

National University of Educational Planning and Administration

Foundation Day Lecture

Designing Architecture for a Learning Revolution based on a Life Cycle Approach

Prof M S Swaminathan, FRS

Member of Parliament (Rajya Sabha)

UNESCO Chair in Ecotechnology, M S Swaminathan Research Foundation

I feel very privileged to have been invited to deliver the Second Foundation Day Lecture of the National University of Educational Planning and Administration (NUEPA). It is now two years since this National University was established although its history dates back to 1962 when the UNESCO established the Asian Regional Centre for Educational Planners, Administrators and Supervisors. Within a short span of time the University has made impressive progress in many areas of our educational system. In addition to innovative initiatives in the field of educational planning and administration, NUEPA has been engaged in research particularly in the area of inclusiveness in access to education by becoming a partner in the International Consortium for Research on Education Access, Transitions and Equity (CREATE). Since the Eleventh Plan goal is “faster but inclusive economic growth”, the emphasis of NUEPA on reaching the unreached in the field of educational empowerment is very appropriate. I have hence chosen for this lecture the theme of reaching the unreached based on a life-cycle approach in educational programmes.

Let me first cite a few statistics. Our performance on the economic front has been impressive in recent years with the growth in Gross Domestic Product rising from 8.4% in 2005-06 to 9.2% in 2006-07. Unfortunately, such a creditable achievement has not been accompanied by equitable growth, with the result that divides like urban-rural, gender, economic, technological, and social divides like caste, tribe, religion and region are increasing. Let me take the case of nutrition. While the prevalence of clinical forms of protein energy malnutrition has decreased significantly, the sub-clinical forms such as underweight, stunting and wasting among children below five remain significantly high. About 23% of newborn in India are of low birth weight due to maternal and foetal under nutrition and malnutrition. According to National Family Health Survey No.3, about 43% of under-five children are under weight and 48% are stunted. About 36% of adult women and 34% of adult men suffer from Chronic Energy Deficiency. Surveys carried out by the National Nutrition Monitoring Bureau (NNMB) during 2005-06 in eight States revealed that about 49% of 10-13 year girls and 18% of 14-17 year adolescent girls in the rural areas are undernourished.

Our poverty line is one of the most austere defined in the world, since it takes into account only the minimum food intake needed for survival. In spite of all the poverty alleviation programmes undertaken during the last sixty years, both rural and urban poverty remain high with 28.3% in

rural areas and 25.7% in urban areas remaining below the poverty line. The percentage of illiterate women and men still remain high. According to the Census of India 2001, literacy rate ranged from 47% in Bihar to 90.9% in Kerala. Mizoram had also a high literacy rate of 88.8%. Female literacy was lower in all States. The position however has been improving since 2001, thanks to Sarva Shiksha Abhiyaan.

The great freedom poet Subramania Bharathi emphasized that food and education constitute the two legs of a human being and that it is the fundamental duty of independent India to ensure nutrition and education for all. It is obvious that in both these areas, we have a big deficit of achievement. With a net addition of about 17 million every year to our population, we have to run twice as fast to stay where we are, as emphasized frequently by Pandit Jawaharlal Nehru. How then can we achieve the goals of Sarva Shiksha Abhiyaan, Integrated Child Development Services (ICDS), Noon Meal Programme in Schools and other Government programmes designed to address the issues of undernutrition and illiteracy in an integrated manner?

In the area of nutrition, it is now realized that there is need for a Life Cycle Approach (Fig.1). We have to start with pregnant women in order to ensure that healthy babies are born. Babies with low birth weight tend to experience impaired mental development, increased risk of adult chronic disease and high mortality rate. How can we organize our education programmes on similar lines, starting with pregnant women and ending with old and infirm persons? Let me follow this order in dealing with a learning revolution based on the principle of social inclusion in opportunities for quality education.

Pregnant Women

An urgent task here is nutritional literacy in order to make them and their families, especially the men, aware of the need for adequate and balanced diet to ensure the birth of healthy babies. Education alone will not be enough since pregnant women suffering from under- and malnutrition are generally poor with inadequate purchasing power. It is the responsibility of the State and Central Governments to ensure availability of food at affordable prices, so that the proportion of new born babies with low birth weight is speedily reduced. Without attention to the nutrition and education of both mother and child, the objective of social inclusion in educational empowerment cannot be achieved. Denying an opportunity for a new born child to realize its innate genetic potential for physical and mental development is the cruelest form of inequity and injustice.

Children (0-6 years)

There has been considerable work in our country on Early Child Care and Education (ECCE). The profile of the young child in India is as follows:

- The child population (0-6 years) is 158 million
- Nearly one-fourth of babies are born with low birth weight
- Only 42 percent children (12-23 months) are fully vaccinated
- 14 percent are not vaccinated at all
- 5 percent of all children 0-6 years suffer from severe or moderate anemia
- 17 million children are added to our population of over 1.1 billion every year.
- The Infant Mortality Rate (IMR) is 70 per 1,000 live births
- 60 million children (<5 years) live in poverty
- Of them, only 19.4 million children (3-5 years) are getting preschool education under ICDS
- Of the over 10 crore children below 6 years, only 3.42 crores are getting supplementary nutrition

(Source: Government of India, 2002(a) The Child in India : A Profile, 2002, New Delhi: UNDP 2003 : Human Development Report)

To quote, from the Position Paper of the National Focus Group on Early Childhood Education, “in the first year of life, the young human being learns more than he ever does in any other year of his life. This is the period of maximum learning and the rate of growth and development is phenomenally high. Starting from almost nothing, the child learns to move, walk and communicate within the short space of twelve months. Learning proceeds rapidly during the next few years, but the rate of growth gradually slows down. The first five years are the period of maximum intellectual development (80% is completed by this time). Of this, 40% is accomplished in the first year of life, and another 40% by the end of the fourth year. These facts alone make this period one of great potential educational significance, and provide the strongest argument in favour of a strong base of education at the pre-primary level”.

The methods of education at this stage will be considered briefly for the light they throw on later stages of education, particularly on the idea of education through work. At this age, education is through play. Play may be defined as an activity having no end outside itself and undertaken for its own sake, unlike work which has to be oriented towards a defined objective. This is the real distinction between work and play, and not that play is pleasurable or useless, while work is not. To the young child, however, play in a serious business, his main function and his way of learning. The child works hard at his play, as serious observers have noted. There is no distinction between work and play for him, and even the most casual observer would be aware of the fact that young children are exhausted after a hard day’s play. The curriculum of a pre-primary school, therefore, is, ideally, everything that can be reasonably taken up by the teacher. It makes full use of the child’s natural environment, and supplements it with specially planned experiences which aid the child’s learning.

The following principles which emerge from early childhood education have an immense bearing on the idea of education through work:

1. The learning process is related to the self-activity of the child. Essential ingredients are a wide range of activities, free choice among them, the guidance of a skilled teacher, problem-solving situations and tasks graded to their ability and stage of development of the individual, a permissive environment, stimulus and challenge to exploration. However the main idea is that learning is an active process and not a passive acceptance of all things told by the teacher.
2. The corollary of this is that there is no such thing as teaching, there is only learning. The “learning environment” and the teacher can together stimulate, direct or stifle the learning process. The material itself is educative, and so is the entire environment. It is up to the teacher to arrange the learning environment in such a way as to yield the maximum results, and to guide and direct the process.
3. Education involves totality. The child is learning all the time, not at set times. He is learning in a variety of areas, and with all aspects of himself. His intellectual, physical, emotional, aesthetic, social and moral learning proceed side by side.

Gurdev Tagore’s poem in Gitanjali on what we can learn from the child captures the essence of child education.

*Child, how happy you are sitting in the dust
 Playing with a broken twig all the morning;
 I smile at your play with that little bit of broken twig
 I am busy with my accounts adding up figures by the hour
 Perhaps you glance at me and think what a stupid game to spoil your morning with
 Child, I have forgotten the art of being absorbed in sticks and mudpiles
 I seek out costly playthings and gather lumps of gold and silver
 With whatever you find, you create glad games;
 I spend both my time and my strength over things I can never obtain;
 In my frail canoe I struggle to cross the sea of desire;
 And forget that I too am playing a game ...*

A National Focus Group on Early Childhood Education set up by the National Council of Education Research and Training with Ms Mina Swaminathan as Chair has emphasized “that the curricular framework for ECCE should be age appropriate, all round, play based, integrated, experimental, flexible and contextual and should be based on the following guidelines.

- “Play as the basis of learning
- Art as the basis of education
- Recognition of the special features of children’s thinking

- Primacy of experience rather than expertise
- Experience of familiarity and challenge in every day routine
- Mix of formal and information interaction
- Blend of the textual (basic literacy and numeracy) and the culture
- Use of local materials, arts and knowledge
- Developmentally appropriate practice, flexibility and plurality
- Health, well-being and healthy habits”

“Child development is a continuous and cumulative process, so that what precedes influences what follows. In terms of programmatic interventions, it is, therefore, important to plan for and address the entire childhood continuum, from prenatal to the end of the primary stage, as opposed to intervening during any one sub stage exclusively. For example, primary education outcomes cannot be improved significantly despite high investment unless the early-childhood outcomes that ensure preparedness are also ensured. Health, nutrition, education and psychosocial development are all synergistically interrelated, which makes a case for addressing all the needs of children through a holistic approach”.

(Source: Position Paper on the National Focus Group on Early Childhood Education, March 2005)

In spite of the importance of this area in the field of education, attention and support have not kept pace with need. Prof Krishna Kumar has pointed out in a recent article in *The Hindu*, (2 July 2008) that “in the context of early childhood education, even national level flagship programmes such as the ICDS have lost their claim to financial favour, what to say of smaller state-level initiatives. The hope of curricular reform in nursery education has dwindled even as aggressive private players have set up business, offering a cacophony of electronic devices and formal instruction through a frugally trained housewife doubling up as a nursery teacher”.

Primary Education:

At the primary level, play gradually turns into work in two ways. First, the activity is undertaken with a definite objective in view. There is an aim to be achieved, and a task to be done. Secondly, the tasks are no longer freely selected by the child, but are socially determined and in practice set by the teacher. Nevertheless, the same purpose can be achieved as in his play, if the task is seen by the child to have some social and personal significance. A socially productive and useful task can be agent of the education – this is another way of expressing the essence of Basic Education, but seen in a new light and not rigidly tied to a particular activity or craft. Here we need to convert the ideas of Mahatma Gandhi and Zakir Hussain as well as the suggestions contained in the report of the Second Education Commission chaired by Prof D S Kothari into practical accomplishment. There is need and scope for adapting Gandhiji’s and Zakir Hussain’s

ideas to contemporary socio-economic and technological milieu. The most recent effort to revitalize the concept of Basic Education has been in the National Focus Group on “Education through Work” set up by NCERT chaired by Dr Anil Sadgopal.

It is a tribute to the genius and vision of Mahatma Gandhi that he identified and discussed at length nearly 80 years ago methods of making our entire population literate. Gandhiji's contribution to educational thought was unique and typical of him. The wonder of his approach is that, merely by applying himself to the problems of Indian education as it was and as it should be, and out of the depths of his intuitive understanding and judgment, he arrived at the same conclusions as those which the best educational thinkers have evolved during the early part of the 20th century. I wonder whether he was acquainted, except in a casual manner, with the writings of Rousseau, Froebel, Pestalozzi, Dewey or Maria Montessori. Yet the principles behind what later came to be known as Basic Education are identical to those stressed by all these educationists, **ie, the principle of activity as the basis of learning**. Gandhiji's concept of Basic Education was essentially that of activity education – it was both craft-centred and child-centred and was thus diametrically opposed to the academic and book-centred system.

Dr Zakir Hussain, who was in many ways the architect of the Basic Education system, was able to provide an operational foundation to Gandhiji's ideas. At the Educational Conference held at Wardha on October 22, 1937, where Gandhiji pleaded for a radical transformation of the Indian educational approach, Dr Hussain said, “Mahatmaji thinks that the scheme which he has placed before you is absolutely original and that it can be accepted only by those who believe in non-violence and in rural civilization. But those working in the educational field will not find Mahatmaji's scheme very new. They know that true learning can be imparted only through doing. This method is called the Project Method in America and the Complex Method in Russia. We can certainly impart education to our children through the *takli* and the *Charkha* and other suitable handicrafts. But the greatest difficulty in carrying out this scheme will be the paucity of trained teachers. Prof. Dewey in America had a similar plan which was welcomed enthusiastically but he had to close down his school in 3 years because he had no teachers to run it”.

Having identified the key input for the successful launching of this new movement in education, Dr Zakir Hussain tried to build through the Jamia Milla Islamia and associated institutions the infrastructure for basic education. Two decades later, in the Sardar Patel Memorial Lectures delivered in 1958, Dr Zakir Hussain concluded, with what pain we can only imagine from one who was the father of this educational movement, that **“Basic Education in our country has been a failure, not because it was educationally unsound but because it was never given a fair trial”**. In quote his words, “We have turned the so-called intellectual book school into a mechanical memory training school and succeeded in making our Work School, the Basic

School, a place of mechanical work. The work is extraneously and uniformly prescribed; there is no semblance of a spontaneous motivation in the child and he is supremely ignorant of any personal or social purpose behind his work. Work which is mechanical, work in which no mental exertion is involved, work in which one is satisfied with just any result and there is no constantly prodding urge to aim at its possible perfection, work in which there is no self-criticism and no real progress, is in no sense educative. Schools that have such work are not Work Schools in any sense". Since the concept of work experience as the medium and means of education had practically been given a burial because of our tendency to discuss ideas out of existence without ever seriously giving them a try, Dr Zakir Hussain could only lament with gentle wit, "I cannot very well deny the wisdom of learning by experience. But I cannot easily concede the claim to be wise without any real experience".

Rural Schools

With simple tools such as a soil testing kit and seed kit, a whole new world can be opened up for the school children in villages. The study of birds, the identification of weeds, the detection of alkalinity, the harvesting of rain water and the prevention of damage by rats and pests both in the field and in the store rooms would all have immense educational and practical value. The equipment needed for such studies is simple and inexpensive and mostly requires only a well informed teacher who does not curb the questioning mind and is not afraid of long walks. With a little training this is one field where all University students of agriculture and science can render great service. This experience will enrich the University graduate's own understanding of our biological assets and problems and at the same time make Mahatma Gandhi's and Dr Zakir Hussain's dream of a learning revolution come true.

In a fascinating book titled, "Last Child in the Woods" (Algonquin Books of Chapel Hill, 2006), Richard Louv has drawn attention to the links between the absence of nature in the lives of today's wired generation and some of the most disturbing childhood trends such as the rise in obesity, attention disorder and depression. He has termed this phenomenon as, "**nature-deficit disorder**". "Nature-deficit disorder" describes the human costs of alienation from nature. By weighing the consequences of the disorder, we can also become aware of how blessed our children can be – biologically, cognitively, and spiritually – through positive physical connection to nature. The best way of saving our children from Nature-deficit disorder is to adopt the learning procedures I have outlined above.

Both the need and the opportunities for a "learning revolution" have never been so great as they are now. What is needed is the will to act and not mere discussion and analysis. "For sheer size, the tasks ahead of us are so demanding that no one can afford to sit back and just watch or let frustration become endemic in our country. **The situation demands of us work, work and**

more work, silent and sincere work, solid and steady reconstruction of the whole material and cultural life of our people” – these words are even more relevant today than when Dr Zakir Hussain spoke them while assuming the office of the President of India on May 13, 1967.

The Education Commission (1964-66) led by Prof D S Kothari offered several practical suggestions to make University students “employable”, or capable of self-employment. In agriculture, the Commission recommended the establishment of Polytechnics where students could acquire the necessary technical skills so as to contribute towards the growth of scientific agriculture. The Commission also suggested ways of achieving a qualitative change in education and of linking admissions to the country’s ability to absorb University-trained personnel. Many of the Commission’s suggestions are yet to receive serious consideration from the view point of implementation.

Meanwhile the problem of jobs and student unrest is growing and there is migration of both educated and uneducated youth from villages to towns, in search of work opportunities. Even more serious than the inability of our University-trained personnel to get or create jobs, is their total insensitivity to the realities of our economic situation. Our average annual per capita income at current prices stood at Rs.32,299 during 2007-08. However, this figure represents an average highly skewed by the presence of a small class of very rich. A truer indicator may be the conclusion of the Arjun Sengupta Committee that 70% of the people are living on Rs.20 a day or less (2004 figure), but the demands placed before the Pay Commissions do not have any relationship with this reality. According to the Punjab State Farmers’ Commission, a Punjab farmer with 2 hectares of land does not have an income comparable to a class IV employee of Government. Our education, while failing to increase our wealth creating capacity, has enhanced our wealth-absorbing desire. Education is also becoming a profitable business and is fostering unsustainable lifestyles and indifference to unacceptable poverty. It is this kind of situation which triggered China’s cultural revolution.

The concept of hierarchical needs in man developed by psychologists clearly underlines the fact that within each one of us, child or adult, there dwells a captive spirit struggling to find fulfillment. The following extract from a poem entitled, “Prayer before birth” by Louis Macniece (Collected Poems, Faber and Faber) expresses this idea beautifully.

*I am not yet born; O hear me
Let not the man who is beast or who thinks he is God.
Come near me
I am not yet born; O fill me
With strength against those who would freeze my
Humanity, would dragoon me into a lethal automaton,
Would make me a cog in a machine, a thing with
One face, a thing, and against all those
Who would dissipate my entirety, would*

*Blow me like thistledown hither and
Thither or hither and thither
Like water held in the hands
Would spill me
Let them not make me a stone and let them not spill me, otherwise kill me*

There is little doubt that education, however, imperfect it may be, kindles this captive spirit. If we wish to take cognizance of this fact, we have to review afresh both our educational methods and our schemes for mobilizing students for social service. In the academic word, the era of working for others has to give way to the era of working with others. It would be useful to recall what Gurdev Tagore said in this context, "A candle which is not lit cannot light others; a teacher who is also not learning cannot teach others". A good teacher thus takes the role of a life long student.

Adult Education

With the spread of new technologies and the dramatic transformation of agriculture in certain areas, new dimensions of adult education also appear. There are new needs for education among farming communities. There is a great hunger not only for new knowledge related to agriculture but also for new skills, particularly technical skills connected with it. The demand for "techniracy" a term I coined in 1971 in my Princess Leelavathi Memorial Lecture delivered at the University of Mysore for defining the pedagogy of learning the latest technical skills through work experience is likely to be much stronger and deeper and also more widespread than that for formal literacy, or even for functional literacy. New approaches to adult education must capitalize on this new demand and need for "techniracy". I later developed the concept of Krishi Vigyan Kendras (KVK) to provide an institutional mechanism for imparting techniracy. KVKs now exist in almost all districts of the country. But, they are tending to become routine institutions with farm women and men remaining passive recipients of information.

Krishi Vigyan Kendras

My original concept of Krishi Vigyan Kendra was that KVK should be a repository of the best available scientific information. Just as breeders' seeds represent the highest quality of seed, KVK should represent the most authentic centre for knowledge and technology dissemination. Unfortunately, over the years the linkages between KVK and the mother `agricultural universities have not been as strong as is desirable from the point of view of the credibility and relevance of the messages transmitted to farm families. Since techniracy is the method of training in KVKs, they should be sufficiently equipped for promoting learning by doing. Also, as suggested by the National Commission on Farmers, KVK should be developed into **Krishi Aur Udyog Vigyan Kendras** by adding a post-harvest technology wing to them. What we need urgently is the creation of multiple livelihood opportunities for farm families through higher on-farm productivity on the one hand, and market-linked non-farm enterprises, on the other. There is currently a

mismatch between production and post-harvest technologies with the result both producers and consumers do not derive full benefit from production.

In addition to Krishi Aur Udyog Vigyan Kendras, there is need for establishing Farm Schools in outstanding farmers' fields. This will help to promote farmer to farmer learning which has a high credibility because of the trust imposed by farmers on the economics of the farm enterprise of fellow farmers. Also Krishi Vigyan Kendras can have staff members and resource persons practising farmers who know the art and science of farming from field experience. It is said that, "one ounce of practice is worth tonnes of theory". This is very true in farming where real life experience is the best guide for sustainable advances in productivity. Today we can see that "techniracy" can be achieved through ICT in rural areas on topics vital to the livelihoods of the rural masses. I shall say more about this a little later.

Education in Rural Areas

It is important that in rural areas, education is very closely related to the day to day realities of life. I proposed at the time of the Eighth Five Year Plan that new educational tools should be developed for the purpose of fostering interest in harmony with nature and with each other. The three tools proposed for this purpose are the following:

- Charter for Nature – School children are enabled by a competent and nature loving teacher to prepare a Charter for Nature for their village, which will help to make them aware of the need for conserving and improving the health of the soil, harvesting rain water, conserving bioresources and converting waste into wealth. A Teachers' Training Manual for helping students to prepare a Charter for Nature is available.
- Socio-Demographic Charter – The major purpose of this educational tool is to make students aware of the population supporting capacity of the ecosystem. Such an educational method of creating awareness of the need for population stabilization as well as avoiding health problems like HIV/AIDS, tuberculosis and malaria can be effective in breeding a new generation of citizens equipped to contribute to finding effective solutions to serious environmental and health problems. The concept of "ecological foot print" can also be inculcated in the minds of young students, so as to dissuade them from unsustainable lifestyles in later life.
- Genome Clubs – These were started in the year 2000 by the M S Swaminathan Research Foundation in Chennai for creating awareness among school children on the implications of genomics with particular reference to the human genome. When students understand that all human beings irrespective of colour, religion, race, caste etc., share similar genomic endowment, they will understand the irrationality of prejudices based on religion, race, colour, caste and gender and thereby help to promote

greater harmony with each other. This small programme has now fortunately become a national movement for starting “DNA Clubs” in Schools with support from the Department of Biotechnology of the Government of India.

The above are a few examples of how education can be made to relate to real life needs and thereby help students to become agents of change.

Universities and Community Development : The Earth University

The role of Universities as vehicles of community development is exemplified by the US land-grant system, which led to the founding of over 100 Universities, including the entire University of California system. This system played a key role in transforming rural America. In addition, it offered to the academic world a new model for bringing knowledge to support development. While the model began with agriculture, its adaptation to industry has been significant, as for example the Massachusetts Institute of Technology (MIT).

The land grant model was the driving force behind our Agricultural Universities, starting with the Post-graduate School of the Indian Agricultural Research Institute, New Delhi in 1958. Unfortunately our farm universities are yet to capture their original spirit of becoming the torch bearers of the rural knowledge revolution.

We can learn much from the **Earth University** created in Costa Rica in 1990. It has developed an innovative, learner-centred and experimental academic programme. Its educational process stresses the development of attitudes and skills necessary for graduates to become transformational agents. They learn to lead, identify with the community in solving field problems, care for the environment and be entrepreneurial. They are committed to life long learning.

In the first and second years, students work in crop, animal and forestry products on Earth University’s 3300 hectare farm. Community outreach is used to develop critical professional skills in students, while at the same time helping to improve the quality of life in nearby rural communities. Unfortunately, our farm Universities have by and large remained just degree-giving institutions with the result that the National Commission on Farmers (NCF) has urged them to adopt the goal, “every scholar an entrepreneur” in their educational and outreach programmes. Many of them located in the agrarian distress “hotspot” areas like Vidharba can get more involved in the economic and ecological problems of farmers and help to make the era of farmers’ suicides history.

Inter-disciplinary Science in Universities

Most modern science of a Nobel Prize winning quality involves the use of the principles and techniques of physics, chemistry, mathematics and biology. Molecular biology is again an inter-

disciplinary science involving biochemistry and often social sciences. Issues like biosafety assessment involve integrated attention to ethics and ecology, in addition to food safety and biosecurity. It is therefore important that our Universities foster an inter and multidisciplinary approach to science education. The Jawaharlal Nehru University and the Madurai Kamaraj University are some of the early ones to provide an institutional structure conducive to the promotion of inter-disciplinary science. I was a Member of the Working Committee of JNU set up by its first Vice Chancellor, the late Mr G Parthasarathy, for the purpose of organizing a School of Life Sciences. Our Committee emphasised the need for a University bearing the name of Jawaharlal Nehru not to create isolated islands of activities. I also pleaded that the University should foster **genes for cooperation** among scientists belonging to different disciplines. Pandit Nehru used to mention often that a university should stand for adventure of ideas and for creating new frontiers for the progress of humankind. He also emphasized that the faculty should achieve excellence in areas of relevance. In other words there is need for both vertical and horizontal dimensions in the organization of science education and research.

The organization of research under inter-disciplinary schools met with opposition from students who found that getting jobs was more easy if they had a Ph.D in Zoology or Botany or Chemistry rather than a Ph.D in Life Sciences. However this reservation started disappearing when many of the scholars of the School of Life Sciences got Post-Doctoral Fellowships in prestigious institutions abroad like the National Institute of Health, Lawrence Berkeley Lab and the Smithsonian Institution in US. Today most Universities have accepted the principle of promoting inter-disciplinary approaches to solve complex problems, whether theoretical or applied. It would be useful if NUEPA were to bring out a publication on successful examples of inter-disciplinary science carried out through Schools of Life Sciences, Environmental Sciences and Social and Space Sciences. Such a publication could point out the pre-requisites for achieving synergy among various scientific disciplines.

University Education: First Generation Learners

Affirmative action in relation to access to university education has to be accompanied by appropriate changes in pedagogic methodologies. Considerable thought has gone into this area. There are many reports on how Education, Equality and Social Justice can be integrated as pointed out by Prof Ved Prakash, in a paper presented at the II International Symposium and Public Forum on "Education, Equality and Social Justice" organized in Brasilia and Campo Grande in April 2008. One area which requires greater attention is the special needs of first generation learners belonging to families where both the father and mother are illiterate. Socially relevant criteria are being introduced in admission policies, but often there is a mismatch between admission policies and pedagogic approaches. The special needs of the first generation learners are yet to receive the attention they need. The US system of course-credit and trimester methods

of organization of university education affords possibilities for enabling first generation learners to overcome the deficiencies in their early educational career by helping to fill the gaps through foundation and additional courses. This may require giving them scholarships for an additional year or two. This should be done. It is not fair to make students belonging to different socio-economic strata follow the same pace in their studies and examinations. The principles of affirmative action now being enforced by the State and Central Governments in educational institutions are providing new opportunities for first generation learners to get university education and thereby enhance their professional skills and academic achievements. We therefore need special provisions and educational procedures for enabling first generation scholars to catch up and then to excel in academic institutions.

Women Graduates : Opportunities for professional fulfillment

It is common knowledge that women graduates often get most of the academic awards in convocations. Unfortunately, opportunities for the full expression of their intellectual brilliance and academic commitment become fewer once they leave the University. The multiple burden on their time, such as child rearing, home keeping and economic activities give them inadequate time to continue with their preferred professional pursuits. This is why we find that the percentage of women Fellows of Science Academies and other positions like General President of the Science Congress is very low. It would be useful if the Placement Bureaus of Universities have a special wing for assisting graduates who need opportunities for self-employment. Also Universities could set up Women's Biotechnology Park, Food Park, etc., to provide women professionals to take a career of self-employment characterized by flexi time in terms of working hours. The Women's Biotechnology Park set up by the Department of Biotechnology of the Government of India and the Tamil Nadu Government at Chennai with the technical support of the M S Swaminathan Research Foundation is a good example of how opportunities can be created for married women professionals to take to market linked biotechnology enterprise. Personnel policies also should be engendered taking into account the special needs of the women graduates. We should not lose the services of large numbers of women graduates with outstanding academic records due to gender insensitivity in academic and personnel policies.

Reaching the Unreached : Role of Sustainability Science

A combination of distance and class room education can help us to achieve the aims of Sarva Shiksha Abhiyaan speedily. The Indira Gandhi National Open University (IGNOU) has a very wide reach and nearly two million students all over the country are benefiting from this unique centre for distance education. IGNOU also adopts a dynamic approach in developing new courses and curricula. For example, I now serve as Honorary Chair for Sustainable Development of IGNOU. Sustainable Development is based on the foundation of sustainability science based

on a multi-disciplinary approach. Such an inter-disciplinary science has to be built on the following guiding principles.

- Ethics – Ethical considerations will have to guide human behaviour in relation to natural resources exploitation. Bioethics and environmental ethics are now developing into well defined scientific areas. The ethical responsibility of safeguarding the environment rests on professionals, political leaders and the public. In the past by investing conservation with spiritual significance, every individual was made to integrate ethics in day today life. Advances in molecular genetics and biotechnology, which permit us to “play God” have increased the urgency of bioethics courses in our Universities.
- Economics – Ecological economics does not permit depreciation of natural assets. Thus it has a time dimension of infinity. Ecological economics is also a fast developing science and it will help to measure the benefit – risk structure of development projects from the point of view of their long term impact. Ecological economics should become part of the curriculum in technological and management institutions. All dependant on natural resources for their enterprises should understand that good ecology is the pathway to good and enduring business.
- Equity – The concept of equity is now discussed in terms of both intra-generational equity and inter-generational equity (i.e. safeguarding the interests of the future generations). For example, over-exploitation and pollution of the aquifer will deny opportunities for ground water availability to the generations yet to be born. Similarly, the melting of ice and glaciers resulting in water shortage in cold desert areas like Ladakh will force future generations to migrate from the area. Climate change leading to the melting of ice will not only cause floods in the plains but also a rise in sea level over a period of time. Another important component of equity relates to the gender dimension of sustainability science. Women have been the great conservers of biodiversity and natural resources. Their role should be acknowledged and strengthened.
- Energy – energy is a key factor in terms of both economic development and climate change. Integrated energy supply systems involving the optimum use of all renewable forms of energy like solar, wind, biomass, biogas and geothermal have to be developed. Other opportunities like hydrogen and nuclear energy will have to be integrated into an overall sustainable energy security system.
- Employment – Many of the livelihood opportunities in developing countries are based on the use of natural resources like land, water, forest and biodiversity. Emerging technologies tend to promote jobless economic growth. In population rich but land and water hungry countries, there is need for job-led economic growth. Therefore development experts and technology developers should take into account the impact of

new technologies and management procedures for work and livelihood security. **Jobless growth is joyless growth in population rich countries like ours.**

- Education – Education is a cross-cutting theme and has to take into account all the above mentioned factors. Environmental literacy should be based on the principle of “do ecology”. For example, in the case of biodiversity, there is need to create an economic stake in conservation. “Orphan” crops can be saved only if there are markets for them. Similarly, in the case of nature tourism, those who operate house boats or hotels in eco-sensitive areas should be made aware that good ecology is good business. Environmental education should also be based on practical examples which can drive home the message which is to be conveyed. Therefore, it should be based on field projects which can demonstrate how to organize ecotourism, conduct green audit or manage rain forests sustainably. Just as action research programmes help to gather data on the economics and ecology of development projects, **action education will derive its roots from field experience.**

Countries like ours require **do ecology** and not just **don't ecology**. Education should go to the grassroots level and in this respect India is fortunate to have grassroots democratic institutions like Panchayats and Nagarpalikas. Elected members of these bodies should become environmentally literate. This is where modern information communication technology (ICT) involving the integrated use of the internet, cable TV, community radio and the cell phone will help to achieve “last mile and last person connectivity” in terms of knowledge empowerment. Distance education methods as promoted by the IGNOU can help to reach the unreached and voice the voiceless.

Sustainability Science is both multidisciplinary and multidimensional. For each area of human activity, there is need to develop technologies which can help to achieve the desired goal without associated ecological harm. For example, in the case of agriculture which occupies the largest land area and utilizes over 75 percent of water resources, there is need for developing methodologies to achieve an “Ever-green Revolution” which can ensure enhancement of productivity in perpetuity without associated ecological harm. Conservation farming and green agriculture which involve the use of integrated natural resources and pest management techniques are the pathways to an ever-green revolution. Sustainability science involves both anticipatory research, as for example in the case of meeting the challenges of climate change, as well as participatory research and knowledge management with rural and tribal communities in order to ensure that the recommended practices are socially compatible and economically feasible. Also education has to be derived from the adoption of an agro-climatic and agro-ecosystem approach, taking into consideration, the specific needs and opportunities prevailing in arid, semi-arid, hill, coastal, irrigated and island ecosystems. **Harmony with nature should**

become a non-negotiable ethic. The rise and fall of great civilizations in the past have been related to the use and abuse of land, water and other natural resources. Therefore, sustainability science should guide all technology development and dissemination programmes of our Universities and research institutions

Population growth should not exceed the population supporting capacity of ecosystems. The human ecological footprint should be reduced through limiting wants and avoiding waste. Many years ago, Gandhiji said, “Nature provides enough for everyone’s need, but not for anyone’s greed”. Yet, today over a billion women, men and children of the human population are living in absolute poverty and destitution, while another billion are leading unsustainable life styles. Therefore, the ethical principles propagated by sustainability science should aim to curtail both poverty, and unsustainable consumption of natural resources. This is the challenge before our Universities from the point of view of ensuring the well-being of both the present and future generations.

In order to develop course material at IGNOU, we are adopting an **Action Education** methodology. Under this method, course material is developed on the basis of field action, so that academic courses have their roots in field realities. Among the courses currently under development, I would like to mention the Sustainable Management of the Himalayan Ecosystem and the Sustainable Management of Wetlands Ecosystem such as the Vembanad Lake and Kuttanad-Kumarakom areas of Kerala. The Vembanad Wetlands is also a Ramsar site (ie, a site which is home for migratory birds). Detailed strategies have been developed for strengthening the ecological security of this unique ecosystem and thereby the livelihood security of the Kuttanad population. Safeguarding the Himalayan ecosystem is also among the eight Missions included in Government of India’s National Action Plan for Climate Change.

Reaching the Unreached : Role of Information Communication Technology (ICT)

In 1992, the M S Swaminathas Research Foundation developed the concept of Village Knowledge Centres for the information, knowledge and skill empowerment of rural families using ICT. Since then, this programme has grown into a national movement titled **Grameen Gyaan Abhiyaan**. This movement is supported by a National Alliance of Partners drawn from the Government, non-government, academia, business and financial sectors, now numbering nearly 400. Seemingly impossible tasks can be achieved only by mobilizing the power of partnership. These centres are able to provide through ICT, what I have earlier described as “techniracy”.

In order to provide trained manpower for achieving the goals of the Grameen Gyaan Abhiyaan, the Jamsetji Tata National Virtual Academy for Rural Prosperity (NVA) and Jamsetji Tata Training School have been started with support from Tata Trusts. The NVA has now over 1000 Fellows

drawn from all parts of the country and a few neighbouring countries. The NVA was described by Dr APJ Abdul Kalam, former President of India as “celebration of India’s rural core competence”. The movement to bridge the urban-rural digital divide consists of the following three institutional devices.

- Village Resource Centre (VRC)

These are organized at the block level by the Indian Space Research Organisation (ISRO). They take the help of ISRO’s uplink/down link satellites helping to equip them with video conferencing facility. Here on-site interactive training programmes are also organized.

- Village Knowledge Centre (Gyan Chaupal)

To begin with, these are being organized at the Panchayat level. Locating the VKC in a public place like the Village chaupal or school will ensure social inclusion in access to ICT. The Government of India has sanctioned 100,000 rural Community Service Centres (CSC). In addition, there are several private sector initiatives like the e-Chaupal of ITC Limited. Public good institutions like MSSRF are also organizing a large number of VKCs which provide both dynamic and demand-driven information and which are structured in a manner that the village community has a strong sense of ownership, an essential pre-requisite for their long term sustainability.

- Last mile and last person connectivity

This is achieved through synergy between the internet and either the FM radio or cell phone. The internet-cell phone synergy is particularly valuable to reach those who are fishing in the sea, for example, so that they have information on wave heights from different distances from the shore line and the location of fish shoals. The Jamsetji Tata Training School is designed to assist the upgradation of the skills of NVA Fellows and also provide trained personnel for programmes like the CSC of the Department of Information and Technology and e-Chaupal of ITC.

There are now uncommon opportunities for leapfrogging in achieving the goals of universal literacy and relevant techniracy. Bridging the digital divide also helps to bridge the gender divide in villages.

Conclusion

For adults, we should select a combination of methods like class room and distance education, literacy and techniracy and lateral learning among farm families and self-help groups of women and men, all based on the principle of “learning by doing”. During the stewardship of Prime Minister Rajiv Gandhi, the Ministry of Education was redesignated as Ministry of Human Resource Development. Nations which under-value the human resource and over-value material resources will tend to remain poor. Hence human resource development holds the key to national

prosperity and well being. It may however be appropriate to rename this Ministry as Ministry for Human Development to emphasise its pivotal role in providing opportunities for every child, woman and man to realize their true potential for human achievement. In this task, the National University of Educational Planning and Administration has a vital role to play. I wish the Vice Chancellor, Faculty and Scholars of this University great success in making our country a land of opportunity for the flowering of the human mind and creativity. NEUPA should assist our Universities to integrate the advice of Mahatma Gandhi in their academic, research and outreach programmes.

“Be the change you wish to bring about”