Innovation in Education

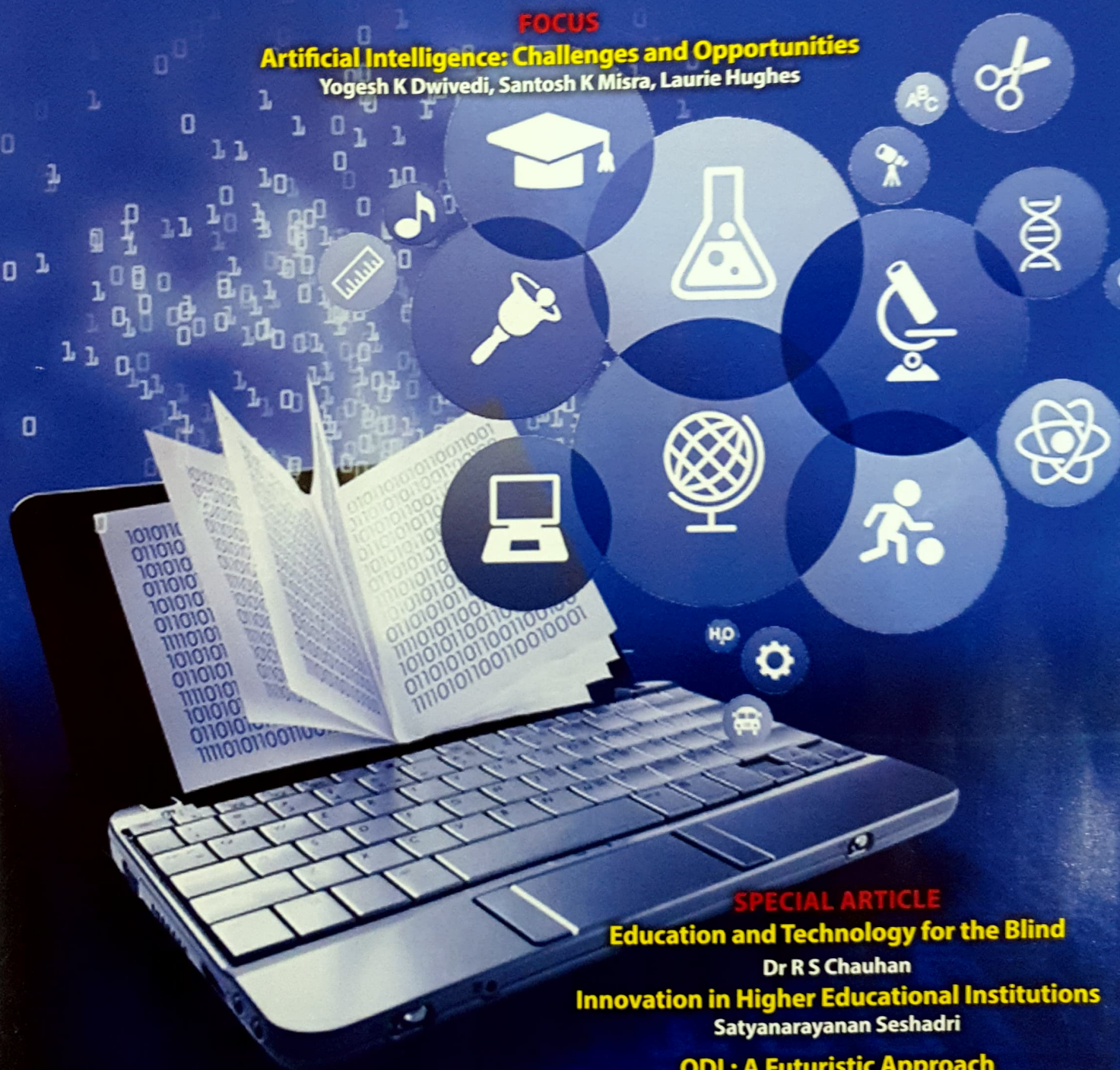**INTERVIEW**
In Conversation with Dr K Sivan

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Artificial Intelligence: Challenges and Opportunities
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SPECIAL ARTICLE
Education and Technology for the Blind
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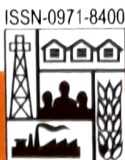Innovation in Higher Educational Institutions
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YOJANA seeks to provide a vibrant platform for discussion on matters of social and economic development of the country through in-depth analysis of these issues in the wider context of government policies. Although published by the Ministry of Information and Broadcasting, YOJANA is not restricted to expressing the official point of view.

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Transforming Education

Education is a virtue which stays with an individual throughout the life. Collectively, educated masses are the think tanks, growth drivers as well as the conscience keepers of any nation. It is the education in multiple streams which brings together a multi-faceted society with a vast spectrum of expertise among its people.

Innovation brings novelty in learning methods and the way education is structured. This also brings better employability and future prospects. Moving ahead from the conventional 'chalk and talk' model of learning to modern digital learning and from passive learning to hands-on experience is the way forward.

The power of innovation lies in its simplicity, applicability and affordability. Innovative models in the field of education have to be sustainable, scaleable and result oriented. They must create an environment of learning which encourages original thinking, creativity, and most importantly, delivering education to the last mile.

Technology is bringing this much-needed innovation in Indian education system. Innovative education fosters sustained learning at an early stage which has the potential to shape the future generations. This can bring a paradigm shift in the way our students learn - from looking to seeking, from mugging up to learning, from copying-pasting to exploring and inventing, from less participatory learning to experiencing and creating. The possibilities are immense when education is teamed up with innovation.

From the Right to Education to *Samagra Shiksha*, education has always been a priority area in devising schemes and initiatives. The Government has also launched several new schemes in higher education to boost research and innovation culture in the country. The Committee for Draft National Education Policy chaired by Dr. K. Kasturirangan has submitted its report proposing an education policy, which seeks to address the challenges of access, equity, quality, affordability and accountability faced by the current education system. The draft Policy provides for reforms at all levels of education from school to higher education. It seeks to increase the focus on early childhood care, reform the current exam system, strengthen teacher training and restructure the education regulatory framework. It also seeks to set up a National Education Commission, increase public investment in education, strengthen the use of technology and increase focus on vocational and adult education, among others.

The public schools and universities are mandated to provide quality education to all. They need to attune themselves with the growing demands of innovative need-based learning. This subsidised education works as an enabler for many with marginalised backgrounds giving wings to their aspirations. The need for the day is to supplement this model of education with public-private partnership. Also, collaboration with global universities in terms of e-learning and exchange programmes will expose the students to the global scenario.

India has been an important seat of learning since ancient times with institutes like Nalanda and Takshila. Today, the country is fortunate to have a youth population like never before. This demographic dividend can be utilised with the right opportunities in education providing them the skill set and experience to aspire big.

Nelson Mandela has called Education as the "most powerful weapon which you can use to change the world." It is the key to eliminating gender inequality, to reducing poverty, to creating a sustainable planet to fostering peace, and to preventing needless deaths and illnesses. In India, innovation is the key to this transformation in the education sector. ❑
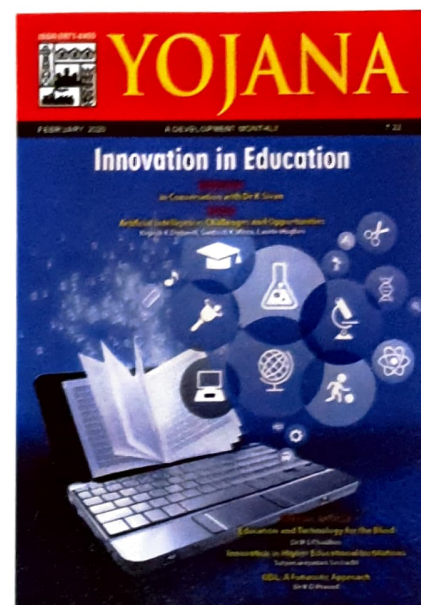
The Vice President on Science Education and Innovation

Yojana Team

The Vice President of India, Shri M. Venkaiah Naidu, called for inculcating scientific temper and nurturing the spirit of inquisitiveness among the children from a young age as science provides answers to challenging problems and contributes to the technological progress of a nation. Addressing the 27th edition of the National Children's Science Congress (30 December, 2019) in Thiruvananthapuram, he said that scientific thinking involves curiosity, reasoning and open-mindedness. "Science education will motivate children to seek truth without any bias or prejudice. It will make children to rely on analysis, questioning and reasoning before arriving at a judgment", he added.

Following are the excerpts from his speech

"I am delighted to be present here at the National Children's Science Congress, the flagship programme of National Council for Science and Technology Communication (NCSTC), Department of Science & Technology (DST), Government of India.

I am happy to note the theme of the Children's Science Congress 2019 is "Science, Technology and Innovation for a Clean, Green and Healthy Nation".

The innovative mind of the youth is the most powerful resource on the earth in this knowledge era. You have the invaluable treasure of creativity and imagination within you. You should draw inspiration from the words of former President A.P.J. Abdul Kalam, who had said in the 'Ignited Minds', "Dream, dream, dream. Dream transforms into thoughts. Thoughts result in action".

Historically, India has been a lighthouse of knowledge. Our Ayurveda system of medicine can be traced back to 5000 BC. Indus Valley civilization had irrigation and sewerage systems as far back as 2500 BC. By 200 BC, South India was making high quality wrought iron and, of course, the invention of 'zero' and contributions to astronomy are well known.

Let us look at some of the invaluable contributions made by our ancestors. Aryabhatta's 'Aryabhattiyam' is considered a seminal work; equally pioneering work is Panchasidhhantika of Varahamihira. Of course, Charaka and Sushruta are known as Fathers of Surgery. Rishi Kanad first spoke of "anu" (atom) as an indestructible particle of matter in Kanada Sutra,

> It is important to inculcate scientific temper in our young minds which will go a long way in the technological progress of this country. We must understand that advancements in science and technology, and innovation will be of no use if they remain in laboratories. All our research and inventions must go beyond labs and try to solve the problems faced by the common people.

The Vice President at 27th National Children's Science Congress.

while Patanjali is considered as Father of Yoga. There are innumerable legendary scientists of ancient India who have enriched the world's scientific treasure.

We need to take pride in their achievements and share the knowledge we have inherited from them with the entire world.

India's contribution to science in modern era is also quite significant. In early 20th century, Prof. Satyendranath Bose's 'Boson', Prof. Subramanian Chandrasekhar's 'Chandrasekhar limit', Sir C.V. Raman's 'Raman effect' and Prof. Jagadish Chandra Bose's 'wireless communication' have earned global recognition. As a matter of fact, there is no dearth of talent in India. The only thing required is to create the right ecosystem for innovation to thrive.

Students must be made aware that the real purpose of science is to make people's lives comfortable and happy. It is important to inculcate scientific temper in our young minds which will go a long way in the technological progress of this country. We must understand that advancements in science and technology, and innovation will be of no use if they remain in laboratories. All our research and inventions must go beyond labs and try to solve the

"Science, technology and innovation are key drivers of economic and social development" : Vice President

problems faced by the common people.

The world is facing the ill-effects of climate change and global warming. We need not only need to find sustainable solutions but we must protect and preserve nature. Science provides answers to challenging problems. Hence, science education is important for the development and growth of a nation.

We are living in an era of unprecedented technological change. This is an age of innovation and scientific temperament from a young age will lay the foundation for innovative thinking. Science education will make children to seek

truth without any bias or prejudice. It will make children to rely on analysis, questioning and reasoning before arriving at a judgement.

Science, technology and innovation are key drivers of economic and social development. They can contribute to the sustainable and inclusive development. Innovative and appropriate technologies can ensure steady improvements in living conditions and ensure rising incomes.

In the global innovation landscape, India continues to be the most innovative economy in the Central and Southern Asia. India can make a true impact on global innovation in the years to come only with your intellectual contributions in innovation and creativity.

Science and technology will be an important factor in transforming India into a developed nation. The young scientific minds assembled here represent a cross section of the 300 million youth of the nation. You should all develop curiosity, knowledge, core competence, determination, perseverance and the courage to pursue your dreams for inventions and make path-breaking discoveries. My best wishes for the success of the scientific pursuits of all the participants from different States. ❑

"It is important to inculcate scientific tempo in our young minds" : Vice President

Source: *Press Information Bureau*

In Conversation with Dr K Sivan

> Today, science and technology are the essential components in the development of any country and they play a major role for improving the quality, safety and security of life of humans. Thus, providing help for inculcating scientific temper in the students assumes added significance.
>
> – Dr K Sivan

Excerpts from Email Interview given to B.K. Kiranmai, our Bengaluru representative

Dr. Vikram A. Sarabhai, the Father of Indian Space Programme had envisioned that the space resources have the potential to address the real problems of man and society. Satellite Instructional Television Experiment (SITE) was the largest sociological experiment in the world. It was on Education. Kindly brief about that.

Indeed, SITE was the largest sociological experiment in the world considering its large outreach. This satellite communications experiment was performed for one year during 1975-76 by ISRO and involved 2400 villages in six states. As part of this experiment, chicken mesh antennas of about 10 feet diameter capable of receiving TV signals directly from a satellite were established along with special TV sets. During SITE, TV programmes on subjects such as health, hygiene, family planning and agriculture were beamed through the American ATS-6 satellite, which revolved round the earth in the 36,000 km high geostationary orbit. This programme exposed our rural folk to the various important issues of day-to-day life and broadened their outlook. Technologically, SITE experience enabled us to evolve our INSAT system for rapid expansion of the country's telecommunication, TV broadcasting and weather monitoring infrastructure.

ISRO has been part and parcel of Tele/distance Education. EDUSAT was one of the pioneering programme. How it was conceived? Which are the other initiatives?

The EDUSAT programme was conceived based on the rich experience we gained in utilising communication satellites for telecommunication and TV broadcasting. First, this valuable experience was gained through the pioneering SITE programme, and later APPLE and INSAT utilisation programme. During the 1990s, many educational and training programmes which enriched our large student and teacher community at different levels were conceived and implemented by

beaming those programmes across the country through satellite. This enabled us to understand the specific requirements of our large student community and paved the way for the conception of EDUSAT programme. During this programme, GSAT-3 or EDUSAT, a dedicated satellite for the educational field, was launched by our GSLV and utilised for enhancing the outreach as well as the quality of the formal as well as informal education sectors. These were mainly intended for semi urban and rural students. Even today, transmission of educational programmes through satellites is continuing based on the EDUSAT experience.

ISRO has been encouraging student community in a big way in developing satellites. What is the present scenario?

To enthuse our large student community, especially engineering student community about spaceflight in general and satellites in particular, ISRO has encouraged them to build micro and nano satellites and has launch them in our trusted workhorse PSLV. Besides, ISRO has helped them in the design, development and testing of those satellites. Till now,

ten student satellites developed by different universities of our country have been launched successfully, providing rich experience to students on intricacies of satellite building, and inspiring them to take up prominent challenges in their professional life later.

Recently DHRUV (An MHRD Programme) was launched from ISRO headquarters. How do you foresee it?

DHRUV, the Pradhan Mantri Innovative Learning Programme, is a unique initiative. The Programme was started to identify and encourage talented children to enrich their skills and knowledge. Gifted children will be mentored and nurtured by renowned experts in different areas in centres of excellence across the country, so that they can reach their full potential. DHRUV acts as a platform to explore the talent of outshining and meritorious students, and help them achieve excellence in their specific areas of interest may it be science, performing arts or creative writing. In this way, these talented students will not only realise their full potential but also contribute to the society in a big way. It is

expected that many of the students selected will reach the highest levels in their chosen fields and bring laurels to their community, State and Nation.

With children drawn from all over the country, the DHRUV programme reflects the true spirit of Ek Bharat Shreshtha Bharat. Not only this, the students will now act as a beacon for the 33 crore students in the country and lay down a unique path for them to follow. I really appreciate the initiatives taken by the Government under the guidance of Prime Minister's Vision. I am glad that DHRUV programme was launched from ISRO headquarters.

You are a son of a farmer and have closely witnessed the villages all along. The Prime Minister's vision is to double the income of farmers by 2022. In that direction, how do you visualise the role of space technology in imparting informal education to farmers?

All along ISRO has been striving to develop and utilise space technology for the benefit of the common man, including the farmer. During SITE programme, TV documentaries on agriculture made

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About Dr. K. Sivan, Chairman ISRO, Secretary DoS

Dr. K Sivan joined ISRO in 1982 and was inducted into PSLV Project. He specialises in Aerospace engineering, Space Transportation Systems Engineering, Launch vehicle and mission design, control & guidance design and mission simulation software design, Mission synthesis, simulation, analysis and validation of flight systems.

He has significantly contributed towards end-to-end mission planning, design, integration and analysis. His innovative contributions, particularly the strategies adopted in mission design enabled the consistent performance of PSLV. This has also proved to be a good foundation for other launch vehicles of ISRO, like, GSLV MkII & MkIII including RLV TD. He is the chief architect of 6D trajectory simulation software, SITARA, which is the backbone of the real-time and non-real-time trajectory simulations of all ISRO launch vehicles. He was responsible for commissioning world-class simulation facility in ISRO for mission synthesis and analysis, which is used for mission design, sub-system level validation and integrated validation of avionics systems in all ISRO launch vehicles. He developed and implemented an innovative 'day-of launch wind biasing strategy' that enables rocket launch on any day, under varied weather and wind conditions. He was the chief mission architect for successful launch of 104 satellites in a single mission of PSLV. He has received many awards including Doctor of Science (Honoris Causa) from selected universities.

Source: www.isro.gov.in

in vernacular languages were beamed to farmers on improving agricultural practices. Later during APPLE and INSAT utilisation programmes, TV documentaries specific to various subjects on agriculture were made and telecast through satellites and they have been continuing. Similarly, our weather monitoring satellites like Kalpana and INSAT-3D have become instrumental in the accurate weather prediction and climate studies which has an important bearing on our farmers. At the same time, our Remote Sensing satellites have enabled our agricultural scientists to detect crop diseases, accurately estimate crop acreage, crop yield, soil quality, which ultimately will bring benefits to the farmers. Thus space technology is helping farmers in many ways.

Tell us about 'Young Scientist Programme' (Yuvika) initiated by ISRO.

Today, science and technology are the essential components in the development of any country and they play a major role for improving the quality, safety and security of life of humans. Thus, providing help for inculcating scientific temper in the students assumes added significance. Today, space technology is virtually touching every facet of life of common man. Yuvika programme is primarily aimed at imparting basic knowledge on space technology and its applications as well as space science to the younger ones with the intent of arousing their interest in the emerging areas of Space activities. The two-week long residential training programme involves invited talks and experience sharing by the eminent scientists, facility and lab visits, hands on training, exclusive sessions for discussions with experts and more importantly, a feedback session. The first batch of 110 selected students representing every state and union territory have already participated in the two week Yuvika resident training programme during May 2019. This task of bringing together students

from different parts of the country helps the task of national integration as well.

ISRO has exhibited its capability of precisely launching (104) satellites. This is because of mastering the techniques of launch expertise which brought global recognition. What are the salient features of forthcoming programmes of ISRO.

In the forthcoming months, we will be launching many communication and earth observation satellites to ensure the continuity of the services provided by such satellites already serving from their orbital home. At the same time, we are striving towards continuously enhancing their service capabilities vis-a-vis their predecessors.

This year, we also endeavouring in earnest to realise Chandryaan-3 mission with a lander and a rover. Plans are also in the offing to launch Aditya-1 satellite for studying the Sun. More importantly, the Honorable Prime minister has already provided us a challenge to realise the Indian Human Spaceflight programme Gaganyaan by 2022. This is a formidable challenge towards which the entire ISRO has geared up and working hard to develop the essential technologies and ensure its success.

India is aiming to be $5 trillion economy by 2024-25. How tools and education in science and technology can contribute?

Tools of science and technology can definitely act like a catalyst to the economic development of the country. In this regard, space technology has already proven its worth by facilitating the rapid development of our telecommunications, TV broadcasting, weather monitoring, educational, healthcare, transportation and banking infrastructure as well as in the planning, implementation and review of various developmental tasks. Now it is even contributing to the governance. In future, with

more broadband communication satellites, more capable earth observation satellites as well as navigation satellites, the potential for more significant development definitely exists. Science and technology education provides the necessary skilled manpower for these tasks and enables the indigenous development of potent tools of science and technology as well as their utilisation. Thus, the role of science and technology education in enabling the proper, adequate and sustainable capacity building is very important indeed.

As part of enhanced outreach programme, ISRO launched 'Samwad with Students' What is the framework of this programme?

Today, it is as important to inspire and galvanise our large student community at different levels, especially at the primary and secondary level, to take up science and technology education more seriously and pursue it with dedication and hard work, as it is to develop various technologies. In this regard, interaction of scientists with students goes a long way in awakening the curiosity and creativity lying inside our student community. With this in mind, as well as with the intention of making our young students proud of their country's achievements in space through the narrative of ISRO scientists themselves, we began this 'Samwad with Students' programme.

I am sure that nothing prevents the present generation of students from even semi urban and rural areas to achieve excellence in their chosen domain in future and assume high offices in that domain, provided they are effectively inspired. With this in mind, I have talked to young student community in many parts of our country and their curious questions have simply overwhelmed me and enabled me to understand the significance of such programmes. ❑

Leadership in Science
Need to Challenge Existing Assumptions

Dr Vikram A Sarabhai

Clearly the development of a nation is intimately linked with understanding and application of science and technology by its people. It has sometimes been argued that the application of technology by itself can contribute to growth. This is certainly true as an abstract proposition, but fails in practice. Witness the state of development and social structure of countries of the Middle East, where for decades resources of oil have been exploited with the most sophisticated technology. History has demonstrated that the real social and economic fruits of technology go to those who apply them through understanding. Therefore a significant number of citizens of every developing country must understand the ways of modern science and of the technology that flows from it.

An ability to question basic assumptions in any situation is fostered by probing the frontiers of science, whatever field one may be engaged in, whether it is Biology, Genetics, Atomic Science or Space Research. It is this ability rather than an empirical hit-and-miss approach which proves most effective in tackling the day-to-day problems of the world. It follows from this that countries have to provide facilities

UNIVERSITY TEACHING THROUGH MOTHER-TONGUE
SCIENTIST AS LEADER OF SOCIETY
BETTER USE FOR ASSAM BAMBOO & COAL

for its nationals to do front-rank research within the resources which are available. It is equally necessary, having produced the men who can do research, to organise task-oriented projects for the nation's practical problems.

One of the inevitable consequences of the introduction of modern technology is a gradual erosion of existing values–a drift towards a man-centred world substituting another in which man is only one element in all of nature. What can replace ethics born out of a religion and a faith which no longer

holds us? You may be surprised that I bring in faith. It implies on my part primarily a recognition that an individual does not exist in isolation. Almost any action that he takes affects the outside world and he has to be aware of how the outside world is likely to react to his action. In other words, he has to have faith and confidence in the type of reaction which he may expect before he can take even the smallest action. If he has to cross the street he must have faith that the driver of a motor car understands the highway code.

It seems to me that a broad understanding of the physical and social environment in which man lives is the most urgent task which faces all humanity. When we come to think of it, lack of insight concerning the environment in which man operates has posed a problem at all times. Just as superstition took hold of an unlightened man who received solace from religion, so can prejudice and a feeling of omnipotence permeate the minds of those who, without bothering to understand science, enjoy the rich rewards flowing from the application of technology. When gimmicks substitute magic, we have produced no essential change in the enlightenment of the total socio political system. On the other hand, today, the consequences of failure

raise the level of enlightenment are more serious to the security of the world than they were ever before. The task of promoting an understanding of science is of course at the core of the problem of education and becomes increasingly more difficult in the context of a population explosion. Acquisition of technology by itself does not contribute to this understanding. One is forced to the regretful conclusion that no society has tackled this problem effectively.

Hinduism has a substratum of philosophy which is fascinating to the modern scientist. The life of the common man reflects many of the values related to this philosophy, unconsciously imbibed through literature, the arts and social traditions. We recognise that perception involves the outside object as well as the observer. We appreciate the subjective character of personal experience. We accept that there are a thousand paths to enlightenment. In relativity we learn of the importance of the frame of reference of the observer and how the results of observation depend on the relative state of his frame with respect to that which he observes. Absolute right and wrong do not exist in the values of those who have understood the Upanishads or those who have followed the concepts of relativity.

When I talk of the scientist in this vein, it is perhaps necessary to point out that I distinguish between one who has merely gone through a formalistic training in science from another whose scientific experience is reflected in his personal values, I think the discussion is meaningful only in regard to the latter.

Science and National Sovereignty

I can illustrate my point concerning science and human values by citing an example which is related to the implications of science and technology to modern warfare and how these affect national sovereignty. As soon as hydrogen bombs could

be delivered with inter-continental ballistic missiles capable of hitting a target to an accuracy of a few miles at a distance of six to eight thousand miles, the implications of a war between adversaries possessing such weapons were too grave for anyone to contemplate armed conflict as a means of solving international disputes. If coexistence between nations formed a part of the "Panchsheel" adopted by Asians from Buddhism, it was also advocated by Premier Khrushchev from an appraisal of the consequences of the balance of terror that exists between the East and the West.

At all times social change has been related to technological developments and in each era new constraints, social and political, are imposed on those who partake of the change. Just as an individual who chooses to live in a community voluntarily renounces the right of throwing a stone anywhere he pleases, which he undoubtedly could exercise in the jungle, so in the atomic age, nations are forced to accept a self-discipline where the freedom of settling disputes through the use of force on a grand scale is no longer meaningful.

But if there are disputes between nations, how are they to be settled? Recourse to negotiations or, if necessary, arbitration through a

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third party or reference to an outside tribunal are the only courses open to us. The provisions of the United Nations Charter referring to collective security imply an acceptance of this. The leaders of the nations who founded the world organisation appreciated what sovereign states could no longer do. These provisions, like many others, have never been effectively implemented. The security of the world and the political settlement of international disputes would be very much assisted if the common man of all nations understood the constraints of the environment in which he lives. In the context of an otherwise bleak international situation, the recent settlement negotiated by our Government on the border issue stands out as a most positive contribution to world peace. In the sniping that has followed from some quarters, we have a remarkable demonstration of the problems of a society which loses faith in Panchsheel and has not yet accepted the ethics growing from modern science.

Perhaps by now you have realised that I am beating about the bush, that I have not talked about leadership in Science. You are right; but I am afraid this fairly long preamble on the significance of science is necessary before I can come to the point. I suggest that we consider leadership in science to achieve the following: First, to foster creativity and an interest in getting to the core of problems, relegating for the moment an empirical approach. Secondly, to provide experience on a wide scale, whereby man can understand the backdrop in front of which he operates and can evolve values and ethics consistent with the real constraints imposed by his environment. Thirdly, to provide the application of science and scientists to the diverse practical tasks of society, that of building the economy, of creating a desirable social environment and to problems of fields such as national policy, security and defence.

Leadership for the development of creative, disciplined individuals, highly motivated to ask basic questions, is not leadership of the type that we normally understand. There is no leader and there are no led. A leader, if one chooses to identify one, has to be a cultivator rather than a manufacturer. He has to provide the soil and the overall climate and the environment in which the seed can grow. One wants permissive individuals who do not have a compelling need to reassure themselves that they are leaders through issuing instructions to others; rather they set an example through their own creativity, love of nature and dedication to what one may call the "scientific method". These are the leaders we need in the field of education and research. It is they who continually challenge existing assumptions on the objectives and methods of education, who concern themselves with providing experiences from which individuals build values and frames of reference, realising the subjective character of perception.

Application to Real Problems

When we come to the application of science to the real tasks of a nation, it is again the interactive type of leader, rather than a boss, who is most effective. He is required to relate himself to the work of others, to give as well as to receive. In our society, scientists encounter a curious difficulty in accomplishing useful tangible results. We place intellectual endeavour on a very high social scale, but believe that those who are engaged in it are unfaithful if they should be interested and concerned with day-to-day practical affairs including their own standard of life and personal security. We look down our research scientists in national laboratories or our academics in universities, if they engage themselves in outside consultation or if they choose to augment their income from projects of a practical nature. We implicitly

> To create conditions for the application of science and scientists to the real problems of society, we have to encourage scientists to interest themselves in problems outside their fields of specialisation.

promote the ivory tower, the alienation of the persons of insight from those who do things. As I have said earlier, I believe that those who can pose basic questions are the one who can best do applied work. For, in most things, locating the real problem goes a long way towards its solution.

To create conditions for the application of science and scientists to the real problems of society, we have to encourage scientists to interest themselves in problems outside their fields of specialisation. Sure enough, one does not expect to give to the opinion of a scientist special weight in fields other than his own. But a person who has imbibed the ways of science injects into a situation a new way of looking at it, hopefully perhaps, a degree of enlightenment with regard to the approach to problems and thus provides leadership which is very valuable.

I am not advocating the getting of scientists into diverse committees. We have plenty of it. I do advocate that we make it possible for them to work in their own fields of specialisation in addition to undertake or collaborate in specific jobs. There are innumerable situations where this is possible at the doorstep of every individual. These could arise in improving curricula and methods of education, in setting up local industry or promoting the productivity of farms, in local and regional planning, in implementing programmes for population control or community development.

Improvement of Science Education

In Ahmedabad, for instance, was started two years ago a Group for the Improvement of Science Education. This Group consists of teachers drawn from schools, colleges and research institutions and some gifted students from these institutions. What brings them together is a strong personal motivation to improve understanding of science and the standard of education. They are ready to question, to innovate, and to share experiences. At each level, wherever they work, they provide the type of leadership which we are considering here.

Through experience we know that conditions of work in India within our own specialised scientific fields rarely match the facilities available in several other countries. Some of us get frustrated striving against heavy odds. Others leave the country. But those that can apply their insights to the problems of the community and of the nation discover an exciting area of activity where effort is rewarding even while the results come slowly.

What should we do to provide opportunity for such leadership? I do not expect attitudes which segregate scientists and intellectuals from the real world to change quickly. I do not believe that in the near future we are likely to provide to scientists and educationists job opportunities and service conditions which are at par with those enjoyed by administrators. But I have a dream, a fantasy may be, that we can provide encouragement to those who will accept responsibilities for real tasks, big and small, even while they continue to do their own work. Moreover that we can secure acceptance of the notion that such task-oriented activity, seriously undertaken and with a well-defined objective to be realised in a given period, should receive financial reward which will ameliorate the total situation in at least one important aspect. Leadership in science may then arise out of a new climate for growth. ❑

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Artificial Intelligence:
# Challenges and Opportunities for India

Yogesh K Dwivedi (1)
Santosh K Misra (2)*
Laurie Hughes (3)

The recent developments in Artificial Intelligence (AI) offer the potential for significant opportunities for industry, governments and society. Within the education sector, AI can be deployed to improve teacher effectiveness and student engagement by offering capabilities such as intelligent game-based learning environments, tutoring systems and intelligent narrative technologies. In this article, the authors aim to outline the opportunities and challenges, particularly focusing on elements of policy that need to be formulated to ensure development and further diffusion of AI-based systems.

Artificial Intelligence can be described as a system's ability to learn and interpret external data via software/algorithms or machines/devices for problem solving by performing specific roles and tasks currently executed by humans.[1,2] The term AI has been used interchangeably with other closely related terms such as expert systems, decision-support system, knowledge-based systems, machine learning, natural language processing, neural networks, pattern recognition, recommender systems and text mining.[1,3]

Although the origin of the term AI can be traced back to early 1950s, the relatively recent advancement in information technology (such as big data, improved computing, storage capability and super-fast speed of data processing machines) and robotics has enabled AI to gain significant momentum in terms of its development, application and use within public and private sector organisations.[1,3]

The recent developments in AI offer the potential for significant opportunities for industry, governments and society, but there are many challenges and subsequent risks as AI-based systems are adopted for an ever increasing
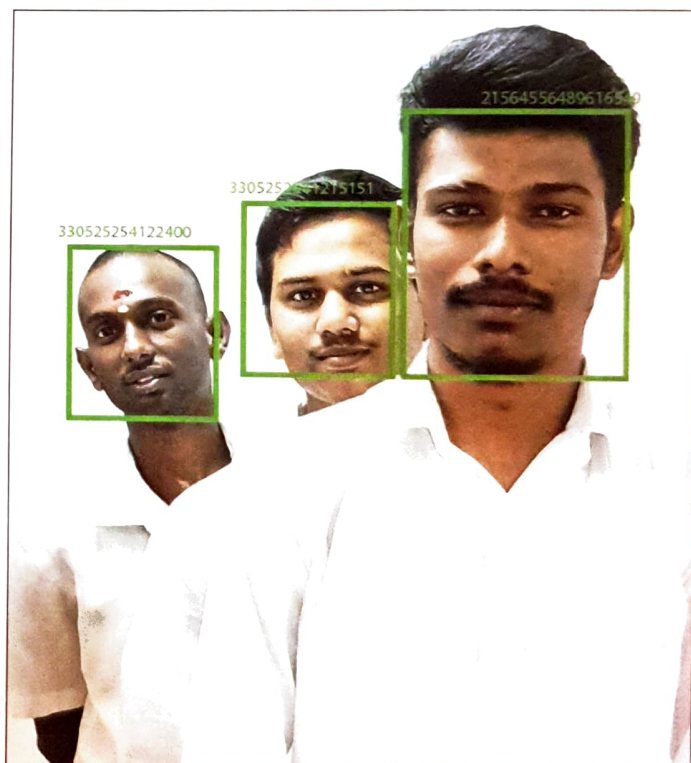
The Tamil Nadu government is using AI-based face recognition for recording attendance

The authors are (1) Professor of Digital Marketing and Innovation and Co-Director at the School of Management, Swansea University, UK. Email: y.k.dwivedi@swansea.ac.uk; (2) IAS and CEO of Tamil Nadu e-Governance Agency, Government of Tamil Nadu, India; Email: misrask@gov.in, and (3) Lecturer at the School of Management, Swansea University, UK; Email: d.l.hughes@swansea.ac.uk.

*Views expressed here are the author's personal and do not reflect that of the Government of Tamil Nadu.

range of tasks and duties. In this article, we aim to briefly outline the opportunities and challenges, particularly focusing on elements of policy that could act as a major roadblock for development and further diffusion of AI-based systems.

Opportunities and Applications

A multitude of opportunities have been presented for the application and use of AI-based systems in various domains particularly to assist where structured decision making is needed.[3] The ability of AI to overcome some of the computationally intensive, intellectual and perhaps creative limitations of humans opens up new application domains within manufacturing, law, medicine, healthcare, education, government, agriculture, marketing, sales, finance, operations and supply chain management, public service delivery and cyber security.[1]

Within the education sector, AI can be deployed to improve teacher effectiveness and student engagement by offering capabilities such as intelligent game-based learning environments, tutoring systems and intelligent narrative technologies.[4] Schmelzer[5] suggested that AI can impact education in three ways. Firstly, AI-enabled hyper-personalisation helps in developing student-specific learning profile and in developing customised learning environments based on ability, preferred mode of learning and experience. Secondly, the use of smart assistants (Amazon Alexa, Google Home, Apple Siri, and Microsoft Cortana) and associated technologies offer significant potential to help students. Universities are already using voice assistants to help answer common questions about campus, student schedules and courses. Thirdly, AI systems can assist educators with secondary tasks such as grading activities, providing personalised responses to students, handling routine and repetitive paperwork and dealing with logistics-related matters.[5] AI-based analytics can help with academic research within various disciplines and potentially transform library processes and staffing requirements with aim to provide a richer user experience.[1]

AI technology can be used within several other sectors for enhancing both efficiency and effectiveness. Dwivedi et al.[1] has elaborated on how AI-based systems can help in achieving United Nations Sustainable Development Goals (SDGs). Specifically, AI can help in achieving good health and well-being goals within rural and remote areas in developing countries where access to medical care is limited. In such scenarios, AI-based systems can be utilised for conducting remote diagnosis supporting doctors to help improve health service delivery. AI-based systems can also help achieve the "Zero Poverty and Zero Hunger" (SDG 2) by assisting in resource allocation for predicting adverse environmental conditions, diagnose crop diseases and identify pests in timely manner to mitigate the risk of catastrophic agricultural events. Similarly, AI-based systems can be used to predict energy and utility demand to help in achieving SDGs such as "Clean water, sanitation" and "Affordable clean energy".

Application of AI in India

Within the Indian context, a number of key indicators from health, education and agriculture sectors are important to highlight as AI is further adopted. India has 0.8 per thousand doctor-to-patient ratio (UK: 2.8, Australia: 5, China: approximately 4). This low ratio implies a heavy workload on Indian doctors. In India, doctors spend just 2 minutes per patient, whereas in the US it is close to 20 minutes. AI could be a valuable assistive tool for doctors in helping reduce their workload and assisting in diagnosis. AI-assisted diagnostics can provide access to quality healthcare for people in remote areas. The per hectare cereal productivity in India is almost half that of China and UK (3000 kg/ha vs. over 6000 kg/ha). There is a significant loss of productivity due to pests and diseases. Within the education sector, India has about 50% less teachers per thousand students when compared with developed countries (India 2.4/thousand vs. UK 6.3/thousand). But there is a silver lining in all this: India has 1.18 billion mobile phone users with 600 million internet users and 374 million smartphone users. It has one of the cheapest data rates in the world ($0.24/GB) and an average data speed of 6 Mbps. These factors open up huge potential for adoption of AI technology in India.

The Tamil Nadu e-Governance Agency has partnered with Anna University to launch a Tamil smart assistant called "Anil". This NLP-based smart assistant provides a step-by-step guide to people in helping them apply online for scores of critical government services. The Tamil Nadu Government has been one of the pioneers in using AI for public service delivery. The agency has recently launched an AI-based agricultural pest and disease identification system and made it available to over half a million farmer families through a mobile app. The farmer clicks an image of diseased crop or a pest and the system processes the image through an AI algorithm to identify the pest or disease and sends a message to the farmer advising the remedial measure. This system is gaining a good field response in which nearly 400 farmers are posting identification requests and getting answers every day.

The Tamil Nadu Government is implementing an innovative use of AI through face recognition for recording attendance. The system is saving more than 45 minutes per day and is freeing up extra time for core educational activities in schools. Within healthcare, AI solutions such as radiographic diagnostics like "detection of internal bleeding in brain from CT scans" are being tried to assist doctors and increase their reach to serve remote areas of India.

AI-based agricultural pest and disease identification system is helping farmers in Tamil Nadu

Job losses – Increasing automation will lead to significant job losses particularly at operational and lower skill levels for repetitive tasks. This critical consequence of AI use will continue to impact all sectors and countries across the world but particularly developing economies where employment opportunities are already limited. This emphasises the need for strategic management of AI transition requiring organisations to carefully consider a number of major challenges: how to select tasks for automation; how to select the level of automation for each task; how to manage the impact of AI-enabled automation on human performance and how to manage AI-enabled automation errors.[1]

Challenges and Shortcomings

There exists a number of challenges and limitations of successfully implementing and utilising AI in both public and private sector organisations. Some of the key challenges are briefly outlined here.

Lack of explainability – Generally AI operates effectively as a black-box–based system that does not transparently provide the reasoning behind a particular decision, classification or forecast made by the systems.[1] This is a major limitation of this technology as it has direct impact on transparency, hence trust and confidence of using decisions made.

Lack of contextual awareness and inability to learn – AI-based systems are good at performing with given parameters and rules. However, they still have major limitations in terms of making decisions where context plays a critical role. Unlike human, AI-based systems cannot learn from their environment. This limits the application of AI to specific types of domains.

Lack of standardisation – AI-based systems that may have utilised different types of technologies/techniques are increasingly being embedded in variety of products and services (for example, smart assistants, modules for enterprise products, widely available cloud libraries and bespoke datascience-driven applications). This poses a critical question: how can the inferences delivered by different AI components be integrated coherently when they may be based on different data and subject to different ecosystem conventions (and the associated quality differences)? Furthermore, organisations face challenges on how to ensure AI and human work together successfully.[1,6]

Lack of competency and need for re-skilling and up-skilling workers – A large number of organisations still lack in-house competency to successfully develop and implement AI-based systems. In such a scenario, organisations utilise specialised consultancy firms which can be very resource intensive. But this restricts organisations having limited resources in using such systems. Similarly, using or working with AI-based systems requires workers to be equipped with a new and advanced set of skills, which is a challenge for government, organisations and individuals.

Lack of trust and resistance to change – Due to above mentioned issues and negative media coverage on the consequences of AI, people are generally apprehensive about its implementation. This poses a major challenge on how to establish trust among workers and stakeholders in the management of resistance to change in adopting AI systems.

Public policy is facing unprecedented uncertainty and challenges in this dynamic world of AI. The velocity and scale of impact of AI is so high that it creates an interesting dynamics in terms of the need to predict its impact and inability to draw boundaries. We have identified six key public policy challenges of AI.

Ethics

Ethics for machines has been an area of immense interest for the researchers. However, defining has proven to be problematic and difficult to make it computable. To tackle this, we need to deal with ethics purely from an AI perspective. There are two dimensions of ethics in AI: (i) Privacy and data protection and (ii) Human and environmental values.

(i) Privacy and Data Protection: Privacy is possibly the top-most concern while using AI systems. Users' sensitive and highly granular data is likely to be stored and shared across the AI network (for example, a person's location for the day based on face recognition and CCTV feeds, food habits, shopping preferences, movies, music etc.).

(ii) Human and Environmental Values: Any AI system has to conform to human value system and the policymakers need to ask: Has the AI system been sensitised to human values such as respect, dignity, kindness, compassion, equity or not? Does the system know that it has a preferential duty towards children, elderly, pregnant women, sick and the vulnerable? An important aspect which needs to be built into AI systems is the overall cost of their decisions on the society.

Transparency and Audit

In the future, many of the AI-based systems could be interacting with humans in fields such as finance, education, healthcare, transportation and elderly care. The technology providers must explain the decision-making process to the user so that the AI system doesn't remain a black box. There exists a legal need to explain the decision taken by such systems in case of litigation. These AI systems must provide an audit trail of decisions made not only to meet the legal needs but also for us to learn and make improvements over past decisions.

Digital Divide and Data Deficit

Since the entire AI revolution has data at its foundation, there is a real danger of societies being left behind. Countries and governments having good quality granular data are likely to derive maximum benefit out of this disruption. Countries where the data is of poor quality or of poor granularity would be left behind in harnessing the power of AI to improve lives of its citizens adversely affecting low-resource communities.
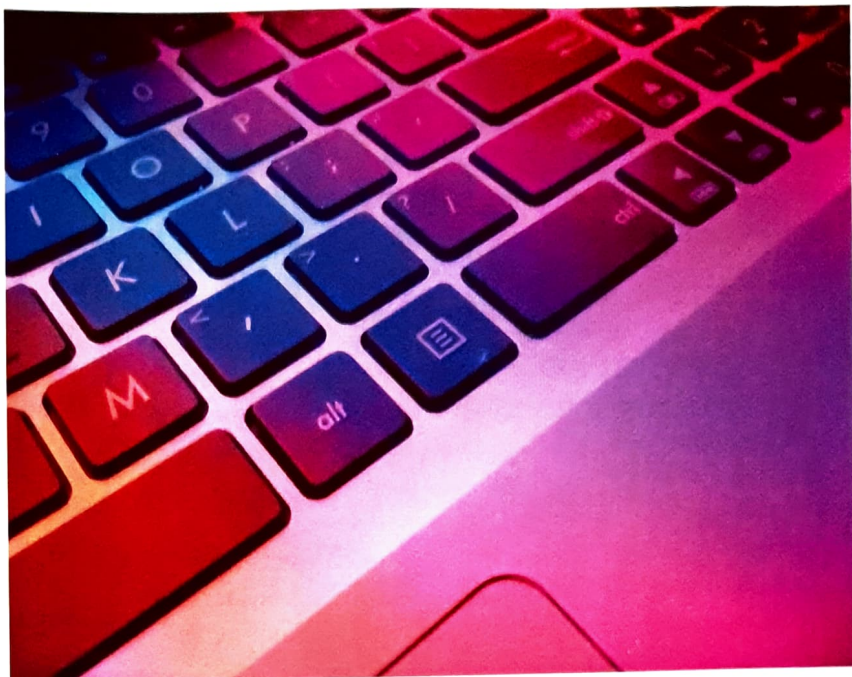
Fairness and Equity

AI can disrupt social order and hierarchy creating new social paradigms, which could damage the social fabric exposing people lower in the bargaining hierarchy with a real threat of exploitation and unfair treatment. This could lead to commoditisation of human labour and chip away human dignity. An AI system designed with equity as a priority would ensure that no one gets left behind in this world. Another key need for autonomous systems is fairness. They must not exhibit any gender or racial bias and they must be designed to stay away from 'social profiling' (especially in law enforcement, fraud detection and crime prevention areas). The recent reports questioning the neutrality of AI systems used by police to identify crime-prone individuals has brought this issue out in sharp focus.

Accountability and Legal Issues

Without AI, any system designed by a human is only a machine under the control of the operator. Therefore, accountability has not been an issue. Almost all civil and criminal liability laws of the world fairly unanimously

The AI can be deployed to improve teacher effectiveness and student engagement.

attribute accountability to the operator, owner and manufacturer of the machine in varying degrees depending upon the facts of the case. However, once machines are equipped with AI and take autonomous decisions, the question of accountability becomes very hard to answer, more so when the algorithms are unknown to the designer.

Misuse Protection

This possibly is the toughest of all six questions. How do we insulate every new technology to prevent it from being twisted for achieving destructive goals? A case in point – how internet proliferated across the globe benefitting billions but also carried along with it a wave of cybercrime, malware, viruses and violent online games which resulted in loss of innocent lives of teens around the world. Autonomous AI systems must be designed for misuse protection. It cannot be an afterthought.

Conclusion

AI as a technology holds tremendous potential for a country like India, which is data rich and has the requisite technological capability to create AI solutions for many of its problems. States like Tamil Nadu have already started deploying AI systems at scale for addressing some of the key challenges in health, education and agriculture sectors. Public roll-out of AI systems needs to address issues of ethics, transparency, audit, fairness, equity,

accountability and misuse prevention. An effective public policy framework for AI along with a practical scorecard[1] would be needed to make this AI revolution work towards an equitable prosperity. ❑

References

1. Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., Misra, S. & Galanos, V. (2019). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*. DoI: https://doi.org/10.1016/j.ijinfomgt.2019.08.002

2. Kaplan, A., & Haenlein, M. (2019). Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence. *Business Horizons*, 62(1), 15-25.

3. Duan, Y., Edwards, J. S., & Dwivedi, Y. K. (2019). Artificial intelligence for decision making in the era of Big Data–evolution, challenges and research agenda. *International Journal of Information Management*, 48, 63-71.

4. Chaudhri, V. K., Lane, H. C., Gunning, D., & Roschelle, J. (2013). Applications of Artificial Intelligence to Contemporary and Emerging Educational Challenges. Artificial Intelligence Magazine, Intelligent Learning Technologies: Part, 2(34), 4.

5. Schmelzer, R. (2019). AI Applications in Education. Forbes. Available at https://www.forbes.com/sites/cognitiveworld/2019/07/12/ai-applications-in-education/#5f93548f62a3

6. Walton, P. (2018). Artificial intelligence and the limitations of information. Information (Switzerland), 9(12) doi:10.3390/info9120332.

DO YOU KNOW?

Artificial Intelligence introduced as a subject in class IX in the schools affiliated with CBSE

Yojana Team

In order to enhance multidisciplinary approach in teaching-learning and to sensitise the new generation, (AI) has been introduced as a subject in class IX from the session 2019-20 in the schools affiliated with Central Board of Secondary Education (CBSE).

'Inspire' module on AI

A twelve-hour 'Inspire' module on AI has also been announced, which schools can take up with the students of class VIII. The study material for teaching AI in classes VIII and IX has already been provided to schools through the CBSE's website (http://cbseacademic.nic.in/ai.html).

Decision to introduce Artificial Intelligence in the States and UTs will have to be taken by the respective Boards. CBSE has collaborated with several organisations, private schools, etc. Over 40 training programmes on AI have been conducted in schools affiliated with CBSE in various parts of the country in which 1690 participants (Principals and teachers) have been trained.

AI is an overarching discipline that covers a broad range of domains and applications, and is expected to impact every field of life in the coming times. Hence, schools may opt for it to make the students AI ready. All CBSE schools are eligible to opt for the AI curriculum.

Schools may apply to opt for this curriculum through http://cbseacademic.nic.in/web_material/Circulars/2019/14_Circular_2019.pdf.

Sources: *PIB, CBSE*

Innovation in Higher Educational Institutions

Satyanarayanan Seshadri

The Innovation centres in institutions fosters team spirit and the ability to work beyond classroom lectures. They prepare the students to take collective ownership of outcomes and work on multigenerational products. Centre for Innovation (CFI) is one such platform for students in IIT Madras which is encouraging them to generate ideas to innovate and invent. With a vision to produce leaders, such institutes are undergoing paradigm shifts. In this article, an attempt is made to trace this transformation at institutes like where transformative start-ups were initiated from solutions developed through research and student projects.

The Indian culture places high emphasis on learning since time immemorial. Premier higher educational institutes in India have always been a gateway to a secure and prosperous life for many. Earlier, the students produced by the premier institutes made a bee-line to destinations in the west in order to broaden their horizons. However, over the last decade a cultural change has begun in these institutes. These temples of learning have been transforming themselves to produce the next generation of leaders who are willing to take-up entrepreneurship, foregoing assured income; thereby creating multiple jobs for the society. At the root of this transformation is the culture of innovation.

Catalysing Student Innovation and Entrepreneurship

Playing with hands, making/breaking stuff has always been a part of childhood and growing up. This need is largely suppressed in the higher secondary classes in school due to competitive exam pressures. It is now being increasingly recognised that a maker space is an integral part of learning. The Atal Innovation Mission (AIM) under the aegis of Niti Aayog is promoting the formation of Atal Tinkering Labs (ATL) in schools to promote this maker space culture.

At IIT Madras (IITM), an after-class activity called the Centre for Innovation (CFI) transformed the students from passive listeners to active learners. The CFI was set up to provide an outlet for the students to try-out their passion without the burden of grades or exams. It started modestly with a seed grant from the 1981 alumni batch which was used for setting up a student-run tinkering lab and a maker space which now serves to empower students who have the passion and motivation to try-out an idea and bring life to it. The centre was set up with the motto *"walk in with an idea and walk out with a product"*. True to its motto, the centre has been producing stellar products displayed to the open public during the annual open house. The ideas and projects range across all domains of science and engineering and spans various stages of development: from breadboard proof of concepts to full-fledged finished products. Recently, the CFI team "Aavishkar" became the only Asian team to qualify and was placed within the top 25 in the hyperloop competition held at SpaceX. Further, the development emphasises on a frugal engineering mindset, where performance is fully met despite costs.

Similarly, there are many student formula racing car teams in the country (such as the IITM Raftar) that routinely participate and win in competitions across the world. These student teams are pushing the boundaries and testing their mettle in emerging technologies such as autonomous vehicles, drones for services, robotics, computer vision, data analytics, genetics etc. Further, centres such as CFI also promote student interest clubs, which also

The author is faculty advisor for Centre for Innovation, Nirmaan pre-incubation centre and Assistant Professor in the Department of Applied Mechanics at IIT Madras. Email: satya@iitm.ac.in

Team Raftar, IITM student formula racing team

enable contextual use of technology by exploring social needs in our country. Some of the themes that are explored include disaster recovery, smart agriculture, rehabilitation, education for the under privileged etc. While the students explore various topics across domains, the higher educational institute serves as the launchpad for these students to dream big and gives them confidence so that they can achieve what they set-out to do.

Innovation as a Catalyst

These innovation centres also fosters team spirit and the ability to work beyond classroom lectures. It prepares the students to take collective ownership of outcomes and work on multi-generational products. While individual merit brought them to these institutes, working on innovation and bringing complete products to life prepares these students for the real world. Innovation comes to life when their inventions are developed further

in the context of the societal needs and wants.

Similarly, the higher educational institutes such as the IITs are also gradually transforming themselves in to research and development powerhouses catering to the needs of the country. The quantum of students pursuing post baccalaureate degrees are now more than those entering

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With over 24 centres of excellence in various domains serving as a fertile ground for idea generations in IITM alone and similar such groupings at various institutes of national importance across the country, these higher education institutes are bursting at seams with solutions waiting from problems.

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at the undergraduate level. Further, many centres of excellence in various domains of national importance has been set up at these institutes. For example, the recently established Robert Bosch Centre for Data Science and Artificial Intelligence (RBC-DSAI) promotes next generation fundamental research in the areas of deep learning, network analytics as well as its applications in various areas such as manufacturing analytics, financial analytics, smart cities, systems biology and health care. The National Centre for Combustion Research and Development (NCCRD) originally set up with interdisciplinary faculty to promote advanced research in the domain of combustion has already started producing niche start-ups in areas like micro-gas turbine, emission sensors, electric planes etc. With over 24 centres of excellence in various domains serving as a fertile ground for idea generations in IITM alone and similar such groupings at various institutes of national

importance across the country, these higher education institutes are bursting at seams with solutions waiting from problems.

Where are the Problems?

The innovation ecosystem can be divided in to four buckets: 1. Ideate, 2. Pre-incubate, 3. Incubate, and 4. Support. Among these, the incubation and support eco-system are highly instrumental. This is especially true in institutes like IITs, where the need to support entrepreneurship has been recognised from early on. Society for Innovation and Entrepreneurship (SINE) in IIT Bombay is one of the earliest incubator in an academic setting in India supporting tech start-ups and socially relevant projects. Similarly, the Foundation for Innovation and Technology Transfer (FITT) in IIT Delhi has been supporting entrepreneurship development since 1992 and has recently come up with an initiative to promote start-ups from PhD thesis research. IIT Madras established India's first university based research park, collocating established companies with start-ups. IITM's incubation cell, hosted inside the research park supports over 200 companies with deep technology focus and with valuation over Rs. 6500 cr. Some of the nationally recognised start-ups from IITM include Ather, one of India's first

IIOT enabled electric scooter, Planys – underwater robotics, Detect – enabling advanced asset monitoring for process industries, AirOK – next generation air purifiers etc. All of these transformative start-ups were initiated from solutions developed through research and student projects at IITM looking for a problem.

However, such transformation is not routine but an exception. There are over 1000 students active in CFI and over 3000 active post graduate researchers in IITM alone and with similar potential numbers across many of our institutes of eminence and national importance. The challenge for our higher educational institutions is to enable routine transformation of these intellectually stimulated individuals to deep tech entrepreneurs and innovators solving societal problems of today and tomorrow. It is often very hard to take a step back from a narrowly defined academic problem definition to identify broad opportunities where the research or technology developed might meet a market need.

Role of Pre-incubation

Incubators (such as CIIE, IITM-IC, etc.) and support systems (such as Keiretsu, TiE, Chennai angels etc. offer mentoring, networking, and funding support for early stage start-ups along with business acceleration support.
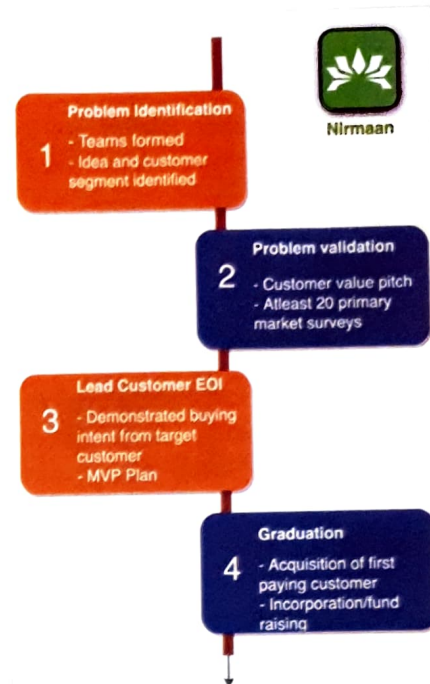
Nirmaan: 4-stage process of pre-incubation

Ideation and technology development is taken care of by the research and tinkering labs. In the digital space, hackathons have become very popular to quickly ideate and come-up with a mock-up of the product or solution for a problem statement. For problems in the clean-tech space, IITM runs the carbon zero challenge (CZC), which aims to unlock potential ideas and support prototype development. However, past experience indicate that many of the hackathons, idea challenges, business plan competitions etc., have not resulted in creation of enterprises. Even in cases where a start-up is established, many struggle in selling and getting funding beyond the early stage seed grant and angel rounds. It is now increasingly being recognised that active support is needed in venture creation at the pre-incubation stage, even more than the incubation support. Pre-incubation can serve as a soft launch for the fleeting entrepreneurial ventures, where the solutions waiting for problems can explore the market for potential customers and the elusive product-market fit. It can also expose the learners to a disciplined approach to customer discovery and venture creation. At IIT Madras, Nirmaan

Team Aavishkar at their hyperloop pod competition in SpaceX, California in 2019

is the pre-incubator, where ideas mature towards incubation. It helps committed teams validate their ideas, approach to market leading to the establishment of a start-up company.

Set-up in the year 2015 to help student teams from CFI, Nirmaan now works with students across the campus to help in their entrepreneurial experience.

The Nirmaan 4-stage process helps with problem identification, validation through primary market research, development of minimum viable product/solution and finally to launch the start-up. It is only at the last stage that the students are encouraged to register their company and take the plunge. Till that time, the pre-incubation facility serves as a sandbox for the teams to try out various approaches to unearth suitable problems that their solutions could solve. Teams are accepted in a cohort mode, which enables peer learning and are further paired up with experienced mentors from our distinguished alumni base.

However, out of many potential ideas from the CFI and other research labs, only a few are considered for the possibility of a start-up. This is primarily due to the fear of the unknown and the uncertainty surrounding the process.

Entrepreneurial Mindset

Recognising the need for a systemic intervention in inculcating an entrepreneurial mindset, IIT Madras had pioneered the post graduate program in entrepreneurship (MS in Entrepreneurship) as early as 1983. However, it was way ahead of its time and had not achieved the desired impact. Recently, with widespread exposure and acceptance of the culture of innovation and entrepreneurship, IITM introduced a first-level elective course in entrepreneurship. The course aims to help students approach innovation and entrepreneurship in a disciplined fashion with periodic testing and

Abhiyaan: Autonomous Ground Vehicle, developed by students at CFI, IITM

validation of assumptions about the product, market need and potential customers. The course turned out to be quite in demand, with over 140 students expressing interest for an available intake of 30. This shows a growing demand for an experiential learning course on entrepreneurship embedded in to course curriculum. With 1000s of crores in research funding spent annually on developing technologies in world class facilities at these institutions, it is imperative that a system to move technologies from lab to market is evolved.

In the United States, the National Science Foundation (NSF) had pioneered the concept of lab to market through the Innovation Corps (I-Corps) program. I-Corps accelerates the economics and societal benefits of NSF funded basic research programs by training scientists and engineers to extend their focus beyond the university laboratory and look at commercialization. The program has resulted in the development of over 600 start-ups, with over 1450 teams trained in 230 universities. Each team consists of faculty and student participants and explores the market potential of the research from their labs. The program has fundamentally changed the perspectives of many faculty members leading to more meaningful outcomes for the society.

A similar lab-to-market program was initiated at IITM with the support of our distinguished alumni Dr. Gururaj Deshpande (Desh) and Mr. Kris Gopalakrishnan. The Gopalakrishnan-Deshpande Centre (GDC)'s I-NCUBATE program enables lab to market transformation through its rigorous 8-week training module developed on the lines of the I-Corps program. Since its launch in 2017, GDC has conducted 7 I-NCUBATE programs, impacting over 70 teams, and training over 400 entrepreneurs and about 60 faculty members across 4 institutions in India. This has led to the creation of about 25 start-ups in this time span. The program also has led to the revelation that there is no market for over 45% of the ideas defined by the participants. However, the biggest impact of the training on faculty will become evident in subsequent research activities performed by them and also in the framing of their academic work in the context of a market or societal problem.

Way Forward

It is heartening to see the rapid pace of the deep tech innovation ecosystem in India. Institutes of higher education, such as the IITs, are adapting to the evolving trend of rapid experimentation and development of technology for the society where it is embedded in. For these institutions, it is no longer sufficient to train and produce good employees. It will be the mandate of these institutions to produce good employers in large numbers that will cater to the aspirations of the next generation India. Our institutions will have to imbibe the spirit of entrepreneurial thinking, which includes rapid adaptation to the societal needs, developing and scaling in resource constrained environments and serving as focal points or nodes of innovation and entrepreneurship, to reach our national goal of a $5 trillion economy. ❑

Education and Technology for the Blind

Dr R S Chauhan

With holistic schemes like 'Samagra Shiksha' providing education to children with special needs, India has witnessed a sea change in inclusive education. However, the country has to go a long way to achieve parity between the visually impaired and sighted children in the area of quality education. The article elucidates the historical perspective of blind education and the way forward with the use of technological innovation.

It was in the early 1950s that a blind boy met a school Principal for admission. He denied his request saying, "How can I give you admission? Our academic environment will be ruined since the students will follow you around; laughing and ridiculing you!"[1]

Almost after two decades, another boy with similar condition approached a prestigious college in the Delhi University for admission in undergraduate course. It was a very hot day in June, 1970. He was confident on the basis of his marks and preparation for the purpose. The Principal said from across the wide table, "Well, our classrooms are located on the first floor". The boy was already prepared to respond and said, "Sir, even at the school, my classroom was at the first floor." He replied, "Fine, I have to consult the University authorities for admission in your case."

Spreading a typewritten sheet before the gentleman, he said with confidence, "Sir, look here, "The Inter-University Board resolved in its 33rd meeting that blind will be eligible to get admission in all colleges among other facilities on the basis of their merit."

This defence annoyed the Principal and he said, "You talk like an advocate!"

He therefore went out of the gate

File Photos

1. Miss Annie Sharp was instrumental in launching a facility in Amritsar for the blind in 1887;
2. Lt. Col. Sir Clutha Machenzie was appointed OSD in 1942 for rehabilitation of the Indian War Blinded during the World War I.

The author is former Head, Department of Special Education & Disability Studies, National Institute for the Visually Handicapped (NIVH), Dehradun. He lost his eyesight at the age of four due to small pox. Email: chauhan.ddn@gmail.com

and stood on the footpath dejected and demoralised. Coincidentally, a young man came and inquired about his problem. On finding the reasons, he guided him to another college and found out his roll number for the interview. He was selected in the interview and got admission at Kirorimal College. The rest is history as the saying goes.

This whole incident is as vivid and fresh in my mind as if it happened yesterday! The kind young man who helped me was a hearing impaired person who eventually became my friend.

It is true that our history of the last millennium is etched with the footprints of a few savants like Soordas, Gattu Maharaj, Swami Birjanand, Swami Gangeshwaranand, etc. But they are a class by themselves, a product of their extraordinary intellectual prowess, exceptional endeavour and perseverance. Towards the fag end of the 19th century, many efforts for educating common blind were taken. Thus, we can categorise the educational services for blind into three stages: Pre-Independence era, Post-Independence era and Modern era commencing with the 21st century.

Miss Annie Sharp, an Anglican was instrumental in launching a facility in Amritsar for the blind in the year 1887. It imparted basic training in bead work, reed work and reading of religious scripture.[2]

It led to establishment of other such institutions at a very slow pace in different parts of the country out of pity, charity and sometimes by a sense of educating them in a limited way. Ms. Jane Askwith was an educationist herself, who desired to impart good education and training to visually impaired in order to make them self-sufficient. That facility commenced in 1890 and Ms. Askwith continuously expanded and improved it till she left for England.[3] On the other hand, Miss Millard gathered some poor blind from some villages during the drought and launched a facility for them at Bombay in 1900 for their care. It blossomed into a fine educational institution later on.[4] Gradually, the number of such institutions continued to increase. It went up to 32 in undivided India by 1944 according to a Government report.[5] Only a few of them could be considered educational facilities. Others ranged from medieval asylums for the homeless to shelters. The major features of this era were:

1. Institutions were limited to primary level only.

2. Lack of an all India Braille code:- Braille is a dot-based tactile system of reading and writing used by visually impaired.

3. Absence of Braille printing unit in the country.

4. Lack of production facility even for simple equipment needed by blind.

The year 1947 turned out the watershed year for the entire country as well as for the blind coincidentally. It was in the month of April, 1947 that a small unit for education and rehabilitation of visually impaired was established in the Ministry of Education (MoE). The Unit came in to existence as per the recommendations contained in the Government of India Report on Blindness, 1944. Lt. Col. Sir Clutha Mackenzie played a major role in writing this report on the basis of his experience as a blinded soldier of World War I. The Government appointed him as an Officer on Special Duty (Blindness) in 1942 for rehabilitation of the Indian War Blinded during the ongoing war and to submit a report for education and rehabilitation of Indian blind of different categories.[6]

The Government took a historic decision for the benefit of Indian and other blind living in various countries. They requested the UNESCO for initiating action for uniformity of Braille codes in the world based on certain principles. After international discussion, the UNESCO finalised principles for drawing Braille codes in different languages. India adopted the uniform Braille codes for various languages in India in 1951. It was truly a historic development of immense importance for future progress. This single decision was more significant than any other taken earlier.

Having overcome the major problem of lack of uniform Braille code, the Government established the

first-ever Braille printing plant named the Central Braille Press at Dehradun in 1952. The Government started to provide financial assistance to four regional Braille presses from the following decade. The Central Braille Press was followed by Manufacturing of Braille Appliances unit set up in 1954 to produce and provide simple equipment like Braille Slate and Stylus, Arithmetic Board and the required types, some recreational items, needle threader and folding white canes, etc.[7]

With the availability of uniform Braille code, Braille press and simple equipment though in a limited measure, the number of schools for the blind registered a rapid growth around the same time. In addition to the NGOs, Government set up its first school called Model School for Blind Children in 1959 at Dehradun. Some state governments also came forward to meet the demand. Thus, the number of such institutions reached 115 by 1964.[8] It went up to 250 by 1995.[9]

Now, a vital missing component for education was quality teachers in this sector. The Government bridged this gap by launching a scheme for preparing special teachers, though feeble efforts were made earlier as well. The central scheme set up four Regional Centres for the Teachers of the Blind commencing the programme in 1960. That decade witnessed the establishment of such centres at Bombay, Delhi, Calcutta and Madras respectively. This training programme was augmented in a small measure by limited opportunities made available to Indians in some foreign countries.[10]

A paradigm shift was witnessed in 1974 when India launched the Integrated Education for Disabled Children (IEDC) scheme to be implemented through govt. schools. It provided financial assistance for special teachers, equipment and educational material to individual students covered under the scheme. The programme made a slow progress during the first decade.[11] However, all of these measures and the scholarships for disabled children and adolescents certainly provided them opportunities at primary, secondary and higher level, of course, only a small number could benefit.[12] The following decades were to witness a much faster growth.

With a view to make the matter easy, the focus has been and will be on education. The IEDC Scheme was transferred to the MoE in 1982 and a cell was set up at NCERT, New Delhi which developed into a Department later. The IEDC Scheme attracted many more children following its modification in 1987 and 1992 along with some other measures. The MHRD began to include the education of the PWD children also in the mainstream policy from the National Policy on Education, 1986.[13]

A combined force of PWD became conscious of their rights, their endeavour to organise themselves into pressure groups and willingness of India to accept and implement the United Nations (UN) resolutions in this sector, which generated momentum for faster progress. Observance of International Year of Disabled Persons (IYDPs) 1981 as declared by the UN, the UN Decade for the Disabled 1983-92, Asian and Pacific Decade for the disabled declared by the ESCAP in its Beijing meeting in 1992, are a few examples. Following the IYDP 1981, a large number of NGOs, autonomous bodies as well as governments became more active for a variety of reasons. Some universities like BHU and Kurukshetra University, etc. launched programmes on special education. With a view to ensure a minimum standard, the Government passed the Rehabilitation Council of India (RCI) Act, 1992. India enacted the Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995 to give effect to the decisions taken in the Beijing meeting in 1992. The Act provided for education in special as well as normal school and informal settings, research and resources required for the disabled among other facilities. Recognising the prevailing environment, this law allowed free and universal education for the disabled up to the age of 18 years.[14] Though called 'Toothless Tiger', even this Act empowered the people in question greatly.

The IYDP 1981, the UN decade for the PWDs and ESCAP declarations, etc. made possible to have imported and/or indigenously developed assistive technology, including high-tech items, for education in India. Some of the most important ones were interpoint slate, mechanical writers, various types of gadgets for audio-material, screen readers for using computers effectively, software and high-speed Braille printers capable of producing thousands of pages in a day. It was truly fascinating and revolutionary. After the Salamanca Statement of UNESCO in 1994 framed by a rights-based perspective on education, the Government of India and others made continuous endeavour to prepare and launch programmes on education for Children with Disabilities at par with other children. Of course, special resources and arrangements were made to make this paradigm shift successful.

Commencing with District Primary Education Programme with the World Bank assistant in mid 1990s in the selected districts, the 21st century witnessed the Sarva Shiksha Abhiyan (SSA) and Rashtriya Madhyamik Shiksha Abhiyan (RMSA) taking shape and being implemented on all India basis. Both the Abhiyans contained necessary components for motivating visually impaired children. They had the financial assistance for children, resource material and special teachers for teaching tool subjects. These schemes have since been merged and renamed as 'Samagra Shiksha' (Inclusive Education for Children with Special Needs). Though the word 'Disability' has been replaced by the phrase 'Special Needs' but it has far-reaching significance. For instance, girls from the tribal communities or minorities are also children with special needs and they must get due attention. However, interventions required for such children are very different as well as the difficulty

India enacted the Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995 to give effect to the decisions taken in the Beijing meeting in 1992. The Act provided for education in special as well as normal school and informal settings, research and resources required for the disabled among other facilities.

level is very high when educating visually impaired children. Therefore, educational needs of children with greater disability have to be kept in mind and met adequately.

Moreover, Assistance to Disabled Persons for purchase, fitting of aids and appliances Scheme extends financial help for purchasing required gadgets. Through other initiatives, high-speed Braille printing plants have been financed in the country. If they are used properly and logically, there can be no dearth of Braille material at any stage.

Not only the Braille producers of different capacities, magnifiers for low-vision children, even paperless Braille reader and writer have come recently in our country. The paperless reader writer is an electronic gadget where the data is stored on an SD card. It is possible to read Braille line by line by pressing a button. If needed, one can use it for writing as well.

With a view to meet the stipulations of the UN Convention on Rights of Persons with Disabilities (UNCRPD), Indian Parliament enacted the Rights of Persons with Disabilities (RPD) Act, 2016. The Act provides another category among the blind called 'Low Vision'.

India has witnessed a sea change in this field and lot of progress has been made. However, the country has

to go a long way to achieve parity between the visually impaired and sighted children in the area of quality education. The parity is certainly desirable for visually impaired individuals and their families but it is even more desirable to make our society inclusive. ❑

Endnotes

1. Verma, V.P. (2008). Ek Yatra Smirtiyon Ki. Allied Publishers Pvt. Ltd. Delhi.

2. Chauhan, R.S. (1994). Triumph of the Spirit. Konark Publishers. New Delhi.

3. Chauhan, R.S. (1992). Chronological Development of Educational Services for the Visually Handicapped, In R.S. Chauhan (ed.), Handbook for the Teachers of the Visually Handicapped. National Institute for the Visually Handicapped. Dehradun.

4. Ahuja, S.C. (1987). Pioneers in the Education and Rehabilitation of the Blind in India. Paper present in National Conference on Centenary of Services to the Blind, 4-6 January New Delhi.

5. Report on Blindness in India. (1944). Govt. of India. New Delhi.

6. Fifty Years of Work for the Blind. (1952). Govt. of India. New Delhi.

7. Manual on Bharati Braille. (1980). National Institute for the Visually Handicapped, Dehradun.

8. Pandey, R.S., Advani, L. (1995). Perspectives and Disability Rehabilitation. Vikas Publishing House. New Delhi.

9. The Programme of Deputing Indian Teachers of the Blind for the Perkins Teachers Training Course - A Follow-up Study (1978). National Association for the Blind. Bombay.

10. Scheme of Integrated Education for the Disabled Children. (1992). Ministry of Human Resources Development. New Delhi.

11. Scholarships for the Disabled Persons. (1982). Ministry of Social Welfare. New Delhi.

12. Advani, L. (1987). Origin and Development of Services for the Blind, In Lal Advani (ed.), Manual of Office Management Training. All India Confederation of the Blind. New Delhi.

13. The Persons with Disabilities (Equal Opportunities, Protection of Rights And Full Participation) Act, 1995. (1996). Govt. of India. Legislative Department. New Delhi.

14. The Rights of Persons with Disabilities Act, 2016. (2016). Ministry of Law and Justice. New Delhi.

Quality Education for Weaker Section and Disadvantaged Groups

Yojana Team

The Right of Children to Free and Compulsory Education (RTE) Act, 2009, entitles every child of age 6 to 14 years to a right to free and compulsory education in a neighbourhood school till completion of elementary education. Section 8(c) of the RTE Act, 2009 provides that the appropriate government would ensure that the child belonging to weaker section and belonging to disadvantaged group are not discriminated against and prevented from pursuing and completing elementary education on any grounds. Further, Section 12(1)(c) of RTE Act, 2009 provides that all specified category schools and unaided schools shall admit at least 25% children belonging to weaker section and disadvantaged group in the neighbourhood in class I and provide free and compulsory elementary education till its completion.

Steps Taken to Ensure Education of Children with Disability

Samagra Shiksha, an overarching programme for the school education sector extending from pre-school to class XII, aims to ensure inclusive and equitable quality education at all levels of school education. It envisages the 'school' as a continuum from pre-school, primary, upper primary, secondary to senior secondary levels. Bridging gender and social category gaps at all levels of school education is one of the major objectives of the scheme. The scheme reaches out to girls, Children with Special Needs (CWSN) and children belonging to Scheduled Castes (SC), Scheduled Tribes (ST), minority communities and transgenders. The focus of major interventions under the Scheme includes provision of RTE. Entitlements include free uniforms, text books, special training of out-of-school children etc., provision for inclusive education of Children with Special Needs (CWSN) and vocational education among others.

The **'Padhe Bharat Badhe Bharat'** (PBBB) is a sub-programme of erstwhile Sarva Shiksha Abhiyan (SSA) which is continued under the new integrated scheme Samagra Shiksha to ensure quality at the foundational years of schooling. The objectives of the programme are to promote early reading and writing with comprehension skills in children, and also basic numeracy skills. States/UTs are implementing PBBB in their respective States/UTs using multiple strategies and approaches. These include adoption of NCERT model of early reading, provision of supplementary reading material, and development of State specific models for early Maths and early reading.

The **Navodaya Vidyalaya Scheme** provides for opening of one JNV in each district of the country to bring out the best of rural talent. Its significance lies in the selection of talented rural children as the target group and the aim to provide them quality education comparable to the best in a residential school system.

Promoting Vocational Educational in Backward Regions

The government has recognised the requirement for spreading vocational education throughout the country including backward regions. Presently, there are 188 Community Colleges, 289 Institutes and 68 DDU Kaushal Kendras functioning under University Grants Commission (UGC) and operating vocational education in various sectors. State governments can offer vocational education through their institutional network as per UGC guidelines. There are various steps already been taken by the government to promote vocational education throughout country, including backward regions.

1. Developing internship/apprenticeship based degree courses in sectors like Retail, Logistics, Media and Entertainment, etc.

2. Increasing number of institutions offering B.VoC courses in the country.

3. Aligning the content of existing skill courses with National Skill Qualification Framework (NSQF).

The Draft National Education Policy 2019 is presently under consideration. The revision of curriculum, syllabi and textbooks for school education would depend on the finalisation and approval of the New Education Policy. ❑

Key Initiatives in Education

Yojana Team

The Government of India initiated the process of formulating a New Education Policy. It aims to meet the changing dynamics of the requirements of the population with regard to quality education, innovation and research to make India a knowledge superpower by equipping its students with the necessary skills and knowledge. Also, to eliminate the shortage of manpower in science, technology, academics and industry. Dr. K. Kasturirangan Committee has submitted the Draft National Education Policy.

In pursuance of the Union Government's vision for 'Transforming India', Ministry of Human Resource Development (MHRD) took a leap forward in transforming the education sector. The Government has launched several new schemes in Higher Education Department to boost research and innovation culture in the country. Department of Higher Education of the Ministry has released a five-year vision plan named Education Quality Upgradation and Inclusion Programme (EQUIP). SWAYAM 2.0, Deeksharambh and PARAMARSH are some of the other major schemes of Department of Higher Education has initiated.
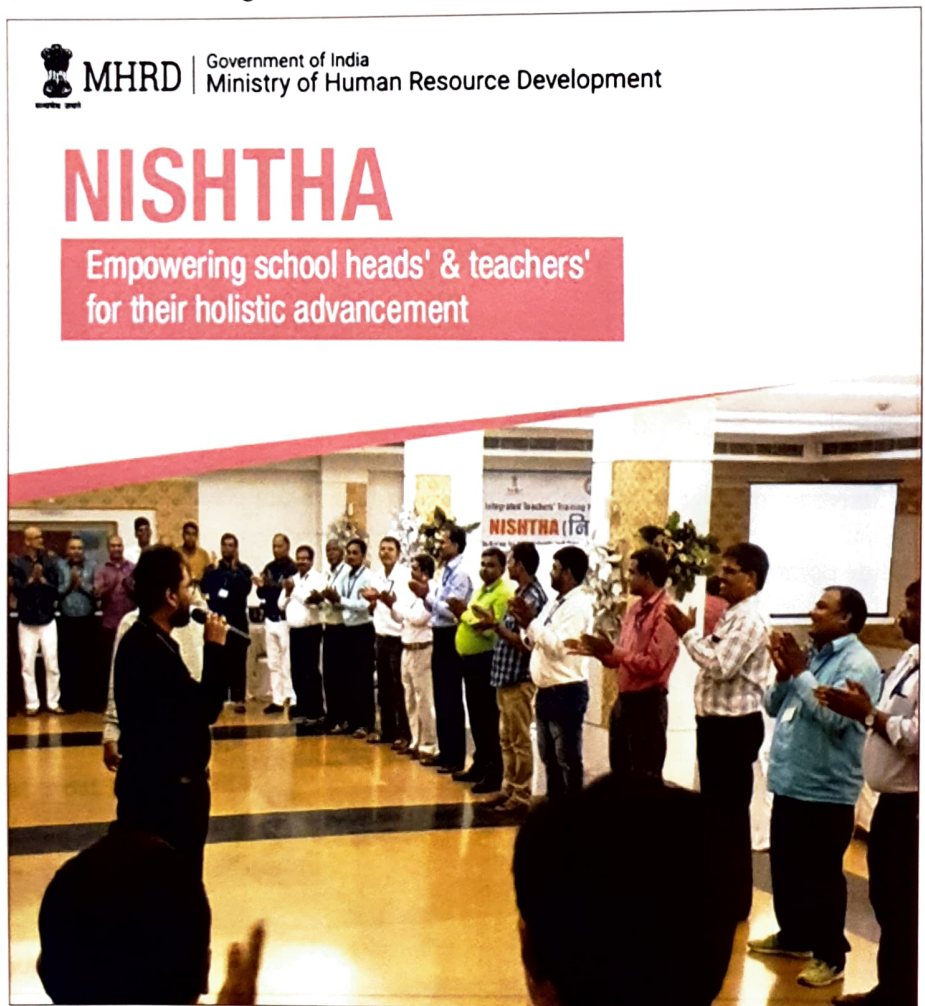
Key Reforms in School Education

NISHTHA

A National Mission to improve learning outcomes at the elementary level through an Integrated Teacher Training Programme called NISHTHA – National Initiative for School Heads' and Teachers' Holistic Advancement was launched. This integrated programme aims to build the capacities of around 42 lakh teachers and heads of schools, faculty

members of SCERTs and DIETs, Block Resource Coordinators and Cluster Resource Coordinators. The initiative is first of its kind wherein standardised training modules are developed at national level for all states and UTs. However, states and UTs can contextualise the training modules and use their own material and resource persons also, keeping

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NISHTHA

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in view the core topics and expected outcomes of NISHTHA.

DHRUV

The Pradhan Mantri Innovative Learning Program (DHRUV) was launched to identify and encourage talented children to enrich their skills and knowledge. The Programme 'DHRUV'will act as a platform to explore the talent of outshining and meritorious students, and help them achieve excellence in their specific areas of interest may it be science, performing arts, creative writing, etc. These talented students apart from realising their full potential are expected to contribute to the society in a big way.

Shagun

One of world's largest Integrated Online Junction for – School Education 'Shagun' (URL: htpp://shagun.govt.in/) is an over-arching initiative to improve school education system by creating a junction for all online portals and websites relating to various activities of the Department of School Education and Literacy in the Government of India and all States and Union Territories. About 1200 Kendriya Vidyalayas, 600 Navodaya Vidyalayas, around 20000 CBSE affiliated schools, 30 SCERTs, 19000 organisations affiliated with NTCE among others are integrated with Shagun. Report cards of 15 lakh schools all over the country will be available on the newly created

junction. The portal seeks to connect approximately 92 lakh teachers and 26 crore students. Common people can directly give their feedback about schools which will further increase the public participation and will ensure accountability and transparency.

Unified District Information System for Education Plus (UDISE+)

To ensure quality, credibility and timely availability of information

from all the schools in the country, the revamped UDISE+ has been launched. The GIS based mapping portal gives information about location of more than 15 lakh schools in the country along with some salient highlights. The Data Analytics portal gives information about the aggregate position of the school.

Digital Infrastructure for Knowledge Sharing (DIKSHA) 2.0

DIKSHA Portal was launched in 2017 for providing digital platform to teachers giving them an opportunity to learn and train themselves and connect with teacher community. This initiative has been taken forward to enhance coverage and improve the quality of e-content for teachers. Till date, more than 67000 of content pieces have been hosted on DIKSHA and more than 10.5 crore scans have been affected.
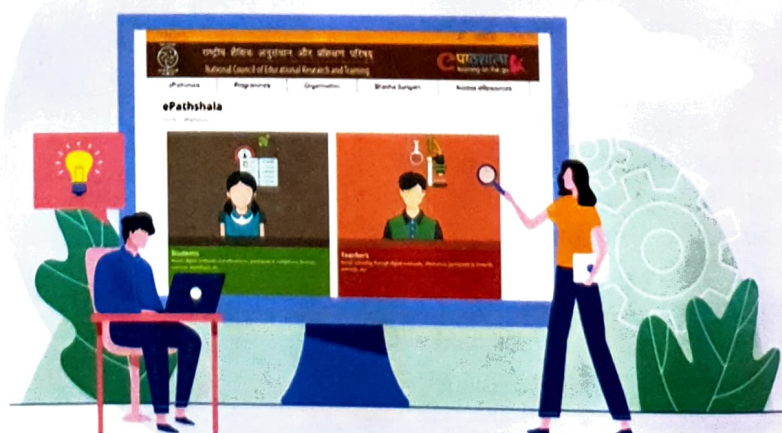
Operation Digital Board (ODB)

The aim is to provide by March 2023, two smart classrooms for

every Secondary/Senior Secondary schools in 1,01,967 Government and 42,917 aided schools in all States/UTs and 1704 KVs and NVs making a total of 1,46,588 schools.
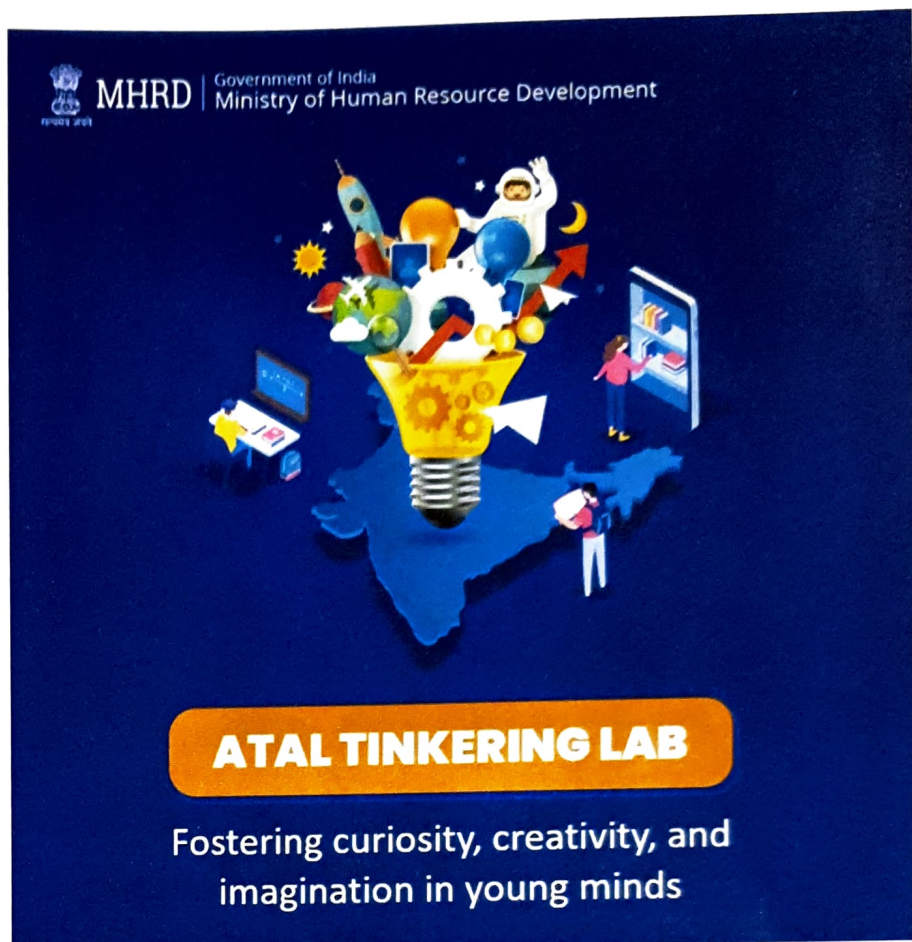
Key Reforms in Higher Education

Five-year vision plan 'Education Quality Upgradation and Inclusion Programme' (EQUIP)

The Department of Higher Education of MHRD has released a five-year vision plan named 'Education Quality Upgradation and Inclusion Programme' (EQUIP). This report sets out to deliver further on principles of access, inclusion, quality, excellence and enhancing employability in Higher Education. EQUIP is a vision plan aiming at ushering transformation in India's higher education system by implementing strategic interventions in the sector over five years (2019-2024). EQUIP has been It has been prepared based on reports of 10 expert groups constituted to deliberate upon important aspects of Higher Education.

Institution of Eminence (IoE)

Ten institutions in public sector and 10 institutions in private sector have to be declared as IoE. Public Sector institutions are IISc Bangalore, IIT Delhi, IIT Bombay, IIT Madras, IIT Kharagpur, University of Hyderabad, Banaras Hindu University, University of Delhi, Jadavpur University and Anna University. Each public institute (IoE) will be eligible to receive Rs. 1000 crore during next 5 years. Private institutions are BITS Pilani, MAHE Karnataka, Jio Institute, Amrita Vishwavidyapeetham, Tamil Nadu, Vellore Institute of Technology, Tamil Nadu, Jamia Hamdard, New Delhi, Kalinga Institute of Industrial Technology, Odisha, O.P. Jindal Global University, Haryana, Bharti Institute, Satya Bharti Foundation, Mohali and Shiv Nadar University, Uttar Pradesh.

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SWAYAM 2.0

SWAYAM 2.0 is initiated with enhanced features and facilities to offer online degree programmes through SWAYAM by top ranking universities.

SWAYAM PRABHA- DTH Educational Channels

It is a project to telecast high-quality educational programs through 32 DTH channels on 24x7 basis to reach out to student/learners of India with wide reach and minimal cost. It aims to support those students who do not have good learning options like lack of teacher or internet etc. It also aims to provide dedicated channels 'IITPAL' to assist the students of XI and XII standards aspiring to join premier educational institutions in the country.

Implementation of Quality Improvement Programme

- **Deeksharambh**: A guide to Student Induction Programme has been launched. Total 319 HEIs have implemented the Student Induction Programme.

- **Learning outcomes based curriculum framework (LOCF) revision:** New curriculum in 16 subjects which is based on LOCF has been uploaded on UGC website to facilitate universities to revise the curriculum.

- Use of ICT based learning tools for effective teaching learning process: 125 universities have come on board for accepting credit transfer done through SWAYAM platform.

- **Scheme for Trans-disciplinary Research for India's Developing Economy (STRIDE):** Launched for promoting quality research by faculty and creation of new knowledge.

- **PARAMARSH-** A scheme to mentor institutions seeking National Assessment and Accreditation Council accreditation. ❏

Source: *MHRD*

Open & Distance Learning: A Futuristic Approach

Dr K D Prasad

The article discusses the use of rapid technological developments with a focus on the provision of life-long and flexible learning pattern. It also highlights how Open & Distance Learning can be made more interactive through the use of technology taking it to the last mile.

Open & Distance Learning (ODL) is distinct because of its teaching methodology. In traditional mode of imparting education emphasis is given on interaction, where the learners and teachers are both present physically and can interact in real time. But in ODL the presence of learners is not mandatory except in practical-based programmes and ultimately communication takes place in one-way leading to dropouts in number of cases. Information Technology (IT) has affected every aspect of human activity and has a potential role to play in the field of education and training, especially in Distance Education (DE). Accurate and right information is necessary for effective teaching and learning and information technology[1] is "set of tools that can help provide the right people with the right information at the right time."

Information rich societies are now controlling the information throughout the world. Information encompasses and relies on the use of different channels of communication, called Information and Communication Technologies (ICT)[2] and incorporates better pedagogical methods. Branson (1991) stated that students learn not only from teachers but also learn along with the teacher and by interacting with the peer group. Information Technology "is any computer-based tool that people use to work with information and support the information and information processing needs of an organization".[1]

ODL is defined by the Commonwealth of Learning (COL) as "a way of providing learning opportunities that is characterised by the separation of teacher and learner in time, or place or both time and place; learning that is certified in some way by an institution or agency; the use of variety of media including print and electronic; two-way communications that allow learners and tutors to interact; the possibility of occasional face-to-face meetings; and a specialized division of labour in the production and delivery of courses." In Distance Education teaching is done with a variety of "mediating process" used to transmit content, to provide tuition and to conduct assessment or measure outcomes.

This article discusses about the use of rapid technological developments with a focus on the provision of life-long and flexible learning pattern. It also highlights how ODL can be made more interactive through the use of technology like managing the virtual classroom with the use of the internet, development
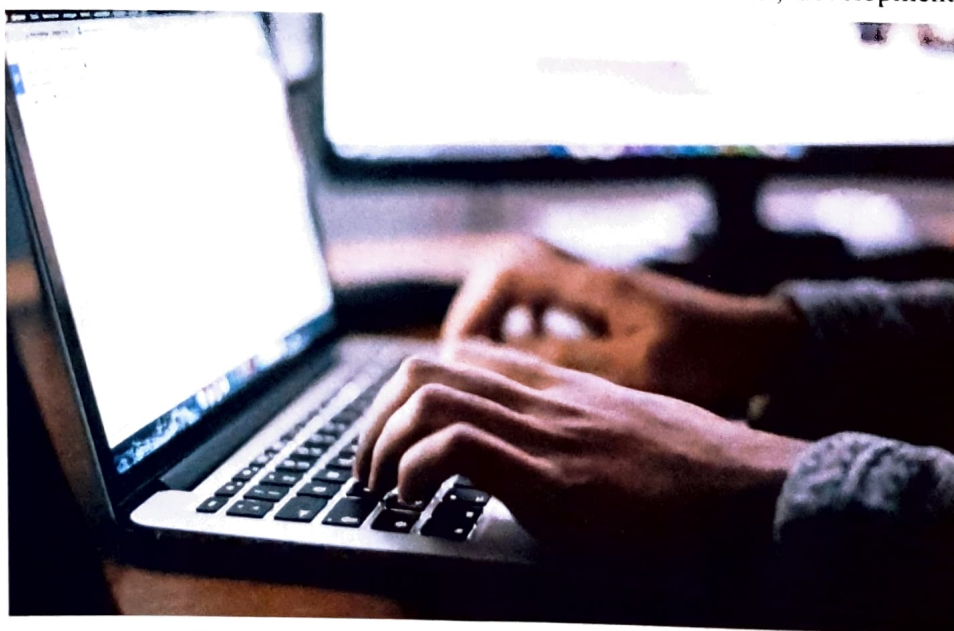
The author is Director, Campus Placement Cell, IGNOU, New Delhi. Email: kdprasad08@gmail.com

of web-based hypermedia, learning through computer-aided interaction, use of interactive teleconferencing and radio counselling, etc. In the virtual classroom the learners and the teachers meet in the cyberspace, a question-and-answer session follows. The learners are required to go through the self instructional materials (SIMs) before the class. This method not only helps the students to learn more but it also facilitates more interaction between the learner and the teacher. These include wireless communications, the information highway, asynchronous mode, integrated services digital networks (ISDNs), multimedia applications, personal digital assistants, artificial intelligence and virtual reality.

The web-based study helps the learners and teachers to access the information at their own choice of time and convenience. It is necessary for the learners to inculcate the habit of inquiring and also to handle the information properly. The web-based hypermedia is generally a module, which contains teaching materials aimed at achieving a specific outcome. It is composed of hypertext pages specially using HTML. In addition, regular interactive teleconferencing, which is one-way video and two-way audio satellite-based learning facility and radio counselling sessions, may be used for the learners. These

technologies will make the distance education more interactive and interesting. With the use of these potential technologies we will not only be able to fill the gap of traditional mode of education (i.e., two-way interaction in real timeframe) but also be able to reach to a relatively large gamut of learners.

Technology will also help in meeting the challenges of ODL education. IT can promote the opportunities of restructuring the teaching-learning process and transform it by offering alternatives to the teacher in providing information, access to virtually unlimited resources, and opportunities for real-world communication, collaboration and competition. The phases of this process as described by Marriam

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Various technologies will make the distance education more interactive and interesting. With the use of potential technologies, we will not only be able to fill the gap of traditional mode of education (i.e., two-way interaction in real timeframe) but also be able to reach to a relatively large gamut of learners.

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et. al.[3] are developing awareness – recognising that something is wrong or different; exploring alternative– researching for new ideas from other institutions and acknowledging that change is needed; making a transition–leaving the old approaches behind (or dramatically changed); achieving integration–putting the pieces from the transition phase back together; and taking action–putting new ideas into operation. The process can work at instructional programmes or institutional level and one or more phases work simultaneously.

Traditional lectures and demonstrations can become web-based multimedia learning experiences for distance learners. Web can enrich the learning resources and help institutions refocus from teaching to learning, from teacher to learner. It can create learning environment throughout the world by networked learning communities. Networks may create educative environments embedded in democratic philosophy of instruction and helping learners learn. The characteristics of which are "respect for personality; participation in decision-making; freedom of expression and availability of information; and mutuality of responsibility in defining goals, planning and conducting activities and evaluating [the process]."[4]

ICT is a potentially powerful tool for extending educational opportunities, both formal and non-formal. It also facilitates access to experts, resource persons, researcher, professionals, mentors, business leader, and peers – all over the world. For developing countries ICT has the potential for increasing access to and improving the relevance and quality of education. The use of computers in ODL has provided new pedagogical strategies in distance learning as well as giving more autonomy to the distance learners. The modern technologies used are telephone tutoring, teleconferencing, audio graphics, video conferencing,

computer conferencing drill and practice, fibre optics, tele-text, and videotext, multimedia and hypermedia CAI, e-books, online database, online discussion, call-in course–on demand, satellite, talk-back TV etc. All of these technologies should have a place in the knowledge base of expert teachers. A potentially useful framework for organising such a knowledge base is provided by the emergence of different generations of distance education. The main advantages of using technologies in distance education are cost effectiveness, independence of time and place, quality of education access resulting from the mass production of course materials, teaching a lot of students simultaneously, and finding a lot of educational resources.

Haddad and Draxler[5] have identified at least five levels of technology use in education: presentation, demonstration, drill & practice, interaction, and collaboration. Each of the different ICTs—print, audio/video cassettes, radio and TV broadcasts, computers or the Internet—may be used for presentation and demonstration, the most basic of the five levels. Technology is nothing but an enabling tool and it is the deconstruction of the course into its core experiences and its communication to the student

Rapid advances in ICT pose new opportunities as well as challenges for every society. In the education sector it has enormous potential to help organisations address issues of access to learning, quality of the teaching-learning process and management of education systems. In order to ensure the quality of education, the distance education institutions must be careful about the use of proper technologies and media.

regardless of its delivery mechanism that is crucial.[6] In using technology which can be integrated into the distance education system based on our experiences, the following factors should be considered: accessibility, cost effectiveness, human acceptance, and pedagogical suitability.

In open and distance education different types of technologies and media are used to transfer education to the learners. According to Prof. Bates[7, 8] there are five important media in education: direct human

contract (face-to-face), text (including still graphics), audio, television and computing media (e.g., Internet, online technologies). The use of each media gives both variety and the chance of accommodating different learning styles. According to him it is better to use a limited range of technologies in order to reduce redundancy and wasteful expenditure; provided all the main media are covered. One medium may serve a teaching function better than another in a particular area. The potential of each technology varies according to how it is used.

In the age of information technology, effective and efficient learning is potentially possible at all levels for all round the clock. Content-centred presentation by teachers to large groups of students cannot be dominant method of instruction anymore. In the era of information technology teachers will be spending more time in facilitating students rather than delivering lectures in the classrooms. They would be working in groups; preparing and evaluating instructional materials and organising data into meaningful information and accessible forms. They will be spending their time in coaching students; helping them to learn through reviewing the huge information. It will be offering group presentations. Presentations will not be used to provide new information; instead, it will be carefully constructed to model and answer existing questions and solve current problems in certain disciplines. They will also be demonstrating the potential of skill development in students by using information in problematic situations. Certain skills capabilities of using different information technologies are necessary for both the students and teachers. Therefore, gradual encounters with the technologies are necessary to prepare themselves for the age of information technology. They will encourage students to use electronic databases in their searches, email to ask questions and

for submitting assignments, make them aware about the advantages and disadvantages of the technologies and exploring the capabilities of CD-ROM, tele/videoconferencing etc.

Rapid advances in ICT pose new opportunities as well as challenges for every society. In the education sector it has enormous potential to help organisations address issues of access to learning, quality of the teaching-learning process and management of education systems. In order to ensure the quality of education, the distance education institutions must be careful about the use of proper technologies and media. We have to think about the uses of media and technology in regard to appropriateness and acceptability in the society as well as on the ability of the institution offering the programme. The socio-economic and cultural background of a person influences their ability to learn from different media technology.
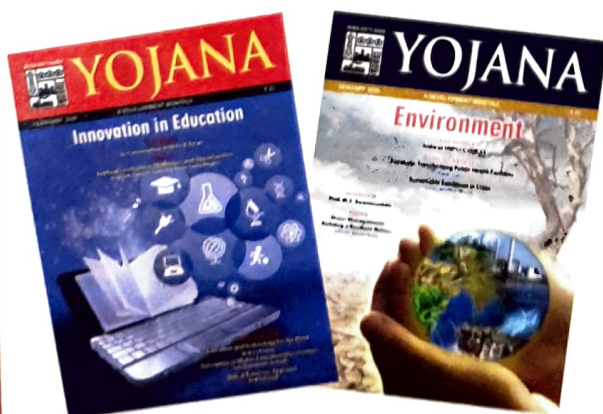
In order to evolve a fully-articulated education system in India and for the success of distance education and ODL must be seen as an equally responsible medium complementing the formal learning system. Teaching organisations are adopting ICT, especially the computers, World Wide Web, teleconferencing and educational television because of their cost effectiveness, access and flexibilities of choices. Effective combination of media and technology is necessary for assuring effectiveness of the open and distance learning system. ❏

References

1. Haag, Cummings and Dawkins. (1999). Management Information Systems for the Information age, McGraw Hill USA.
2. Hussain, I. (2005). A Study of Emerging Technologies and their Impact on Teaching Learning Process. Allama Iqbal Open University, Pakistan.
3. Marriam, S. B. & Cafarella, R.S. (1997). Learning in Adulthood: A Comprehensive Guide, San Francisco, Jossey-Bass Publishers.
4. Knowles, M.S. (1980). The Growth and Development of Adult Education in John M. Peter & Associates (eds.): Building an Effective Adult Education Enterprise, London: Jossey Bass Publishers. P. 85.
5. Haddad, W., & Drexler, A.A. (2002) (eds) Technologies for Education: Potentials, Parameters, and Prospect, Washington D.C.
6. Coble, W. (1996). Tele-learning: Deconstructing Courses. International Conference on Technology and Education, New Orleans, Louisiana, USA, March 17-20, pp. 416-18.
7. Bates, A.W. (1995). Technology, Open Learning and Distance Education. London: Routledge, pp. 29-31.
8. Bates, A.W. (1993). Interactivity as a criterion for media selection in distance education: Never Too far, 1(): 5-9.

Cybersecurity: Issues and Challenges

G P Pandey

Humans are the weakest link in cyber security chain. Amateurs hack systems but professionals hack people. It has become imperative to create awareness in the use of digital platforms through digital literacy. It is an essential requirement for safe and secured use of digital resources.

The world we live in is highly connected and digitally exhaustive. Of the 7.6 billion humans on earth, around 3.6 billion are online. Today, social networks have become one of the main communication channels. Within relatively short time social media has empowered people and connected them. But, at the same time, they have also provided platforms for some decidedly unhealthy and destructive behaviour. Social media platforms have become just one of the endless data channels that cybercriminals are exploiting.

In this era we need skills for surviving in digital environment. For security and safe use of digital resources, digital literacy has become a must. It empowers us with the ability to use information and communication technologies to find, evaluate, create and communicate information requiring both cognitive and technical skills. Digital natives are always with laptops or smart devices in their hand, but how effectively they are using internet for their capacity building is questionable. There are many problems like bullying, cyber crime, copyright issues, security threat and social unawareness among others. Digitally literate individuals find meaning in digital information and make use of it; they exhibit the characteristics of cultural and social understanding, collaboration, the ability to find and select information, effective communication, E-safety, functional skills, creativity and critical thinking. Therefore, to avoid and prevent threats in digital world, digital literacy is essential, which helps in creating awareness in digital space.

In the year 2016, there were a total of 758 million online attacks worldwide, which amounts to around 2 million in a single day. Even technically legal activities often involve misuse of individuals' Personally Identifiable Information (PII). Every organisation, be it big or small, has been the victim of cyber attacks. This reiterates that cyber attacks are real and your and my account can fall prey to it, counting on any random day. Therefore, it is required to create awareness on learning to mitigate the attacks.
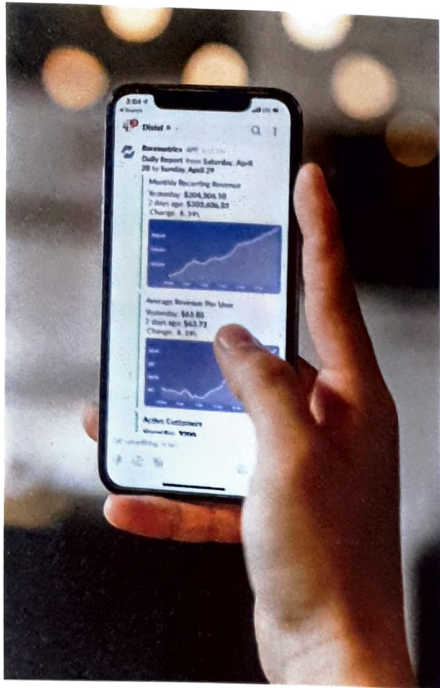
Bots

Bots and fake followers are a big concern in the social media environment. Bot programs target specific hashtags and work by auto-commenting and auto-liking in order
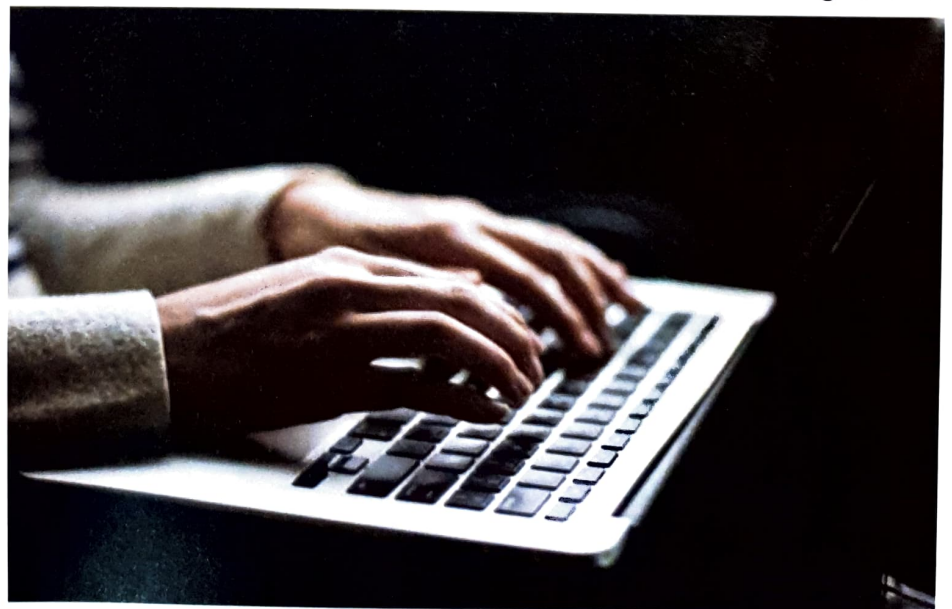
The author is Professor and Dean, Abanindranath Tagore School of Creative Arts and Communication Studies, Assam Central University, Silchar, Assam. Email: gpp59aus@gmail.com

to attract followers who are mostly other fake bot accounts. These are automated systems which can on their own get engaged with other users without any active presence. Developed primarily for companies to engage with their users automatically for increasing customer engagement, bots are now being used much beyond their harmless cause and are misused for manipulating a conversation to creating a mirage of someone's personality and much more.

More than half of the Twitter followers of many public figures around the world were found to be fake.[1] Companies are addressing the issue by suspending fake accounts. But the problem persists. We do not know if a 'like' is generated by a bot or a real user. Though there are ways to differentiate between a real and a fake profile, it is not always carried out. In this age of misinformation, bots possess the power to hijack a conversation, troll someone, promote propaganda and even cause security issues.

Terrorist Attacks

Terrorists have always sought attention and that is what they receive from the social media. Whenever there is any terror attack, as a response to the horrific events, people share images and videos of the devastating attack on social media. Social media thus spread the horror far and wide and unknowingly amplify the chaos that the terrorists intend to spread. In the process, misinformation and fear spread. It further traumatises the families of the victims and also the public at large.

Extremists use the social media to make an impact. They even use it to recruit, propagate and to connect. Moreover, they rely on the regular social media users to spread the impact of terror further to a greater degree than what they themselves could have done in addition to confusing authorities with misinformation.

Misinformation, the rapid spread of false information through social media is among the emerging risks identified in Global Risks Report. Fake news and rumours spread like wildfire in the social media and it is also increasingly used for militancy.

Social media sites have now initiated reporting procedures that allow users to flag any kind of content that supports terrorism which can be then removed. Also, the social networking sites today are playing an important role in counter-terrorism operations. The law enforcement authorities make good use of the social media by keeping people informed regularly. For example, Assam State Police opened a cell to monitor social media and keep track of the spread of rumours.

Cyber Security Challenges

Some new threats have also come up like organised cyber crime, cyber crime trading, smishing (phishing with SMS), hacktivism (hacker with activism) etc. Another type of attack that is rising recently is distributed denial of service (DDoS) attacks. Here the intruder is not interested in actually stealing your information but in bombarding your server with unnecessary traffic thereby crashing it. Huge servers like video streaming apps and majority of banks are under this type of attack. Any device that can connect to the internet can be breached. If an individual by mistake clicks on a link that contains malware or accidentally discloses sensitive information, their accounts get exposed to hackers, cybercriminals and identity thieves.

Mobile Technologies

Not only are we living in a highly connected world but also in a world that is highly mobile, given the amazing number of apps that we use on a daily basis. Have you ever wondered how many sensors are there in your smartphone and what type of personal information are they collecting?

Accelerometer, microphone, camera, location, contacts, gyroscope (for orientation), heart rate, proximity, light, temperature, pressure, barometer (for altitude) are some of the information that are collected from your phone. All the apps that you use let your smartphone know who you are, where you are, where you have been, who you know, where the people you now currently are, what you bought, where you bought, what you ate, whether you went and

> Digitally literate individuals find meaning in digital information and make use of it; they exhibit the characteristics of cultural and social understanding, collaboration, the ability to find and select information, effective communication, E-safety, functional skills, creativity and critical thinking. To avoid and prevent threats in digital world, digital literacy is essential, which helps in creating awareness in digital space.

even your current mood! But the more important question is who is it sharing the information with? When you download third-party apps, are you really aware that you are giving away the rights to collect your information? If your fitness app needs access to your text messages, that doesn't sound right, does it? What if a hacker is able to build your digital profile by collecting all these sensored information and the data from the third-party apps and use it against you?

A popular third-party app recently disclosed a data breach that compromised all of its 4.7 million users' email addresses and phone numbers. This data can be used to execute large-scale phishing attacks meant to compromise a company's network and systems.

Internet of Things (IoTs) is another such challenge posed by the new technology whereby every object we use is equipped with the capabilities to identify, locate, sense its surroundings, compute and communicate. Now what will happen if all these objects could talk to each other and share information? It is said that soon there will be one billion IOT devices and they will all be talking to each other. Imagine what a rich attack surface it is going to give the hacker and the number of attacks that can happen with IOT devices.

> It has become imperative to create awareness in the use of digital platforms through digital literacy. Digital literacy is an essential requirement for safe and secured use of digital resources which can contribute to efficiently tackle the cyberspace.

Ransomware

This ransom demanding malware is a virus which gets into your computer, either when you download an attachment containing the virus or when you visit any such website and click on a link. Once it gets into your computer, it starts to encrypt all your files thereby rendering them useless. The only way to unlock your files is to get a secret key from the hacker by paying a ransom. And this ransom is usually demanded through bitcoin which keeps the payee anonymous. There has been a 600% increase in ransomware variants since 2016. Major universities, hospitals, businesses and even individuals have been target of such attacks.

Big Data

We are actually living in exponential data times. In just 60 seconds 149,513 emails can be sent, 3.3 million FB posts can be made,

3.8 million Google searches can be performed, 500 hours of YouTube videos can be uploaded, 29 million WhatsApp messages can be sent and 448,800 Tweets can be made and millions of other online activities can be performed leaving incredibly large digital footprint.

Unfortunately, humans are the weakest link in cyber security chain. Amateurs hack systems but professionals hack people. It is way easier to con people using social engineering techniques and make them reveal information rather than using tools and technology. The weakest link happens to be our password with which social accounts, mail accounts and millions of bank accounts have been hacked. An analysis of 32 million breached accounts has revealed that people most often use insecure passwords.

While all these makes the cyberspace a huge threat in the socio-economic environment of the present times, it has become imperative to create awareness in the use of digital platforms through digital literacy. Digital literacy is an essential requirement for safe and secured use of digital resources which can contribute to efficiently tackle the cyberspace.

Today, the Government is increasingly going for a digital system for more transparency. When we welcome development, insecurities come with it and tackling such insecurities is the main concern.

Protection against Cyber Attacks

As the channels and networks for data sharing continue to evolve and grow, so do the risks. For securing information on the social networking sites, following guidelines can be followed:

1. Limit the amount of information that you disclose on the social networking sites;

2. Do not establish friendship with strangers;

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3. Do not believe online information blindly as it can be misleading;

4. Customise your system settings according to your needs by changing the default settings. Learn how to use privacy settings on your social profiles properly;

5. Beware of third-party applications. Avoid applications that seem suspicious, and make sure to modify your settings to limit the amount of information which the applications can access;

6. Secure your system, because unsecured network can lead to loss of your personal data;

7. Use antivirus software to secure your computers and electronic devices;

8. Use strong passwords to protect your account and personal information. Change your passwords frequently;

9. Do not set the same password for all social accounts, because if one site's password is compromised, all other accounts will be exposed to threats;

10. Choose suitable authentication scheme so that no one can access the details. Two-factor and multi-factor authentication should be in place. In two-factor authentication along with username and password, another form of identification, often a security code in the form of a "*Captcha*", is used. In multi-factor authentication, more than one form of authentication to verify an identity is used. Some examples are facial recognition, iris recognition, voice ID and finger scanning.

Today's digital world necessitates people to know the network security implications and spot suspicious activities. Oversharing helps hackers steal PII and sell it to the dark web.

Conclusion

Digital literacy is a broader concept that consists of developing new skills and knowledge which provides awareness and advanced level thinking skills. It is extremely essential to be digitally literate for appropriate utilisation of digital information resources. Therefore, it is the responsibility of each one of us to understand and help others to understand and use the cyberspace sensibly and responsibly. This will definitely ensure that the netizens are not only techno-savvy and socially existent but also digitally safe.   ❑

Reference

1. Twiplomacy Study: https://twiplomacy. com/

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Global Synergy in Higher Education

Natasha Jha Bhaskar

India enjoys a demographic dividend where population of its working class is larger than its non-working population. It is world's youngest country with an average age of 29. This comes at a time, when rest of the world is ageing. The outflow of Indian students for education abroad is more than 15 times the inflow of international students to India. Its draft National Education Policy, 2019 proposes to invite the top 200 global universities to establish foreign branch campuses in India.

The need for quality, relevance and employability are integral components of any discourse on higher education, driven by access, equity and affordability. With the size of Indian young demographics and demand, an increased and sustained focus on the development of its human resource is imperative.

India aims to become a five trillion dollar economy by 2024-25; the realisation of this goal is incumbent upon the capability of its education and training institutions to equip young Indians with knowledge and skills relevant to an evolving job market. It needs quality, excellence, innovation and constant upgradation.

India's draft National Education Policy aims at increasing the gross enrolment ratio (GER) in higher education to at least 50 per cent by 2035, which would mean that one in four graduates in the world would be a product of the Indian higher education system. The current GER stands at just 26.3 per cent, and doubling it in the next 15 years will require significant reforms both at planning and execution level. India's GER is lower than the global average of 36.7%.

Higher Education – Critical Challenges for India

India enjoys a demographic dividend. Population of its working class is larger than its non-working population. It is world's youngest country with an average age of 29. This comes at a time, when rest of the world is ageing. Average working age in the United States is 40, Western Europe is 46 and Japan is 47 years. Thus, India will not only have a young workforce to fulfil its domestic needs, it also has the opportunity to be the global hub for skilled workforce. This opportunity is also a challenge. The Indian youth need education and skills, and the current Indian system has to be well equipped to handle it.

Market forces have played a major role in the higher education landscape. Of the 993 universities in India, nearly 39 per cent are privately-managed. Of the 39,931 colleges, 78 per cent are from the private sector

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The author is General Manager of Newland Global Group, a corporate advisory firm specialising in the India-Australia space based in Sydney. Email: natashajhabhaskar@gmail.com

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(aided and unaided). Private colleges cater to 66.4 per cent of the total enrolment in higher education, which means that a mere 22 per cent of government colleges are catering to a disproportionately large number of students who could not afford to seek higher education in private Higher Education Institutions (HEIs).[1]

Increasing social aspirations have made the education divide between urban and rural centres more obvious. Five Indian states—Uttar Pradesh, Maharashtra, Tamil Nadu, West Bengal and Karnataka—account for more than 54 per cent of the total student enrolment in higher education. Of the 39,931 colleges across the country, 50 districts (out of 731) account for more than 32 per cent of it. As a result, although the college density (per one hundred thousand eligible population) is 28 nationally, it varies from seven in Bihar to 53 in Karnataka. The opportunity cost of higher education (commute, hostel fees etc.) for disadvantaged section is often too high and hinders the education process.

Low employability of graduates, poor quality of teaching, weak governance, insufficient funding, and complex regulatory norms continue to affect the Indian higher education sector. The number of international students is generally a reliable indicator of the quality and robustness of a higher education system. As of 2018-19, only 47,427 foreign students were enrolled in the Indian higher education system, which is not enough for a country with more than 950 universities.[2] This number stands at more than 4,00,000 international students in China, more than 3,00,000 in Germany and 75,000 in Singapore. Globally, India caters to less than one per cent of all international students. Indian institutes have failed to feature in the top 100 of world university rankings published by reputed ranking frameworks. The outflow of Indian students for education abroad is itself more than 15 times the inflow of international students to India.

Global Synergy Scenario

India's recently released draft National Education Policy 2019 proposes inviting the top 200 global universities to establish foreign branch campuses in India. The Ministry of Human Resource Development (MHRD) has developed a five-year action plan named EQUIP (Education Quality Upgradation and Inclusion Programme). The initiative is made to bring transformation in the higher education system in the upcoming 5 years. NITI Aayog has more recently favoured the development of Exclusive Education Zones (EEZs) akin to SEZs in a few select cities in Bengaluru, Hyderabad, Ahmedabad, Pune, Chandigarh and parts of Sikkim, to boost growth in the inflow of foreign students.

As education remains a major key to employability and upward social mobility, there is growing awareness among rising aspirational middle class to invest in quality education. Getting the right education is critical for India to maximise the potential of its demographic dividend. India will not have the capacity to meet this demand on its own. NITI Aayog and several other organisations have developed policy documents on higher education that have stressed on the need of international assistance in higher education.

For nurturing long-term partnerships in building India's higher education institutions and fill the gap in this market by offering better quality courses, foreign countries are being discussed.

Opportunity for Deeper Engagement

International education is Australia's third largest export industry. As a world-class provider of education and training, Australia is well positioned to partner with India in the higher education sector. The number of Indian students studying in Australia has grown by 71 per cent since 2014, with 107,673 students enrolled to study in 2019.[3] Out of all the international students in Australia currently, Indians make up for 15 per cent. After the US and UK, Australia is one of the top preferred destinations for Indian students looking to studying abroad. However, the present trend of only sending students to Australia is not a sustainable one and a creative and innovative collaboration may be established between countries like Australian and Indian universities to design joint courses and build up alternative business models.[4] Linkages between HEIs and industries with diversified course offerings can prepare students for the job market. Global education institutes may also consider looking at

building partnerships, beyond HEIs in metro cities to Tier 2 and Tier 3 cities and regional/state institutions, which offer tremendous possibilities because of large number of students with untapped potential and lack foreign collaborations currently.

The joint student-academic mobility programmes, joint research, international collaborations boost rankings. India is also seeking to attract international faculty into the country for short-term research and teaching visits. Indian Government's initiatives like the Global Initiative of Academic Networks (GIAN), which provides funding for teaching at selected Indian higher education institutions and Scheme for Promotion of Academic and Research Collaboration (SPARC) are opportunities that can be explored. However, lack of knowledge of India's higher education sector, including how to address regulatory issues, contributes to low faculty participation in mobility schemes.

The education landscape is changing vigorously; exciting development is taking place at the confluence or intersection of two fields. Partnerships may look beyond silos and into areas where Australia has an advantage and India has a need, for instance, in mining safety, bio engineering, signal processing, health

> As education remains a major key to employability and upward social mobility, there is growing awareness among rising aspirational middle class to invest in quality education. Getting the right education is critical for India to maximise the potential of its demographic dividend. India will not have the capacity to meet this demand on its own.

systems, artificial intelligence, cyber security, climate change. Integrated degrees and multi-disciplinary learning are emerging as areas of interest.
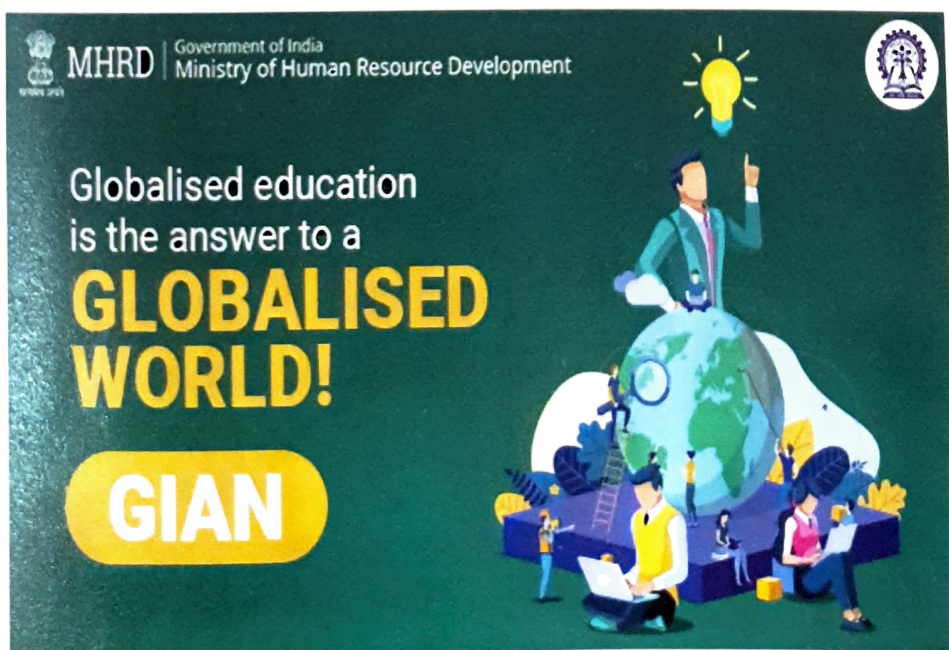
Despite the tripling of the Indian population in Australia since 2005, knowledge about India in Australia is low. Six universities in Australia taught one Indian language in 1996. Now only two do so.[5] Increasing the level of mutual cultural understanding and developing a strong knowledge base for India and Australia can further bolster these relations. This could also help both the countries in creating new opportunities for students, colleges and universities at central and state level to explore partnership potential.

English language teaching and training, use of technology for experiential learning and equipping and training teachers/faculty can be explored for building capacities where Australia has major strength, including partnering with major government initiatives like the Rashtriya Uchhatar Shiksha Abhiyan (RUSA). Research partnerships can also be developed that could deliver solutions to clearly specified problems in water, infrastructure, poverty alleviation, security, health and governance. Increased focus on vocational and professional led education can help India find ways to up-skill 400 million workers by 2022. However, what is needed is targeted and granular advice from governments to assist providers to identify, from the mass of possibilities, viable opportunities that match Australian strengths with Indian needs. Also, Indian students' expectations around cost and employment outcomes need to be understood carefully.

Educational outreach in India must be a true partnership that is beneficial to both partner countries, driven by multiple policy dialogues, institutional partnerships, research collaborations, capacity building initiatives and student enrolments. ❑

Endnotes

1. http://aishe.nic.in/aishe/viewDocument.action?documentId=262 (accessed on 8 January, 2020).

2. https://www.orfonline.org/expert-speak/increasing-enrolment-in-higher-education-a-quantitative-and-qualitative-challenge-55883/ (accessed on 8 January, 2020).

3. https://ministers.education.gov.au/tehan/growing-engagement-between-australia-and-india (accessed on 8 January, 2020).

4. https://www.afr.com/policy/health-and-education/australia-s-education-approach-to-india-not-sustainable-20190428-p51i0c (accessed on 8 January, 2020).

5. https://theconversation.com/how-australia-can-help-reform-higher-education-in-india-88479 (accessed on 8 January, 2020).

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Employment Opportunities in Rural Homestays

Ratna Bhuyan

Development of rural tourism can enhance economic empowerment and employment generation of rural communities through sustainable livelihoods. As the showcase of rural life, art, culture, food, customs and heritage, rural homestays can provide direct benefits to the local communities or stakeholders, both economically and socially. It also enables interaction between tourists and local population for a mutually enriching experience. This article studies the potential of rural homestays and the various initiatives and policies by the Government at the Central and State level to enhance this tourism potential in North East India for sustainable rural development.

A group of 21 all-women homestay aspirants from Arunachal Pradesh joined a one-month-long certificate programme in the north-eastern regional centre of the National Institute of Rural Development and Panchayati Raj (NIRDPR), an autonomous organisation under the Ministry of Rural Development in Guwahati. The objective of designing and launching of this certificate course was to promote rural homestays across the eight states of North East India, to capture some of the tourists' inflow into the region. This would not only add to the family and community income but will also open doors for cultural interaction with the outside world. For NIRDPR, this maiden attempt at bringing out women from their bastions from the interior hills of Arunachal Pradesh and grooming them to be rural homestay entrepreneurs is a silent pink revolution. For these 21 all-women homestay aspirants, rural homestay was an open field for a vibrant stay with a traditional touch. For the Arunachal State Rural Livelihoods Mission (ArSRLM), the umbrella organisation in this

context which carried out the task of identifying this robust group of women aspirants, it was more a role of a beacon responsible for making them learn the course content on field. The task was quite challenging for ArSRLM as they had to play a more proactive role in moving things in their State and giving all need-based support to the group in coming up with rural homestays. With the question of sustainability at the base, ArSRLM

either had to do it at individual level or take community support in order to make this revolutionise rural homestays in Arunachal Pradesh.

With the aim to standardise facilities across homestays, the Ministry of Tourism had issued a set of guidelines for homestay establishments in 2006. Since then though many a revision have been made, the core essence of the original policy guidelines have been carried

Dr Ratna Bhuyan is Assistant Professor, National Institute of Rural Development and Panchayati Raj (NIRDPR), North Eastern Regional Centre, Guwahati. Email: ratnabhuyan.nird@gov.in

forward. In India, to get a formal recognition, a homestay needs to get registered and approved following the Incredible India Bed & Breakfast/ Homestay Establishments guidelines. Once approved by the Ministry of Tourism, the homestay is given due certification. These homestays are categorised into gold and silver based on the facilities and services they offer. Each establishment is classified based on a two-stage process wherein the facilities and services available in the establishment are evaluated against a standardised checklist. In the process, due recognition is given to the establishments which maintain traditional décor along with providing homely but authentic traditional recipes which can satisfy the taste buds of the tourists. These guidelines are applicable pan India and are taken as the benchmark for common national standards.

Rural homestays in North East are however very difficult to categorise on the basis of these guidelines for Silver and Gold category. A checklist laid out with 36 parameters makes it difficult for the rural homestays in North East to fit in the outlined criteria. However, there is a provision for the States and Union Territories across the country to customise and add on to these guidelines as per their needs, provided the core principles outlined in the guidelines remain intact. In States like Himachal Pradesh and Uttarakhand where the tourism industry is popular, there are number of homestays registered under the Tourism departments spread across Kullu, Shimla, Chamba and Solan, and Nanda Devi and Valley of Flowers in both the States respectively.[1,2] Down South, Kerala, Karnataka, and Tamil Nadu have some homestay destinations. In Kerala Alappuzha, Kumarakom, Kolagappara, and Mananthavady homestays are operated as prospective enterprises. In Karnataka and Tamil Nadu, homestays have come up around the plantations. In Kerala, the Homestay and Tourism Society (HATS) has come up with unique stipulations to be fulfilled by the establishments to make them eco-friendly. In West Bengal, there are approximately 100 homestays that have come up in Dooars, the foothills of the eastern Himalayas and around Bhutan till 2015. However,

> Before scaling up rural homestays in terms of numbers, especially in the hill states and forest fringe areas of the region, there is also a need to give due consideration to the ecological perspective of propagating homestay tourism. Homestay tourism is to be looked into from the ecological perspective having a cause-and-effect relationship both aiding and limiting the environmental concerns.

States like Odisha, which too have a huge tourists' inflow, has revised the Central Government guidelines to accommodate hassle-free procedure and timely grant of permission to homestay establishments, so far could promote 50 registered homestays, mostly operating in and around Bhubaneswar. The question therefore is, are these guidelines enough?

There is a need for a concerted vision which can aid in policy planning and drawing strategies and programmes. In fact, the right intervention strategies can turn homestay establishments in rural areas into instruments for promoting rural entrepreneurship with a cascading effect touching upon traditional art, craft, cuisine, music. This calls for identifying the rural homestay tourism destinations first, followed by drawing an inclusive plan for further need-based interventions like capacitating and grooming the individuals and communities identified under homestay tourism destinations while capacity building and grooming cannot be a standalone platform, it becomes imperative to call in all stakeholders and partners in the process.

Rural homestays in North East India are still far from reality, except in some pockets like Tawang in Arunachal Pradesh, Cherrapunjee in Meghalaya, and Kaziranga in Assam though the influx is just for six months. The Panchayati Raj Department in Sikkim has come up with tourists'

lodges in places like Gayzing in West Sikkim due to huge tourist inflow. For rest of the North East, the case is quite different. Except Ziro valley in Lower Subansiri district–the rice bowl of the East or for that matter Eastern Himalayas and Mechuka valley in West Siang district bordering China which has the presence of army personnel, number of tourists visiting the places like West Siang, Upper Siang, and East Kameng districts in Arunachal Pradesh are exceptionally low. It is in this context that homestay policy guidelines developed for the State of Arunachal Pradesh by WWF-India with the support of GoI-UNDP in 2012 had suggested the constitution of Village Tourism Management Committee (VTMC) of local villagers affiliated to State Tourism Department for managing all Community Based Tourism (CBT)-related activities including homestays in the village.

Before scaling up rural homestays in terms of numbers, especially in the hill states and forest fringe areas of the region, there is also a need to give due consideration to the ecological perspective of propagating homestay tourism. Homestay tourism is to be looked into from the ecological perspective having a cause-and-effect relationship both aiding and limiting the environmental concerns. Homestays, as understood, have the potentiality to transform the livelihoods of forest fringe

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If one takes into consideration the ecological vulnerability and threat aspects to rural homestays in North East, nature and its unpredictability in the region plays an important role. It, therefore, becomes pertinent to calculate the risk factors and inevitabilities associated with nature while planning rural homestays. In North East, because of the extended monsoons, tourism in the region is rather seasonal.

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marginalised communities in North East provided the existing Joint Forest Management Committees (JFMCs) and Eco-Development Committees (EDCs) are mentored and guided to promote rural homestays as a gainful livelihood option. Homestay tourism has the potent effect of reducing the dependency of these marginalised sections on forest resources and also creating a symbiotic relationship among the fringe communities, tourists, and pristine flora and fauna. Another aspect that is to be taken into consideration is the non-timber forest produce (NTFP) which most of the times is informally channelized, and which can find formal exchanges

through tourist inflow with fair bargains. For example, *sal* leaves' plates can find a way to the market as an eco-friendly alternative to plastics. This calls for awareness on adoption of eco-friendly practices by the homestays from the ecological perspective.

If one takes into consideration the ecological vulnerability and threat aspects to rural homestays in North East, nature and its unpredictability in the region plays an important role. It, therefore, becomes pertinent to calculate the risk factors and inevitabilities associated with nature while planning rural homestays. In North East, because of the extended monsoons, tourism in the region is rather seasonal. Therefore, rural homestay is a possibility only for four to five months of the year and homestays remain idle for the rest of the year. This calls for involvement of higher transaction and maintenance cost. Without a clear earning viability and reasonable return on investment, the financial institutions most of the time consider this sector as non-remunerative. Circumventing this seasonality is a challenge. Therefore, it is important to have contingency plans for these inevitabilities. For this, an exhaustive package of handholding on homestay management and paraphernalia, which is environment friendly, along with learning in hospitality and service sector business

models is required. Additionally, a gestation period of not less than one to two years has to be permitted, which in turn would require capital investment with almost no returns. For this, corporate social responsibility (CSR) and private partners can come in and play a decisive role.

To develop tourism as an eco-system in entirety in the region, quintessentially connectivity, communication infrastructure, logistics, business development service providers like tour operators, tour guides, publicity and hospitality to be put in place and given the right kind of exposure. Capacity building with sporadic and detached programmes in homestays by the different Ministries, which are often discreet and disconnected, will not help in taking homestays to tourist locations, which are in need of the warmth of homestays. Also, one needs to assess whether the present policies of the State governments for promoting rural tourism and homestays have been realised in the light of location-specific trends of tourist inflow to optimise capacity and occupation ratio of the homestays.

Along with publicity of rural homestays, one also needs to assess the ICT aspect. With the mobile data and smart phone ratio among the highest in the world, rural homestays need to know how to reach the worldwide hospitality service providers. Very few rural homestays in Arunachal Pradesh and Assam are being promoted through such service providers; some can be found in Aalo and Roying in Arunachal Pradesh and Dimow and Dhekiajuliin in Assam. The State of Arunachal Pradesh for that matter with a decent record of 17 homestays in Tawang, 10 in East Siang, 24 in Lower Subansiri, 12 in West Siang, two in East Kameng and 11 in West Kameng, need to find a place with private service providers and Government establishments.

The State Rural Livelihoods Mission (SRLM) can include rural homestays as a sustainable non-farm sector livelihood and provide continuous long-term handholding. The respective SRLMs may also come up with MoU/MoA with private partners for investing during the gestation period for handholding. All relevant stakeholders can be brought on table by forming a District Rural Homestay Coordination/Advisory Committee comprising of the Deputy Commissioner as Chairman, District Tourism Officer, District Industry Official, Anchalik/Gram Panchayat/Village Development Board representative, District Project Manager, Representative of Traditional Bodies at village level where homestays are located, like Kebang in Arunachal Pradesh, personnel from various departments like PWD, Forest (in case the homestay is in the vicinity of forest area), handlooms, handicrafts, Border Roads Organisation, etc. The NIRDPR and other relevant state-specific autonomous organisations under different ministries can also be members in the Committee.

Standardisation of the process of grooming rural homestays and the cluster approach to developing and nurturing them in places with uniqueness like Tawang and Ziro in Arunachal Pradesh with a remarkable annual tourist flow can be a way out in propagating rural homestays in North East India. And lastly, for the 21 all-women prospective homestay entrepreneurs, it would be a challenge for them to lead the rest of the North East region in the rural homestay movement. Till then, coordinated and cohobated efforts need to continue. ❑

References

1. Gangotia, A. (2013). Home Stay Scheme in Himachal Pradesh: A Successful Story of Community Based Tourism Initiatives (CBTIS). Global Research Analysis, Vol.2, Issue 2.

2. Macek, I.C. (2012). Homestays as Livelihood Strategies in Rural Economies: The Case of Johar Valley, Uttarakhand, India. Thesis submitted to University of Washington, Washington.