THE FUTURE OF TECHNICAL EDUCATION, OR THE LESSONS OF A SURVEY

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It is commonly known that the level of a country's technical development and technical culture basically depends on education, more precisely, the quality of basic education and that of technical education, one built on the other. In modern society, technical education fulfills a priority role in founding an individual's social competence, since in this case it is the foundation of the social success of large masses of people rather than that of an insignificant stratum of society that is at stake.

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In order to fulfill the function of the technical education appropriately, which determines both the future of the individual and that of society, it is imperative to regularly improve and update this education from a structural, organizational and pedagogical point of view. In recognition of all this, technical literature intensively deals with the problems of technical education, taking into account its significance, more precisely, the macro world of technical education (Benedek, 2002, 2003, Adonyi, 2002, Szígyártó-Zachar, 2002).

In our first survey, we were trying to find out how appropriate the preparatory activity of the Hungarian primary school of today is, or on the contrary, what deficiencies it shows. The findings of this survey were described in the 4/2005 issue of the journal Szakképzési Szemle. (The article is entitled "The Pedagogical Problems of Founding Technical Education based on a Survey").

Our second survey, mainly focusing on the activities performed by the institutions of technical education, aimed to outline the deficiencies of the latter, as well as the alternatives to improve education and training at these institutions.

Our survey was carried out at the Department of Technical Education of the Budapest University of Technology and Economics in the spring of 2006, where the respondents included fifty active technical instructors who had to complete a questionnaire.

We divided the respondents into two groups: engineering lecturers and technical instructors. We processed the findings also in comparison with one another, in this sense we applied the principles of qualitative research (Szabolcs, 2001).

One of the most important findings from the responses was that there is not enough time for the integration of weaker students, due to the lack of time and the excessive teaching material. It is obvious that the lack of time and excessive teaching material are in a close causal relationship with each other, as long as the lack of time is primarily caused by the excessive

teaching material. Thus, the increasingly widespread opinion according to which the reduction of the teaching material used at the schools to an optimum level would increase rather than decrease efficiency, is also confirmed from this side.

Furthermore, one of our most important questions was the following: "Do you think that the knowledge taught in the framework of technical education is in line with the expectations of reality?"

Based on the distribution of the responses given by the two groups of educators, and the tendencies thereof, we can state that it is clearly the practicability of the intermediated knowledge, more precisely, its ability to provide a basis for professional practice that seems to be missing.

We also asked the educators to make specific statements on the reasons why the teaching material is not suitable for practical use, why it is not in line with the requirements of the individual professions.

The responses were not at all formal, the majority of them even defined noteworthy alternatives for the method of solving the problem, which went beyond the scope of the question.

With regard to the reasons for inappropriateness, the responses given by the engineering lecturers and those provided by the technical instructors well supplement each other, they make up a list which properly describes and covers these problems.

The responses can be grouped in the following list of frequency:

- ✓ engineering lecturers: low number of practice sessions;
  - o the teaching material does not focus on useful, practical information (i.e. the structure of the teaching material is outdated);
  - o the visual aids are outdated (sometimes they are 30-40 years old);
- ✓ technical instructors: the material of technical education covers the necessary practical knowledge only partially;
  - o many times there is no opportunity to get familiar with, and practice modern technologies;
  - o high standard material, too high a level for the technical workers, however, new, modern knowledge is not taught;
  - o there is no time to apply the knowledge gained, and to give a foundation for professional skills.

As it turns out, the problem is not simplified by the responses to the juxtaposition of theoretical and practical knowledge. Of course, the requirement to render practical skills dominant or at least proportionate in the structure of the teaching material, as part of the general need to modernize the structure of the teaching material, is present but the strongest focus is on being up-to-date and modern. This means that the key issue in increasing the professional orientation and efficiency of technical education is the modernization of the structure of the teaching material, and the related system of teaching aids, the incorporation of up-to-date elements of knowledge and the related teaching aids, which facilitate the conveyance of knowledge, into the process of technical education. It is true that the range of teaching aids to be selected is very wide and diverse (see for example, Karlovitz, 1999), it seems like the development of the group of teaching aids adequate for technical education has been slower than necessary.

The conclusions drawn from the responses analyzed above are confirmed by the responses given to the last question in this section of the questionnaire, which underline the importance of the modernization of the teaching material and the teaching aids even more strongly and in an even more differentiated manner but they often bring up the idea of modernizing

the teaching methods and even, that of the further development of methodology in a technical education-specific direction as well. This coincides with what is emphasized by other writers of this topic, and this bears special importance for the significant amount of underprivileged persons falling behind, who make up a large part of the participants of technical education (see for instance, Torgyik, 2006).

The last question in this section was the following: "What kind of modifications do you think would result in approaching technical education to the requirements of practice?"

Prioritizing the answers on the basis of their frequency, the engineering lecturers identified the following modifications:

- Closer cooperation between the lecturers and the practical instructors is necessary.
- The appropriate number of practical sessions would be vitally important.
- Well-equipped practice workshops would be necessary.
- New textbooks with up-to-date contents would be necessary.
- It would be important for the students to participate in practice at various types of factories.
- A more comprehensive demonstration of modern materials and technologies would be necessary in the course of training.
- The permanent further education of lecturers is imperative.

In the teaching material, industrial practice should serve as a starting point. The responses given by the technical instructors also emphasized (though in a different wording) the need for a modernized teaching material and measures aimed at bringing methodology in line with the above. The priority of the responses is as follows:

- It would be desirable to organize special professional presentations and plant visits in order to broaden the students' horizons and to ensure possibilities to compare and analyze.
- More practice should be provided for the students, connected to "live" tasks at real companies.
- It seems to be important to increase training time, including a changed proportion of professional practice sessions and theoretical lessons for mastering the lexical material, to the effect of increasing the former.
- In line with the opinions of engineering teachers, it would be beneficial to provide training at diverse and carefully selected sites (at plants and the practice workshop of the school).
- Finally, better quality, and first of all, more modern technical equipment would facilitate progress in increasing the efficiency of technical education.

It is a publicly known fact that the performance of technical education tasks is hindered most of all, and most visibly, by the deficits in skills, and these deficits are the most conspicuous amongst the students.

Our first question referring to these problems aimed at a more detailed clarification of the situation was the following: "In your opinion, the lack of which student skill is the biggest problem?"

In their responses, the engineering lecturers, almost without exception, named the lack of four skills, i.e. those of calculation, reading, independent learning and Hungarian spelling.

The technical instructors, going slightly beyond the scope of our question, but remaining within the context of the problem, highlighted the

lack of two cognitive abilities in their responses with reasonable unanimity: these are underdeveloped attention-concentration, and poor ability to understand and solve problems.

Our next important question was as follows: "What are the major training methods applied at your institution?" - The responses reflect some uncertainty about the interpretation of the concept of training methods, since there is confusion between training methods and training organization models, and the two categories intermingle.

Wrong answers have occurred in the responses given by both groups of educators and if these answers are left out of our analysis, the same teaching methods were named by both groups, in the following order of frequency: demonstration; presentation; computerized training; practice on test papers.

Our second question was aimed at assessing efficiency, in the following form: "Which of these training methods do you regard as efficient?" - All the methods listed in the first question were regarded as efficient by the instructors, underlining demonstration and "targeted testing" as a new element.

The responses given to the last question in this section suggest noticeable signs of the difference between the knowledge and application of efficient methods. This question went like "What kind of training methods would prove to be the most efficient for technical education?"

The top-down order of frequency of the mentioned methods was the following in the overall responses given by all the instructors: demonstration; "exploratory learning"; "methods of activation"; plant visits; "life-like role plays"; practical work; computerized teaching; discussion; small group workshop sessions.

The responses basically reflect the technical training model regarded as ideal from a teaching methodology aspect, from the viewpoint of the practicing instructors. This model can in fact be considered ideal and modern, as long as it builds on the students' active participation in the teaching-learning process (problem solving – "exploration"; plant visits; role plays; practical work; workshop sessions). At the same time, however, it also takes into account the role of instructors in the orientation of the teaching process, more precisely, their role in analyzing the factual material with which they have gained experience and which they have accumulated (demonstration, discussion). What is more, the techniques of independent students' access to the knowledge are also intended to be mastered by the students (computerized learning).

If this virtual model is examined from the aspect of whether it can develop the accumulated knowledge and skills appropriately and in a balanced way, this model seems to be ideal in this respect as well.

Eventually, the conclusions that we can draw from the responses suggest that the image of a technical education model that can be regarded as ideal from a methodological aspect has already emerged on the level of awareness, it is present in the minds of the educators, which is a vital condition for development. In the future, it is the strengthening and spreading of this kind of awareness, as well as overcoming the obstacles that prevent the implementation of this methodological model (first of all, the identification of the quantitative and qualitative problems of the teaching material) that may contribute to rendering technical education more efficient and up-to-date.

The next important question was the following: "What teaching organizational methods are applied at your educational institution (frontal classroom teaching, individual learning, group work, pair work, project work)?"

The overwhelming majority of engineering lecturers mentioned frontal classroom work at the first place, the second place was taken by group work and individual learning.

Half of the respondents mentioned project work. Technical instructors named group work and individual learning at the first two places, with a uniform number of votes. Frontal classroom teaching, project work and pair work only received half of the votes.

A noteworthy difference between the responses given by the two groups of educators is that in the case of engineering lecturers involved in the theoretical realm of technical education, the application of cooperative and individualized teaching organizational solutions is less frequent than in the case of technical instructors. Presumably, there is more direct pressure on the latter group starting out from the practical expectations of the profession, and they strive to organize the educational process in accordance with this requirement.

Our following question was closely related to this, i.e.: "Which of the teaching organizational methods do you regard as efficient?"

Engineering lecturers put group work and individual activities in the first place but in the second place, with the same number of votes, they also named project work and frontal classroom work. Pair work came to be the last of the order, with an insignificant number of votes.

In the case of technical instructors, group work and, with a slight difference in the number of votes, individual work became the list leaders. The second place was taken by project work and pair work, with the same number of votes.

The responses reflect a situation according to which both the engineering lecturers and the technical instructors are aware of the advantages of cooperative and individualized forms of work, which recognition is more characteristic in the case of technical instructors.

Finally, our last question was aimed at finding out the ideal or optimum characteristics of technical education and went like: "List which characteristics do you think would suit technical education in an ideal case?" Both groups of trainers primarily emphasized the necessity of modern theoretical and practical teaching material.

This circumstance seems to prove our conclusion defined in relation to the previous question, according to which the participants of technical education identify the most express deficiency in relation to the teaching material. As regards the direction of change, in this respect the need for more modern content is dominant, overtaking even the requirement of reduced volume. As a second condition for ideal technical education, both the group of engineering lecturers and that of technical instructors defined the availability of well-trained lecturers and technical instructors.

Based on the aggregated responses of the two groups of educators, the third element of the set of conditions for optimization is appropriate training time. On the basis of the responses, this means, more specifically, longer than current training time, i.e. practical training started earlier, and a higher number of practical sessions. The fourth place in the list of conditions was taken by the earlier mentioned modern workshop equipment and visual aids.

Last but not least, the responses highlighted the importance of motivating the students, and they went into surprising detail with regard to the main alternatives of enforcing motivation. Thus, the instructors think that it is primarily through visiting foreign factories and a many-sided and life-like presentation of the methods of applying the acquired knowledge that the students can become motivated for their profession.

It is undoubtable that the responses given by the educators, remaining within the boundaries of feasibility, in fact outlined the characteristics of a desirable model of technical education, which should be reckoned with in planning the steps of future development.

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