

SCIENCE AND TECHNOLOGY EDUCATION AND THE FUTURE SOCIETY

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Introduction :

Education must be visionary and future oriented. With rapid changes at the threshold of the future society, innovation, technology and research are indispensable tools of education. Educational innovations would be effective if they are research based and permeated with technology of education ie systematic approach to the teaching - learning process, and technology in education ie use of teaching aids. Especially, in a developing country like Sri Lanka this should be the criterion in planning a broad-based, long term educational system.

In general education has both positive and negative trends. Knowledge explosion - science and technology, the development search of the nations for better quality of life, emerging interdependent world, etc, are positive educational trends. Science and technology applied to destructive purposes, environmental degradation, population growth, etc, are negative educational trends ie problems of mortal danger to mankind. But, education must be in the lead and play a major role in societal development of the future. Education system, educational process, both should serve to realize the learning society, and hold together the individual and society through the flux of change.

Education must develop the capacity of the society to make visions. Vision rests basically on changing the present towards actualizing the future. Science and technology based knowledge revolution so vividly being demonstrated in the latter half of the present century, has characteristics of special significance for future - oriented education. Scientific knowledge and technological knowledge have to go hand in hand.

In this article attempt is made to analyse, what is societal change ?, how far the science and technology has influenced the society?, how it should be for the future development of the society?' and what is the role of education in this sphere?.

Societal Change:

The experiences, insights and trends catalysed by the past and the present, as much as the expectations and aspirations towards the desired images of the future, go into the complex web of possibilities which constitute the future.

The future is not formed by merely projecting the past and the present. Educational development becomes more consciously future-oriented rather than being only a medium for the transmission of the past. The setting of goals for education becomes a crucially important strategy in effecting change. In education the future is intruding in the present in many important ways. Children and young people who are in school presently will be manning the work places in the future. They and their successive followers in the next generation or so will be at the levers in their societies. With the accelerating pace of change, the generational shift is not a mere transition, but a new beginning. This is true of all societies, notably so of the developing societies with a large proportion of young people. This is quite so with a developing nation like Sri Lanka.

If society tends on the whole to conserve the present state of affairs, our present knowledge has a high chance of being valid in the future. On the other hand, the future validity of our knowledge becomes increasingly doubtful as the mood of society inclines towards change, and changes promise to be more rapid.¹ Change then is a decisively defining element in the choices that may be made in future possibilities. Education in its widest sense is at cross-roads of societal change and knowledge, of dynamic change processes and the capacities to make choices. Education is at its creative best when it is interwoven with the total social-human-knowledge environment of the future. It is determined by several environments-political and cultural setting, beliefs, economy, social mentality, doctrines, etc. These environments are now quickly changing. We should be in a position to understand them and to be able to design education as the force for development and create a healthier future. "The future is not some place we are going to, it is one we are creating".² Creation implies a vision and choice.

The present period is the one-unique and beyond comparison-for the human achievements in knowledge. Science became the mainspring of the growth of knowledge. Later science as technology has become the moving force. The accelerating pace of science and technology-based knowledge has been extraordinarily high. It is estimated that now the body of this knowledge is doubling every 10-12 years. The fusion of knowledge and its application has been the fertile ground for generating more knowledge and more applications. The great turning points in the evolution of human societies are marked by new knowledge, new inventions and new applications. Thus the transition is from the agricultural base to industrial base, and now in the advanced countries, from the industrial base to automation-communication technology base, leading up to the 'post-industrial' society. When an advanced and excellent technology is widely diffused to other fields, it becomes innovative technology. It is indispensable that a new technology should be developed into industrial technology in order to contribute to the development of industries. Industrialization definitely changes a developing country to a developed nation.

Beginning in the 1950s a series of technological revolutions took place. Three of these now exist. They are, the technologies of the silicon chip which has generated the information revolution, the manipulation of the D.N.A molecule which has created the biotechnology revolution, and the creation of new advanced industrial materials'.³ The revolutionary developments in science and technology have led in the last few decades to the emergence of 'knowledge-based' societies in which the central capital is knowledge. A knowledge-based society is one that derives from human potential. Education is central to the knowledge-based society because it is the human being who is the creator, the preserver and sometimes tragically, the destroyer of knowledge. Science and technology are now established as forces of great power in the shaping of the future.

Science and Technology Education and Its Impact on Society:

Science:

Man has learned how to live in this world, to conquer it, not by force but by understanding and it is the quest of science. Science is thus a special interaction between the searching human mind and the physical biological world in which we live. Science is a process of,

- ordering and classifying.
- establishing relationship.
- formulations, explanations and hypotheses, through experiments.
- understanding our world.

Asking questions and solving problems, following the processes of science, is an intellectual strategy which every learning human being should adopt. It is one of the most powerful tools in man's search for understanding, for sharpening his power of reasoning, for developing the world in which he lives and for enhancing the quality of life.

Technology:

Technology is the application of science and like science itself, can be traced back to the earliest days when man first began to adapt to live in the world.⁴

Science and Technology:

At the personal and national levels the applications of science - technology - have developed in various forms over the centuries, from the earliest crude tools of stone age men to the sophisticated personal technology of today and to the even more sophisticated technology of nations. Technology is manifest in the applications of science to health, nutrition, medicine, sanitation, agriculture,

engineering and in the general creative response of man to the problems of his life and his environment. Of course the applications of science through technology and industrialization can lead to pollution, depletion of resources and other environmental damage. This is the area where values and ethics impinge on science and technology, where personal and social attitudes are all important and where the proper responsible use of science and technology is an urgent need for all nations and for all individuals.

The motto "Science for All" reflects the need to democratise science, to make science available for all as part of culture and society. A scientifically informed populace can more easily take part in, and support national and local decision - making which involves technological change and relate such changes to their own moral and cultural values. In addition, it provides a wide talent base from whom technical and scientific specialists may arise. But above all, science and technology education means the provisions to all individuals, through national programmes and in other ways, of scientific competencies, knowledge and skills which will improve their quality of life and contribute to community, national and economic development. Most countries in Asia have national science policies, usually linking scientific and industrial research and development with economic development and national goal. Even in Sri Lanka a step towards attaining the above goal has been already taken by the introduction of Integrated Science in School curriculum.

Science and Technology Education :

Science and technology are one of the important sources of empowerment of education to deal with and respond to the demands and the unpredictabilities of the changing world. Intellectual institutions of the education complex have the crucial role in societal development. They are knowledge generators, also centres of innovation, and are service centres for their communities, facilitating and promoting change and development. In the developing countries science - technology's role in education is defined by these three functions.

To ignore the limitation of science and technology would be to distort education's full contribution to human welfare and to create a fatal defect in the agenda of societal progress. The scientific- technological act of pursuing is increasingly perceived as carrying its own justification and beyond questioning the validity of the use to which its results are put. In effect there is a growing disjunction between science - technology and wisdom. All the experience of the current deepening crises of environmental degeneration, pollution, ecological imbalances, population problems and resources depletion underlines the fact that technology cannot solve the fatal problems that it creates. Most of the scientists and the technologists are engaged in inventing and developing deadly weapons

of mass destruction. The unpleasant pursuit has now entered the biological world also. Human genetic engineering has the power to modify human bodies, characteristics and mental abilities and interpose in the course of evolution.⁵

The scientific and technological achievements which call up future images of co-operative international order have also generated problems that darken and overshadow these images. Infact the problems rather than the achievements begin to define the future of the society. They are the unique products of modern times. The problems which are created by the technological development, lags in providing the solutions. Of course, these problems are also not 'origination-bound' (Industrilization → Environmental degeneration → Medical advances → Population growth). But their impact and consequences become quickly global. The problems associated with the environment have their origin in the industrialized countries, and the problems of population growth are great in the developing countries.

When men can generally acquiesce in the destruction of their living contemporaries, why should they be expected to take the painful actions needed to prevent the destruction of future generations whose faces they will never live to see?⁶ 'If fate brings suffering to one member, the others cannot stay at rest. And you who remain indifferent to the burden of pain of others, do not deserve to be human' (Persian poet-Saadi, in his classic GULISTAN). Here in this stage human values which are high in character are indispensable in shaping the behaviours of the society for their better future. Social responsibility and social consciousness which underlie all lofty values can only be fostered through education in its broad meaning. Their moral loftiness, universality and the profound insights into human nature may provide the links of continuity in the flow of developmental change.

The educational and societal goals merge in a vision of the learning society which serves the enrichment and fulfilment of all human beings in the fullness of their diversities, complexity and profundity. These goals are part of the process of envisioning, serving in part as sign posts of the development patterns and value trends underlying the present situation's movement towards the future, and in part anticipation of that future in an act of realizing it. They stem from the present realities and the societal consensus and at the same time go beyond them. They not only seek to affect or modify the present but also aim at shaping the future. Educational goals have to be envisioned as choices relative both to the social purposes and responsibility and to the individual empowerment and development. Education for the future needs to be based on a higher synthesis, a new holism, of the needs of the individuals and the societal responsibilities.

Restructuring Education for the Future:

In changing education for the future, the restructuring and reorientation of the education system is essential. Much of the crisis in education at present in developing countries, has its origin in institutions which dominated by the system, are reproducing rather than creating. A crucial way to lift the leaden weight of the system would be to displace it in many of its functions by networks of creative institutions with capacity for collective response, to the innovative challenges of future-oriented education. The new goals of future-oriented education in terms of the domain of knowledge, the education-work linkage, and the extension of education to all people constituting the "learning force", will call for new orientation in the internal structures of the education system.

The innovative strategy may aim at creating new institutions, programmes and methods in order to by pass the regorisms of the traditional formal system. Apart from the traditional educating activities, there are now an increasing range of programmes, generally for training and re-training of adults and out-of-school youth, community development activities, community health centres, small-scale industries development and the modern communication media. Most of these institutional developments such as small-scale industrial development are outside the formal system. Some of them such as adults education programmes are in the bounding line of the education system rather than at the core. The separating lines between the formal education systems and the activities and institutions in the general societal environment will shade off and make both systems open. The open educative system will be distinguished by the variety and forms of knowledge, experience, skills. social and cultural insights that it attracts through full-time, part-time or voluntary routes.

The essential, indeed key, concept in changing education for the future is its qualitative transformation. This applies in one form or another to all countries and with special relevance and immediacy to developing countries. A qualitative transformation for future-oriented education, involves no less than a 'double leap' in order to move ahead in the quantitative dimension and simultaneously set in motion the process of qualitative change. Qualitative change in education is a multi-faceted phenomenon. One key aspect is the breadth of learning encompassed, the need of the learners for exposure not only to a broader range of disciplines but to new generative synthesis and to new areas of inquiry. The approach is not one of superficial 'contact' but in some depth in terms of the insights that are acquired.

In the framework of the common educational structure, the principle of broad-based learning will translate at the first level of education (basic stage) as learning for caring, for personal physical and health development, and for acquisition of basic learning skills by all children.⁷ At the post-basic stage,

broad-based learning is maintained in relevant forms and specialization comes later. At the post-basic stages the organizations of broad-based learning are guided by the principle that the streams of knowing and development continue together and are not to be prematurely separated. The way of knowing of humanities and creative expression is not separated from the way of knowing of the scientific-technological, and these again are not separated from the way of knowing and action embodied in social-economic knowledge.

The future societies, quite clearly, continue to be shaped by science and technology. These are indispensable in helping the societies from where they are now to where they aspire to be in the future. Questions about what kind of science and technology and for whom, are central to a qualitative transformation of education. Science education has now a recognized place in school education in developing countries. Science - Technology - Social (S. T.S) Education is an important aspect in recommendation regarding Science Education in the modern world. This technology serves as a bridge coupling science and society.⁸ But, there are a variety of short comings which should compel a major re-orienting effect in this area. They are,

1. Much of science education in the schools is designed as a preparation for the study of science at the higher, specialist levels.
2. Science education programmes split off the science disciplines into specialized groups. Biological sciences, physical sciences, environmental sciences, are split off from each other.
3. The links of science and technology in science education programmes are slight and weak.

Science and technology education has to be broad based and accessible to all students, to all stages, in an appropriate form. It has also to be a significant element in adult and continuing educations. Therefore, the most important of the reorientation is the integration of technology and science. The integration of theoretical knowledge and its application with the related skills is at the heart of a qualitative change of science education at the school level. This integrated body of knowledge including computer science applications and related skills should make it accessible for all children to gain an understanding of the nature of technology and prepare them to use science and technological skills in the problems of daily life as much as in further education or entry into the world of work.

Another area of integration is the linking of science - technology and environmental science which should nourish in the young people a caring understanding of the interdependence of all living organisms and of the delicate life supporting balances which hold the living and the inorganic together. If the

scientific process is introduced into education and research is incorporated with learning and learning is applied to the real environment around the education system, knowledge will be generated all over for relevant uses.

Essential in the educational method of science and technology is sharpening and enhancing the ability to identify and define a problem and use knowledge and skills effectively towards a solution. While the developments in science and related disciplines dramatically represent the knowledge explosion, the human sciences and language have the potential of a very high order for changing and redirecting education. Language is also the principal communicating link among the different disciplines, including the scientific.

Conclusion :

As human capacities begin to dominate the development process, training at work, or change of work or creating new work will be very widespread. Its content and range will be an important indicator of a society's development. Further more, education and training will lose the sharp distinction separating the two. The artificial distinction between formal education and non-formal education will cease to have the undertones of two separate and different educational world.

The perception of a future education is implicitly a view of the moral order of the future. Its important role in contributing to the creation of an economically and ecologically sustainable future lies both in the domain of values and attitudes and in the domain of knowledge.

The success of science and technology education depends on the proper utilization of all the resources available in a society. This in turn should produce enlightened individuals in a society leading to a literate world. Thus future wellbeing of the world, we live in, depends on knowledge gained through science and technology education. It is fairly certain that if the next generation do not know and understand the world much better than the present generation and its leaders and opinion makers, their survival chances will be in grave danger.

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