

## **School-Factory is Doomed. What's next?<sup>1</sup>**

(EDUCATION AT THE TURN OF CIVILIZATIONS)

*Why the traditional school is arranged the way it is? What makes this educational system so relevant and survivable?*

*Nature is generous for diversity. Even living close by, we are all so different. There exist so many races, nations, religions. What is it that arranges schools uniformly all over the civilized world? Rare "individual" teaching methods are only the prove-the-rule exceptions. No matter how attractive they may look, they are unable to compete with the traditional education.*

### **What shapes the school?**

In the 18<sup>th</sup> century Europe witnessed unprecedented changes. People altered their way of life and centuries-old traditions of government system, family values, morals and ethics, ways of traveling, obtaining and storing food. There appeared mercury thermometers and lightning rods, vaccination against smallpox and electrical experiments, the probability theory and the differential calculus. The thousand-year dream of flying came true when the Montgolfier brothers launched the first manned hot-air balloon. But nothing can compare in its importance with the invention of the steam engine by James Watt.

It was the boiler, not the bottle that let the genie out. He possessed the same legendary feature of the fairy-tale character, namely the force. "Without its steam engines ... Britain would be deprived of all its power and wealth," wrote French physicist and military engineer Sadi Carnot<sup>2</sup> who is often called the "father of thermodynamics".

The time of creation followed. The genie had an army of thousands of bright minds and millions of hands. Some were busy inventing, others – selling, implementing and making use of it. But the new demiurge was cunning. Having invented the steam engine, he promoted its application in all possible spheres of life. He neither felt shy when organizing joint productive effort of many people at the factory.

Factory is the second name of the genie. Factory is the symbol of industrial time. Even the long-established agricultural labor acquired the factory features and the rhythm. Factory-made mechanical devices dramatically increased the productivity of the manual labor. As a result, there appeared a huge number of free hands in the countryside. Villagers moved to rapidly growing cities and found themselves at the factory. Thirty years after the Watt's invention of steam engine, the number of people in England engaged in industrial or handicraft production surpassed the number of farmers.

Following the example of production facilities, the features and the rhythm of the factory took over trade. If previously a buyer had usually got the product from its owner, now there appeared contracted vendors (per se workers). They sold goods according to standard rules and at fixed prices, and worked regular hours just as they did at the factory. But this marked only the beginning of social reforms.

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<sup>1</sup> The article was first published in *School Technologies Magazine* (Russia) No. 5, 2000.

<sup>2</sup> See R. Stewart *Ideas That Shaped Our World*.

Founders of the social sphere believed that plants and factories were the most progressive and efficient production entities, and tried to extend their practices to other spheres. This explains why schools, hospitals, prisons, government bodies and other institutions have many features of factory production, namely the division of labor, hierarchy and complete facelessness.<sup>3</sup>

Emergence of schools may be attributed to a number of reasons. However, there is a common basis, which is both the original cause and the background, against which mass education came forward and developed. Schools, which were and still are the prototype of contemporary traditional schools, have been born by industrialization.

The school appeared to resolve a social contradiction. The factory owners had to hire people who had been raised up before the industrial revolution because there were no others, and they were not very happy with it, because adult farmers and craftsmen were unlikely to become efficient industrial workers.<sup>4</sup>

Industrialization put forward new demands. Literacy started gaining ground among common people of the Third Estate. By the end of 18<sup>th</sup> century 47% of men and 26% of women in France could read and write. Education problems came to the foreground of public opinion making the best minds break a lance over the issue. Voltaire openly argued against educating common people. Diderot, on the contrary, favored free schools, open to all layers of the society. In their brilliant works humanistic philosophers pictured dream schools where studies resembled holidays.

However, the outcome was predetermined. Just as a lemon tree can bear only lemons, the industrial society could create only mass-production schools. The objectives were obvious: to teach obedience through listening, remembering and complying with instructions in order to coordinate individual actions with the collective effort. The aim was to teach reading and writing, as well as punctuality and accuracy in performing monotonous work. Children became feedstock to be further processed by a particular technology and become *homo industrial*.

Growing complexity of production entailed the increase in the volume of required education. Children started attending schools at an earlier age; school hours and school year were getting longer. Gradually, the share of arithmetic and natural sciences in the curricula was growing. In the 19<sup>th</sup> and 20<sup>th</sup> centuries the school became more complex, reflecting the progress of science, changes in the cultural, technological and household environment. But in its essence the school retained its factory-like features.

However, the aspirations of individuals very often do not coincide with the predominant trends in the society. In all historical times there were teachers who resisted the educational production line, though this resistance was not necessarily of progressive nature. The most gifted children also fell out of the general tendency.<sup>5</sup> Disagreement between the curricula and the teaching skills on the one hand and the spiritual needs of gifted people on the other hand generated myths of stupidity, displayed in school by such pillars of science as Charles Darwin, Blaise Pascal, Albert Einstein and others.

A more complex cultural environment provides more loopholes for talented students and outstanding teachers, helping them to avoid “overall egalitarianism”. This is not surprising, for the industrial society required not only workers, but managers, process engineers and scientists as well.

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<sup>3</sup> See A. Toffler. *The Third Wave*.

<sup>4</sup> Ibid.

<sup>5</sup> American psychologists studied the careers of 400 famous people and found out that 60% of them faced problems in schools.

At the early industrialization stages all the attempts to fill this gap by teaching upper class children only failed.

It is not accidental that today the mass-production school is still alive, but is far from being safe and sound. To understand the reasons we should consider the three stages of civilization.<sup>6</sup>

**Stage 1 – Pre-Industrial.** It lasted until early 18<sup>th</sup> century. At that stage the child's outlook was formed by the family. The youngster spent almost all the time in the family, and his contacts with the outside world were practically non-existent. In those days the vast majority of common people never traveled beyond neighboring villages.

**Stage 2 - Industrial.** It has lasted approximately for the past three centuries and was characterized by mass migration of people to urban areas, which dramatically increased the density of population there. There appeared postal service for the population. The railway and steamship communication made the world reachable, if not little. Telegraph, radio and TV provide access to information from anywhere in practically no time. However, the information flow goes predominantly from the ruling elite to the population, and the state gradually replaces the family in shaping the world outlook of its citizens. State subordinated radio and television can arbitrarily interpret events and shape the public opinion. Attempts to counter this process are doomed, since even nurseries, kindergartens and schools are also state-controlled.

**Stage 3 - Information.** It starts in our times and it's hard to say how long it will last. For the first time in history information becomes the most valued, profitable and mass commodity. Information technologies emerge to allow vast numbers of people on opposite sides of the globe to communicate, argue, see, and influence each other. In the very near future any person living on the Earth will be able to transmit video, self-made movies and telecasts as well as broadcast through the Internet via individual TV channels. This ocean (or chaos?) of information will hamper exerting influence on the younger generation and shaping their outlook. And this is true for both the public media and the school as well. For example, Russian teachers, especially in large cities, where after the collapse of the Soviet Union access to information has significantly increased, note growing problems with controlling the views and attitudes of children.

With the world changing so rapidly, we enter a new stage of civilization. Thus, it is not surprising that the school faces hard times worldwide. According to a Princeton University survey, the math and natural sciences working knowledge of American students represents a serious threat to the U.S. positions in the world. It is so easy to find statements of concerned politicians and scientists, substantiating their displeasure with education, while it is hard to come across an opinion expressing satisfaction with it in civilized countries.

## **New Tasks of Education**

Some 15 years ago I delivered lectures in a dismal industrial city. An old school building was dirty, stinking and had seen better days. The most fervent debate among elementary school teachers was provoked by the issue of cursive writing.

“It develops culture and accuracy!” they exclaimed.

“Look out of the window”, I answered.

I am ready to agree that cursive writing may be useful. Or, at least, it was useful when the main purpose of primary education was to teach children assiduity. Teach by hook or by crook ... But those days are long gone, having left behind the mentality inertia and obsolete educational patterns.

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<sup>6</sup> Here we use the model of society split into stages as proposed by Alvin Toffler.

Of course, such disputes are becoming rare and the number of advocates of cursive writing is constantly declining. Moreover, psychologists have found out that handwriting depends on the nature of a person than on training. Besides, nowadays writers use keyboards rather than pens.

Here is another example that seems more illustrative.

Is literacy really the purpose of education? If so, do we mean by it the ability to read and write? In his controversial article for the Edinburgh Centre for Future Studies a renowned social anthropologist Edmund Leach argues, that reading is easier than writing and has much more practical use. More than that, there may be no need in learning to write at all, since technical devices recognizing speech open up infinite possibilities.<sup>7</sup>

Several years ago this idea would have sounded as a fantasy, but right now I am dictating this article to my computer.

Smart devices, appliances and gadgets quickly fill our life. Life perception undergoes rapid changes. Sometimes it is worth taking a break to look around, see what is going on and think it over. Let us not be afraid of giving something a thought even if the conclusions happen to turn out quite unexpected.

What kind of problems does the modern school teach to solve? And what kind of problems has a young man to solve in life? We feel by intuition that the above types of problems are of entirely different nature.

The school openly declares that it strives to teach reading and writing, as well as familiarize students with the fundamentals of science. Teaching obedience to the will of the higher-ups, compliance with the rules and instructions is not such an obvious, but no less significant modern school goal. Perhaps, even more significant. The school has always been more sensitive to misconduct, than to poor progress of students, even if a breach of discipline is a violation of long-obsolete rules. The school would rather accept changes of the cognitive domain than put up with altering the established ways of learning.

I will not assert that this goal is erroneous. I just believe that it's time to change the emphasis and introduce a different type of school practice. The school applied so much effort to enforcing industrial discipline that it failed to notice the change in social needs. Today the share of people employed in mass production in developed countries is only about 10%. But the need for energetic, self-reliant and resourceful employees capable of decision-making is incessantly gaining ground. I assert that the public school is not involved in the purposeful development of these qualities that are absolutely necessary for a successful existence in the new world. In other words, the school tries to ignore its prime task of teaching children how to live in a dynamic, rapidly changing world.

Life is already hard for people who have not learned to make choices, and in the future things will only get worse for them.

Getting married looks easy. Previously, the choice was not great and very often it was not made by the bridegroom, let alone the bride. With the current density of population and the development of mass media, the choices seem unlimited. However, some people never manage to make it.

Today offers a completely new scenario. Couples make acquaintance on the Internet, write to each other, then meet and get married. Boundaries disappear, different countries, languages, nations, races are no longer an obstacle. It is happening already, and so it will be in the future.

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<sup>7</sup> See A. Toffler. *The Third Wave*.

Now this has become a genuine open problem. Due to a huge variety of choices, selecting a trade or a place of study, changing residence and finding a new job, even making a purchase has become an open problem. And we need to learn to live in this world of enormous variety. And again we have a choice.

In a daze, we can give up and yield to those who strive for power. We can concede the right to decide. After interviews with survivors of the mass suicide in Jonestown psychiatrist H. A. Sachdeo from New Jersey Medical School came to the conclusion that the Peoples Temple members had so many choices that they could not effectively make decisions and preferred to follow the decision made for them by someone else.

People can learn and school can teach to live in this new reality, pattern their behavior on data assessment and make their own decisions.

There is another fine distinction that makes all the difference. If a person is unable to cope with piling up problems, he is more and more difficult to deal with. It is common knowledge that you sow a temper and reap a destiny. If you want children to be happy and problem-free, teach them properly in accordance with their actual needs and the new realities of life. Incidentally, in this case children display no such reluctance to study as they usually do in relation to an ordinary school.

The big question is how to properly orientate education? Here are some effective remedies defined as principles in my book *Methods of Teaching Techniques*. These principles build a bridge between the present and the future. They are already put into practice in today's best schools and will be just as relevant in future, though applied technically in a different way.

## **Methods of Teaching Techniques: Basic Principles**

### **FREEDOM OF CHOICE**

#### **Definition**

In any action of training or management, wherever possible grant the student the right to choose. Provided that the choice is always balanced by the conscious responsibility!

This can be done within the framework of the present education system. Here are just some examples of free choice, offered by Russian finest educators. V.F. Shatalov gives his students an assortment of tasks, and they themselves decide what problems to solve. S.N. Lysenkova offers her children to choose themselves what difficult words the teacher should write on the blackboard. I.P. Volkov gives students only the topic and the students themselves determine which object to make and out of what material.

### **OPENNESS**

#### **Definition**

In the process of teaching use open problems; while sharing the knowledge show the latter's confines; confront students with problems, solutions to which go beyond the scope of the studied course.

Students have a very vague idea of the scope of their information awareness, let alone the boundaries of scientific knowledge. No wonder, they display no curiosity, without which any teaching comes down to upbringing of obedient doers.

At school students learn to solve closed problems (from point A to point B...), while life puts forward open ones. The students' interest and, accordingly, all our educational efforts vanish in the gaping chasm between them.

## ACTIVITY

### Definition

Organize development of the students' knowledge, skills, abilities and purports mainly in the form of activity.

While knowledge tests come down to glib answers, resembling a tape-recorder playback, while learning and reviewing are carried out in the mode of memorizing, 90 per cent of school efforts are futile and bear no fruit.

To make knowledge a tool rather than a trashcan in the backyard of the mind, students must work with it. By this we mean that students should assess, apply, convert, extend and complement it, as well as find its new connections and relationships, see it in different models and contexts.

## FEEDBACK

### Definition

Regularly monitor the learning process through an advanced system of feedback methods.

The more developed technological, economic, social and educational systems are, the more feedback mechanisms they contain. The pilot in-flight monitors the outside temperature, the amount of fuel left in the tanks and other instrument readings all the time. This is a must for a safe flight. The same approach is true for a successful lesson, too. During a lesson the teacher constantly monitors the mood of the students, their interest, the level of understanding and other factors.

## IDEALITY

### Definition

Improve education efficiency and make it cost-effective by taking full advantage of the opportunities, knowledge and interests of students.

Activity and self-organization of students increases the idealness or efficiency of teaching and monitoring efforts of the teacher. If we manage to adapt the content of studies and forms of training to the development and academic needs of the class, the students will crave for the knowledge themselves. If we manage to agree the pace, rhythm and complexity of learning with the abilities of students, they will feel successful and want to further sustain it. This principle implies active involvement of students in management of the team they belong to and, accordingly, in teaching each other. The teacher does not get tired while the efficiency of the teaching effort goes beyond the limit. Certain quite useful teaching techniques have been rejected in view of their low idealness: they require either too much effort on behalf of the teacher or too rare qualities of character.

Principles of teaching techniques are declaratory per se. It is the methods and technologies that make them practical. But even the best teaching technique makes only half the work. The second half is the content of education. What exactly shall we teach?

## What Shall We Teach?

Education is based on the transfer of knowledge, which often becomes outdated before becoming part of educational programs. It is impossible to keep up with the science.

We are facing a paradox: we must teach children to live in the world of future which is a closed book for ourselves. This paradox appeared relatively recently, when technological and scientific paradigms started to change within one generation.<sup>8</sup>

Strictly specialized education does not meet the challenges of life any longer. A domain expert is hard to retrain and knows little if anything of related branches of knowledge. Solution of modern problems requires a systems approach, the ability to see long-term consequences. A successfully solved problem creates new opportunities. A badly solved one brings trouble. This is true not only for academic and other professional activities, but for everyday life as well.

At the present, neither higher nor secondary education meets this requirement. Large commercial companies are increasingly trying – with varied success – to solve the problem in-house. In an attempt to counter narrow specialization the US Bell System has established The Humanitarian Institute for promising managers.

In today's school students acquire knowledge in "subjects and portions". At a lesson of physics in a class with bright students I asked them to solve a problem that required their knowledge of chemistry. The results were miserable. When we discussed it together, the students explained that they would have easily solved the problem if they had been prompted to turn to chemistry.

After many years of education "subjects and portions" it is hard to expect that systems thinking will come into existence all by itself. Here is how an eminent Russian educator K. Ushinsky figuratively described the results of such education for an average student. "Concepts and even ideas are arranged in his mind in dead strings, resembling rows of swallows benumbed by the cold. Despite being very close, the swallows are yet unaware of each other's existence; and similarly the two closely related ideas can exist in such a truly murky mind for decades, failing to take notice of each other."

A renowned physicist Leo Szilard gave a very bright illustration of the unknown. It is the space outside a ball, which symbolizes all the knowledge of the mankind. The greater the ball is the greater becomes the touch area with the unknown. And each spot of this area is nothing other than a new open problem.

There is nothing that prevents saturating school education with open problems. Regular confrontations with exploratory and creative problems of unknown solutions are as critical for the development of mind as vitamins for a growing body. There are such problems in every subject and interdisciplinary area. And it is these problems that shape and develop creative intuition. After all, apart from being a God-given talent, intuition is a specifically organized and embedded in the subconscious creative experience of solving unusual problems.

Methods of developing imagination and inventive thinking have already come to education. Here are some facts. The Young Engineers Club in Britain runs regular national competitions, publishes its own magazine. The U.S. Patent and Trademark Office initiated a special partnership PROJECT XL, designed to support the development of inventive thinking curriculum for all student populations. The PTO has also developed the Inventive Thinking Resource Directory for teachers.

Albert Einstein noted that "imagination is more important than knowledge, for imagination embraces the world". We agree with this, but with one elaboration: knowing how to think outside the box, that is, how to imagine, is even more important. The Theory of Inventive Problem Solving develops and puts into practice high-order thinking skills. Although this theory has already gained

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<sup>8</sup> For example, technological paradigms of radio-design changed four times in one generation: vacuum tube – transistor – micro-circuitry – large-scale integrations.

ground the world over, the most interesting experimental platforms for its application in education take place in Russia. Of course, these are only tiny sparks in the awakening volcano of new education but they are quite capable of kindling a flame.

However, inventive thinking development alone is not enough for success. To reach the desired goal, it is necessary to acquire teaching skills for creative work organization. This includes scheduling and time recording, ability to work with databases, elaboration of scientific development evaluation criteria and, of course, discipline. But discipline should be conscious and creative as well as differ from the primitive implementation practice. And all this is quite feasible.

## **Conclusions**

*The ideal didactics* means no didactics at all. A student strives for knowledge so vigorously that nothing can stop him. Without electricity he would read by candlelight.

*The ideal management* means absence of management while its functions are performed. Everyone knows what to do and does what he should because he wants it himself.

The future of the school is determined by neither the head ruler nor by education minister nor even by teacher. Each education process participant makes his own decision whether to keep pace with the future or turn back on it.