

## FOUNDATIONS OF EDUCATION

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### Summary

The main items that influence education in the post-industrial world and some tendencies in the development of education systems are briefly observed. Among them are political and economical goals of modern education and the role of education in global politics. The origins of education and its close relations with science are considered. It is concluded that the development of human interests and of a global sense of a common future for the whole of humankind is the most important goal of modern education.

### 1. Introduction

The beginning of the new millennium has coincided with the entrance of humankind into an epoch of information technology that the sociologists call post-industrial society. Today it becomes apparent that the abundance of material benefits generates new, non-material values. The tendency of human beings to maximum self-development is a major source of advance. It presupposes not the saturation of their material needs but boundless consumption of information values. The most valuable and expensive product now is not goods, but knowledge -- information about things and their methods of production. A high level of education will soon become indispensable not only to develop and produce new goods with higher consumption properties, but also to be able to use them. Without a definite educational level even passive life in the modern world is impossible, and this minimum "threshold" level of knowledge, indispensable for any

individual, permanently grows.

There are numerous outstanding achievements in the research of space, the understanding of properties of matter, in power engineering, biology and medicine. But not less impressive is the advance in everyday household activities and those capabilities that have become accessible practically to everyone. The most important achievement of recent decades that radically changed the face of society was the development of modern information technologies. The role of this event in the history of humankind can be compared only with the appearance of writing or the invention of book printing. Theoretically the creation of the personal computer and worldwide information networks has made accessible to each person in any corner of the Earth the whole volume of knowledge accumulated by humankind during the millennia of its existence.

The exponential increase in the volume of knowledge necessary for successful activity in modern society has dramatically raised the significance and value of education, having made the provision of it one of the major functions of society and the state. The increasing rate of change in industrial and household technologies that are replaced several times during the life of one generation causes everybody from time to time to find opened for himself/herself practically a new world. Young specialists find out, at certain points, that the greater part of the knowledge they have received in the course of education has lost practical value. Everybody, from scientists to housewives, has to master new technologies of existence in this world. The education process became a synonym of life. Only education enables the individual to have adequate control over newly-arising living situations. The social status of an individual in society is not determined any more so much by his/her origin, i.e. belonging to specific social groups or possessing certain levels of capital. The most important criterion is educational level, the capacity to transform information into knowledge, the potential for productive activity in a highly technological society. Class distinctions in the post-industrial world will be conditioned first of all by differences in education.

Only a high educational level allows the individual to use in full the possibilities created by society, and to take a worthy place in the public hierarchy. As well as enabling the individual to take best advantage of modern day opportunities, creative self-expression is also the strongest motive for a constant rise in educational level. Education becomes the main capital. Potentially, under conditions of equal access to education, the information society of the future can become a society of equal opportunities, where everyone will hold a position determined only by his/her capacities and personal achievements. But it is necessary to realize that a distinction between educational level and potential opportunities can also become a source of deep social inequality.

Everybody who lives in the modern world needs to be well educated. At earlier times, societies lived in a world of machines and gears that maintained human existence. So individuals needed elementary skills of dealing with them, controlling them, not only to receive the definite benefits of their existence, but also to avoid the potential harm which they could cause. Later the world became one which rapidly varied because of increasing anthropogenic advance. Human beings changed nature, the atmosphere, the soil. There were new chemicals, drugs, plants and animals daily introduced into nature.

There were new illnesses. Every individual needed elementary skills for the maintenance of his/her own health and the preservation of the nature, for safeguarding the existence both of himself and of the biological species. In the third stage, individuals live in a society whose existence is impossible without respecting the rights of others and without having the skills to defend their own rights, i.e. possessing elementary skills of public life. And to live in our most recent, modern society, and to use its values, the individual needs to know how to contribute usefully to that society -- i.e., how to find a productive role within that context.

## **2. Origins of Education**

The need for education matches new needs for the preservation and transmission of accumulated knowledge. Once the volume of skills acquired by the human population as a whole clearly exceeded the personal experience of each individual, human beings felt the need to transmit knowledge from one generation to the next. Certainly, something similar to training can be watched among animals. Some animals bred in captivity can not be released into their once natural habitat as, not having gained the necessary skills, they would perish. Among the immediate ancestors of human beings the volume of transmitted knowledge reached such a level that it became expedient to spare part of the scanty food resources to support the existence of some of its members who, although they were useless for breeding or active provision of food, were smarter or more experienced in other skills. Such altruistic behavior has been proved among Neanderthals living more than 40 thousand years ago.

In the late Stone Age after the appearance of Cro-Magnon man the rapid biological evolution of human ancestors suddenly stopped. Simultaneously all rival branches of the species *Homo*, such as the Neanderthals, disappeared, and ancestors of modern people began their rapid and irrepressible spread across the planet. One of the most probable explanations of this radical change in the nature of human evolution, the so-called “late Stone Age revolution”, was the appearance of a qualitatively new phenomenon in the society which may be called “collective memory”, or, at any rate, its more important public role. Society invented mechanisms for the more complete preservation and transmission of accumulated knowledge from generation to generation, having opened thus for itself a route to social evolution that has replaced biological evolution. The value of society members began to be determined not only by their physical attributes and corresponding ability to give their descendants advantages in physical struggles with their rivals. The society and public consciousness was rebuilt in such a manner that physically weaker but smarter or more skilful members of the society also had an opportunity to remain full members of that society and to transmit their genes to descendants. The price of the termination of intraspecific struggle was a rapid decrease in the rate of biological evolution. It was changed by the evolution of society, which gave Cro-Magnon man the edge over potential contenders in the struggle for the right to be called our human ancestors. Society had started along the path towards the creation of civilization, for which, apart from a developed brain, which had been given by the previous biological evolution, it needed a developed collective memory, i.e., a system of accumulation, storage and transmission of knowledge. Unlike animals, the human being has no inherent instinctive schedule of behavior in typical living situations. Before beginning to act or to work, human beings had to create in their heads an ideal plan of

outcome of future activity and a schedule of their achievements. Therefore, before beginning to make something, or to create, the human being had to store the information and knowledge for a long time, i.e., to study. The need for such study was the origin of our educational system.

During historical development, knowledge stored by society took different forms. Probably the lowest form of collective knowledge was mythological knowledge. This was not consciously created. It arose as though of its own accord, varied extremely slowly and was transmitted in oral form. It was not specific in its field of knowledge; therefore its carriers -- the pagan priests -- were not only keepers of a cult, but simultaneously general specialists of the whole set of accumulated knowledge. Only as a result of long evolution did mythological knowledge undergo a step-by-step transformation into scientific knowledge.

The main tool for knowledge transmission in human society is language. The issue of its genesis is one of the most complex among scientific problems. Even the most “primitive” of the more than 6 thousand languages that exist now or have existed in historical time on the Earth is actually extremely developed. The most “primitive” tribes known today actually are not primitive people. They speak languages as complex as all other languages. In the modern world there are no transition links between animals and human beings, and the genesis of language creates a huge obstacle to comprehension. It is clear only that the genesis of language is directly connected with the beginnings of abstract thinking among our human ancestors. This capacity is absent among all animals, however “clever” they might seem. Only the brain of a human being (including a newborn baby) has the potential capacity for abstract thinking. Probably, contrary to generally accepted opinion, language arose not as a means of communication, but first of all as a means of knowledge. Primitive human beings denominated a subject to distinguish it from others and through that to become acquainted with it.

The appearance of language and the creation of a transmission system of accumulated knowledge were quantum leaps in the history of humankind that changed the nature of the evolution of human ancestry and made education one of the main functions of society.

Education, science, and their representatives have suffered abuse and persecution in many previous eras such as the Middle Ages, or under fascism or other totalitarian regimes. But rulers were always compelled in one way or another to leave the means for preservation of education and science and, consequently, to some extent, of the free-thinking that finally led to their downfall. History did not leave them a choice. Those who rejected education and progress for the retention of power perished even earlier under the force of more quickly progressing neighbors. The necessity of supporting industrial, military and, therefore, educational levels in the population always constrained the rulers to reconcile themselves to the existence of a number of educated and independently minded people that was always a potential source of free-thinking.

### **3. Science and Education**

Science plays the dominating role in education. Science is usually interpreted as a

general set of expressions about natural events, which may be confirmed by practice (experiment). The physical views about the universe make the body of the true culture of modern times. Today the overwhelming majority of the intellectual representatives of society profess a somewhat unified faith that the values of science are the most general values of humankind. The majority of those who work in different branches of science are united by a common attitude to the world, identical style and norms of behavior, similar approaches to problems and their relative starting positions.

Science is not the only form of accumulation and submission of knowledge. There are also other forms of knowledge -- for example, mythology, religion, and superstition. Their difference from science is that it is impossible to confirm such knowledge practically. They may be correct or incorrect. Religion responds to those problems which are basically beyond the competence of science. For this reason there are many sincere believers among scientists. But science and superstition are incompatible. Therefore modern education is absurd and senseless without science. If experience is not classified, it remains at the level of a fairy tale, myth. Until now even among a considerable number of educated people scientific rationality is held alongside a faith in magic, wizardry, and an imaginary world. In modern “educated” times of supercomputers, global communication systems and space research the scientific picture of the world remains the possession of only a small part of the population of the planet.

Only in rare moments of history has science become anything more important in society than the supplement to an educational system. Before the twentieth century practically all science was concentrated at universities. In the eighteenth and nineteenth centuries universities and the academies of science were seen first and foremost as educational functions. To the present day in many countries the science organization assumes that to be the main purpose of the education the scientist receives, accomplishing an educational function in society. Scientific research is esteemed as a demonstration of conformity to a level of scientific proficiency to a position held in the educational hierarchy. However, officials of main industrial countries have for a long time realized that the quality of scientific research at universities is the foundation of civilization and a potential force for long-term development. Therefore they invest huge funds in scientific research in educational institutions.

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### **Biographical Sketches**

**Ludmila N. Strekova** was born at Usman, Lipetsk (Russia) August 1, 1954. In 1977 she graduated from Voronezh State University, Biological Department, Chair of Biophysics. Since 1977 she worked in Semenov Institute of Chemical Physics, Russian Academy of Sciences, in the field of photosynthesis, photochemical conversion of solar energy, ESR and molecular spectroscopy. In 1987 she received her degree: Candidate of Chemical Sciences (equivalent to Ph.D) in Semenov Institute of Chemical Physics, Russian Academy of Sciences. Topic of the thesis: "Tunneling of electron in reaction centers of photosynthesis and in model systems". Since 1997 worked as a lecturer and then assistant professor in High Chemical College of Russian Academy of Sciences. Since 2000 has been assistant professor in Institute for the problems of sustainable development of D. Mendeleev University of Chemical Technology of Russia. Now she is assistant professor in D. Mendeleev University of Chemical Technology of Russia and assistant professor in Moscow State Pedagogical University. Her scientific interests include: photochemistry of porphyrins, electron transfer in tunnel reactions at natural photosynthesis and in model systems, ecological problems of energy, sociological problems of science and education, professional sociology of scientific community, humanitarian aspects of scientific activity, and the problems of sustainable development. She has published about sixty scientific publications, in including monographs, Russian and English.

**Vladimir S. Arutyunov** was born at Moscow (Russia), June 6, 1946. In 1970 he graduated from Moscow Institute of Physics and Technology, Department of Molecular and Chemical Physics. Since 1970 he has worked in Semenov Institute of Chemical Physics, Russian Academy of Sciences. Now he is a head of Laboratory of hydrocarbons oxidation and professor of Chair of Gas Chemistry in Gubkin Russian State University of Oil and Gas. Has forty years of scientific activity in the field of gas phase kinetics, study of elementary chemical reactions, kinetic modeling of chemical processes, flashphotolysis, ESR, resonance-fluorescence and molecular spectroscopy. In 1979 received in Moscow Institute of Physics and Technology degree: Candidate of Physical and Mathematical Sciences (equivalent to Ph.D). Topic of the thesis: "Experimental Study of Some Reactions of Fluorine Atoms and Trifluoromethyl Radicals". In 1993 received in Semenov Institute of Chemical Physics, Russian Academy of Sciences degree: Doctor of Science. Topic of the thesis: "Kinetics of Gas Phase Processes in Carbon and Sulfur Containing Systems". His research interests include: elementary chemical reactions in gas phase including multi-channel reactions, chain-branched processes of oxidation and sulfurization, oxidative conversion of methane and other saturated hydrocarbons, kinetics of complex gas phase reactions, kinetic simulation, conversion and processing of natural gas, ecological problems of energy and transport, sociological problems of science and education, professional sociology of scientific community, humanitarian aspects of scientific activity, and the problems of sustainable development. He has been responsible for over two hundred and sixty scientific publications, including monographs, in Russian and English.