



National Institute of Technical Teachers Training and Research, Sector 26, Chandigarh

VISION

To be a lead resource institute for promoting excellence in technical education system

MISSION

To offer continuing education and training programs for the faculty and staff of the technical education system.

To develop need-based curricula for technical education program.

To develop instructional material to enhance effectiveness of teaching-learning process.

To undertake research and development in engineering & technology and technical education.

To provide extension and consultancy services to technical education system.







Prof.(Dr.) K.K. Talwar Advisor (Hon) Government of Punjab Health and Medical Education & Former Chairman, BOG, NITTTR, Chandigarh

Message

I am extremely delighted to know that the National Institute of Technical Teachers Training and Research (NITTR) is celebrating its 53rd year of service to the nation on 7th September, 2020.

The NITTTR has a special and significant place in the spectrum of the technical education in the country. With the advent of National Education Policy (NEP) 2020, the NITTTR has to play an important role in developing e-courses, virtual laboratories etc. This institute, being a pioneer in implementing ICT based training to technical teachers, has been making valuable contribution in the improvement and development of technical education system. The importance of virtual learning / ICT based learning has been amply realized upon in the Covid-19 pandemic even for schools and various other higher educational Institutes. I am sure, this institute will make long strides in developing e-contents for facilitating teaching-learning in the technical institutions, aligning curricula of various technical programmes to National Skill Qualification Framework etc. to meet the kaleidoscopic needs of the clientele system.

I am confident that the innovative approaches and efforts made by the faculty and staff of the institute, supported by transparent and participative leadership, will bring many laurels for the institute.

I convey my best wishes and sincere greetings to the Director, faculty and staff of the NITTTR on this auspicious occasion.

(K. K. Talwar)



Shri J. R. Singal Hon'ble Ex-Chairman, BOGs, NITTTR Chandigarh

It gives me immense pleasure to know that National Institute of Technical Teachers Training and Research, Chandigarh is completing 53 years in the service of Technical Education in India. On this auspicious day i.e 7th September, 2020, I congratulate the entire NITTTR team. The credit for its phenomenal success and achievement goes to the hard working and pain staking team members.

Academia and Industry are two important pillars of our economy. A robust collaboration between the two will augur well for enabling innovation, growth in the education system and producing an employment ready workforce. It is heartening to know that NITTTR Chandigarh has been doing valuable efforts in industry-academia collaboration, thereby creating a nurturing environment where the industry and the educational institutes work hand in hand. I hope and wish that the institute will be a trendsetter in addressing industry issues like Industrial Internet of Things (IIoT), Augmented/Virtual Reality, Industry 4.0, Block Chain and other emerging areas.

I convey my profound best wishes to the Director, Faculty and Staff and am sure that this institute will continue its endeavor to provide services to the technical education system and foster industryacademia interaction.

My best wishes to the entire NITTTR Chandigarh family on the auspicious 53rd Annual Day of the institute.

(J. R. Singal)

NITTTR CHANDIGARH



Prof.(Dr.) Raj Kumar Vice Chancellor Panjab University, Chandigarh

I congratulate the entire NITTTR family on the occasion of its 53rd Annual Day on 7th September, 2020. During the last five decades of its existence, this institute has moved on carrying forward its legacy and carved a niche for itself in the field of teacher training. NITTTR Chandigarh has provided many eminent teachers, scientists and distinguished alumni and also played an innovative role towards academia-industry collaboration.

I am also delighted to know that NITTTR is also bringing out an e-Souvenir on this occasion. I convey my profound best wishes to the Director, faculty and staff for continuing such a dedicated service to the nation and hope that the institute of such repute shall be a source of inspiration.

(Raj Kumar)



Prof. (Dr.) Jagat Ram Director, PGI Chandigarh

It is heartening to know that National Institute of Technical Teachers Training and Research, Chandigarh is celebrating its 53rd Annual Day on 7th September, 2020.

During the last five decades of its existence, this institute has provided quality education and training to the technical teachers of the nation. NITTTR Chandigarh has provided many eminent teachers, scientists and distinguished alumni and also played an innovative role towards academia-industry collaboration.

In today's context of economic development and various government initiatives like Digital India, Skilling India, Startup India, training of technical teachers and orienting them towards research and development, assumes greater importance. NITTTR Chandigarh has been at the forefront of these activities and its contribution towards quality improvement and development of technical education system has been unparalleled in the country.

I congratulate the entire NITTTR family and call upon them to continue to strive for excellence and use the acquired knowledge for the noble task of Nation Building.

(Jagat Ram)



Prof.(Dr.) Jagat Bhushan Nadda Director Consortium for Educational Communication, New Delhi

I, on behalf of our entire family at the Consortium for Educational Communication (CEC), express my heartiest compliments and greetings on the happy occasion of the 53rd Annual Day of National Institute of Technical Teachers Training & Research (NITTTR), Chandigarh.

CEC and NITTTR, Chandigarh have been working together as a close-unit to promote development of innovative pedagogical practices. Our commitment has been to ensure holistic development of our learners as well as teachers by creating an inclusive learning environment through digital education.

NITTTR, Chandigarh, is dedicated to provide the students and academicians with apt skill-sets to enhance their knowledge and proficiency.

It is a matter of utmost pleasure for me to partake in this joyous celebration of your journey.

We, at CEC, convey our best wishes to you and wish you good luck in all your future endeavours!!

(Jagat Bhushan Nadda)



Prof. (Dr.) Lalit Kumar Awasthi Director, NIT Jalandhar

Message

Greetings from Dr. B. R. Ambedkar National Institute of Technology, Jalandhar!

First of all, on behalf of Dr B. R. Ambedkar National Institute of Technology, Jalandhar, I would like to congratulate Director, Faculty, Staff and Students of National Institute of Technical Teacher Training and Research, Chandigarh on 53rd foundation day of the institute. Since its inception in 1967, this institute has been continuously making efforts for training, uplifting and working for enhancing quality of technical institutions in the country by enhancing the skills and qualifications of technical teachers. Started initially as a technical training institute, the mandate has been extended to research as well.

Since humble beginning in 1967, NITTR has come up as best institute ever to impart training and research specifically to teachers of technical institutions. It's indeed a great pleasure for the NITTR family and I am really happy to see the progress that the institute has made during the short stay of my friend Prof. Shyam Sundar Pattnaik as the director of the institute. This day is also an exceptional one as it offers a unique opportunity to congratulate those who have contributed to the growth of the institute and strengthen the resolve for continuous development of the institution's future generations. NITTR has to go a long way and I am sure that this institute will touch great heights under dynamic and visionary leadership of Prof. S.S. Pattnaik.

Director Prof. Shyam Sundar Pattnaik has really worked very hard in the process to make NITTR as a leading teaching and research organization. He is indeed a great leader who showed the right path to NITTR family to lead this institute to a newer height.

Once again, I heartily congratulate NITTR Chandigarh family on the Foundation Day! Due to selfless, creative efforts of Prof. Pattnaik, the Institute has become one of the finest institutes in the country and I know it will achieve more heights under his visionary leadership.

During this pandemic time I wish you all good health and wish that humanity as a whole should come out of this pandemic at an early time.

I wish the institute Director, faculty and staff all the very best for their future endeavours.

JAI HIND! JAI BHARAT!

(Lalit Kumar Awasthi)



Prof. (Dr.) Satish Kumar Director, NIT Kurukshetra

I am happy to learn that the National Institute of Technical Teachers Training & Research, Chandigarh is celebrating its 53rd Annual Day on the 7th of September 2020 and an e-Souvenir is also being brought out to commemorate the occasion.

National Institutes of Technical Teachers Training & Research have been contributing a lot towards technological advancements and imparting quality training to the teachers of technical institutions as mandated. I am glad to note that NITTTR Chandigarh is at the forefront in this direction right from its inception and has got a rich legacy of contributions.

A nation's progress and its human development are linked to science and technology. Our best science and technology institutions should further strengthen their basic and applied research in line with leading global standards. It's high time to raise the bar and put efforts so as to come up to the standards of world's best technological institutes. We should think in terms of leveraging the evolving technologies and train our teachers to stay relevant in the changing times. It is here that institutions like NITTTR Chandigarh can play a leading role. I am of the firm belief that NITTTR Chandigarh holds that potential.

I extend my warm greetings and felicitations to the administration, faculty and staff members of the NITTTR, Chandigarh and send my best wishes for the success of the event. Wishing all well!!

(Satish Kumar)



Prof. (Dr.) Sudhindra Nath Panda Director, NITTTR Chennai

I am happy to know that National Institute of Technical Teachers Training and Research, Chandigarh is celebrating 53 years of excellence and is organizing its 53rd Annual Day on 7th September 2020 to commemorate this occasion.

I appreciate the efforts made by the NITTTR Chandigarh in terms of its excellent performance related to Technical Education in Northern India. The progress made by NITTTR Chandigarh with the firm commitment & dedication in the technical education field is commendable.

I extend my warm greetings and felicitations to the Director, Faculty, Staff and Students Community of NITTTR Chandigarh and wish the 53rd Annual Day Function a Grand Success.

(S N Panda)



Prof. (Dr.) C. Thangaraj Director, NITTTR Bhopal

It gives me immense pleasure to know that National Institute of Technical Teachers' Training & Research, Chandigarh is celebrating its '53rd Annual Day on 7th September, 2020. It is time to recall the dedicated services and contributions it has made during the glorious 53 years of existence.

I personally appreciate the contributions and accomplishments of successive Directors and the faculty members of NITTTR Chandigarh. They have made significant contributions not only towards the vision of the institute but also towards the national agenda for technical teachers' training and related matters. A special mention may be made of its efforts in internationalizing their activities and adoption of ICT to reach out larger number of trainers. Another notable contributions towards extension of activities, which equals their contributions towards education and training activities, if not more. NITTTR Chandigarh also has the unique distinction of being the only QIP Centre for polytechnic teachers across the country. I am happy to understand it has elaborate plans for its futuristic activities and re-dedicate itself in the service of the nation on this occasion of its 53rd Annual Day celebrations.

53 Years of service to the nation is a matter of honor and an achievement for any institution. I sincerely hope that the teachers, trainees, staff and students of the institute will more actively contribute to the development of our nation and particularly through teacher training and development of engineering education system of our country.

I felicitate and congratulate all the faculty & staff on this auspicious celebration and wish them all success. I congratulate NITTTR, Chandigarh on reaching the important milestone of its 53 years and wish them all success in all their future endeavors.

(C. Thangaraj)



Prof. (Dr.) Debi Prasad Mishra Director, NITTTR Kolkata

I am happy to learn that the National Institute of Technical Teachers' Training & Research, Chandigarh is celebrating its 53rd Annual day on 7th September, 2020 and publishing an e-souvenir on this occasion.

On this auspicious occasion, I convey my best wishes to the members of faculty, staff and students of the Institute and hope that the Institute would continue its glorious traditions towards excellence in technical education with added zeal and enthusiasm in the years to come.

With best wishes

(Debi Prasad Mishra)





Dear partners from NITTTR Chandigarh,

In the light of the Annual Day celebration, Typhoon HIL is honored on the opportunity to congratulate you on the hard work and achievements that you accomplished in the 53 years since the Institute was founded. Collaborating with you is always a great pleasure.

We wish you the best success in continuing to share knowledge and promote excellence, and we are looking forward to working with you in the years to come!



Typhoon HIL



NITTTR Chandigarh









Applied Science Department





Civil Engineering Department





Computer Science Department



Curriculum Development







Electronics & Communication Engineering Department





Education and Education Management Department







53rd Annual Day e-Souvenir



Mechanical Engineering Department









NITTTR CHANDIGARH

Media Engineering





Rural Development





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Auditorium & Guest House







Campus



From the Desk of the Faculty



SOCIO-DIGITAL PEDAGOGY: A NEW PEDAGOGY FOR EFFECTIVE IMPLEMENTATION OF NEP-2020

Prof. Shyam Sundar Pattnaik Director National Institute of Technical Teachers Training and Research (NITTTR) Sector-26, Chandigarh-160019 profshyampattnaik@gmail.com

Technology enabled, technology supported and technology based education are not new to the education ecosystem. But the differential is the power of online learning which was never explored before the way it has been embraced during the recent COVID-19 pandemic period. Three clear derivatives have emerged during these periods: (i) realizing the undermined digital strength of the country, (ii) networking of experts and (iii) acceptance to online education thus, removing the ifs and buts which were prevalent for a considerable time in the mind of the implementers. Hence, the teaching-learning ecosystem is no more chained by rigid walls of institute or university rather it is now open ended system. The Teaching-Learning ecosystem has evolved as a social teaching-learning. The evolving Society of teaching-learning is leading to multiple options, diversified choices and flexibility. The digital connection is becoming so seamless that the discomfort of not being present physically is to a large extent has been addressed. With the advent of newer technology and its advances, in times to come the cyber-physical integration would be so real that it would be difficult to differentiate between a remote learner and a host location learner called contact mode of learner. In author's opinion post COVID-19 education will take (Contact-Open-Virtual-Immersive-Digital-Learning) shape of COVIDL а education by integrating all such possibilities. Students and teachers will place themselves in available options for teaching-learning with much flexibility to move from one mode to another. Hence, the pedagogy defined for contact mode of learning or open learning or ICT mode of learning would not suffice the requirements. As the learning has now spread to resources of the society connected by digital mode, therefore, a new teaching-learning pedagogy named as socio-digital pedagogy is proposed by the author. The proposed pedagogy takes care of instructive learning, supervised learning, guided learning, peer learning, project based learning, work based learning, self-learning, and life-long learning. National Education Policy (NEP-2020) has lots of opportunity and hopes for learners. Some of the highlights are multidisciplinary education system, multi-entry and multi-exit, faculty and institutional autonomy, revamping curriculum, pedagogy, assessment, quality online/ODL, academic bank of credits (ABC), multidisciplinary education and research university(MERU), reimagining vocational education (at present : India-5%, USA-52%, Germany-75%, South Korea-96%) and internationalization. Socio-digital pedagogy with its flexibility, inclusivity and practicability is expected to be a prime catalyst to the effective implementation of the various features enumerated in NEP-2020.

The technological advancement in internet technology, computational tools and digital communication has transformed the teaching-learning scenario. Today, network, machine and teacher are the holy trinity of education. With the upcoming

Virtual Reality, Augmented Reality and Holographic tools, the teaching-learning is going to be more immersive and technology dependent. The technology integrated pedagogy would make the teaching-learning more engaging, exciting and embracing. The geographical distance would not be a barrier to the learner to get connected with the teacher. Integrating technology with education will not only solve the problems plaguing the system currently but also help reaching higher goals. The need of the hour is not simple fixes but entire transformation of the system. The time is ripe and technologies are mature to start this ambitious endeavor. Today a learner does not wait for any defined institute to learn. With available multiple points of learning he sees a society of learning. The digital communication platform like WebEx/ Google meet/Rainbow/ Jio meet etc has made the life easy for the learner to get connected to learning points seamlessly. Ubiguitous learning environment speaks on content and interaction for learner anytime and anywhere. It is happening today and is going to be more aggressive in time to come. The country has nearly 11 lakhs technical institutions having approximately 33 lakhs students guided by 5.6 lakhs faculty. The infrastructures to support this huge population are also in place that become a big strength of the country. The huge optical mesh laid down in the recent past has built up optical super highway for high speed data transmission. As regard to weakness, the technical institutes of this country are weakly coupled with industries. As per AICTE-CII 2018 report, only 19% of the institutes have platinum linkage. India-Skill report 2019 projects only 47% are employable. Learner lacks industry needed skills like complex problem solving, critical thinking, creativity, cognitive flexibility etc. These can be largely enhanced/improved through sociodigital pedagogy which aims at integrating all spheres of learning. In the presented network, the students has ample choices of the subjects from various baskets. The learning modes are of multiple options. The student may complete the cluster of subjects defined for the degree and go with a degree or he may have a choice to withdraw in between and join a job. In this case, on return, he will have the option of exercising his academic bank of credits (ABC) earned before in the programme. The remote leaner case to case basis can have work based learning from industry/NGO/Govt. or Pvt. establishment/ startup or even from the neighborhood institute. Think, pair, share and care model will enhance the learning skill and competency. Think: Students think of a problem, Pair: Students form a cluster of nearest neighbor and discuss the problem, Share: Students share the problems with bigger cluster and Care: Students get support from seniors or faculty members. The mantras or prime focuses of socio-digital pedagogy are to be mainly on exciting, engaging, enforcing, enabling, encouraging, enhancing, embracing, empowering, earning and enduring. Basically the intention is to create a contact mode learner (C-Learner) from remote or e-learner. The followings are the some of the core features that require transformation to achieve the objectives of NEP-2020.

E-Person Curriculum, E-Content, E-Learning Management, E-Communication/ Interaction, E-Assessment, E-Service, E-Experiments/E-Skilling, E-Collaboration, E- Group Consultation, and E-Socializing, Video resources will play a pivotal role. Hence, e-content development is required to follow four quadrant approach as stipulated in SWAYAM. But video must also follow four quadrant approach such as text dominance, speaker dominance animation/graphics/example dominance and short class room task dominance screen display approach. The great teachers of this country, our value, bonding and glorify history specially the Takhshila and Nalanda Education system are the motivating factor to our present initiatives. World is looking at us hence, we must decidedly different to give a transformed technical education system to the country and the world as a whole.


Integrated Quality Assurance in Higher Education in NEP2020

Dr B S Pabla Professor, Mechanical Engineering Department, NITTTR Chandigarh

Abstract

National Education Policy approved by Ministry of Education, Government of India gives a holistic approach to quality assurance in education system in general and Higher Education in particular. The policy covers the concerns about employable skills of the graduation students to the quality of the faculty of HEIs. NEP 2020 stresses on improving the GER by allowing the learners to take courses at their own convenience with stress in overhauling the assessment and evaluation system. However the implementation part, as always, can make or mar the system. A brief account of various aspects of quality assurance in NEP 2020 is briefly discussed in this paper.

Introduction

National Education Policy (NEP 2020) announced by Ministry of Education, Government of India take a holistic view of the entire education system with a view to improve the quality of students graduating from the education system with intent of "Catch Them Young" by introducing the students to vocational education at an early stage. NEP 2020 aims to increase the enrolment in higher education institutions from 26.3% (2020) to 50% by 2035 as India is lagging in GER compared to many Asian countries which have GER than India. Globally, USA's higher education GER is 88, UK's is 60, Germany is at 70 and Canada's is 69 etc. A lower value of GER indicates the lesser number of students taking admission in the higher education programs. To make quality education available to the citizens of India, some of the provisions in the NEP are:

- Capacity building by establishment of HEIs in underserved regions to ensure full access, equity, and inclusion. By 2030, there shall be at least one large multidisciplinary HEI in or near every district.
- To enable the students to excel in the field of their choice, multi disciplinary institute will be set up giving wider choice of courses to the students.
- Flexible mode of offering of the courses will encourage the students to learn at their own pace allowing them to continue their studies without leaving their job.
- Multipoint Entry and Multipoint exit with passbook of credits.
- Clear differentiation in expectations from Research Universities, Teaching Universities and Degree awarding Institutions doing away with the concept of affiliating universities.
- Focus on faculty empowerment.

Quality Assurance in Technical Education

National Education Policy aims at developing holistic individuals to be able contribute in their job roles with employable skills coupled with moral values and ethics and concern for environmental issues and sustainability with complete overhaul of the education system from regulation at central and state level to administering the programs in the educational Institutions. NEP envisions that the single specialization institutions will not be allowed in the coming years and all HEIs will be multidisciplinary institutions and fall into one of the three categories i.e. Research-intensive Universities which place equal emphasis on teaching and research, Teaching-intensive Universities that place greater emphasis on teaching but still conduct significant research and Autonomous degree-granting College (AC) will primarily focused on undergraduate teaching. These three broad types of institutions are not rigid with provision for moving up based on meeting the quality parameters. To ensure maintenance of minimum standards of quality the regulatory system of higher education will ensure that the distinct functions of regulation, accreditation, funding, and academic standard setting will be performed by distinct, independent, and empowered bodies. To ensure quality in HEIs, accreditation of the Universities/ Institutions/Programs will be mandatory which will also be one of the factors for moving the HEI from one category to other category.

Quality of technical education is reflected in the quality of the technical graduates being produced. Factors that contribute to quality in the system are:

Curriculum:

The curriculum followed in the present education system is rigid with fixed contents and courses to be studied by the students. The curriculum is developed in isolation from the user system resulting in gaps in what industry wants the students to know and what HEIs are teaching. The situation in affiliated college is still bad because the curriculum is thrust on the affiliated colleges without any flexibility to implement any changes as per employment scenario or technology development. In addition, there are implementation issues due to shortage of faculty and other physical resources. NEP 2020 aims to convert all the HEIs into autonomous Institutes/universities giving control of design and review of curriculum to the individual HEIs with independent bodies for setting the standard of education at different levels and affective monitoring mechanism. NEP envisages learner centric vibrant and rigorous curriculum. With effective monitoring at state and center level and competition from National and National HEIs the implementation issues are likely to get solved. The curriculum will allow choice to the students to nurture skills in preferred vocation.

Human and Physical Resources:

At present the major issue faced by HEIs is the non-availability of qualified and experienced faculty and technical staff with little or no exposure to the developments in technology and missing connects with the industry. Faculty members are required to work as per very rigid guidelines which results in many students not attaining the required competencies. NEP 2020 envisages Full autonomy to the faculty with performance based compensation and stress on training and retraining of faculty and staff.

Teaching and Learning Process

In the present teacher centered teaching learning process the aim of every teacher is to complete the syllabus of the course being taught without any importance given to student learning. The age old chalk board method is mostly prevalent in HEIs. NEP recommends use of varied method for teaching-learning with integration of ICT to make the students understand the concepts. NEP also recommends teacher training in advance pedagogy (induction training programme) to understand the psychology of learning. Midterm feedback to know the correction required in the teaching learning process is also emphasized. NEP emphasizes on development of higher order thinking skills and complex problem solving skills in the students. Feedback mechanism will help in taking corrective action before the damage goes beyond control.

Assessment and Evaluation

Assessment and evaluation is the, major ill of the present education system. In addition to having been taken non seriously by the question paper setters, evaluators and students, the present system is based on passing or failing and comparing the students. The current norm based system will be replaced with criteria based system with more weightage to the formative evaluation compared to summative evaluation.

Accreditation Framework

Accreditation of all HEIs will be mandatory for which National Accreditation Council (NAC) will be setup which will develop systems with Accreditation Institutes (AIs). Accreditation will be binary instead of graded. To ensure that the HEIs maintain the standards of education, accreditation will for a period of five years after which the Institute/University will be assessed again.

Implementation

NEP 2020 envisages complete overhaul of the education system with stress on the holistic development of the learner. However, the success of the initiatives outlined in NEP will depend how effectively the intent is translated into action. We, the teachers and administrators of the HEIs, have to ensure the successful implementation of the new policy to ensure that graduating students have the right kind of employable skills to compete at national and international level.

References :

- 1. New Education Policy 2020, Government of India Publication
- 2. Survey of Higher Education 2018-19, Department of Higher Education, Ministry of Human Resource Development, Government of India Publication.

AI-Based Learning Management System

Dr. Maitryee Dutta Prof and Head, ICSE Department NITTTR, Chandigarh

Jagriti Saini

Ph.D. Research Scholar NITTTR, Chandigarh

Gone are the days when we were highly dependent upon classroom-based education to boost our knowledge and learning. With the advancements in technologies, it is now possible to organize training programs, courses, and even practical sessions over eLearning platforms.

Artificial Intelligence (AI) has incredible potential to speed up the design and development of online learning systems. From the past few years, it left a strong impact on the manufacturing, retail, and healthcare sector, and now, it is working as a driving force for the education industry as well. There is no doubt to say that AI works in every phase of our lives while offering the greatest opportunities for automation and optimization.

Artificial Intelligence and Learning Management System: Overview

Before getting deeper into the potential of AI in the learning management system, let us go through a short description to understand what is AI basically. It mainly refers to the capability of machines to learn from a set of data and then make relevant decisions on its own. It makes use of a specific set of algorithms to analyze available information and consolidate knowledge to align information with specific needs and preferences.

Learning Management System (LMS) on the other hand help educators and students to enjoy the online learning experience. When powered with AI, it can help to boost precision and quality in the educational processes. The idea can be implemented in educational institutes, virtual learning platforms, corporates, small and large-scale groups.

The series of events in the AI-powered system is controlled and managed by software; it helps to eliminate human intervention. The ability to predict things makes AI-powered LMS the best choice for virtual education as it helps to develop an unparalleled relationship between learners and the training platform. It helps to develop a highly personalized training process with easy identification of behavioral, social, emotional, cognitive, and personality aspects of users. As a result, they can be motivated to learn a custom strategy that fits their personality traits and can help them acquire new skills in the desired field.

Student expectations and previous experiences are taken into account to lead a productive learning experience. In this way, an AI-based LMS system helps to meet

the educational needs of specific users. Furthermore, advanced tools like Chatbots, Data Analytics, Machine Learning, Natural Language Processing, and Deep Learning Algorithms, etc can extract data intelligence while helping LMS to behave intelligently so that learners can feel more engaged in the system.

Incredible Benefits of AI-based LMS:

Al has a prodigious prospect in the world of LMS and it can help you to build a comprehensive learning technology solution. With the successful adoption of this advanced mechanism, it is possible to develop a sustainable and fruitful relationship between user and application. Here we are going to discuss a few benefits of Albased LMS:

• Personalized content recommendation:

Al-based LMS makes use of deep learning and artificial neural network algorithms to optimize content by processing available data. Personalized learning experience as per the specific preferences of the learners can help to build an optimal learning strategy. With this targeted teaching-learning practices, the learners get more inclined to progress as course content seems more useful and relevant to them. For instance, if you have done courses on neural networks and MATLAB in the past, the AI-based LMS will guide you better to choose the most relevant course in the future. The best recommendation may be Python and Deep Learning to boost your knowledge base and experience. In this way, students can make better decisions for skill development in a specific field. It also saves time and effort in making a selection for the best courses to lead an exponentially rising learning curve.

• Intelligent content transformation:

In the constantly changing learning world, intelligent content transformation can provide a competitive advantage to the organization. With the effective authoring tools associated with AI-based LMS, it is possible to transform content in such a manner that it becomes compatible with both Apple and Android devices. Such a revolutionary approach may help learners to enjoy immense satisfaction with the effective delivery of lessons. The cloud-based system further helps to ensure easy access to study material so that learners can stay tuned to the desired content on the go.

• Gamification for seamless work:

Another engaging solution developed for improved performance with an Albased LMS system is gamification. The idea is to add intelligent game-like features to the LMS to ensure a seamless learning experience. With this feature, the virtual courses become more engaging and ensure higher retention rates. This immersive learning experience varies as per the unique needs and preferences of the individuals. The game features push learning activity with simpler, efficient, and accurate results. Moreover, this dynamic system can enhance skill development with a smoother experience.

Integrating AI into Learning Management System:

There are unlimited benefits of merging AI tools into LMS systems. It promises smart content delivery, digital curriculums, and customized learning interfaces. The learning outcome can be enhanced via audio-visual mediums and online assistance. The intelligent tutoring systems with visual facilitators such as 3D gaming, computer animation, and gesture recognition technology make it easier to improve interactions. Virtual reality and augmented reality can further enhance engagement online.

AI-based LMS systems improve universal access to education; learners can connect to desired courses online. At the same time, it also eliminates human intervention in management while automating admin tasks. There are plenty of tools and techniques that can be used to improve the learning curve with AI-based LMS, the list includes Google's TensorFlow, Massive Open Online Courses (MOOCs), Chatbots, Eklavvya – online assessment solution, and many more. These advanced tools ensure the seamless integration of virtual teaching-learning practices while ensuring favorable course outcomes. This advanced approach can be implemented at school, college, university level, including all higher education, technical, and non-technical teachinglearning programs.

Enhancing Vocational Education through National Education Policy 2020

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Introduction

The new National Education Policy (NEP), 2020 has introduced a number of changes in the Indian education system beginning from the school level to college level. The main aim of NEP 2020 is to make India a global knowledge superpower. According to the new Education policy 2020 it has been decided that for higher education there will be large multidisciplinary universities and Higher Educational Institution (HEI) clusters. The above decision has been based upon our ancient history, which catered to multidisciplinary environments and was a great success. The present structure has been based upon our country's historical universities namely Takshashila, Nalanda, Vallabhi, and Vikramshila, these universities were instrumental in providing education to thousands of students not only from our own country but from outside world too. Among other major developments the new policy has stressed upon the importance and improvement of Vocational Education.

Now with the introduction of new NEP 2020 there will be an option of skill and vocational education at school level. Vocational subjects would be introduced at school level itself. Students in the early years of their education will be given an opportunity to undergo vocational skills, which will begin from grades 6-8. So apart from the regular academic courses, which the student is taking, they will have access to vocational course too in grades 9-12. The students will have a choice of a combination of traditional academic courses along with vocational courses. Further more there will be an alternative for the students to exit after Grade 10 and re-enter in the next phase where he can pursue vocational course or any other course of his choice in Grades 11- 12.

Need of Vocational Education

As estimated from the 12th Five-Year Plan (2012–2017) in India the percentage of students/ children who are in the age group of 19 years to 24 years (less than 5%) obtained formal vocational education. This percentage is very less when compared to some other countries like USA, Germany and South Korea where the percentage of workforce obtaining vocational education is 52%, 75%, 96% respectively. Hence through the new NEP 2020 it has been decided that there is a dire need of increasing the vocational education in India.

Present Structure of vocational and skill development

Skill India is a very good initiative taken by Government of our country which has been launched in order to empower the young population of the country. This will empower them with skill sets which will make them self sufficient to work and enable them more employability opportunities and more productive in their work environment. In India almost 65% of its youth lie in the working age group. One of the best techniques to utilise the talent of young Indian population is through skill development. The advantage of giving skill training to the youth is multifold. Firstly it would add to the growth of the youth, secondly it would be a step forward for the economic growth of the country. There are numerous courses being offered by our government, which have been designed in alignment with the requirements of the industry and latest technological developments. These are governed by the National Skill Qualification Framework (NSQF).

The National Skills Qualifications Framework (NSQF) organizes qualifications according to various levels. These levels have been defined based on the outcomes of learning. The learner is supposed to possess these outcomes irrespective of the way he acquired it whether through any formal education or informal or non-formal education. NSQF is a framework which is in fact a quality assurance framework. It is based on competency and a nationally integrated education and skill framework whose basic function is to provide a number of pathways for the following:

- vocational education
- vocational training
- o general education and
- technical education

This framework will help in linking a lower level of learning to another higher level of learning. Henceforth, the person undergoing this learning will be able to acquire the required level of competency and transit to the job market and, later can continue to acquire additional skills if he wishes to upgrade his skill competencies.

The NSQF successfully acclimates the diverse aspects of the Indian education and training systems. It permits to develop set of qualification for different levels, which are based on outcomes as accepted throughout the nation. NSQF is a stable structure, which is responsible for the development and maintenance of progressive pathways that provide access to qualifications. It allows a number of entry points and exit points between vocational education, skilled training, academic education, general education, technical education and job markets. It provides learners to acquire both education and training and hence gain recognition for their prior learning and experience.

The aim of ministry of skill development and entrepreneurship (MSDE) is to skill India on a larger scale by achieving higher standards. There are presently a number of schemes to impart vocational education and skill development to befit youth of India. Pradhan Mantri Kaushal Vikas Yojana (PMKVY) is a flagship scheme of government of India, which will help in fulfilling this vision. The main aim of this scheme is to support and promote Skill Development for the youth throughout the country by aligning itself with the Common Norms guidelines. Main aim of the scheme is to train a large number of youth to make them industry ready and become employable and they can earn their livelihood. The successful implementation of the scheme will lead to an enhancement in the productivity of the prevalent workforce, and also align the skill training with the actual industrial needs of the nation. It will lead to the standardisation of the process of Certification and also lay the foundation for creating a registry of skills.

The courses offered through PMKVY help a person to learn new skills, which help him to enhance his practical knowledge and expertise. The entire expenditure for the training is borne by the government of India. The person getting skill training doesn't have to pay any fees. After he obtains the required skill sets he is ready to work for any company according to his acquired skills and also he can start his own venture. PMKVY has presently provided skill to more than 50 lakh people and prepared for a new successful India.

Future Scope of Vocational and Skill Training through NEP 2020

Present and past study shows that the main reason for lesser students opting for vocational education is that the main focus was mainly on Grades 11–12 and on dropouts in Grade 8. Further the students who took vocational training had no defined pathway to continue higher education in vocational sector. There were loopholes in admission criteria for higher education for students who wanted to pursue vocational education. The new National Education Policy 2020 aims to integrate vocational education programmes into the mainstream education in all the education institutions in a phased manner. It is only through this that vocational education will achieve its required status.

Since this scheme aims at introduction of vocational education at an early level in middle and secondary school, hence a better quality vocational education could easily be integrated into higher education. It will ensure that all the school going children are masters of atleast one vocational training course and are exposed to several more. The mainstream academic education will also include vocational capacities and both will go hand-in-hand.

Vocational education will be introduced in secondary schools in a phased manner over the next decade. There will be scope for the secondary schools to collaborate with various ITIs, polytechnics, as well as local industry, etc. There will be provision of creation of new Skill labs in the schools which will set as a hub for other nearby schools also.

As per the new policy it has been planned that higher education institutions will offer vocational education to the students either individually or in collaboration with industry and other non-profit organisations. The previous programmes introduced in year 2013 i.e. the B. Voc. degrees will continue as per their prevalent structure.

However, vocational courses will also be introduced and made available to students who would be pursuing other Bachelor's Degree programmes and also the 4-year multidisciplinary Bachelor's programmes.

There will be provision of HEIs for providing short-term certificate courses in various skills. The major areas for vocational education will be based on the skills gap critical analysis and will be based upon mapping of opportunities in consultation with industrial needs. Higher education institutes will be motivated to set up Incubation Centers in collaboration with industries. The National Skills Qualifications Framework will be detailed further separately for each academic, vocational and professional programme. The credit-based Framework will also help to mobilise general and vocational education.

Another vertical of HECI will be the General Education Council (GEC), which will be responsible for framing learning outcomes for higher education programmes. GEC will form a National Higher Education Qualification Framework (NHEQF) in sync with the National Skills Qualifications Framework (NSQF) in order to integrate vocational education into higher education. The aim will be to increase the Gross Enrolment Ratio in higher education including vocational education from 26.3% (2018) to 50% by 2035.

Conclusions

The new NEP 2020 with new holistic and multidisciplinary education inspired by our past is a step forward for our country to lead us to the 21st century and the fourth industrial revolution. The concept of introducing vocational education from an early stage i.e. school level and continuing it to higher education will help to fulfil our target of skill India. By 2025, at least 50% of learners through the school and higher education system shall have exposure to vocational education, for which a clear action plan with targets and timelines will be developed.

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NEP 2020 - A REASON TO REJOICE?

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CHANGE IS THE ONLY CONSTANT!

With the YOUNG INDIA its vibrant demographic, a change was required to strive towards globally competent education system. It was all the more important in the present times, in the light of fast technological advancements in the work places, globalization and economic reforms, to nurture our demographic potential so that they are relevant to the world economy. For transforming India into a 'global knowledge superpower', we need to focus our energy and resources to develop holistic, multidisciplinary and flexible structure of education which can help in developing the unique brain of every child of our country.

During the Round Table Conference ((November 1930 – January 1931), Mahatma Gandhi, in one of his speeches, said, "The beautiful tree of education was cut down by you British. Therefore, today, India is far more illiterate than it was 100 years ago." The British Raj had delegitimized the Indian education system. While the Western education was spread amongst Indians by Macaulay Education system; scientific, technical and moral education was largely ignored by the then legislators. After Independence, several changes were brought about in the Indian education system, but latest major change has been 34 years old, a more apt vision was needed for large scale transformational reforms for both higher education and school education to meet the aspirations of DEVELOPING India. This was a major challenge and was adversely affecting all our efforts for an integrated development supported by a strong higher education system of the country.

Long-awaited National Education Policy 2020 ("**NEP 2020**") has been announced by the Union Cabinet on July 29, 2020 that aspires towards a holistic education of students. "It is based on five pillars of access, equity, quality, affordability and accountability is aimed at sustainable development". The New Education Policy is ambitious and futuristic, which ensures providing the opportunities for the holistic development of students and for globally competency.

The former President A.P.J. Abdul Kalam emphasized on the need of a 'value based education system' that instills principles of righteousness at a young age to form the cultural citizenry to transform India into a prosperous, peaceful, happy and developed nation. The rich heritage of ancient and eternal Indian knowledge has been a guiding light for the New Education Policy - 2020. It aims to inculcate a deep rooted pride in being Indian amongst our students. It aspires to blossoming the learners in true citizens who will not only be committed to human rights but also work for global well-being.

As per this National Education Policy "It envisions an education system rooted in Indian ethos that contributes directly to transforming Bharat, sustainably into an equitable and vibrant knowledge society, and making India a global knowledge superpower". This Policy proposes the revision and revamping of entire spectrum of the education structure. It aims at developing a system and aligning it to global perspectives and requirements to address the growing developmental imperatives of our country.

Overhauling the existing Higher Education system

One of the limitations of present education system is laying less emphasis on the development of learning outcomes and cognitive skills which is resulting in a severely fragmented higher educational ecosystem. It encompassed a rigid separation of disciplines, with narrow range and less flexibility in choice of disciplines and courses. For Higher Education, large affiliating universities having negligible emphasis on research, limitations in funding across disciplines resulted in lower standard of technical education.

A good quality higher education must enable at providing productive contribution to the society accomplished with personal accomplishment and enlightenment. Higher education must form the basis for knowledge creation and innovation to enable our students to contribute more meaningfully towards national economy and at the same time satisfying their personal aspirations. The flexibility, autonomy and freedom given to higher educational institutes in this policy will definitely lead to more vibrant, socially engaged, cooperative communities and a happier, cohesive, cultured, productive, innovative, progressive, and prosperous nation.

NEP 2020 will empower higher education institutions to take decisions with responsibility and be accountable at the same time, so that they can contribute more effectively in the overall growth of the country. All the autonomous bodies will be assimilated into The Higher Education Commission of India (HECI), a single overarching umbrella body for entire higher education, excluding medical and legal education.

The entire higher education ecosystem has been revamped to meet the need to build a culture of trust, respect and collegiums among government agencies, regulatory bodies and higher education institutions. The policy encompasses creation of Academic Bank of Credit in HEI, providing flexibility for inter disciplinary choices, giving the students a choice between research and teaching. This approach will be an added advantage for NSQF (National Skill Qualification Framework) compliant curriculum framework for all the students at every level of their education.

The NEP aims at promoting research by establishing National Research Foundation to address the skill gap between institutional learning and practical learning. The multidisciplinary environments, the breaking of silos, and the connection with local communities and industry will help greatly in making research by faculty and graduate students more interdisciplinary and locally relevant.

It proposes a new National Educational Technology Forum and looks forward to new age technologies such as AI-driven customized learning solutions, Augmented

Reality, virtual reality based learning, peer-to-peer learning and many more. The internationalization of education will be realized through the student-faculty exchange, institutional collaborations and opening up campuses of top ranking universities in India.

Futuristic curricula

Current curricula in subject areas frequently attempt to cover as much content as possible, regard all content as equal, and divide content into artificial categories that bear little relationship to how they are used. Such curricula provide the students with relevant professional knowledge and skills, make them capable of tackling industrial and field problems, and at the same time earn their livelihood.

But, for growth in all dimensions and to make our students compete globally, a wider perspective has to be envisaged from the beginning during child education itself. For overall holistic growth and development focusing on critical thinking, the core contents in curriculum have to make space in the existing schemes for inquiry-based, discovery-based, discussion-based, and analysis based learning.

A cross-curricular pedagogical approach has to be adopted that utilizes various aspects and forms of art and culture as the basis for learning of concepts. For imbibing the Indian ethos in the teaching and learning process, art-integrated education will be embedded in curriculum through integration of Indian art and culture. Sports-integration pedagogical approach will utilizes physical activities to help in developing collaboration, self-initiative, self-direction, self-discipline, teamwork, responsibility skills.

With the NEP -2020 on board, the students shall gain disciplinary knowledge through theory and practical in their area of specialisation (major). They will have the choice to gain additional understanding in any additional area of study (minor). They will be allowed to choose subject combinations across the current so-called 'streams', including professional and vocational.

HEIs will offer flexibility in curriculum, and novel and engaging course options to students through increased faculty and institutional autonomy in setting curricula. The flexibility in choice of courses will not only foster holistic development by promoting physical and psychological well-being, but also ensure that our education is maximally relatable, relevant, interesting, and effective for our students. As per NEP, "there will be no boundaries among 'curricular', 'extracurricular ', or 'co-curricular', among 'arts', 'humanities', and 'sciences', or between 'vocational' or 'academic' streams for diversified learning.

The Policy envisages that the curriculum and pedagogy of our institutions must develop among the students, a deep sense of respect towards the Indian culture and its ethos, bonding with one's country, socio-economic diversity and a conscious awareness of one's roles and responsibilities in a changing world. The curriculum so designed will not only add to cognitive abilities and skill of the students but also will boost international business relations in not only education but in support services too.

This policy will bridge the gap in education through technology and digitization. The pedagogoy will include blended and hybrid model of learning making education more participative. A dedicated unit development and execution of digital infrastructure, and capacity building of institutes in technology should be on cards to make India a digitally empowered education hub.

Where do we stand?

Teachers are collaborators in every student's academic journey. Teachers in higher education in this country are not fully equipped gualitatively and guantitatively, as there are not enough teachers' training institutions. Teachers alone cannot meet all the objectives of this upcoming education policy, whatever the curriculum, instructional material or other aids be. To implement this policy in the letter and spirit with which it has been designed, priority should be given to 'Educational Sector' by the Centre and State governments. Emphasis should be given to teachers' training institutions so that the higher level institutions achieve the envisioned goals of the NEP 2020. These teachers' training institutions will also cater to the requirement of training and skill development of students, on pilot basis, at every level. The policy should transform educators by enhancing the professional standards among teachers and equipping them with latest technology and education methodology. NEP 2020 has a balanced and inclusive outlook and is believed to have surreal effects, especially on higher education, which is going to draw a new roadmap for young minds. The stage has been set to embark on the journey and galloping towards a new horizon, triumphing over all adversaries. At least, the ball has been set rolling.....

REJOICE !!!

New Education Policy 2020: A Roadmap towards making 'Aatm Nirbhar Bharat'

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India's much-awaited New Education Policy (NEP) 2020, a reformatory step by Honorable PMO, is expected to introduce many reformations in India's education sector. The focus on education technology to be introduced in NEP is going to be a game-changer for the face of education system in India. Emphasizing on the blend of modern science, modern knowledge systems with traditional wisdom, it envisages a holistic system of education. Giving both vocational and professional education an equal status, NEP has a multi-disciplinary, value-based approach along with special focus on honing the life-skills of students. The students will have flexibility to learn the subjects of their choice and the option of multiple entry-exit points will ensure that everyone can complete a college education. The college affiliation system in higher education will be phased out. This will allow curriculum innovations and pave the path for creating industry-linked curriculum based on industry's needs. This will be a win-win situation for both students and industry as it will help the students in placements while the industry will get skilled manpower, thus saving its money and time in training newly inducted staff.

Although much has been said about NEP 2020 and the transformation it is expected to bring in the education system of India, this article focuses on the role of NEP 2020 in making India self-reliant in the direction of Aatm Nirbhar Bharat Abhiyaan by our honourable prime Minister. As the focus of NEP 2020 is introducing technology education in early ages in middle and secondary school it will lay foundation for holistic development of a child, who will have practical exposure at an early age and thus make him ready for the real world. One of the interesting elements of the policy is the option of multiple entry-exit points to the students. This will further boost innovation and startups, encouraging students more freedom and opportunity to pursue the fields they are truly interested leading to more patents and research work. The key focus of NEP is on skills and not just marks, which reminds me of a famous quote by Albert Einstein, who said that "Everybody is a genius. But if you judge a fish by its ability to climb a tree, it will live its whole life believing that it is stupid." Every student is unique and has different skillsets, but the current marks system judges them all on one single parameter. For example, a single exam, which is set at a single bar becomes the basis for judging a student's calibre. However, each student has different potential and capabilities of grasping the concept. It leads in creation of an education system which makes the student's mind the proverbial well's frog whose thinking is confined till its well and has no idea about what is happening in the infinitely large world outside that well. The New Education Policy, replacing the 34 years old National Policy on Education (NPE), 1986 puts focus on holistic development of students with an emphasis on skills development, extracurricular activities, music, arts & sports.

The NEP will not only benefit the students to expand their scope but also bring the teachers in the forefront. Being a part of technical teacher training institute, I believe that with implementation of NEP, there will be dire need of training the present technical teachers. As said by John Dewey "If we teach students today, as we taught yesterday, we rob them of tomorrow." The greatest challenge for successful implementation of new education policy is teacher training. A large percentage of inservice teachers do not have the skills required for such changes and are tasked with innumerable administrative responsibilities. This leaves them with little time for hands-on teaching, let alone training. In such time, the role of Teacher training institutes is very crucial in envisaging this new concept in our education system. Thus, it is the need of the hour to strengthen technical teachers training institutes and link them with multidisciplinary universities. This will help India to prepare high-quality teachers and thus pave the way to make Aatm Nirbhar Bharat.

Much has been said till now about NEP and its path-breaking reformations expected in the current education system, it is high time to implement these reforms and bring the much needed changes that this policy envisages. With the nation gearing for an Aatm Nirbhar Bharat, the timing of much awaited NEP 2020 couldn't be better. If implemented well, that day is not far away when the NEP 2020 will bring about a new era of Entrepreneurs, artists, researchers innovators, thus paving the way towards making Aatm Nirbhar Bharat.

Overview of New Education Policy 2020

Dr. Piush Verma Professor Electrical engineering

The Govt. Of India has passed India's first **New National Education Policy** on 29 July 2020. It replaced a 34-year-old National Policy on Education, 1986 and introduces wide-ranging reforms aimed at making the Indian education system more contemporary and skill-oriented. The policy is aimed at transforming the Indian education system to meet the needs of the 21st Century. The new policy seeks rectification of poor literacy and numeracy outcomes associated with primary schools, reduction in dropout levels in middle and secondary schools and adoption of the multi-disciplinary approach in the higher education system. Besides this, the policy also emphasis on early childhood care, restructuring curriculum and pedagogy; reforming assessments and exams, and investing in teacher training and broad-basing their appraisal. Although the NEP 2020 seeks to bring a holistic change in the education system of India, yet its success depends on the will and way in which it will be implemented.

Impact of New Education Policy :

1. Schooling starts at 3 years:

- NEP expands 6-14 years of mandatory schooling to 3-18 years of schooling.
- The new system will have 12 years of schooling with three years of Anganwadi/ pre-schooling.
- For emphasis on **Early Childhood Care and Education**, 10+2 structure of school curriculum replaced by a **5+3+3+4** structure for ages 3-8, 8-11, 11-14, and 14-18 years.
- 2. Mother tongue as medium of instruction:
 - Focus on **students' mother tongue** as medium of instruction in **both public and private** schools but it is not compulsory.
 - Wherever possible, medium of instruction **until at least Grade 5**, preferably till Grade 8 and beyond will be home language, mother tongue, local language or the regional language.
 - Science, arts, commerce division gets blurred:
 - No rigid separations **between arts and sciences**, curricular and extracurricular activities & vocational and academic streams.
 - Vocational education will start in schools from 6th grade, and will include internships.
- 4. Single regulator for higher education institutions:
 - Higher Education Commission of India will be a single overarching umbrella body for entire higher education, excluding medical and legal education.

- Public and private higher education institutions will be governed by **same set of norms** for regulation, accreditation and academic standards.
- Affiliation of colleges will be phased out in 15 years and mechanism to be established for granting graded autonomy to colleges.
- 5. Multiple entry and exit options in degree courses:
 - Undergraduate degree will be of either **3 or 4-year duration** with multiple exit options within this period.
 - College will be mandated to give **certificate after completing 1 year** in a discipline including vocational and professional areas, a **diploma** after 2 years, or a **Bachelor's degree** after a 3-year programme.

Transfer of Credits:

- An Academic Bank of Credit will be established for digitally storing academic credits earned from different HEIs so that these can be transferred and counted towards final degree earned.
- Freedom from **periodic inspections** in schools, colleges and universities and place them on the **path of self-assessment** and voluntary declaration
- Allowing Foreign Universities: The document states universities from among the top 100 in the world will be able to set up campuses in India. This will lead to an infusion of international perspective and innovation, which will make the Indian education system more efficient and competitive.

Issues Related to NEP 2020

Knowledge-Jobs Mismatch: There is a persistent mismatch between the knowledge & skills imparted and the jobs available. This has been one of the main challenges that have affected the Indian education system since Independence. NEP 2020 failed to check this, as it is silent on education related to emerging technological fields like artificial intelligence, cyberspace, nanotech, etc.

Requirement of Enormous Resources. An ambitious target of public spending at 6% of GDP has been set. Mobilising financial resources will be a big challenge, given the low tax-to-GDP ratio and competing claims on the national exchequer of healthcare, national security and other key sectors.

Challenges:

- The goals of **50% Gross Enrolment Ratio** in higher education and **100% in secondary school** are laudable.
- However, it is currently **25.8%** in Higher Education and 68% in Class 9, which make the goals more idealist **than realistic.**

- 3. Right guidance:
 - With multiple choices and multi-disciplinarity, there must **come some support in making those choices for the young.**
 - This must be a part of the structural shift and **needs resources**, training and a clear place in the changed structure.
 - **Faculty training** in university teaching remains a huge gap too.

4. Research environment:

- The NEP should have offered more **tangible & realisable targets** for research.
- Total investment on research & innovation in India declined from 0.84% of GDP in 2008 to 0.6% in 2018.
- There are currently only 15 researchers in India per 100,000 of population, compared with 111 in China.

Concluding Remarks

The new National Education Policy (NEP) 2020, is a good policy as it aims at making the education system holistic, flexible, multidisciplinary, aligned to the needs of the 21st century. The intent of policy seems to be ideal in many ways but it is the implementation where lies the key to success.

3D Printing Futuristic Technology as Game Changer in Conventional Mechanical Manufacturing

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Introduction : In past four decades conventional mechanical manufacturing has majorly focused on bulk material removal processes (subtractive been manufacturing) to assist the concept of mass production [1-3]. But in recent years especially after the concept of Industry 4.0 has become popular the trends have now shifted to customization, tailor made products, shorter product life cycle (shelf life) and time to introduce the product in order to become pioneer in product development and finally its launching. This has given a big motivation to digital form of manufacturing and under the umbrella of digital manufacturing, number of 3D printing based technologies (also called additive manufacturing or rapid prototyping) have been introduced and commercialized [4-6]. But hitherto all 3D printing technologies are still limited to job type or batch type production and the capabilities of these 3D printing technologies have not been fully explored for mass production. It is expected that in coming 10 years, 90% of the subtractive manufacturing may be shifted to additive manufacturing giving lot of avenues to mechanical engineers to recast their career in diverse areas varying from conventional manufacturing, bio-medical, structural and non-structural engineering applications. The competition in the world market for manufactured products has intensified tremendously in the recent years. It has become important, if not vital, for new products to reach the market as early as possible, before the competitors [1-3]. To bring products to the market swiftly, many of the processes involved in design, test, manufacture and market of the product has been squeezed, both in terms of time and material resources [4]. The optimum use of such valuable resources calls for new tools and approaches in dealing with them, and many of these tools and approaches have evolved. They are mainly technology-driven, usually involving the computers. This is mainly a result of rapid development and advancement in such technologies over the last few decades. In product development, time pressure has a major factor in determining the direction of the development and success of new methodologies and technologies for enhancing its performance. These also have a direct impact on the age-old practice of prototyping in the product development process. This article will introduce in a clear way, one such development of additive manufacturing technologies as a case study, which produces parts by deposition of material, layer by layer for assisting the heart surgeon in critical surgery with low cost printing technology.

Historical Background : Today, the key benefits of additive manufacturing are mostly derived from its ability to create physical models- regardless of their shapes and complexities- directly from CAD models. In addition, models built with the help of additive manufacturing processes are used as tools for casting and molding i.e. dies for an injection molding process and pattern for a casting process [5-8].

However, manual prototyping by a skilled craftsman has been an age-old practice for many centuries and is considered as first phase of technological development in prototyping. Second phase of prototyping started around mid-1970s, when a soft prototype modeled by 3D curves and surfaces could be stressed in virtual environment, simulated and tested with exact material and other properties. Third and the latest trend of prototyping, i.e. rapid prototyping (RP) by layer-by-layer material deposition, started during early 1980s with the enormous growth in computer aided design and manufacturing (CAD/CAM) technologies when almost unambiguous solid models with knitted information of edges and surfaces could define a product and also manufacture it by CNC machining [7-9]. The historical development of RP and related technologies are presented in Table 1.

[7-9]	
Year of inception	Technology
1770	Mechanization
1946	First computer
1952	First Numerical Control (NC) machine tool
1960	First commercial laser
1961	First commercial Robot
1963	First interactive graphics system (early version of CAD)
1988	First commercial Rapid Prototyping system

Table 1 : Historical developments of Rapid Prototyping and related technologies

Additive manufacturing or layered manufacturing is a fabrication method where objects are constructed layer upon layer by depositing material under computer control. Also called solid freeform fabrication, additive manufacturing takes virtual designs (from CAD), transforms them into cross sections, still virtual, and then creates each cross section in physical space, one after the next until the model is finished. It is widely used for the rapid fabrication of physical prototypes of functional parts, patterns for moulds, medical prototypes such as bones and consumer products [10-14].

Basic rapid prototyping process: Rapid prototyping is an "additive" process, combining layers of paper, wax, powder or plastic to create a solid object. In contrast, most machining processes (milling, drilling, grinding, etc.) are "subtractive" processes that remove material from a solid block. Although several rapid prototyping techniques exist, all employ the same basic five-steps [11-14]. These steps are:

- 1. Design: Create a 3D CAD solid model of the design
- 2. Converting: Convert the CAD model to STL format
- 3. Pre-Process: Slice the STL file into thin cross-sectional layers (generated by a dedicated software
- 4. Building Process: Construct the model one layer atop another
- 5. Post-process: Clean and finish the model

CAD Model Creation: First, the component to be built is modeled using a CAD software package. Solid modelers, such as UNIGRAPHICS, tend to represent 3-D objects more accurately than wire-frame modelers such as AutoCAD, and will therefore yield better results. The designer can use a pre-existing CAD file or may wish to create one, expressly for prototyping purposes. This process is identical for all of the RP build techniques.

Conversion to STL Format: The various CAD packages use a number of different algorithms to represent solid objects. To establish consistency, the STL (standard triangulation language) format has been adopted as the standard of the rapid prototyping industry. The second step, therefore, is to convert the CAD file into STL format. This format represents a three-dimensional surface as an assembly of planar triangles, "like the facets of a cut jewel." The file contains the coordinates of the vertices and the direction of the outward normal of each triangle. Increasing the number of triangles improves the approximation, but at the cost of bigger file size. Large, complicated files require more time to pre-process and build, so the designer must balance accuracy with manageability to produce a useful STL file. Since the STL format is universal, this process is identical for all of the RP build techniques.

Slice the STL file: In the third step, a pre-processing program prepares the STL file to be built. Several programs are available, and most allow the user to adjust the size, location and orientation of the model. Build orientation is important for several reasons. First, properties of rapid prototypes vary from one coordinate direction to another. For example, prototypes are usually weaker and less accurate in the z (vertical) direction than in the x-y plane. In addition, part orientation partially determines the amount of time required to build the model. Placing the shortest dimension in the z direction reduces the number of layers, thereby shortening build time. The pre-processing software slices the STL model into a number of layers, depending on the build technique. Each RP machine manufacturer supplies their own proprietary pre-processing software.

Layer-by-Layer construction: The fourth step is the actual construction of the part. Using one of several techniques (described in the next section), RP machines build one layer at a time from polymers, paper, or powdered metal. Most machines are fairly autonomous, needing little human intervention.

Clean and finish: The final step is post-processing. This involves removing the prototype from the machine and detaching any supports. Some photosensitive materials need to be fully cured before use. Prototypes may also require minor cleaning and surface treatment. Sanding and painting the model will improve its appearance and durability.

Classification of rapid prototyping processes: The various commercially available rapid prototyping processes can be classified on the basis of the base material used to make the prototype. Figure 1 shows the classification of the various rapid prototyping processes.



Figure 1: Classification of various rapid prototyping processes

Case study of mechanical intervention in typical biomedical applications: In a perfect example of cutting edge technology helping surgical skills – a 3D print of a rare and potentially fatal malformation helped in the conduct of a safe and a perfect surgery. Mr. Parwinder Singh a 23 year old young man was noted to have a bluish discoloration of his body since childhood along with shortness of breath. It was thought that he had a heart problem and no specific treatment was done. When his colour started getting worse he came to Dr. Harinder Singh Bedi – Chairman Cardiac Sciences at Ludhiana Mediways Hospital in Ludhiana. His heart scans were normalso Dr. Bedi suspected a lung problem and got a CT scan done. There was a large connection between the right sided pulmonary artery and vein which was bypassing the lung. So blue blood was entering the body without picking up oxygen. This is called a large pulmonary arterio-venous malformation (AVM) and is a rare disease. Dr. Bedi realized that the AVM could suddenly burst leading to a life threatening bleeding. On the CT the malformation looked extremely complex with the arteries and veins hopelessly intermixed. The treatment was an early intervention. However it was expected to cause major problems during the procedure as the pathology was intricate. So Dr.Bedi decided to take the help of a new technology called 3D printing. This was performed in consultation with Prof.Rupinder Singh, who has earlier explored capabilities of 3D printing in mechanical engineering applications. Using the CT scan images as a base Prof Rupinder Singh along with his team used special equipment (3D printing hardware/software) to create a life sized 3D print of the malformation. The technique is called Fused Deposition Modelling (FDM). For this prototype, Stratasys - 3D printer U-Print SEPlus (USA), having accuracy of 0.025mm has been used. The filament for 3D printing was of 1.75 mm diameter, made up of acraylonitrile butadiene styrene (ABS) material.

This specimen could be rotated all around and visualized from all angles. After a careful study of this specimen Dr. Bedi went ahead with the minimally invasive

surgery. This would normally have taken over 3 hours and there was a risk that even a 1 mm mistake could trigger a torrential bleed. With the knowledge provided by the 3D – Dr. Bedi was able to remove the whole AVM in just 23 minutes with hardly any blood loss. Mr. Parwinder Singh recovered well . His bluish colour has been replaced with a healthy normal pink and his breathing is normal.

Dr. Bedi said that he could foresee the immense contribution of this modality in minimally invasive surgery and precise procedures all of which lead to enhanced patient safety. On an exhaustive internet search there has been no mention of the use of 3D printing in such a potentially dangerous lung pathology. The team has sent this report to an International Journal so that other doctors can be made aware of this development. The case study is also be available on Stratasys USA website for further reference.

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No Crisis Should Go Waste

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'When you go through it, make sure you grow through it'.

The world is passing through unprecedented times and the crisis is directing the human race towards a paradigm shift in their thinking, emotions and behavior. The Global Health pandemic is touching every aspect of life - social, emotional and professional. All over the world, educational fraternity is trying its best to follow Churchill's motto, "NO CRISIS TO GO WASTE" and making all possible effort to reach out to students online, using various platforms, electronic media and digit formats. It is standing-up to the situation and doing its best, even though the situation has befallen without a warning. With sudden changes in the teaching-learning processes from regular classroom through contact and distance modes to total reliance on online mode of delivery, coupled with Government of India's decision to implement 'New Education Policy 2020', the pedagogical processes are experiencing paradigm shifts. In order to meet the changed pedagogical requirements, new systems and strategies are being evolved. These unprecedented circumstances have added to uncertainty and caused psychological setbacks to both teachers and pupils. The emotional, psychological and mental health needs of teachers is of paramount significance as they are the touch points, who are in contact with millions of students, who are also going through struggles and turmoil. There is an absolute need to enhance teachers' own mental health and raise their wellness quotient to create a domino effect and a surge in positive effect on the students.

When one passes through unpredictable times and circumstances, one tries to cope with fear. Usually, people deviate and morph into irrationality. Novelty and change lead to anxiety and one masks anxiety with control because one needs a sense of certainty and predictability. One experiences imprisoning pressure. The dysfunctional emotions like sadness, anxiety and anger paralyze one's power to think rationally and act judiciously. However, every adversity can be a trigger for healing transformation and here are a few suggestions to get there:

Learn to manage 'Self': Self-management requirements in life include coping with time, relationships and stress etc. Enhancement of self-management skills requires appropriate and active focusing, improving upon and discharging daily tasks. Self-management skills can be enhanced by assessing personal strengths, prioritizing responsibilities and continuous formative and evaluation of progress. By performing one task at a time and fully accomplishing outcomes of each task before moving on to another can help in managing time and energy efficiently. Being respectful and appreciation of everyone's individuality and acceptance of diversity can help manage relationships effortlessly.

Learn to deal with Emotions: Embracing new things often requires embracing fears and insecurities; however trivial they may seem to be. One needs to deal with these impairing emotions not by denying or repressing but by being aware of these and facing these head-on in a mature and effective manner. Talking, crying and laughing are the three natural ways to deal with these. One needs to listen to these signals as these often give signs of something liberating and nourishing about the deeper conflicts and their resolutions.

Learn new Skills: Human beings are the creatures of their habits. Humans lose free will to their programmes. The scripts embedded in subconscious mind run men on an autopilot mode. However, new challenges cannot be met using old habits and ways. Very often, to cope-up with difficult times, one needs to acquire new skills. This can happen only when one is open to embrace learning opportunities. Following fitness regimes, reading routines and practicing meditation are the three must DOs for a healthy body, mind and spirit.

Conscious and Mindful Living: "A life lived of choice is a life of conscious action. A life lived of chance is a life of unconscious creation." – Neale Donald Walsch. Living consciously is about taking control of one's life, making decisions out of awareness and about creating a life that one wants to live rather than settling for the one that befalls. To take a holistic approach to filling one's life with goodness every day, one may start with three simple practices that relate to physical, mental, and spiritual nature of each individual, which can have a positive impact on health, happiness, and spiritual awakening: (i) Eat nutritious food in appropriate portions, (ii) Cultivate contentment and (iii) Meditate every day. These three practices, taken up together as a daily discipline, will work synergistically to fill life with goodness.

Learn to become a Victor: When someone lacks inner strengths, little things overwhelm him. Developing inner reserves is essential to immunize oneself to external challenges. One has to drive past one's own barriers and rise-up to one's true potential. Become aware, accept and allow experiences to make you stronger and an evolved version of yourself. Embrace the Change and own your path of action to move from the state of a helpless 'victim' to a triumphant 'victor'.

Learn to raise your Energy: Man is an energy beings - vibrating at different frequencies depending on the thoughts and emotions one entertains. Pure intension, positive mindset, Pranayam and prayer are the ways to tune into higher levels of consciousness. Practicing these, one is not only uplift oneself but also people around. Anyone, who helps others in the time of crisis is a true spiritual warrior.

Learn to be Happy: Happiness is a state of mind and it is a choice one makes about the way of life one wants to lead. Happy people move away from 'control' and 'criticism' and consciously and they choose 'compassion' and 'connections'. Happy and content people adjust their desires to be consistent with their resources and abilities. Learn to create Connections: Relationships are the greatest predictor of one's quality of life. Sincere, honest and forthright love for fellow-being is the key to build connections and maintain healthy lifelong relationships. Understanding, affection, respect and trust, coupled with appropriate and effective communication, are the expressions that build healthy, positive and permanent relationships. Nurturing relationships provide a sense of security, positive emotional strokes and a sense of self-worth. These are the most effective antidote to all stressors and challenges of life.

Learn to be kind: It is said that 'every adversary has its blessings too'. Crisis is an opportunity to develop one's spiritual muscle. It is a time to focus on solutions, instead of problem. Random acts of kindness have great therapeutic value. Converting the sense of helplessness into act of service is a sure way towards wellness. Include mercy, empathy and compassion in your character. It is time to enter community, engage in selfless positive activities and contribute.

Remember the Golden Triangle – Stay calm, remain informed and accept responsibility. Instead of blaming others, think what best can be done for the greater good. A mindful living is what it needs to be 'in the zone'. Mindfulness is a process of active, open, nonjudgmental awareness. It is paying attention to present moment with openness, curiosity, kindness and flexibility. Life becomes a celebration by paying attention to purpose and living in the present moment, without judging what is happening. Learning to breathe deeply and supporting someone else who is under stress and suffering, instead of getting triggered during disagreement or being undermined at work, are some clear times to practice 'Golden Triangle'. One does not have to be remarkable or extraordinary, one can just be ordinary and do remarkable and extraordinary things to lead a happy, fulfilling and content life.

The present pandemic carries an essence of spirituality. Let's take this opportunity to evolve and up-skill. This time will not stay forever but the learnings assimilated during this time can graduate us to a much higher level of awareness and performance and all it needs to qualify is the will and intent to do the same.

The Serenity Prayer revised:

God grant me the serenity to accept the things I cannot change, courage to change the things I can, and wisdom to know that what can be changed is ME.

Nanoelectronics for Neuromorphic Computing and Artificial Intelligence

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Abstract: This article presents role of nanoelectronics devices and circuits in Artificial Intelligence (AI). During the last two decade there is increasing use of 2D Materials, Graphene, Quantum Dots, memristors etc for nanoelectronics in nuromarphic computing and Artificial Intelligence (AI). The neuromorphic computing hardware requires high memory density, fast speed, and low power as well as a unique characteristic that simulates the function of learning by imitating the process of the human brain, nanoelectronics devices are considered as a promising candidate because of their desirable characteristic. Current Convergence between nanoelectronics and artificial intelligence can lead the technological advancement in the field of electronics and computer sciences that will depends on alternative computing architectures and data processing, hybrid advanced technologies that used for research and industrial applications. This paper also discusses some of the aspects that machine learning help to improve the yield of devices and circuit design. **Keywords:** Machine Learning, Nanoelectronics, Artificial intelligence, Neuromorphic Computing and Memristors.

1. Introduction

Artificial intelligence means machines that imitate the cognitive functions of humans such as learning and problem solving. Similarly, neuromorphic computing has been researched that imitates the process of the human brain compute and store [1]. Research have been conducted to simulate human learning skills by mimicking the process the human brain learns using the computational structure of a computer in the form of an artificial neural network. A confluence of nanoelectronics is creating an opening for new devices, circuits and systems for machine learning and artificial intelligence (AI) to allow Brain Machine Interfaces (BMI) [2]. New nano materials, devices, circuits are systems are required for artificial brain of a machine for thinking and decision taking capability. The motive of nanoelectronics devices is to communicate with the brain in such a ways that hold contextual learning in memory and revise the useful changes as per requirements. Advances in nanoelectronics process technologies for computation systems, hardware, and softwares that be trained and familiarize yourself in a contextually needy way will be able to leverage the capabilities that nanoelectronics have for brain machine interfaces. Demand of nanoelectonics industry is typically driven by a disruptive advanced technology. Last two decades have huge demand of PCs for central processing units (CPUs), semiconductor memories and Application Specific Integrated Circuits (ASICs) design. Now, artificial intelligence will be the channel for next decade-long development cycle for the semiconductor industry and along with advancement in nanoelectronics [3].

2. Neuromorphic Computing

The computation process of computer hardware using transistors mimics the brain's computation process on the neuromorphic computing. Over the decades, the concept has been studied by researchers to make machines that think and learn like humans in various forms. Studies have been conducted to simulate human learning skills using computer hardware in the form of an artificial neural network by mimicking the method the human brain learns and computes [4]. The human brain has a very complex structure in which there are over a billion of neurons and trillions of synapses. Neurons consist of a cell body, an axon that produces neural signal impulse, and a dendrite that receives signals from other neurons as illustrated in Figure 1. A synapse is a structure that permits a neuron to deliver an electrical signal to another neuron.



Figure 1 Neurons Network of the Human Brain [4]

The neuromorphic hardware typically consists of neurons and synapses to imitate the nerve system of the human brain as shown in Figure 2b. In the neuromorphic hardware, each neuron is a core that processes data and, neurons are connected in parallel through synapses to transmit information. There is no von Neumann bottleneck caused by having one signal bus in the neuromorphic hardware. To implement this in practical design, the development of artificial synaptic devices is necessary that reflect the characteristics of bio-synapses rather than conventional CMOS devices. Figure 2a shows the block diagram of the conventional von Neumann architecture and the emerging neuromorphic architecture.



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Figure 2. Block diagram of computing systems: (a) von Neumann architecture; (b) neuromorphic architecture

3. Nanoelectronics and Artificial Intelligence Opportunity

Advancement in Integrated Circuits (IC) design with nanotechnology is the main achievement of researchers in last few decades. This plays a key role for developing advanced computing systems required for **Artificial Intelligence**. **Artificial Intelligence** is the capability of computing systems to simulate intelligent human brain and taking decisions based on complicated analysis of data sets and predefined sets of instructions and rules. Semiconductors based nanoelectronics are main cause for development of the Artificial Intelligence and their applications [5]. This is opening new opportunity for nanoelectronics development i.e 2D materials based advance semiconductor devices, memory circuits, high end computing units and boosting innovation in the field of Artificial Intelligence.

3.1 Artificial Intelligence Algorithms

The use of **Artificial Intelligence** mainly depends on three types of algorithms as briefly Discussed below:

- i. **Machine learning (ML):** is a subset of artificial intelligence (AI) that makes systems learn and develop capability with experience without programming. Machine learning derives from the efforts of psychologists to make more precise their theories of animal and human learning through computational models [6].
- ii. **Deep learning (DL):** Deep learning is further subset of machine learning, in this systems learns without supervisor or unsupervised leading from the data set [7].
- iii. **Natural language processing (NLP):** Language is a method of communication with the help of which we can speak, read and write. This automatically manipulating languages that may be text or speech [8].

3.2 Implementation of Artificial Intelligence

Artificial Intelligence use two primary implementation type's i.e. training and inference:

- i. **Training Systems:** This type of learning by repeating set of things in a sequential manner. These influence huge data sets for learn how to carry out specific taskes and to continuously develop the learning process itself.
- ii. **Inference systems:** This is type of system where involvement of logical methods is there for real-time decisions making using predefined models [9].

3.4 The emerging Silicon Nanoelectronics for Artificial Intelligence

The market of silicon nanoelectronics systems is likely to remain fragmented, because its use in numbers applications few of them are robotics, industry automation, driverless car driving and scrutiny will require a solution with advanced technologies i.e artificial intelligence. This goal can be achieved by training systems making traditional computing units intelligent for decision making capability. Reconfigurable computing with FPGA and ASIC design can play a key role in this process with advanced features of integrated circuits with involvement of silicon nanotechnology. Intelligence integrated circuits for computational unit and memory can be designed with memristors. Many applications in artificial intelligence require extremely large numbers of nanoscale semiconductor devices and are sensitive to device parameter variations. The conventional CMOS technology can be replaced with memistor devices for the development of non-volatile SRAM that can act as storage of intelligent systems. These platforms are enabling us and our collaborators to create new families of nanodevice measurements and foster a rapid expansion of research in new forms of integrated nanoelectronics for advanced information processing [6, 10].

4. Nanoelectronics Device-Algorithm Interaction

The control systems required for AI can be directly implemented with hardware model and directly test nanoelectronics device with build in test system for algorithm interactions. This potential is used to check the performance of assured classes of nanoelectronics devices with artificial learning methods and operational techniques. The work has been reported in literature on the development and use of nanoelectronics aimed at interacting brain and central nervous system generally. There is a probable chance and requirement for the development of machine learning algorithms specifically designed to take advantage of and control nanoengineered Brain Machine Interfaces (BMI) nanoelectronics devices [8-10].

4.2 Machine Learning for Semiconductor Manufacturing Problems

There is spectacular advancement in computer vision in last 20 years that can be applied along with machine learning. There are a number of problems in the domain of visual inspection of semiconductor wafers during the fabrication that may be agreeable to more automation or to improved accuracy over the existing approaches in this area. By detecting defects earlier or more accurately with Artificial intelligence, we may be able to achieve higher yields or reduced costs.

5. Conclusion

The integration of nanoelectronics with artificial intelligence with nanoengineered brain machine interfaces has potential for major improvements in neurotechnology. Brain Machine Interface has the ability to learn and possibilities to radically change the treatment and quality of life of patients. For these nanoelectronics has a key role with novel devices such as memristor based circuits and system design. Specifically non-volatile memories design for neuromarphic computing and in-memory computing for artificial intelligence applications.

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A TRIP TO JAPAN VIS- A- VIS A NEW EDUCATION POLICY; A FEW EXPECTATIONS Comparing existing to desired

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One can find an enormous structured as well as non-structured material related to japan as well the about the education policies of various countries in this world of information technology. This article is my experience of a trip to japan in comparison to what I observed in India and comparing the expectation from NEP. Hence after every point I thought of Indian scenario.

The moment I landed in Tokyo and was guided to board the public bus, putting on your Seat belts were first thing that surprised me (safety belt in bus), Safety First was the indication. Although the new education Policy (NEP) talks about the safety across the policy document but imbibing it as a culture in the society is the need. While we presently enjoy the overloaded bus, take pride in riding on the bus top, standing on the bus gate but these aspects require restriction.

Enroute to Tokyo even the trucks that were carrying the excavated soil were sparking clean. Well trucks in India need no explanation with a thick layer of black soot enough to ______(fill in the blank). Again although the new education Policy talks about the cleanliness across the policy document but it is only through practicals and practice that the set standard of the society can be achieved. Theoretical definition, types, characteristic of cleanliness will be of least significance if taught in the classroom through blackboard lecture or presentations.

My morning experience was with sensor based Toto sanitary gadgets with enough number of buttons as an option and confusion. And through the day one after another innovative surprises. Although in the past 5 year, India has achieved heights by rising 33 through place from the rank of 81 to 48 in the Global Innovation Index of World Intellectual Property Organization United Nations. It is the next decade 2021-30 that will reveal the appropriate implementation of NEP which talk about Creativity and critical thinking as one of the fundamental principles, Continuous professional development for the teachers to learn the latest innovations and inspire the students, innovation and initiative by local stakeholders in school complex management committees, Growing the national economy through innovation, Increasing the number of startups incubation centre which has already started aggressively, Developing a culture of innovation across HEIs, Revision of choice based credit system for introducing innovation, Innovation in teaching and pedagogy, Enlightened nation through research in the arts and Humanities with innovation in science and social science

If you are habitual late comer in the classroom then go to japan to change your habit. I was made to learn on the very first day when I slept after breakfast may be due to jet lag and the whole centre was vibrating Mr Vinayak from India report to Room No. ... immediately. Everywhere in Tokyo in the streets you will find hundreds of vending machines for juices, ice creams, tea both hot and cold. In India we do not prefer to leave anything unguarded in streets instead the moment we get a chance would pick up such item for our house and will guard them appropriately. Self-discipline will one the key skill that this NEP should try to develop across the society.

Although Japan have been generating huge waste plastic bottle daily. But due to their advanced waste management technology this is not an issue. It is the expectation from Higher Education Institutions through NEP that such technologies do get implemented in India to have a sustainable society to live in.

With Family mart spread across the metropolitan cities of japan will not leave you hungry, but since it will be difficult to afford 3 meals daily in the restaurant with budget salary, thus making packaged food finds a huge business. The only point is that one has to develop the habit of eating bread of different shape, size, taste and flavours in a variety of packing. It is the blend of innovation and technological development that such system got developed and an expectation from NEP.

Shinkansen, speed 320 km/hr, bullet shaped front, rotating seat, noiseless, best thing train checker and snack sellers greet the passenger by bowing down every time they entered and while leaving the coach. This reflected the blend of culture, innovation and technological development which I hope NEP will try to achieve.

Although earthquakes might be horrific, but not in Japan. During my stay period the particular places witnessed earthquake twice. One below Ritcher 4.0 was not noticeable while I was in room in Tokyo international centre and in another case in Tsukuba it was morning 4.45 am I suppose when I realized that I was been shaken and was least interest in getting horrified instead I preferred enjoying my sleep in the 5th floor of the hotel. Both buildings were base isolated, a technology still to capture the market in India. Although we do talk of innovations and technological advancement but sensitization to larger segment is required which is expected to achieve by increased gross enrollment ratio.

For the first time I saw the umbrella stand and machines to cover the wet umbrella preventing the dripping of water beyond entry into the hotel, it hardly matters in India if some rain water is in our corridors or rooms. Is this the subject of being perfect which is being incorporated in NEP under Holistic development of learners. Holistic development talks about "knowledge is a deep-seated treasure and education helps in its manifestation as the perfection which is already within an individual"

The hotel rooms were of sufficient size with no almirah. Yes for first time I realized what is the need, think of it. Does the optimized learning that the student will go through under NEP will be able to incorporate higher level optimization in his life and day to day activity.

Combined Bathroom and toilet which had a slip on a tap written drinkable water, Unimaginable in India not only our traditions /customs will not allow but water supply

department will also support us in not drinking water directly from tap due to their dependency on water purifier companies. Remember one thing you can drink from anywhere provided your mind should be able to accept. Try drinking through branded lifestraw directly from any river water. When I compare this aspect with the standards that NEP has set and will trying to achieve, I would only emphasize that the learner be able to understand the difference between quality of standards and does not dilute the characteristics that the nation expects while he/she hold position in the society to serve.

In one of the initial lectures the expert pointed out that among various things that japan has given to India, Delhi Metro is one them. Compare yourself by traveling in Delhi and Tokyo metro were his lines. It needs to be checked that how many such success stories does the output of NEP will be able to write in the next coming decades

Various place that I visited- Tsukuba city having network of research facility, Japan's one of largest experimental research facility - National Research Institute for Earth Science and Disaster Prevention, Odaiba – large artificial beach – a place for fun and Mirakain an astonishing museum, Tomioka Silk Mill – UNESCO world heritage site. It is hoped the NEP will lead to development of more world class museums and start of the art laboratories in future.

Read the book IKIGAI to understand the how the Japanese are able to live long, be happy and active even in their old age. Once you have spent some time in japan one realizes that all Japanese are highly soft spoken and have preserved their culture of greeting the guests and each other by bowing down.

Do we have some similar expectation through NEP.

Tinkering: An Approach to Foster Critical and Innovative Thinking Skills

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1. Introduction

The National Education Policy (NEP) 2020 has laid an immense emphasis on conceptual understanding rather than rote learning and learning-for-exams. It also focuses on creativity and critical thinking to encourage logical decision-making and innovation [1]. In this article, the 'Tinkering' has been outlined as an approach to accomplish the above cited objectives at least for electronics and electrical engineering based subjects.

Tinkering refers to the composing and decomposing physical things with practical or playful objectives. In the domain of electronic/electric circuits, it is equally applicable to tinker with the circuits to learn in a playful way for the novice and to solve problems through experimentation for skilled [2]. Tinkering can use only conventional approaches and components; however, today the use of e-resources and simulators is also becoming a favourite trend. In tinkering approach, the learner gets engaged, stuck and plays with a problem until he/she finds a solution and in this process, the learner explores various alternatives and gets the deeper understanding. A combination of confidence and competence has been observed in the learners taking this approach of learning [2]. So, the tinkering elements should be in learning environments for introducing the critical thinking and innovative qualities in the learners.

Making and tinkering are two terms which are closely related and these terms represent the ways of learning or knowing. The making refers to the role of construction or building something in learning process. The final product to be made forms the basis of this approach and accordingly the tools and materials ae selected and utilized. The tinkering approach more refers to a way of thinking of finding solutions to problems through direct experience, experimentation, and discovery [3]. The present structure-based schedule of engaging students in formal classes is mainly an educator friendly approach. It helps in managing large number of students by setting a pace of learning though time-tables, lectures, assignments, tests and a fixed list of experiments for few of the subjects. All this helps in creating an efficient teaching environment not the learning environment. To create an effective learning environment, these managing resources focused mindset needs to be altered by introducing multiple styles of learning e.g. the experimental or activity-based learning. We should make provisions of various learning styles in the classrooms. The general perception that there is only one particular way of learning a specific subject need to be discarded and the students should be free to experiment with their ideas and the teacher should value their way finding solutions to problem with a mindset that there may be many solutions to a problem at hand [3].
Tinkering is an alternative and effective approach to learn basic fundamental of subjects especially scientific subjects. It is also known as "Soft Mastery" as compared to "Hard Mastery" the traditional approach of learning [3]. Tinkering is activity-based learning which often involve teams so it also strengthens the social skills. It refers to learning through doing and getting inquisitive about what happens if something is done in a particular way. It also involves making assumptions and investigating the solution with intuition and the knowledge of fundamentals. This approach specifically excludes the traditional step-by-step procedure of problem solving that leads to predetermined end results. Tinkering involve a lot of iterations in problem solving and in this process a chance of grasping invaluable and enriching understanding [2].

2. Tinkering Environment and Activities

While tinkering in a designated lab/space, the learners need to be provided with tools to develop and follow personal ideas. Also the learners should be provided with materials to evolve these ideas with experimentation under the supervision of facilitators to provide feedback and assistance. To know whether the learners are on right trajectory of learning, the common evidences are (i) Engagement or participation (ii) Intentionality (iii) Innovation and (iv) Solidarity with other learners. The role of the teacher in such cases is to design the learning environment in such a manner that learners have the opportunity of finding and pursuing a purpose, experiment with their creative and imaginative skills and solve the problems at hand [4].

Various activities which can be included from Tinkering circuits point of view can be classified under the following major categories. All these activities help the learners to develop creative and innovative thinking skills [5].

- Circuit Boards based activities
- Paper Circuits based activities
- Sewn Circuits based activities
- Scribbling Machines based activities

The Circuit Boards based activities introduce the learner to various electrical components and various ways of interconnecting them. This results in variety of experiments by learner to understand how something works and what are the right and wrong ways of connections.

Paper Circuits based activities provide a platform where there is combination of art, science and technology. The designs created while doing activities make learners to go through the process of testing, questioning and sometimes failing also.

Sewn Circuits based activities involves working with conductive threads, batteries, LEDs and fabric to design circuits. These activities also help in the inculcation of skills related to art, science and technology. The learners get motivated and involved when they construct meaningful designs with these unusual materials.

Scribbling machines based activities involved motorized apparatus that trace their paths in unusual ways. The availability of various types of materials and options provide opportunities to learners to rebuild and redesign experiments as their curiosity level increases.

3. Related Flagships Government Schemes

ATAL Tinkering Lab (ATL) scheme of Government of India under ATAL Innovation Mission at NITI Aayog is a visionary approach to create an environment to foster curiosity, creativity and imagination in young minds. The major objectives of this scheme focus on inculcating the design mindset, computational thinking, adaptive learning, physical computing, etc. The ATL provides a chance to learners to work with tools and equipment to get deeper knowledge of Science, Technology, Engineering and Mathematics (STEM). This scheme targets mainly school students. Also, there is provision of competitions, exhibitions, workshops, lectures, etc. to further foster inventiveness among students [6].

The ATAL Incubation Centre (AIC) scheme is another major initiative of NITI Aayog to nurture innovative start-ups to promote culture of innovation in India. Higher Educational institutes, R & D Institutes etc. as well as other stake holders can establish AICs with funding from NITI Aayog. The broad objective of AIC is to support innovators and startup businesses to become successful businesses by providing essential infrastructure and services [7].

4. Conclusion:

In this article, a way of realizing the critical and innovative thinking objectives of NEP 2020 has been outlined. The Tinkering approach has been introduced as an effective alternative to the traditional teaching-learning process. However, the creation of such learning environment needs a mindset change from the management side. The Tinkering circuits activities have been discussed as one of various alternatives to foster critical thinking and innovative skills of learners. The ATL and AIC schemes of NITI Aayog are visionary initiatives in developing innovation and critical thinking using STEM concepts. However, such schemes should be utilized to their fullest potential to get maximum benefit.

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Science and Covid-19

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The year 2020 so far has been the most stressful year of the 21st century due to ongoing coronavirus disease of 2019 (COVID 19) pandemic. The pandemic has affected human life globally and created physical and mental public health emergencies. From initial days of panic and anxiety now, we are progressively moving toward a new normal of routine life. On one side, humanity is learning to live with the virus by following several precautionary guidelines of the world health organization (WHO) and local governments, on the other hand, the progress toward the elimination or containment of the virus via scientific research is evolving very fast. The word epidemic is used when a disease infects a population within a community or region. The word pandemic is however, used when the epidemic becomes widespread in a large region of multiple continents or worldwide. The black death (plague) of the 14th century has been the most dreadful pandemic in history which killed around 75- 200 million people. The current pandemic has also maliciously created extreme panic and economic slowdown across the nations. The WHO did not take much time in declaring the COVID 19 crisis from epidemic to pandemic as the virus quickly spread globally. Very specifically the first case of COVID 19 was detected in Wuhan, China in December 2019. On January 30, 2020 WHO assessed its risk as a public health emergency of international concerns followed by declaration as pandemic on March 11, 2020. As of September 05, 2020, more than 26.6 million people have been tested positive, 17.7 million people recovered and 875 thousand people have died. The India reported the first positive case on January 30, 2020 of a student returnee from Wuhan, China [1]. On September 05, 2020, India reported 4.02 million positive cases, 3.11 million recovered and 69,561 people died.

The scientists successfully recognized the microscopic virus and sequenced its genome within a few weeks of the initially reported cases. Besides, scientists and medical professionals very soon understood the human-to-human transmission nature of COVID 19, and promptly several detailed reports on the various stages of the disease were published. The cases from asymptomatic and infectious to numerous symptoms appeared with several complications in the most severe cases. The fight to combat COVID 19 pandemic involves the knowledge and resources of the medical establishment, the healthcare industry, and the resources of hundreds of thousands of professionals [2]. Today most of the COVID-19 symptoms are now known which help with more precise tentative diagnosis. The confirmation testing is performed through real time reverse transcription polymerase chain reaction (RT-PCR) of sick discharges, computerized tomography (CT) scan imaging of the chest, etc. The recent evidence advocates that CT scans and X-rays are not precisely sufficient to detect or exclude COVID-19 infection [3].

Science/ technology is an effective tool to combat epidemics like COVID 19. Every country worldwide is progressively working to find an effective solution in term or medical equipment and/ or vaccine development. China alone has launched 83, R &

D projects with focus on vaccine development, clinical treatment and drug screening, pathogenic and epidemiological study, test methods and products, and animal model study [4]. The world response including India toward COVID 19 is the same audacious as China. The more scientific research worldwide today has been directed towards clinical treatment, virus prevention and control. Many nucleic acid kits, testing equipment and reagents were developed during COVID 19 outbreak. Scientists and doctors worldwide have put truly sincere efforts in testing, screening and exploring new drugs and treatment methods. Several therapies, convalescent plasma including medicines such as hydroxychloroquine, tocilizumab, favipiravir, remdesivir, lopinavir, etc have been tested. Further, big data, artificial intelligence and 5G have significantly helped with prediction of epidemic trends and epidemiological investigation.

Since the start of the epidemic various drugs which were already available and used in the treatment of the other disease have been tested for the COVID 19 worldwide. Scientists in South Korea tested 48 FDA-approved drugs and found that antihelminthic drug called niclosamide, and antiviral and anti-inflammatory drug called ciclesonide were very effective in COVID 19 treatment.

Particularly in India, several funding agencies such as CSIR, DAE, DRDO, DBT, DST have allotted a large part of their funding budget towards COVID 19 R & D and vaccine development. Nonconventional innovative solutions have been proposed, evaluated and tested to mitigate COVID 19 infection, amplification, transmission and its negative impact of economy and society [5]

Though many alternative drugs and therapies have been tested, and efforts in the direction of developing the vaccine have been very rigorous, neither the vaccine has been developed yet nor the foolproof medication is available. Hence, prevention till now has been a key to contain COVID 19. The protection includes the establishment of scientific guidelines and protocols for the use of PPEs. The allocation of resources and reuse of critical medical equipment, etc. have raised many difficulties in preventing local transmission by healthcare staff and society.

Today COVID 19 diagnosis has been improved. New mass screening approaches include cough acoustics to AI based chest X-rays. Affordable RT-PCR technologies for identifying the viral genes and pooling of testing samples have been realized. Appropriate antibody tests to recognise the spread of the disease and screening large populations have been performed. Labs of DST, DBT, DAE and CSIR are conducting diagnosis tests with testing protocols designed by our scientists [6].

Treatment of COVID 19, now has progressed a lot from its initial days. Today our national recovery rate is about 77 %. Though the recovery rate has been improved and is improving day by day an absolute solution or vaccine development is still not very near. Whole world including India so far have used several anti-viral drugs, patient plasma and other globally approved therapies to cure COVID 19. India is also part of the WHO solidarity global clinical trials. The belief and hope are that the vaccine will be available by end of the year 2020 and treatment will mature too.

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Hybrid Pedagogy: An Indian Perspective

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Indian thinkers have long understood that purpose of education in an unique manner. They did not think of learners as the empty vessels which needs to be filled with knowledge. They realised that the light of knowledge resides in every person. As pointed by Krishna in the above quoted shloka from Bhagavad-Gita the object and goal of knowledge is in everyones heart. The goal of education then becomes clear. It is not to impart something new. The real purpose of education is to just remove the veil of darkness surrounding the lamp of knowledge.

The word "Guru" also means this. The literal meaning of the all important word Guru is remover of darkness. When darkness is gone, the lamp of knowledge will shine bright. The role of teacher in education system should be motivated by this. Teachers today overburden themselves by assuming more responsibilities. They think they are the sole proprietors of knowledge. This wrong assumption has resulted not only in the bad design of the system but also alienated students from learning.

The main goal of education is two-fold. One is to develop lifeskill to students and the other is to impart human values. The former fills their stomach and latter the soul. The twin goals of the education should be achieved together. One cannot be sacrificed for the other. Unfortunately today there is too much emphasis on the developing skills that the other aspect is completely forgotten. The result of this skewed model is being seen today. On one hand we have demotivated teachers. And on the other we have students who are neither skilled nor aware of societal responsibilities.

The early education system in India was designed to give students a balanced view of life. Children of king and commoner would study together in a Gurukula system. The 'brahmacharya' ashram stage as it was called did not offer much comforts for students. They had to take care of themselves, serve the teacher and gain knowledge the hard way. Ability to pay fees was not the criteria for getting entrance to these schools. Interest to learn was. A teacher would demand fees, if interested, after the completion of course.

The traditional system of learning in India was demeaned with the entry of foreign rule. Like many other systems even the time tested way of learning was found outdated. In the name of modernising the country, the English rulers introduced a system of teaching which has survived even to this day. The compartmentalised system of education draws strict lines between different domains of knowledge. So if you are student of medicine you cannot learn geography, an arts student has no business with physics. The tight boundaries ensure a keen student shall not trespass into other domain keeping them ignorant about large parts of human knowledge.

The traditional learning system in India can be Bradly classified into two periods. The earlier the Vedic period where Gurukula system operated in systematic manner. The

head of the institution, called, kulapathi, was responsible for providing free food and education to all the pupils. There is no mention of teachers who were working in these institutes getting paid. From the available literature we learn that partly these institutions were funded by the kings but they sustained mainly through the physical labour of the inmates. The learning was mostly through listening from teachers. The ancient corpus of knowledge in this country survived many generations through this oral tradition.

It was with the arrival of Buddhism and Jainism, the educational system underwent a major transformation. They differed with the Vedic systems in many ways but understood the importance of institutionalised learning. Therefore they adopted and modified the existing rules of universities. The new institutes were thus a continuation of old ways but suited for their times. They had some rules for entrance but once the student was admitted continued to give him food and education for free. The famed institutes of Takshashila and Nalanda were of these kinds. They not only provided spiritual education but also were centres for skill based learning. Every branch of knowledge was to be learnt and every deserving student had to be taught.

In addition to this, temples and houses of learned scholars continued to be places of learning. For a long time in this country temples were first school for most people. Even today people have retained this practise of education children first in temples. Many scholars would encourage students to stay with them and learn. Imparting knowledge to students was considered an essential dharma of learned men. The personal connect between learner and teacher is considered best form of education.

In summary the Indian system of education offered the students a variety of choices. One could get preliminary education in their neighbourhood temples. Universities were open for anyone willing to learn specialised topics. If one wanted to get a personal touch to his learning, he could approach a learned guru who would take him under his care. So a student had no complaints about not finding appropriate avenues for learning.

This balanced system of learning was suddenly declared outdated by the foreign rulers. Without understanding the rational of the system they started dismantling the system which was built over centuries. The resulting loss has long term effects. The new system which took its place had single point agenda. To remove people from their roots and transplant them in new culture. For a century and more Indians had to face the discrimination served by the new education system. The latest knowledge was anyway denied to the citizens and they also developed low belief about themselves.

There were notable thinkers during those times who understood the value of well grounded education to foster young minds. The efforts of Rabindranath Tagore is important in this regard. It aimed at creating individuals who are free to pick the area of study and excel in that by removing artificial boundaries. Many other reformers understood the value of integrating Indian cultural values in education. But such efforts were few. The more dominating vision of education was to train Indians to suit the requirement of British rule.

Even after independence this system continued for a while. The legacy system of colonial rule emphasised on ability to pay as a criteria to join the school and also divided learning domains in a strict manner. This resulted in large numbers of students staying outside the schooling system as they could not afford it. Also since government was the sole agency of establishing colleges, their numbers were limited. So many were left to fend for themselves. Also people who joined these places had no exposure to wholesome education. They had to limit themselves to narrow band of knowledge. This was hurting the nation in many ways. The out of school population could not contribute much to the economy in meaningful way. The narrow specialisation offered only limited numbers of experts in a large country like India.

Technology was highly understood as the means of improving the situation. The first tool to be used in a big was was satellite based television. It had the potential of reaching many remote parts of the country. Earlier Radio was used for instructional purposes. This experiment had met limited success. As a visual medium, television offered more. But the much famed experiment to reach remote population of this country and train them thorough television did not meet much success. But the lessons leant from this episode became useful later.

Computers provided a way to overcome the problems of television. Early attempts to use computers in education included automating basic learning methods. Availability of contents in local language became a barrier. But later as computers made their entry into peoples lives in big way, they soon became an important tool in education. With the arrival of Internet, the possibilities of digital education finally arrived.

Today network, machine and teacher are the holy trinity of education. From elementary school to research, computers and Internet have become indispensable. But there is a general consensus that technology is not put to full use in education. When finance, banking and other services have completely automated their processes, educators have been reluctant to let in technology into their domain. The entire system is a loser in this process. It is high time that policy makers and administrators understand the value to technology. Integrating technology with education will not only solve the problems plaguing the system currently but also help it reach higher goals. The need of the hour is not simple fixes but entire transformation of the system. The time is ripe and technologies are mature to start this ambitious but neglected endeavour.

The transformations required in this process can be listed as follows

- 1. Curriculum development
- 2. Content delivery
- 3. Learning assessment
- 4. Development of new skills
- 5. Building digital ecosystem for learning

Curriculum development: The traditional system offered a 'one size fits all' model for learning. The entire student group in a course had to undertake the same subjects.

This was necessary for mass scale education process. But in an era of digital education, courses can be given to students in a personalized manner. Every student will have a different learning curve. It can be satisfied by customizing the learning materials and teaching resources required by each students. By combining artificial technologies with aptitude of individual student, it is possible to tailor make the course content for every student. The personalized learning environment will not only encourage students to understand things more clearly but also make the entire process more engaging.

Content delivery: In traditional teaching, the content delivery is very static. Though the use of ICT tools in classrooms bring certain amount of dynamisms in classrooms, they are essentially limited. But in the world of digital education, the delivery of content can take many forms. From pure talk the various animations and simulations can keep students engaged for a longer time. The facilities available today can even make conduction of lab experiments digital. New breakthroughs in virtual reality and HCI can bring much needed improvements in this regard.

Learning assessment: Digital technologies have evolved to a level where assessment can be done in non-intrusive manner. The explicit testing of students by means of exams and other means is today considered non-efficient. It is understood that student should be tested continuously as he consumes a course. This method is difficult to implement in the real world scenario. But with the digital education in place, assessment items can be designed to measure his learning involvement, engagement and participation. This will help the teacher assess the student better instead of relying only on performance in exams.

Development of new skills: Todays worlds demands everyone upgrades their skills continuously. Learning is not limited to certain periods in life. It is a continuous process. Also the students enrolled for professional courses today are required to learn new skills which are difficult to deliver in real environment. In digital space, such skills can be imparted in an easy manner. collaboration, group working and problem solving are requirements of modern times. In digital world, these skills are learnt as part of process. Educators will have to find ways to integrate these into formal learning methods.

Building digital ecosystem for learning: Learning is not limited to teachers and students. Its success depends on the contributions of various stakeholders. Lawmakers, regulatory organizations and institutions which make law regarding education sectors have a major role to play. Availability of digital infrastructure like machine and network even to the last student will determine the success of this model. The enabling environment will have to change its mindset regarding the digital education. E-Education should not be considered as small part of regular process but an independent entity in itself. Policy makers should give high priority for transformative reforms in this sector to reap benefits from digital technologies.

The following are the specific suggestions which can be considered for transforming the education landscape of the country

- a. Every student should be provided with appropriate digital device for accessing E-Education resources. This device should be changed every three years.
- b. Network access should be improved in mission mode so that remotest parts of the country is connected with Internet with reasonable speed.
- c. Development of learning resources in regional languages. The learning material should include more interactive lessons instead of prose.
- d. The structure of learning should be personalized so that every student will choose their own scheme of study. This must be supported by automated system which recommends the next course based on his previous performances.
- e. At any stage, the student must be able to stop the course with certificate issued about the skills acquired from him till that time. This will help the learners re-skill themselves multiple times when the need arises.
- f. Learning environment should be broadened to include anyone who is interested to deliver a course if he clears certain criteria. This will help bring in motivated and interested persons as teachers.
- g. Integrating companies/NGO's as mentor institutes for imparting practical training.
- h. Periodic up-skilling/re-skilling of teaching staff.
- i. Enabling institutes to offer new courses in quick times depending on market needs.
- j. Converting the traditional time bound degree programs into modular based learning programs to keep them short and relevant.

Education is the only means for a county to progress. All others drivers of growth depend on education. An educated, skilled and empathic populace can make wonders. In this regard, the educators and policy makers have a major national responsibility upon them. IT based learning can bring transformative changes into this sector. It's time to look beyond using short term solutions using computers. The developments in the technical world should be seamlessly integrated with education system for the betterment of our nation. If E-education becomes a reality, India can definitely count itself among developed nations of this world.



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