirit of courage, confidence, patriotism, discipline, human values and sacrifice in the youth and recognize model institutions offering selfless service to society and the nation.

Setting up of comprehensive higher education development plan (CHEDP) and a broad framework for governance, monitoring the performance of institutions, and coordinated national effort to tackle the problem of reforms could transform the higher education quickly. Certain individuals, parents, professors and people, must be instrumental in bringing government, industry and academia together to chart a progressive growth trajectory for specialized subjects in India and strategic research in frontier areas of science and technology. At present, there is a lack of sensitized awareness for the higher education issues that are not easily comprehended. Scientists have gained a lot of ground in the past three decades and better enforcement of existing legislation and framing new laws could pave the way for victory driven by passion. Campaign encompassing print and broadcast media forms across every platform and harnessing the power of internet and mobile phones are integral to educate and create awareness about the importance of higher education. This platform could be used to discuss and debate approaches they can take and execute ideas in creating a vibrant higher education system with more academic freedom. It is essential to establish higher education endowment fund (HEEF) and activate several self-help groups (SHGs) that form the core of the education activism.

Content presentation, rich animations, exciting graphics, pictures, creative visualizations, and virtual labs facilitate learning with a comprehensive understanding in different disciplines. The massive open online courses (MOOCs) including video-lectures, lecture notes, regular assignments, and periodic assessments have acquired greater importance in the current context where educational expression is gaining ground.[1)] This is looked upon as an alternative avenue of higher education and helps enhance the teaching-learning process in specific subject areas. However, a number of courses on different branches of science and engineering are required and active involvement of experienced teachers in creating reliable and practical resources of knowledge for teaching community is expected. It is important to explore educational technology tools in higher education, training and development using learning management systems (LMS) such as Moodle (Ellis, 2009) and Assessment, Review and Instruction System (ARIS).[2)] In an integrated learning approach, these methods are useful to enrich their experiences in addition to classroom lecture involving questioning, reflecting, discussing and understanding. Formation of higher education 'think tank' as part of the expert review committee on the educational issues is another step. The members could consider many critical criteria for higher education reforms, suggest reforms, strategies and micro-planning and help find deeper scientific meanings via macro-view on problems and issues. Individual objectives must be in line with the national objectives and every individual has to find a balance between personal needs and all that the world around requires (Fig 1). This should be reflected in thoughts, opinions, and actions of higher education stakeholders to encapsulate the human expression to have better prospects on the path of techno-

logical progress in our country. Every voice is crucial in providing multiple positions, actions, transformations and the wave that emerges from these special activities shows collective consciousness of our society representing national interest and aspirations, and demonstrates our collective strength as a team to academic communities. If we can unlock even a fraction of our tremendous talent power, we can achieve success in our own sphere of activity. We have to recharge our batteries by determination, dedication, discipline and higher education fuels our journey to success via a positive attitude, approach, adequate attention and abilities.

One of the major purposes of higher education is to produce original thinkers, who invent, expand knowledge, and discover novel products, processes or systems. In this context, it is important to encourage new thinking and methodical research in frontier areas of science, engineering and technology. Effective steps should be taken to facilitate high quality higher education through proper policy framework and investment. This should be done in a more orderly, systematic, and reasonably structured manner to improve the quality of life. A comprehensive explanation of the educational process would require taking literary skill to considerable advantage and drive people by passion to contribute. This should be reflected in the excitement on their faces, energy and enthusiasm and a choice spanning a wide range of cutting edge career options to represent their hopes, expectations, aspirations, dreams and goals. The higher education reform marks a turning point in the evolution to head in the right direction to make young people become strong, powerful and potent. The government should be committed to nurturing the right environment to fully engage the largest population of youth in every academic activity and enable them to contribute to the betterment of society. The power of youth is incredible and if harnessed properly it can do wonders for India and greater achievements are certainly possible. The institutes and universities should give priority to academic activities rather than administration of student, faculty and staff support systems. The government should formulate clear and transparent policies on allocation of financial resources and to control funds and functioning to serve the nation with renewed vigor. The greater degree of financial autonomy and functional independence to project leaders can provide a chance to grow and improve self-confidence and quality of life. This will add to the overall excitement of the educational experience while keeping the national flag flying high. The central government should chalk out comprehensive higher education development program and policy to be implemented in the next five years. It should also encourage research and development in specialized domains by establishing world class research infrastructure and recruiting the best scientific and engineering minds to accelerate growth by running a high performance engine. We have to create a situation such that an increasing number of students choose to pursue higher education and join research or teaching careers in the future.

Revolutionary approach-better prospects

There is an urgent need to consider revolutionary approach as strong social support sets off a cascade of sensitization reactions. The definite purpose of this open-minded approach to change is to initiate a public discussion on higher education reforms in India and this should be the immediate concern of educated young Indians. Higher education revolution can reshape education landscape and create an environment that allows individuals to pursue their interests, participate in education delivery process and dedicate themselves for social cause. The revolutionary education solutions can deliver high-impact professional outputs. It is absolutely important to realize and understand that we have to build innovative mindsets, like the bricks in a building, in diverse fields to actualize the aspiration to see a vibrant and prosperous India. It is important to create the mass sentiment and give public expression to their views on reforms and help reshaping India's outlook. It is up to the new government to make a first move in framing actual policies as a part of reform process and take actions and ideals forward with a sense of justice. The use of sciences for a better world would involve working in shaping the world in a certain way and contributing remarkably to various levels of development. India's development trajectory could involve ten stages considering the heterogeneous nature of development: (i) Increase awareness about higher education reforms to form the activist community to act as catalysts of radical change to see a vibrant, dynamic and prosperous India; (ii) Educate the young Indians about preserving and protecting our only planet in a structured interaction with intellectuals to make sustainable progress; (iii) Use of narrative skills of popular authors, officials, and teachers to excite the target audiences about changing their inner perception and develop reformist thinking; (iv) Plan communication strategies to mobilize support across the country and make people think of what is good for the nation; (v) Deliver inspiring address by leading figures, scientists, intellectuals and writers on the importance of higher education reforms; (vi) Prepare people with a voice to express themselves in reshaping the destiny of this country from construction of roads to manufacturing spacecraft to the red planet Mars; (vii) Mobilize the audience to influence the parliamentarians to bring about the required policy changes with social implications; (viii) Implement education reforms to radically transform the entire educational landscape of the country leading to successful innovation; (ix) Emphasize on investments in rapid infrastructure, industry and agriculture expansion to raise productivity; (x) Fix the gaze upon a distant dream; vision of human progress and achieve the vision of the world.

Creation of a new international order based on higher education outcome and mutual cooperation in broad spectrum learning, joint research programs, faculty and student exchange, and intense industry interface is required. Today's academic leaders should show regard to ideological concerns and rise above their narrow personal and scientific

considerations and be able to look at and resolve problems in a larger context of the nation to find suitable solutions. This helps us to evolve as stronger, better human beings and raise strong voice about higher education reforms. The basic reason for the diminished growth performance in the last decade is in the very nature of the education and the lack of general preparedness to face the situation.[3)] The enrollment pattern of Indian students in higher education is guided by key factors; power of money, style statement, attributes of the college and personal needs of family. What we really need is an educational revolution that brings out the positive possibilities. The early identification of talented persons and training them to meet the challenges at the international level with support on both micro and macro-level on a priority basis are essential. A correction of policy and executional paralysis and growth stimulation requires restructuring and rejuvenating public sector institutions in the country. It is essential to encourage to performing or stopping the life support systems of terminally ill public sector research institutions. The universities and organizations in the public and private sectors can play a unique role in scientific evolution of the nation.[4)] The main reasons for the sharp decline in standards of certain state and central universities include mediocrity and bureaucracy issues, sub-optimal use of natural and human resources, corruption, politics, red tapism, and inefficiencies. They have responsibility to play much larger role in raising the quality of Indian higher education and to stimulate educational processes. We have to prescribe performance and efficiency norms and establish parameters to make them accountable. We need to make dedicated efforts towards implementing better practices and it is important to weed out non-performing or incompetent teachers or researchers from the education system.

There is a need to set up higher education commission (HEC) with regulatory powers and functions to boost the efficiency of the higher education sector in the country. The central government should frame a national higher education policy with specific guidelines and appropriate regulatory mechanism, after consulting the education and legal experts. We have to change science, engineering and medical education by creating regulatory apex bodies that have representatives from civil society and NGOs, and leading academicians. Similarly, policies related to educational administrative reforms, effective guidelines for monitoring mechanisms, use of technology and communication devices should be framed and address the managerial challenges in a time-bound manner. In this direction, preparing higher educational impact assessment (HEIA) statements and preparation of cumulative educational impact analysis report (CEIAR) by a neutral competent body would be helpful. It is essential to create a department of higher education to develop and articulate an integrated higher education policy with inbuilt checks and balances, and laser-sharp focus on implementing effective performance support, monitoring the progress of execution at a micro level and educational administrative reforms. Alternatively, setting up of national higher education development council (NHEDC)

with statutory powers to discuss the findings in higher education reports, recommend reform plans, and implement the plan, helps to trigger radical change in the system. It should be in a position to encourage special academic initiatives, offer comprehensive solutions across higher education with tangible benefits, and raise the quality of Indian higher education. Awareness among youngsters about the benefits of high-impact higher education and an opportunity for changing the public perception in this sector should be created to have a wider impact. Campaigning needs wide support and it is realistic to expect an early education change by concrete actions by the new government. Formulating and drafting proper national higher education policy aimed at resolving issues related to quality improvement in teaching and research, and taking rational steps to create an enabling environment of equal opportunity in higher education and livelihood would certainly attract intelligent and talented people across the cross section of society. The revolutionary approach to reforms with a message to perform better would result in creativity, impactful research, revolutionary experiments, and record of accomplishments in various fields of science. A movement to spread immense awareness about the benefits of higher education reforms could be developed in the country with the help of NGOs, science practitioners, social activists and media persons. The complementary activities like seminars and workshops can be organized to spread the idea of reform among educationists and learners. The uses of videos to sensitize people on science higher education issues help accelerate movement of change and help innovators to put their talent to practical use. There is a sense of urgency in one of the most pressing higher education management practices and it would require a number of changes in the present practices in India that can directly or indirectly influence the educational outcome. Disciplined voice is more effective and appealing, and the concerned citizens should immediately resort to decent, rational techniques to initiate higher education reform revolution. We have to toughen up to change the world because our potential is only meaningful if we reach it through higher education, inspiring actions and creating solutions.

Change challenge-message moments

The change challenge includes developing reflective, analytical, collaborative, worldly, and action-oriented mindset in extending educational experience. The forward looking and innovative mindset is required in learning, research and development activities that enrich the teaching-learning process, develop problem solving skills, and enhance creativity. Change involves unlearning, relearning, knowledge management and changing current classroom practices. Best practices for an effective teaching-learning process and innovative research can be incorporated through acceptance and a little practice. Scientific community should rapidly evolve into a cohesive unit and enrich youngsters by their experience to solve issues of local and global importance and meeting the many

challenges in this area in the future in a complex Indian socioeconomic context. The five key elements of changing actions and attitudes to experience the excitement of higher education and research include:

Balance of power

Faculty transformation from being 'sage on stage' to 'guide on side' role has to take place as there is a huge change in the learning styles of current generation of students. Generally observed four types of students involving attention seeking, inattentive, unprepared, and power seekers have to be handled by proper classroom management approaches by involving them in various classroom activities including virtual classrooms. We must equip, nurture and channelize learner's intellectual potential with the right kind of education and extra effort by faculty members on additional activities is also required. Integration of technology in educational process and restructuring of learning environment are essential to maintain the dynamism in the classroom. Special attention should be paid to understand the learner interests, and learning needs and choices. Maintaining the balance of power with more learner involvement and less teacher control would be helpful in moving towards the learning paradigm. Then the responsibility of the learner to adopt proper learning methods becomes important (Fig. 1). There should be a balance of the need to understand nature from an eel to an elephant and penguin to peacock and learn the design and function of objects from pain balm to pepper spray and alarm clock to airplane.

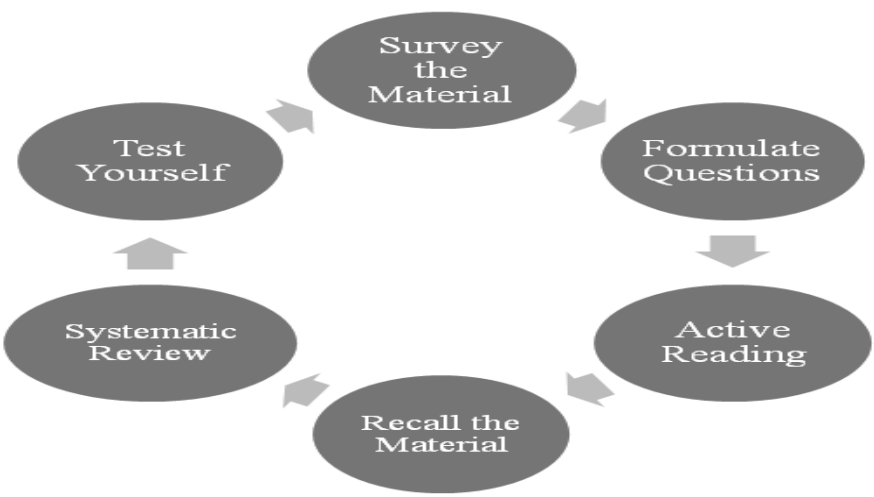

Fig. 1. Scheme showing study techniques that is very helpful package for regular practice towards high performance and achievement level

The Stokes' research model categorizes research into curiosity-driven pure basic research, use-inspired pure basic research, pure applied research and research that are neither scientifically interesting nor useful (Stokes, 1997). There should be a balance in research and development funding between fundamental and applied research areas. Basic research often leads to great discoveries or revolutions and applied research can generate new questions for fundamental research or reforms. Conducting research that advances basic sciences with the aim to fundamental understanding of phenomena and research as a part of the quest to address practical problems of importance are equally important from an Indian perspective. Usually, a small portion of most corporate research budgets are devoted to basic science research. The specific result is that it produces unreliable outcomes as it is uninteresting in terms of the science and the use. Moreover, multinational companies should encourage basic research projects with a substantial portion of the total research and development budget. The design of science roadmaps to pursue certain specific goals must be clear to produce reliable outcomes. Further, expanding basic science research activities in different branches of science can eventually create practical applications to create economic benefits and national good for India. A project portfolio should include a healthy balance of both kinds of development-oriented initiatives-projects that are actively focused on new discoveries and those that are focused on solving environmental problems. Setting up of an autonomous commission to carry out a periodic review of textbooks or references to cleanse the system from objectionable or obsolete materials and launching special projects to set the higher education system in order are equally important. The high-impact teaching and research implications include restructuring the teaching activities, enhance strength and confidence in certain core areas and provide opportunities to research scholars. The key factors that influence quality higher education include competent faculty, proper infrastructure, quality academic input, inspiring leadership, and research and innovation. The balance of power should smoothly spread the light of scientific knowledge that permeates across generations and reach a meaningful outcome through a better way of thinking and acting.

Role of a facilitator

We have to support the active learning shift from instruction paradigm to learning paradigm from an educational perspective. It would be better if the faculty acts as a facilitator rather than playing the role of a regulator. The facilitator has a role to engage the learners in an interesting and productive manner and help them to understand the profound significance and purpose of active learning methods. The commitment to deliver positive social impact should be reflected in motivating learners to action by intense educational excitement. It is important to follow the code of professional ethics

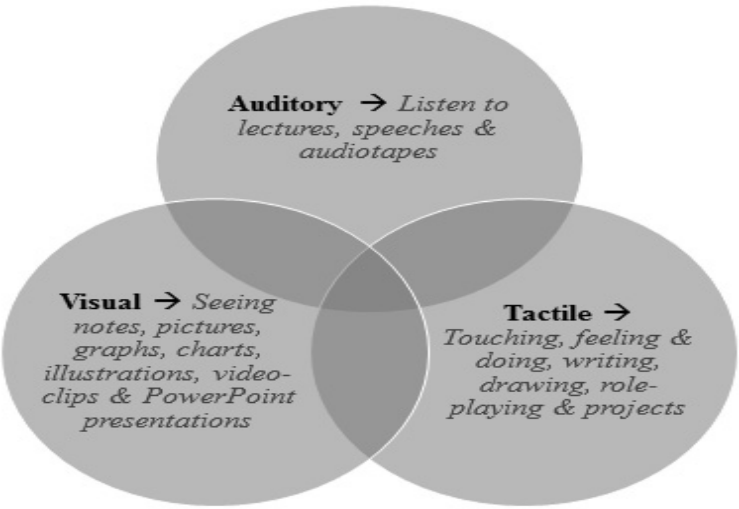

Fig. 2. Effective teaching strategy should cater to different individual learning styles in a strong educational system

and display professional integrity through thoughts, words and deeds to serve the nation with dedication. The central government can facilitate internationalization of education by allowing top level foreign universities to set up their campuses in India and Indian institutes can open their branches abroad. Bold decisions need to be taken in senate, executive committee meetings, and adequate resource allocation for various educational and research activities by the institutes or universities will provide a more conducive environment for rapid reforms. Let us work together to produce refined individuals with core competencies, honesty, right attitude and ability to do hard work for the development of our nation. The government should be cautious on how funds are allocated to researchers and a special focus on advanced science and technology projects is necessary in nurturing and protecting innovations. Offering more number of relevant and interesting program electives and open elective subjects in a particular program is also an educational initiative designed to change the learning culture and to give the power of choice to students. They can choose the right combination of subjects according to their interests and ability. The role as a facilitator is to facilitate the learning process and it includes the following multiple roles, responsibilities and commitments- guide, role model, coordinator, mentor, leader, philosopher, resource provider, manager, counselor, innovator and planner. Implementing active learning strategies such as case study dis-

cussion, demonstration, group discussion and quiz in the classrooms provide powerful learning environments. It is important to cater to different learning styles (auditory, visual, and tactile) for absorbing, processing and retaining information (Fig. 2). Effective classroom practices such as session plan, objectives, and assignments essential for our education system, bring in discipline to deliver the curriculum effectively (Svinicki & McKeachie, 2010).

We have to balance the vast scientific knowledge from the smallest of sub-atomic particles to the largest cluster of galaxies, from dermatology to neurology and the classification of broad specialties and super-specialties. Further, the micromanagement of squeezing the information, stirring the mind and sharing the specialized knowledge to make learners feel inspired enough to emerge as strong force are associated with hope and a brighter future. The facilitators play a key role in awakening the natural curiosity of young minds and ignite an interest in science. The importance of innovative learning methods ranging from role-play to reading exercise, from mnemonics to models, or brainstorming to story-telling in bringing about a paradigm shift from petrol-pump concept to interactive system of education cannot be overemphasized (Fig. 3). Innovations would further empower learners in their journey towards excellence in higher education. In the process, facilitators' role in accountability and transparency comes in to picture. The need to promote a culture of higher learning, constructive criticism, novel experiments and product/process innovation can provide opportunity to demonstrate action and deliver breakthrough solutions. The use of e-learning solutions, smart-class products and multimedia learning experience involving the textbook content, relevant animations and videos in addition to establishing academic education and research network in India helps in skill development. The role of the facilitator to impart key thoughts to solve problems by changing our attitude fosters character building. The human behavior is shaped by unique combination of heredity, life experience and background. The new working model should also inculcate human rights and values, justice and equity, and integrity without being affected by extraneous considerations. It is also essential to provide research exposure to students in a guided academic environment and train them to handle sophisticated instruments as part of the modern higher education practices. The facilitator should encourage learners to develop the reading strategies, healthy reading culture and skills for academic purposes using reference sources and convey the message that the benefits of science outweigh the negative aspects.

Professional development

Different kinds of intelligences present in individuals in varying degrees can be nurtured with specialized quality training and professional practice. It is important to sensitize students for a changing global educational environment to pursue useful, re-

Fig. 3. The high impact teaching skills to help learners imbibe higher levels of understanding and to enhance employability of graduates

alistic educational dreams. Faculty members, with their standard teaching philosophy and research statements, have the responsibility of continuous learning to update their knowledge and upgrade their skills to have core competence in their field. The action of reading academic publications such as textbooks, journals, and reference works (encyclopedias, dictionaries, database of patents) is important in the field of education to obtain the enormous benefits of knowledge, empowerment and to make important professional contribution. The availability of free online video-based teacher training courses is also helpful in this continuous learning direction. In addition to domain knowledge, it is important to acquire excellent communication skills, soft skills, and strengthen their professional presentation skills. There is a need to strive for the professional excellence, enrichment of human values, strong commitment to purpose and research on intelligent teaching systems. It is important to improve and prove one's full potential to take their rightful place in the world and to take on the path of true progress of the nation as a whole. Creating power learning course materials for the teaching community to inculcate the habit of preparing, organizing, working, evaluating and rethinking in learners will strengthen our long-term professional development. Broad-based exposure and adequate training in the multiple interlinked steps involved in the scientific research such as problem identification, literature review, objectives formulation, methods and materials selection, data collection and detailed critical analysis and drawing conclusions, should be provided at the higher level. Conducting workshops on

research proposal submission process to different public and private funding agencies would be helpful for the young researchers to submit well-written and meaningful proposals. The identification of teaching/research gaps and implementing the best ideas for improving higher education/research underline the importance of long-term staff development. Regular faculty development programs and skill development initiatives provide a platform for learning and development. An institute level expert committee can suggest specific kinds of hybrid teaching techniques, valuable resource materials, suitable precautionary measures and appropriate financial support schemes to disseminate knowledge to learners and to carry out research activities. Developing harmony of head (cognitive knowledge, educational thinking), hand (physical and practical skills, gross and fine motor skills) and heart (personality and attitude, emotional and spiritual learning) through holistic education could have long-lasting impact and could have serious life-changing implications.

Function of content

Knowledge, when shared in a language that can be understood, is power and promoting scientific temper among the masses certainly help in launching a new reform revolution. Faculty members with sound teaching experience could create proper content with visual, auditory, kinesthetic and read/write aspects that stimulate learning process by active learning mode and help enhance analytical and critical thinking skills. Creating excellent academic rigor is a necessary part of an education paradigm to develop competency in specialized subject areas. High level of innovation in curricula, education programs, teaching tools and techniques, and interdisciplinary approach with inputs from academicians and researchers are essential for enhancing the quality of higher education in India. The courses should provide a broad and proper perspective of the topics related to science, engineering and management with emphasis on education delivery with the spirit of innovation and creativity and must incorporate latest trends in research with topics to address. The content of a particular program must be such that there should be match between the requirements of the workplace and available human resource. The faculty members who have deep scientific knowledge and thought leaders can create reports with a clear vision to grow that may inspire an entire research community and empower numerous young minds to address major national problems. A variety of specific solutions ranging from proof-of-concept to validation of established technologies are necessary to achieve reasonable goals. Proper content plays a critical role to orient the learners to higher orders of thinking and to recreate the higher education system for meaningful education to raise confidence level through internal justification processes. One year coursework should be incorporated in all institutions in the PhD program to introduce the learners to research related activities and to obtain the in-depth knowledge

about certain specialized areas of a subject. Universities/institutes should provide four year undergraduate bachelor's degrees in all the disciplines uniformly throughout the country to become internationally acceptable and to facilitate young learners to advance their studies in foreign A-grade universities of their choice. The message must spread out dismantling scientific hierarchies that exist today that the professionals in different categories of subjects are experts in their own specialized field. The appropriate course content in line with the program content, proper presentation can increase the quantum of learning excitement and enable learner to master the higher order thinking skills. The challenges faced in applying fundamental academic concepts in real world at workplace need to be addressed and imparting of industry relevant practical skills is essential for employability. It is certainly essential to create new resources, evaluate their quality and suitability for different audiences, and make them available through a generic information gateway. What we need is good scientific content to transform the country via shared experience and value of higher learning. It is also important to inform learners about new scientific trends and support them through various extension programs or lateral learning materials. The course content should generate employability and help Indian students in building up a successful career.

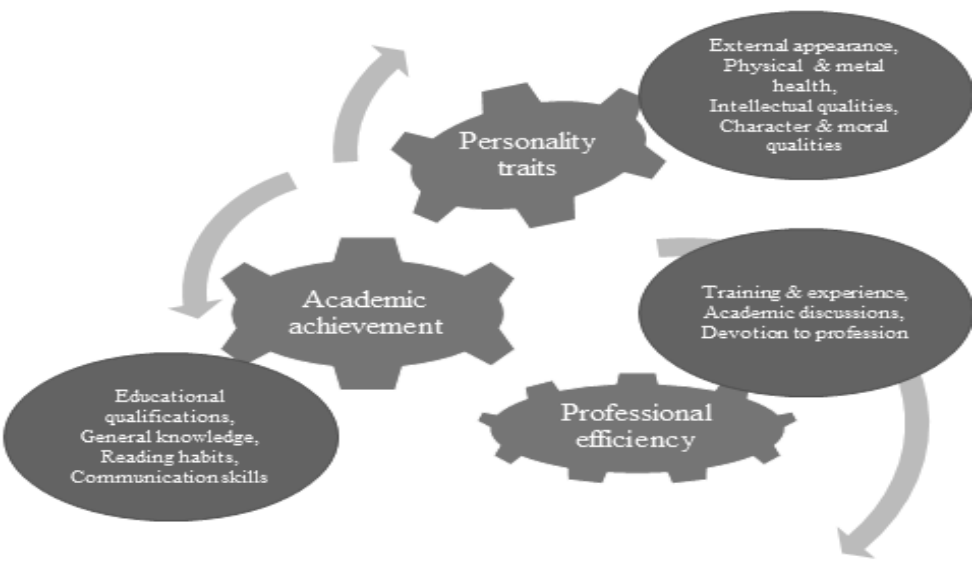

Fig. 4. Essential qualities of a teacher involving personality traits, academic achievement and professional efficiency

Evaluation process

The purposes and processes of evaluation should be linked to the following objectives: (i) program objectives such as life-long learning, computer literacy, and thinking skills; (ii) educational objectives such as data interpretation, and problem solving approach; (iii) instructional objectives such as interpretation of bar graphs, and repair malfunctioning devices. These are in turn interlinked to measurable program, course and course unit outcomes. Assessment procedures to collect information about learning and instruction have to include formative and summative assessments, the two of the most commonly used in education today and the teacher has to endeavor to be objective and balanced in judgments. If we create an assessment for learning, learners feel motivated and performance and learning levels will be increased. The preparation of question papers should be according to objectives of assessment and test the conceptual comprehension and critical thinking skills. The educational testing and assessment should actively focus on subject comprehension and data interpretation, logical reasoning and analytical ability, decision-making and problem solving, and integrated thinking and general mental ability. Course evaluation should be conducted through students' feedback, experts' opinion and concrete and specific suggestions from industry. It is important to have standardized national test to rank students for admissions in various colleges. Similarly, certification and accreditation of higher educational institutions must be made mandatory and announced at the time of admissions for students to make their choice based on the rankings. The benchmarking with peer group of universities at disciplinary and university levels provides international recognition and visibility that enable them to thrive in their educational journey (Fig. 5). The benchmarking process must be transparent and must be based on the parameters used internationally for such systems.[5)] In addition to internal evaluation process, participation in national and international rankings based on the survey of certain defined parameters is strongly suggested for forward looking institutions. Now there is a need to improve the ways in which the scientific research outputs are evaluated. Current valuations are mostly based on productivity criteria, characterized by 'fast science' academic publications in high-impact journals. High quality in-depth studies characterized by 'slow science' should also be taken into consideration. The content and other aspects of meticulous and methodical research work rather than the shallow superficial studies may provide insight into a structured way of solving the various complex problems. Over the years, the numerous critical observations recorded may prove to be a valuable source of relevant information and several significant findings may emerge in establishing performance measures. Quality teaching learning interactions can significantly enhance cognitive abilities of learners and it would be worthwhile to have a few good papers than many routine ones as research outcomes. There is need to carry out stringent quality audit of all higher educational institutions to improve their

standards, stimulate greater productivity and to excel on various fronts. Key challenges affecting the quality of research include limited attractiveness due to poor quality, shortage of qualified faculty to conduct research, lack of financial and infrastructural support for advanced research and poor linkages of education institutes with industry and research organizations. A meaningful change in the priorities and workings can set the tone for a discernible improvement in the standard of performance in science in the future. There are suggestions by funding agencies to have tougher enforcement action and stronger penalties for any deliberate scientific research misconduct as it amounts to misuse of public money.

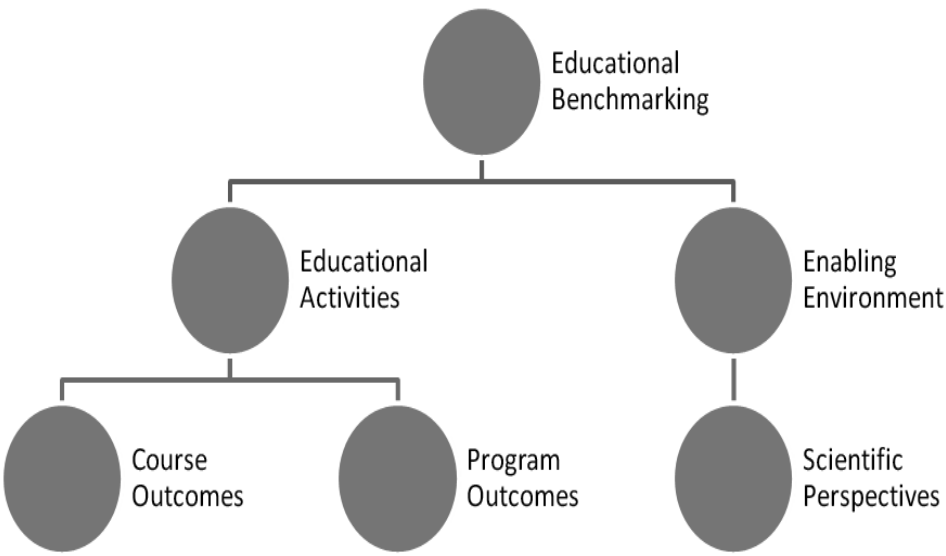

Fig.5. Different aspects of academic initiatives to achieve excellence with a contemporary touch

Random sketches - education journey

Disciplined learners at higher level are the true assets of a nation and the journey of reconstruction and rebuilding of our nation involves streamlining higher education system in India. Higher education must provide substantial academic activities and proper incentives for strengthening the nation through individual development. The education journey must be filled with an air of excitement, motivation and recognition that acts as catalyst to developing more vibrant work culture. The increased interaction among the academic community will lead to the final desired performance and a strong system with scientific perspectives will have a good global impact. We would continue this exciting

educational journey via common values, interests, passions that hold us together by strong bonds. Embarking on higher education reforms based on setting high standards and search for other perspectives on multiple options generated by higher education, broadens our horizon. Intensive industrial training program to provide an opportunity to students to acquire practical skills and project experience, and to provide an opportunity to industry leaders to identify potential employees is essential as a part of collaborative work. It is absolutely important to encourage small and medium scale enterprises (SMEs) and explore opportunities in the online marketing portals. The development strategy for the next decade should enhance the capability and capacity to produce marketable goods and services. This is possible through skilled learning at higher level, diversification and technology transfer, translating concepts into reality and other measures to promote manufacturing and services sectors. Many manufacturing industries from automobiles to textiles and those with different production capacities from micro to multinational firms are going in for automation in production and testing process, design changes and mechanization in a big way. These measures are essential to improve efficiency, increase productivity, and reduce manpower and operational cost. Indian industries have to attain global leadership positions in specified sectors through sound technological ideas, concepts, converting an idea into a prototype, time management and teamwork, innovative projects, filing of patents, scaling up operations, and manufacturing and marketing finished products. The manufacturing revolutions in certain sectors such as automobiles, chemicals, telecommunications and software could propel India on the path of planned and balanced development. The potential for production of novel products, byproducts, multifunctional materials, and process intensification technologies in several industries should be exploited to build technology capability. The strong mindsets using immense domain expertise available with the industry and fruitful collaborations with research and development (R & D) institutions can significantly enhance the number of patents filed. At the same time, protecting intellectual property and proprietary information through non-disclosure agreements and actual technology transfer through proper negotiations should take place at the maximum speed.

Channelizing natural resources including human resources that exist can help us to acquire and develop inner strength. Establishing goals that people can achieve via social, scientific and administrative empowerment enable us to promote economic growth. Domain-specific development models should be developed taking into account the special needs and unique problems of a particular domain. Special emphasis on improving the interdisciplinary research activities with time-bound focused deliverables from principal investigators will result in proactive engagement. Steps should be taken to identify the special needs of scientific community in India. India has to establish itself as a leader in promoting high quality higher education, high-impact research and development and

technological innovation. There is a need for other academic and administrative reforms such as input-control system for admissions, students' mobility between institutions with credit transfer, continuous and internal evaluation procedures, industrial collaboration to offer professional and skill based courses, active industry participation in curriculum design and detailed reviews, internal governance and improving autonomy and performance of the universities/institutions, and holistic higher education with multiple dimensions. As India is the 17th signatory to the select nations in Washington accord, acceptance of academic programs elsewhere and mobility with credit transfer would have far reaching impact in the current global scenario. The educationists should devote some serious attention to alter the current situation impacting the learning outcomes. It is important to liberalize and transform the Indian science and technology ecosystem that supports innovation and entrepreneurship in most academic institutions and universities. Changing the track and entering the woods to explore often leads to innovation and results in amazing inventions, and breakthrough results will be critical to the further development of science.

Indeed it will be easier to reach every objective if a group of individuals works towards a common goal with a true team spirit. It definitely has a tremendous long-term impact on people to lay the foundations of modern India to reach the destination (Fig. 6). It is essential to have fellowship program designed for Indian science faculty who have potential to play a key role in improving education at their institutes. An exciting new development is conducting audio-, web- and video conferences that help in exchanging data, sharing ideas, getting response, diligent execution and commercial success. Placement and internship opportunities should be such that they provide the best-fit in the human resource ladder. The institutes should enhance their employability quotient by introducing many specialized programs at undergraduate and postgraduate levels. It is a matter of concern that the highly educated people remain idle and often do not get a meaningful job. Restructuring the existing employment exchanges is the need of the hour to orient them to become 'career centers' or 'training and placement cells' that help valuable intellectual resource in counselling, liaison, training and final placement on a large scale. The needs for rapid industrialization and protection of Mother Earth have to be balanced. The establishment of key industrial clusters in the target sectors with useful industrial development policies facilitates employment generation with a significant impact on the future. The presence of large scale industrial and plastic waste is a sign of human disregard for nature and scant respect for the law of the land. We have to reduce waste materials produced in the processes of production and consumption by adapting environmentally sustainable production and proper waste disposal methods. The environmental concerns must be integrated into the industrial growth process via suitable management practices, rules, regulations and progressive laws. In developing

a strong exceling spirit, the role of vibrant higher education system is of paramount importance, to act as catalysts of change in society.

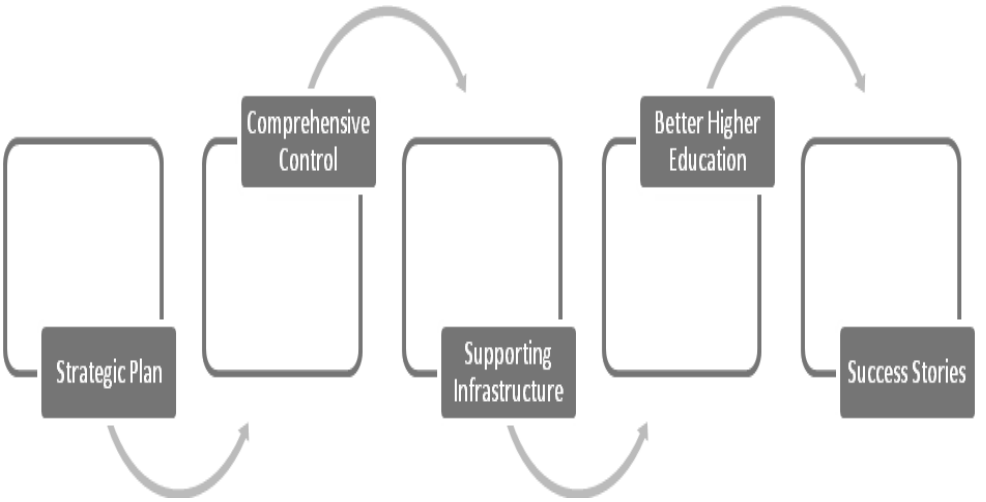

Fig. 6. Building stability and consistency through strategic, rational and systematic efforts that creates a spirit of excitement

As higher education impacts the growth and development of a country, it is important to inculcate intellectual curiosity to inquire and commitment to deliver positive social impact in a learner. A problem like this demands multiple solutions in three dimensions, technical, financial and political. Some serious rethinking is required and paying special attention to areas of immediate concern will help in multiple reforms that are urgently required and the delivery of widespread development at all levels and justice. The setting up of special task force (STF) to suggest, assign clear educational tasks, special investigation team (SIT) to conduct detailed investigation about irregularities or misappropriation cases and special protection groups (SPG) to protect the larger interest of academicians, will go a long way in bringing the necessary changes. Similarly, setting up of industry consortium, helping academic institutions in revising their syllabus or other academic matters, could contribute significantly to the field of higher education. The industrial experts can spend some time in researching, writing and lecturing in colleges, planning expansion and diversification strategies, managing talent for tangible results, changing the learning and development (L & D) function, and building the future with integrated learning. The launch of a new center on higher education reform (CHER) to explore opportunities for reform, to recommend relevant policy changes and directives on imple-

mentation, to conduct independent educational research and to suggest specific solutions to higher education issues is absolutely essential in the Indian context. The Indian government should initiate schemes introducing a range of reforms to improve immensely our higher education system. Reforming institutions by transformation process, with concrete value addition, could make a difference in catalyzing rapid transformations in the lives of learners. These changes will create greater choice of accessibility, affordability, and accountability of higher education for enthusiastic and receptive learners. Journey through the changing landscapes of Indian higher education including development of teaching and promotional materials could provide a few interesting, and rare insights and breakthrough research outcomes (Fig.7). The demonstration of collective success by the critical thinking community incorporating representative teachers, writers, publishers, authors, illustrators, reformers, planners, investigators, intellectuals, industrialists, entrepreneurs, and science thinkers to create the desired intellectual, economic and social values serves the purpose of educational journey.

Fig. 7 Application of the basic principles to systematic and results-oriented actions in unlocking human potential

Elevated thinking-educate to succeed

The quality higher educational institute can become springboard for winners to change the world through proper purpose and fierce determination accompanied by organized planning and attention to detail, robust strategy and strong execution. We have to establish more number of A-grade institutions to match the required number of seats for the top 10 percent of learners. Ideally, higher education system should have the following characteristics: (a) large number of well-differentiated educational programs; (b) the connection between learner's needs and program design has to exist to make learning an engaging, enriching, exciting and enjoyable experience; (c) the educational interests of institutes should be aligned to the interests of the individual learners; (d) long-term commitment to growth-oriented investment by government or private bodies; (e) adopt global perspectives and value addition; (f) excellent placement prospects on successful completion of a program; (g) curriculum framework designed to establish connection between education and life and also aligned with research needs; (h) excellence in teaching, learning, research and scholarship. Major reforms are expected relating to the streamlining educational processes for institutions, universities and research centers and take steps to boost research development in more targeted areas of science, engineering, technology, agriculture and medicine. The strategy and tactics to create and campaign higher education reforms involve capturing popular imagination across the length and breadth of the country and social media platforms to magnify the impact of campaign at every step of the educational ladder.

As higher education is one of the most powerful change agents, the learner at the end of each sessions has to become more excited, eager to learn and enthusiastic to collaborate and it would enhance the creative capabilities and performance of learners. Progressive leaders who can take the nation forward and have the ability of address immediate challenges and medium term concerns of broader educational development and deliver educational results can come forward to join hands with educational and social activists with their creative expression on higher education reforms. It may be worthwhile to set up 'holistic integrative science education center' to address the issues affecting degree equivalency involving specific criteria such as curriculum, teaching and learning assessment, critical infrastructure and resources, and management aspects to provide quality assurance and general education at the undergraduate level. India can become a high-priority higher educational market place by placing public interest initiatives involving 4Es -engage, educate, enrich and encourage. The capability to conduct new educational programs effectively and efficiently, in part, is established by the quality of the proposed program itself. The educational content should be designed to stimulate the brain to produce chemicals that add to the learning excitement. It is important to increase more direct involvement of institutions in decision-making and

education reforms to include roadmap for future growth or to address specific concerns. Let this autonomy allow them to achieve important milestones before becoming top-class university/higher education institution and learn about the 'survival of the fittest' principle. The large presence of higher education institutions in the capital cities of all the states is expected to complement the growth potential. Also, creation of innovation institutions with favorable administrative atmosphere in selected places may provide higher education with a difference. The government should initiate a science infrastructure development project to create 30 science power centers that are built around specific themes that contribute to nation building process. The active collaboration and cooperative effort between academic and research institutions and those between industrial centers and nearby institutes would certainly enhance the merits of the advanced educational and research projects. It is essential to commercialize research output, scientific ideas, and technological advances into products or processes to transform the Indian economy. Growing number of industry sponsored research activities and technology transfers to industry is a sign of high level of innovation in the science and technology sector. A strong and united group with a perfect blend of youngsters and veterans could result in high level performance because of experience, skill sets, decision-making and hardworking nature.

India could potentially emerge as a global supplier of skilled manpower and eventually become a prominent knowledge and research destination in the world (Fig. 8). It can excel on the world platform on fairly consistent basis, create global brands, win Nobel prizes, and improve productivity to the extent possible, provided we develop a special ability and aptitude that provides a winning edge in a particular field. The higher education is necessary to accelerate the progress of the nation and India needs a comprehensive, sustainable, replicable and need-based higher education model. The requirement is to increase the core strengths of premier institutes and premium private universities to make them world class and to address the systems that are expected to streamline education and enable administration to take fast-track decisions, based on the national skill report 2014.[6] The lesson for India is that it has to adopt pragmatic approach based on teaching philosophy and research statement to bring about higher education specific targeted reforms.[7] We have to work hard by adopting contemporary educational design, quality control, skill up-gradation, product/process innovation, and value addition to translate thought into action. This becomes essential to build a strong India and to assume strategic global leadership positions in the near future through new ideas, visions, creativity and constant innovation. It remains to be seen if the government will take immediate and positive steps to bring about an improvement in the conditions of higher education to face the global challenges.

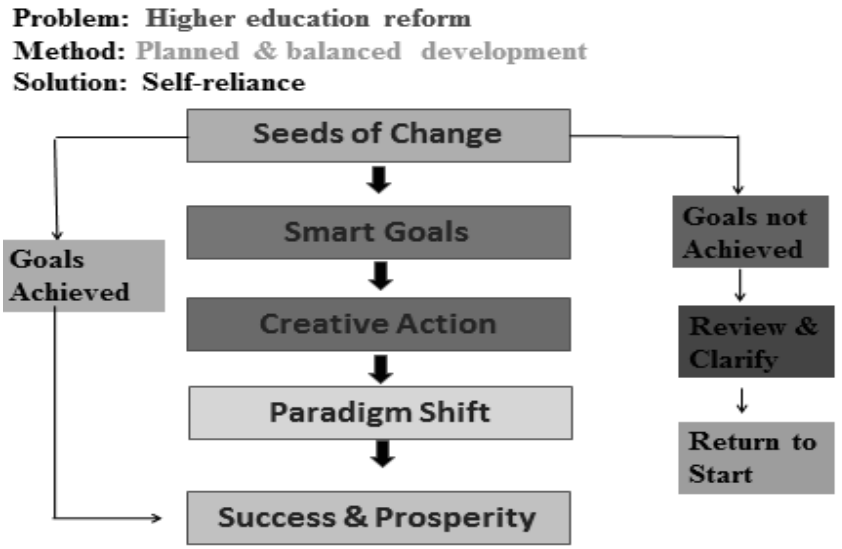

Fig. 8. A brief summary flow-chart depicting linked steps in overall development net

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NOTES

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