

CONTRIBUTION TO THE SYMPOSIUM*

OR

The Training of Students in Science and Technology

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I

The extensive examination of the problem of the training of students in science and technology has been urged on us by the extremely extensive and manysided development in the last years of the natural and technical sciences and the revolutionary transformation of the whole of industrial technology before our very eyes.

The transformation of industrial production and technology has been accompanied by a tremendous increase in the number of technical specialists trained on the intermediate and higher level. Figures on this numerical increase in such leading industrial countries as the United States of America, the Soviet Union and Great Britain are generally known, therefore I consider it superfluous to quote these statistics. I do not think it uninteresting, however, to give a few figures of the extent development of training technical students in such a small country, as Hungary, since 1945, when fascism was defeated, the country released from the shackles of feudalism, and we could set out on the path of free industrial development. During the 1937—38 academic year 1050 undergraduates were registered at the engineering faculties for degree courses consisting of nine terms lasting half a year each. For the 1955—56 academic year 16 400 undergraduates were taking the same courses. That is an increase of fifteen-and-a half times.

The rate of development on the intermediate level is still greater. In 1937—38 altogether 1000 young people studied in the various technical schools at the intermediate level. Compared with 20 000 in 1955/56, that is twenty times more. To this should be added a further 16 000 who are attending evening or correspondence courses, which were completely unknown in pre-war Hungary. That is to say compared with pre-war time the number of those — acquiring technical training on an intermediate level — increased roughly thirty-five times.

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These little known figures also show that the progress made in the natural sciences and technics has in all countries tremendously increased the number of students trained in the past few years. There is no doubt that side by side with its positive, absolute importance, this gigantic and extremely rapid development (precisely due to its dimensions and rapidity) has raised numerous difficulties in all countries. These difficulties are by their very nature different in many respects in the individual countries. Apart from the social system, these problems are determined particularly by the whole historic past and established traditions of the specific country's scientific and technical development. In my opinion, however, there are objective tendencies and problems in the training of technical students which are common to countries with differing social systems and scientific traditions.

In accordance with the aims of the World Federation, I should like to deal precisely with these objective problems which are causing difficulties of more or less similar nature in all countries.

II

In recent years the question of training students in science and technology has been widely discussed in the scientific and technical press. Particularly the professional press in Great Britain, the USA and the Soviet Union has approached this question from many sides. I have tried to group from among this extremely rich literature the problems I have considered to be more or less independent from the social system and about the solution of which extremely heated controversies are taking place in all industrial countries, roughly according to the following:

a) the desired level of training students in science and technology; the basic school training required to commence training on the lowest level;

b) the aims and duration of training on the various levels and the relation of one to the other;

c) the question and transition from one level to the next (under what conditions can a person qualified in one level obtain higher qualifications), and as part of this problem, the opportunity for skilled workers to qualify as technologists (evening, correspondence, sandwich and other courses);

d) the relation and proportion of the fundamentals of the natural sciences and applied special subjects at the various levels;

e) the degree of specialization on the intermediary and higher level;

f) the proportion in the various branches of industry of specialist trained on the lower and higher levels to one another and to the total number of workers employed;

g) the proper relation and proportion of theoretical and practical (laboratory and workshop) instruction in the course of training; the necessity and possibility of practical factory work during study years.

Discussion on the above, more or less arbitrarily dissected groups of problems has been in the forefront in the past few years in the professional press. Such extensive, rapid and in many respects unavoidably spontaneous development has left these problems unanswered all over the world. This circumstance is causing greater or smaller conflicts — to varying degrees, but in every country — in the course of university and college instruction, and particularly between industry and educational institutions.

The conflict between the requirements of industry and the methods of instruction evolved at universities and colleges is primarily evident in the fact that industrial managers are inclined to put too high the standard of practical knowledge demanded of young people leaving universities and colleges. They are apt to regard much of their theoretical knowledge as “unnecessary” and “superfluous”. The lack of experience of young graduates in practical work often makes them brand them as “useless”. On the other hand, the universities and colleges are liable to reduce to secondary importance instruction in current industrial technology compared with theoretical instruction. Their efforts are directed at including in the curriculum the latest results in the given branch of science.

At the same time the extremely rapid development and expansion of the natural and technical sciences makes it almost impossible to equip the large majority of students in the time available at any university or college, with even overall, “complete” theoretical knowledge in a relatively narrow special field.

It would be difficult to sketch some “ideal” solution to the conflict outlined. At least ten to fifteen years of training — and this is obviously absurd — would be required to supply young technical specialists at the present stage of scientific development with the most essential theoretical training together with fully satisfactory practical technological qualifications.

In the keen controversy on the training and utilization of specialists which is going on the world over between the state bodies supervising higher education, industry and the high schools, the responsibility is being passed on one to the other. In this debate the one who comes off the shortest is the young specialist graduating from intermediate and even more from higher institutions. The discussion raging on their training and qualifications — in many countries — gives rise to a certain pessimism among these young specialists. They feel uncertain, their theoretical knowledge seems to be not thorough enough, and their technological practice appears neither attractive nor satisfactory. In addition in many countries — precisely because the afore-mentioned problems have not yet been solved — the wage scales are not consistent; they

offer insufficient incentive to the young specialists trying to obtain higher theoretical qualifications.

I have emphasised the probleme sketched above as the most characteristic group of questions. I have not touched other groups of problems connected with and arising out of the above, such as the special multifariousness of engineers in general and according to branches of industry (research, construction, technical development, management, technology, standardization, etc.), and the problem of aptitude and selection for the engineering career. Extensive literature is available on these questions and important scientific research work is in progress among others in the United States (Engineers Council for Professional Development), the German Democratic Republic (Institute of Engineering Pedagogy at the Technical University of Dresden), in Great Britain (National Council for Technological Awards, etc.) and in other countries.

After studying this extensive literature I have tried to give a short summary of how this problem stands at the moment. Allow me now, to draw a few conclusions.

III

Many of the problems cropping up in technical training at the intermediary and higher level can be attributed to the extremely great, manysided and rapid development of the natural and technical science. I should like to remark the following in connection with the discussion on this question :

1. These problems in my opinion — and here I dissent from some of the opinions dealing with these questions — are not due to some mistakes committed either by the universities and colleges or by industry and its managers ; therefore it is hardly likely that it will be solved by reciprocal “reproaching”.

2. These problems are due to the basic contradiction existing at present between the structure of production, which is developing by leaps and bounds and undergoing a qualitative transformation, and the present categories of technical instruction. This contradiction is extremely sharp. While industry is going over — or partly has already gone over with tremendous speed (which varies in rate and method according to branches of industry) — to completely new methods of production, the fundamentals, structure and standards of technical instruction are extremely rigid and, apart from the introduction of certain new subjects and branches, correspond in general to the educational structure half a century ago. In other words, while the content of an engineer's work and the demands made on technical experts are radically different from what they were a few decades ago, the forms and methods of preparing engineers have progressed only little in essentials. As I see the problem, the serious difficulties evident in the tremendous and on the whole positive development and the controversy around the training of students in science and technology.

which is occupying technical quarters throughout the world, can be traced to this basic contradiction. It seems unavoidable, therefore, to re-examine, re-assess and make radical, structural changes in the system which was evolved in essence in the latter half of the last century.

3. It follows from what has been said that the correct method to resolve this basic contradiction would be to improve down to the last detail the customary and traditional categories of technical training, its forms and methods, and for the experts representing the various countries and social systems interested in this question to make common efforts to this end.

They ought to work out general principles for the new structure of a system of technical training which would correspond to modern industrial production advancing with seven league boots, utilizing also the results achieved hitherto in work being conducted in isolation already in many countries.

In my opinion the World Federation of Scientific Workers has done great service to international co-operation by placing on the agenda of the present Assembly this question, which is of such great significance from the point of view of world social progress.

I should like to propose that the World Federation of Scientific Workers set up a permanent committee composed of the representatives of its affiliated organizations to study in detail the problem outlined which, I think, goes down to the roots of the problems on the agenda of this symposium. It would be the task of the committee to promote the solution of the question by organizing international (regional) discussions and debates in the ensuing two years and to co-ordinate the concrete work being conducted by the individual affiliated national organizations. The committee would submit a comprehensive report to the general meeting to be held in two years time.

As I have indicated, in passing, this question is also a problem of protecting the interests of technical and scientific workers, both in the narrow and the wider sense of the term, especially as far as the youngest generation of technical workers in almost every country is concerned.

Further, I feel that by laying added stress on this question, the World Federation of Scientific Workers would serve the cause of co-operation between the experts of countries with differing social systems and thereby the great, common cause of peace.

