

SCIENCE AND EDUCATION

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The problem is as old as the school itself. I became aware of this fact, when I went through the files in my records. There have been numerous articles written in the past, and numerous articles will be written on the same subject in the future.

Germany will be treated preferentially, because education is *also* a national problem. But the international scale of the problem will not be forgotten.

Already in 1983, the *Süddeutsche Zeitung* presented an article talking about our schools. In this article, the schools were considered to be rather remote from the world. The paper describes that modern pedagogy went into abstract regions, talking about structures which would present a more complicated system of life, with the result, that the kids gather less and less and become increasingly unenthusiastically. Has the reform of education maybe achieved the opposite it was supposed to do? The school is characterized by an often meaningless tenor of learning and very often school is advancing too much and too early, penetrating into things, which clearly are the matter of the university. To find explanations for this fact, you have only to take school books or curricula in your hands. It could seem that many of them have been written only with the purpose to embitter the youths, to make sure they will never enter the sciences or the humanities. Theodor Hellbrügge, a specialist in children's medicine, was formulating it like that: 'The problems of school, under which the entire population suffers, results above all that school advances without goal and that it does not even know, what the children suffer from. This is a grotesque and depressing development though it once was the high level goal of the reform of our educational institutions to free our population from such problems'. But this is largely a German problem, written on already in 1983. Since then, nothing essential has changed. Besides,

teachers are burdened with the whole responsibility and they are considered the scapegoats for everything. In Germany, we have in some branches a lack of teachers, a fact, which has to be blamed on two main sources: Older teachers feel burnt out, get sick and try for early retirement. Young people, on the other hand, hesitate to become teachers, because they are then the scapegoats for all the problems of society. Besides, they don't get the necessary training in didactics and pedagogies for dealing with the youth.

We cite in the following a few of the items, which I consider of principal interest for schools:

- 1) It is crucial to have the right motivation for the pupils, i.e. one has to motivate the students when they have no motivation of their own. Children start grammar school being interested and curious, but later on they very often lack the proper motivation. It is especially at high school, which necessitates the right motivation. Universities are here much less concerned, because the students at universities usually are already having the right motivation, while it is at the high school level, where students are very often frustrated. Yet it is at high school, where they get selected for their future studies. Incidentally, high school in Germany should finish at least at the age of 18, instead of 19 or 20, but this is a special German problem.
- 2) It is essential that the students have their proper self-confidence, because it is only then, that they can get on with their life. A lack of self-confidence makes all kind of troubles. The children often feel very much under pressure at school. The notion of being 'cool' is a reflection of the lack of self-confidence, with the students simply putting away matters. I felt the pressure in my own case, when my father said if you are not doing well at school, you will be transferred to an apprenticeship. This notion was so impressive, that I thought for a long time, that an apprenticeship was the worst thing that could ever happen to me. But he never was putting me down, saying that I was bad or some similar notion, which lowers the self-confidence. Education means to escort somebody, not to pull him down. Trained and emotionally stable students are essential for the future of a modern society. Talented kids with a good self-confidence will always make it, but most pupils have to be motivated for a subject. This is leading to the next fundamental point:
- 3) The quality of teachers is also crucial. Much emphasis has to be put on this point. The selection and training of teachers is essential for the advancement of a country. The most important criterion for the

selection of good teachers is: He must be fond of kids, must be sociable and must be able to stand emotional and physical stress. A one-track specialist who cannot empathize with children will always deter from his subject, even if he is an expert in his field. Teachers must be continuously trained; this must be compulsory. The German civil service program is counterproductive to this point. Teachers should get a program in their own subject as well as in pedagogies and didactics. One learns a life long and this should also hold for teachers. In particular, high school teachers are not prepared for the job they are doing later on, not so much in their own subject, but especially in pedagogy and didactics. We have had in the German town of Dillingen a continuation seminar for teachers, which was exclusively limited to the field of natural sciences, but it was always the same 1.5 % of the teachers of the country which participated, irrespective of whether the training was in elementary physics or in solid state physics. This has to be changed. I remember in this context the case of two Hungarian high schools, where many famous people came from in the natural sciences, people such as Szillard, von Neumann, Caratheodory, Telegdi and so on. I talked this over with the Minister of Education of Hungaria, but he simply said: 'Bring me the teachers'. These points are the crucial ones. Yet there are others, which should be mentioned:

- 4) A solid education and possibly even enthusiasm should be prerequisite for a particular subject. Education here has two notions: First of all, it is instruction and training. But secondly, it is also the formation of a character and of mental powers. A school system, which does not educate people according to their elementary needs, remains unsocial. While it is the prime task of the schools to provide the youth with a human education, in some cases quite the opposite happens. A human education in this sense does not comprise, for instance, linguistics, the analysis of processes, molecular biology, mathematical set theory, elementary particle physics and so on. These matters are subjects for university studies; at high school level they serve largely the self-esteem of the teachers and their superiors, but they don't serve the education of children.
- 5) Schools should provide an opportunity for practical work, for instance in banks, hospitals, industry and so on, in order that some pupils get sure about a subject of their interest.

- 6) There is the question of suicidal actions. It is a fact that in western countries suicide is on the second place in the statistics of the reasons of death of young males between 16 and 25. Often these are very gifted and sensitive young men. Teachers should be trained to see signs of crucial depression and should know how to offer help, as is already enforced by law in Sveden.
- 7) There should be psychologists at each school. These people should have experience in teaching, and should have special competence in advising youths, parents, other teachers and headmasters.
- 8) Children today have very often much distraction and the lessons are in clear competition to these distractions. By consequence, the children lack concentration. In my own case, I remember that the question of concentration was crucial for me: During my whole studies I pursued the goal how to concentrate.
- 9) We come to the point of mobbing at school. It is sad but it is a fact, that the weak ones – either physically or mentally – are teased by some other kids. A teacher should know how to intervene in this case.
- 10) We come to the role of parents in the education. Parents play a crucial role and many are not apt to that role and therefore tend to delegate their responsibility to school and other public institutions. Here I have to cite a special German problem: We have in Germany at the 'Hauptschule' large crowds of immigrants, who have lots of problems of their own. Prime problem is the German language, which a large share amongst them is simply missing, especially when their parents don't know German, too. Some of them are doing well at school, others lack completely an understanding of the lessons. This holds, in particular, for girls, who often are abused for taking care of the smaller ones, if the parents are both working.
- 11) The Abitur in Germany – it is called Matura in Switzerland and Austria – is like the eye of a needle, through which everyone has to go, if he wants to enter university. It is the exit examination of the high school. Parents often put pressure on the kids, because they think only with the Abitur the kids can finally have a good life. In other countries, there is an entrance examination at the university. It has to be seen, which one is better.

There are many other problems at our schools and I have cited only the crucial ones.

There is the question of the formation of an elite, a notion which in Germany will rise some eyebrows. The standard criterion of an elite should

be only the talent of a student, which for ideological reasons is difficult to sell in present Germany, which is a socialistic country.

Already in 1981 we had a meeting at the Bavarian Parliament with the title 'On the Position of Research'. The result was discouraging. The educational reform is the major domestic issue in Germany. But nothing essential happened.

It is probably not very far fetched to assume, that there is a connection between the defects of the school system and the quality of research. The advance of research within new scientific fields is hardly made any more in Germany, and this has its roots partly in the schools. Already the elementary school teacher often prefers fields other than science, because the natural sciences are considered to be very difficult and the education there is very abstract. It is even chic to present a lack of knowledge in the sciences, while it is an outrage against good taste to present such a lack in the humanities. This has to be avoided. Particularly in science children should have the opportunity to do concrete examples, involving illustrative and intuitive material.

It is a worldwide phenomenon that there is a drastic shortage in the number of students, who enter the natural sciences and engineering and this fact has its roots partly in the schooling systems. This matter is handled in the United States in the following way: There has always been a shortage of scientists at the universities, but it was coped with immigrants, which, incidentally, are also saving the expenses for the education of these urgently needed scientists. You have, of course, also set aside the necessary funds, but this has never been a problem in the U.S. In Germany, we are presently lacking both the proper scientists and the necessary funds and in addition we have the problem that many German scientists are leaving the country for other European countries and for the U.S. because of the superior conditions for research with respect to funds and also less bureaucracy.

Another German problem is the question of tuition fees at the universities, which largely is an ideological question. Education is supposed to be free, even if the ordinary worker with his taxes is paying for it. In my own case we had tuition fees, but we also had large scholarships, which meant, that I never paid anything for the tuition, even got some money for buying books. This system was abandoned in the meantime, but the present system is counterproductive to its goal.

One could add quite some more points, but I just wanted to show the main tracks.

Finally I want to point out my opinion, that we should make all efforts to establish an educational system, which helps children and youth to preserve their joy of life, their curiosity and their concern for one another. This should be the prime goal of every education.