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FUTURE OF SCIENCE AND TECHNOLOGY IN PAKISTAN

BY

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ABSTRACT.

In the past, science was supposed to be an academic subject, the attitude was purely individualistic and only a few selected rather devoted attached importance and sanctity to this profession. Now-a-days, tendencies have changed, science has extended its horizons, it has produced a significant impact on our daily life and has already changed our traditional values. Several R&D scholars are continuously working on systematic/Collaborative projects related to consumer sophisticated and heavy products. We need strong R&D groups in Universities; trained, talented and interested teachers for formulating curricula and system of examination if we modify the pattern of evaluation. In this respect there already exist a culture of Institutions/ Councils/Foundations/Commissions in the country such as Pakistan Science Foundation, University Grants Commission and National Institute of Power etc. All have a role to play. Some of these agencies are concerned only with higher education and totally ignore science education at primary secondary and higher secondary level, wherein quality of future scientists is determined and foundation for scientific attitude is laid down over there only.

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The present age is the age of science and most things around us are conditioned by it. It is perhaps not incorrect to say that our very life is governed and conditioned by science and its products.

Man is in pursuit of food, freedom, security and work. Science has made it available to all but instead of using science for these constructive purposes, men are using it for war and destruction. It is very sad. Man could have brought about fruitful change in the world if they know what they can do with the help of science. It is, therefore, necessary the science be explained in the light of changing situations. Science should not be interpreted as a part time such an interpretation was suitable for the time where there was no danger to the individual and the society. The world is being smashed into pieces by scientific products and in these circumstances an academic research work seems to be useless. An average citizen of a state can hardly consider himself an educated person unless he is acquainted with basic principles of science and is able to take an intelligent interest in modern scientific developments. This will become possible if every child is familiarized with the basic principles of science as a means of mental discipline.

Science has helped man to gain control over nature, understand its secrets and resolve its mystics. It has enabled him to reduce distance through air flights, and bring the different pepoles of the world closer to one another. The modern man climbs over the heights of the Himalyas and descends to the depth of oceans; he measures the heights of the former and discovers the mystics of the latter. He gets news and views of other countries and people by merely installing radio and television sets. He weighs, measures and analyse the starts. He has through the invention of the printing press, cheapened knowledge all these miraculous achievements, he owes to science.

The objection of common man is correct but modern academic is itself against mere theorising and leaving it in the hands of the selected few with little reference to the needs of life. It is

actually taking part in all technologies i.e. Civil, Electronic Computer, Mechanic etc. (Economics, Agricultural Business, Health and other) very important sides of life has become a very potent agency of evolution. People can not understand science because its progress is very rapid. It was not with nineteenth century what it was in the eighteenth century. Similarly there was a tremendous change in the twentieth century as compared to nineteenth century. Although the fundamental principles are merely the same as they were in the nineteen century but the attitude towards the subject has vastly changed.

There are four changes in science. The general theory which deals with the atoms and molecules, has combined Physics and Chemistry, Bio-Chemistry has interpreted life; (Biology) in terms Chemistry. The most controversial point of heredity has been solved through the theory that chromosm are material Physical basis of heredity.

Science has provided steam power which helps to run monstrous vehicles without much effort, dig canals and raise palatial buildings in very little time. It has introduced the use of electricity which helps us not only to ripen crops and cook our food, but also to preserve it for any length of time. All these and many more scientific inventions and discoveries have brought joys into life and added to the interests of human existence. Science has also brought miracles in the field of medicine and surgery.

Science deals with concrete facts and basis its conclusions on reasons. It encourages the development of scientific spirit and did interested four suit of truth without basis and little thought of material utility. Its knowledge tends to make a person accurate and matter of fact, and discard the age-old prejudices and supersititions.

The progress of modern science is greater than, as well as different, in nature, from the previous once. This new way of thinking has separated the modern scientists from the old. During the Greek period and later, the conception of atoms etc. was quite elementary; whereas today it has become quite complicated. Higher theories of Mathematics and Physics are un-intelligable to the man in the street. They think that it is abused. Nevertheless no one can deny the realities of science and its utility in every day life.

Common sense is the general intelligence which helps a man to understand ordinary things of life, but now this intelligence is used to follow the ever increasing complications caused by science. In spite of its un-intelligible characteristic, science has influenced the modern art

to a considerable extent. The modern artist has caused to care for the customary technique of art. He has adopted a new method. It is a natural consequence of the influence of modern science that the artist has taken help from science in drawing their pictures etc.

Newton did not believe in the system of organization and grouping. He laid stress upon individual units working separately and independently but the modern scientists believe are in organization. They supposed that groups work together in coopration. Glmipses of this attitude are seen in the works of Carl Marx and Engeles. Nearly a century before their works are read and admired now-a-days. All the branches of science are brought nearer. Efforts are being made to create a closer and finer bond among all the branches of science. The result is that all the scientists are working in cooperation as one team of workers and given up competition and jealous.

But it has to be admitted that science is not an unmixed blessing for humanity. It has led to an era of industrialism which implies a scientific attempt on the part of the modern man to utilize the potentialities of Nature for the enrichment of the human soul. But it has brought in its wake over-work, under-feeding, disease and misery to the God for-saken millions of the lower strata of society.

Science has today become the hand-maid of war. Modern warfare owes much to the scientific inventions and discoveries which are being put to a deadly use. The deadly types of monstrous tanks and antifaules guns, mines and mine-sweepers, U-boats and depth charges, bombers and fighters, poisonous gases, cosmic rays and the atom bomb are the products of science. It is therefore, not wrong to say that modern war is a war of scientists who fight it not the battle fronts, but in their laboratories which have become manufactories of newer and more deadful and deadly war weapons. Science has, in fact emerged as the greatest of all conquerors in history. Its proper use is indeed a blessing, for it can make man healthier, happier and nobler. But its misuse which has already become a veritable course and brought misery to the millions of the poor and down trodden creation of God, may eventually lead to complete annihillation of humanity. It is therefore, high time for man, the noblest of God's creations, to learn to utilize the truimphs of science for the good of the whole human race and thus help to bring back an era of peace and prosperity.

In these circumstances, science has been brought in with the so called un scientific world. It is not limited to the selected few who do the research work a pastime. Now it is given a serious consideration. Thousands of whole time workers are engaged in it. It is not an academic

thing. Only scientific research is done on a larger scale. It is a very important aid to industries. On the other hand, industries are promoting science by providing it with the necessary apparatus.

The twentieth century is called the age of Anxiety, because suspiciion, hatred and greed reign supreme every where. This world of ours is indeed passing through a period of double crisis. The dark of clouds of world war III are hovering over our heads and though the Philadelphian lawyers are crying hoarse for peace, this rare thing today seems almost impossible of achievements. In their anxiety to hold at least the statusquo they spend millions of dollars on the preparation and accumulation of heavy armaments hoping by so doing to frighten away the enemies of world peace and help to save the world from the yawning chasm. But it leads to a race of armament. Sideby side with this great problem is an other equally grave problem, the problem of the ever increasing world population without the agricultural out-put increasing in the same ratio. Even if there were no global war in the near future, humanity would have to face an unprecedented economic chaos unless, of course, genuine efforts are made by one and all to avert it. The inner world is thus bleak the outer world shiffy. Under such circumstances any country, failing to maintain its economic stability, is deemed to wreck and ruin.

The Pakistan is passing through a transitional stage. For the defence of the country she needs to have a strong army, equipped with modern arms which would cost the exchequer enormous suns every year for some time to come. She has to improve the standard of living of the common man by increasing the natural resources, providing them with gainful employment and making them free from want. She must of necessity establish her economic stability, without which no country can command influence in world politics or carry much weight in the international sphere.

It is therefore, necessary for the Government of Pakistan to formulate an industrial policy which would help build up a stable and balanced economy for this new born state. Such a policy can provide equality of opportunity for one and all and make equitable distribution of wealth. A systematic and planned industrial expansion, which perhaps is the need of the hour in the Pakistan pre-supposes through knowledge of potentialities of land and necessitiates the regulation of mines, oil fields and other mineral resources besides harnessing water and steam-power. This alone would inspire confidence and stimulate the flow of private capital both home and foreign into the industrial field.

Pakistan would thus increase her national dividened and establish a stable

industrial economy which leads normally to national prosperity. But such a policy must not in any way check or hinder the free play of private enterprise and individual initiative, except in so far as it aims to check monopolies and lopsided development.

But certain major industries vital to the well-being of the country, such as the manufacture of capital goods, oil development, jute, paper, heavy chemicals and fertilizers, require millions of rupees to invest at the out-set which is beyond the means of private individuals to supply. To meet this eventuality the Government has created a statutory body, called the industrial development corporation, which aims of assuming the responsibility of establishing or sponsoring such industries.

After keeping in view above facts, for which talented persons are required to who have to be educated/introduced about "today's" science and tomorrow's technologies effectively. Effective process for the reformation and improvements in our various fields can be developed when we provide them intelligent technical hands and this only can be done when in our country technologies have to be given more importance and its education practically as well as theoritically, be common for all peoples who are interested but some where they are being unable to pay required requirement. They have to encourage those clever people to impart education in various fields of technologies but below give technologies have to be introduced in the light of practical field so that our new generation creates knowledge in various technologies and spread over rapidly.

As such we live in an era of scientific modern and technoligical advances. From the kitchen appliances to oil drilling rigs, from micro computer to laser controlled long range missiles and from life saving machines in an opration theatre to the F-16 sweeping up in our blue skies, one witnesses a wide range of technology at man's disposal.

The fact that we owe the comfort and luxury of modern living to U.S. aid or loans from other developed countries is seldom realized by our planners and policy makers. Neither the constant drain on our foreign exchange nor the heavy interests paid on these loans have prompted to frame an efficient scheme for technology transfer. It is evident that if we wish to survive as an independent nation and maintain our identity amongst developing countries, we must learn to rely upon our own resources.

Only Science Education can provide a sound basis for scientific research and technological development. In his key address on the occasion of second general conference of third

world academy of sciences, held in Beijing in September last, Prof. Salam made the remark that science of today is the technology of tomorrow. To build an infrastructure of technology and to develop self reliance and intellectual credibility in the world of science, we need strong R&D (research and development) groups. And to achieve these objectives we must invest in school and college levels. Our education system in general and science education in particular is affiliated with:

- Paucity of funds.
- Higher student/teacher ratio
- Unrealistic course load
- Out dated curricula
- Ill equipped laboratories
- Lack of qualified teachers
- Conservative system of examination
- Coaching centres or group tuitions
- Five year paper syndrome.

We are short of institutions that impart good science education. We do not have a well defined science policy. We are still allocating a meagre 2.1" of GNP to education. While developed countries earmark more than 5". And the sort of education we are providing at our schools fails to develop the attitude of critical enquiry and aptitude for conceptual understanding which is pre-requisite for evolving scientists.

The criteria for admission to prestigious colleges is simply grade and the pattern of examination forces the school students to cram instead of understanding the subject. They resort to tuitions coaching centres and very often use unfair means to get good marks.

Same story is repeated at the inter science level where the majority of students compete for admission to professional colleges.

There is motivation for enquiry nor for applied science studies. The system of education fails to spot and exploit the talented students who are imaginative and have some originality of ideas.

To mend this sorry state of things, we must revolutionize the education system at the school and college level. The objective should be to inculcate a sense of enquiry and genrate an understanding of basic oncepts and habit of systematic hard work amongst students. Talented

students should be spotted in various science activities, i,e,. science quiz, lab, performance and science fairs and should be given special guidance. At the primary and lower secondary level (from class three to class eight) the emphasis should be:

- Exploring the physical phenomenon.
- Stating the fundamental facts.
  about different science subjects.
- Demonstrating interesting experiments and cultivating basic mathematical skills.

Textual information must be supplemented by field trips and visits to industrial plants. An extremely effective method of inculcating scientific attitude can be visits to science centres or science museum. I wish our planners could negotiate loans to set up science centres in all major cities instead of bargaining for import of luxury items.

In all the developed countries almost every city has a science centre where younger generation not only learn about the recent scientific and technological advances but also gets involved in it.

I remember the expression on the faces of school children in boston science Museum when the thum deving sparks from a van deGraph accelerator touched the wire mesh in their front. Their excitement on touching the electric field, watching the electric forces work and testing their lung strength by blowing at a huge film formed due to surface tension is unforgettable.

Even with a revolutionary science policy perhaps it will take a long time to establish such science museum in our country. But we can improve by seeing VCR and television sets. In fact we should have an audiovisual section in all school and college libraries and should not only obtain video casette from abroad but also prepare some of our own. A size-able video cassette central library should be maintained of education or directorate of education.

Formal treatment of subjects on individual basis should be introduced at class IX stage, and a co-ordination between different science subjects, i.e. Physics and Chemistry should be minimal i.e. atomic structure should either be included in Chemistry or in Physics. Also consistency should be maintained in the units followed in different subjects and at different levels.

I realize that the changes can not be introduced without a concerted effort on the

part of educational authorities i.e. Ministry of education and Board of education. And only trained and dedicated teachers can formulate the policies and make their implementation possible.

Even with the existing curricula and system of examination we can achieve better results if only we modify the pattern of evaluation. In all the texts and review articles about educational measurements two conventional views are very prominent.

(i) Conventional or conservative view.

(ii) Progressive view.

Conservative view is concerned primarily with the subject matter, social needs and products of learning.

In progressive view, an atmosphere of participation exists between the teacher and taught, job of the teacher is to motivate the students and create an urge for conceptual understanding and inquisitiveness in them.

One very useful suggestion, which appears to be most difficult to incorporate is to have the final examination supplement by assignments and projects. If we wish our science students of today to blossom into researchers, scientists and technologists they must learn not only to think but also express themselves, to put their ideal into words. And part of the material which is lengthy and tedious should be mastered by writing assignments only.
One could suggest internal evaluation but the inherent corruption in our society will defeat the purpose.

I must admit that all these suggestions are futile unless there is a will to change the system. The policy makers, the educational authorities and the teachers must join hands for this purpose.

It should be clearly understood what that student must know, comprehend and express at the end of each course segment. For example any science student after passing high school should understand the fundamentals of mathematics. He/She should be able to read and photograph, manipulate and substitute in Algebraic equations transcribe powers of ten and know the basis of geometry and Trignometry.

There are many agencies concerned with the course of science education curriculum wing, text book board, Pakistan Science Foundation (PSF) University Grants Commission (UGC) and probably many other have some role to play.

Some of these agencies are concerned only with higher education and totally ignore science education at primary, secondary and high secondary level, where the quality of future scientists is determined and foundation for scientific attitude laid down.

University Grants Commission does not recognize even the degree colleges teachers though they might be teaching BSc classes.

The air of arrogance and policy of selection can never serve the purpose of effective education. A large amount of our previous 2.1% of GNP is squandered away in maintaining the bureaucracy of various parallel organizations who frequently indulge in antiparallel activities. It is suggested that one more agency may be created and added in aforesaid agencies which could correlate and co-ordinate the activities of all these organizations illustrating different science policies to the nation.

Towards the end, I would like to deal more explicitely with three important tiers of our present day Science and Technology System, i.e. Basic Education Centres, Higher Educational Establishments, National Institutes.

The Basic Education Sector could be classified in the form of Primary Education; Secondary - Higher Secondary Education. If we fail in our endeavour to provide all the necessary impetus to consolidate, we all would ill serve this nation and tell the world that we are unfit to live up to such legacy. Hence there stems the need to reorganize the present Primary Education Sector with high-military precision. The evils of tuitions, inbreeding, incompetency, lack of English language as a foreign second language, VCR culture must be totally eliminated from our society.

The Higher Educational Sector embodies organization such as Universitities. These days, within Universities there has emerged Klashenkov environment. This ought to be necessarily done away with high hand in what ever possible way. At a certain lower level, there should be bifurcation of students, only those who have the right aptitude for higher Education should be allowed to pursue such career studies; teachers accountability must be strictly ushered in. Inbreeding is an other cause of deteriorating academic standards in Universities. Being highest

learning seats, these should not be closed except on those days as approved by Government of Pakistan. National uniform calendar based on International standards, must be introduced. Code of ethics, similiar to the one prevailing in USA, Japan, UK, Singapore, Malaysia, be legislationised and uniformly adopted.

The National Institutes of research and development ought to have close collaboration with the Universities; they should encourage younger generation to do specialization and concentrate on research and development. Job opportunities should be provided to outstanding students from Universities.

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