THE TASKS OF ASSISTANT-PROFESSORS AT THE POLYTECHNICAL UNIVERSITY*

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To be part of the educational system of a university does not merely mean a profession but is also a mission, and therefore immense responsibility is called for. The future engineering generation is formed by this body and they get the basis of their special training, the technical and scientific understanding, and in consequence of the characteristic feature of their age, they form the adult's opinion of the world and society. This work means so much. How simple all this sounds. But in reality the instruction and educational work of a university is a very compound development.

To decrease the extent, a section of this study only, contains the practical training problems of the Mechanical Engineering Technology, but does not deal with the other activities of the assistant-professors and omits the references of the vast literature in connection with this.

Introduction

First of all, let us make the nature of the practical training, led by the author, clear. The methodological fundamental principles of the university instruction prescribe the types of the practical activities as follows:

1. Innervation trainings
2. Advanced trainings
3. Practical exercises outside the University

Varieties of the innervation trainings :

a) Learning-group and lecture-room work
b) Engineering graphics
c) Laboratory techniques

Varieties of the advanced trainings :

a) Seminary
b) Specialized laboratories
c) Machine design and empirical design

* A part of the study which won the prize at the University's competition.

Varieties of the outdoor exercises

a) Work in production plants

b) Surveying.

In his educational work at the Department the assistant-professor deals with the following trainings:

Supervising the practical trainings on the subject "Mechanical Engineering Technology" for the diurnal and correspondence courses;

Supervising the training at the workshop for the diurnal course;

Supervision of the students' work in production plants for the diurnal course;

Thesis consultation for the diurnal course;

Supervision of the students' work in the workshop for the correspondence course;

Thesis consultation for the correspondence course.

Consultation relating to the subjects for the diurnal and correspondence courses;

Examination for the diurnal and correspondence courses;

Occasional substitution of the lecturer for the diurnal and correspondence courses.

At the first glance the educational tasks of the assistant-professor are of exceedingly multifold character. In comparison with the methodological fundamental principles it can be stated, that they comprise the elements, aims and forms of all three practical training types. As a matter of fact, the very educational work of the assistant-professor applies the principles of the advanced and outdoor trainings and, to a minor extent, those of the innervation trainings. This shows that the educational work, in practice, is more colourful and diverging than was correctly determined by the methodological fundamental principles, and there are practical trainings comprising the elements and methods of several types of practical training, and only on the basis of the percentage of the individual elements can they be classified into the one or the other group of the named types.

Perhaps, to a certain degree, the practical trainings on Mechanical Engineering Technology subjects are also complex ones. Let us deal in detail with this, and to shorten the extent — analyse the other activities of an assistant-professor more profoundly.

Knowledge of curricula

One of the most important requirements of the educational activity is the deep knowledge of the curricula, including the programs of the Faculty of Mechanical Engineering, as well. These requirements were hardly to be realised till the programs were constantly changing. In recent years the introduction of lasting curricula made it possible to get acquainted with the intentions and solutions of the programs. The trends are: in the first six semesters general instructions on a high level, uniformly for all the students of Mechanical Engineering, in the 7 and 8 semesters instructions of special subjects corresponding to the individual specialities and, finally, in the 9 and 10 semesters advanced studies in a special field or a more specialized course. In Mechanical Engineering instructions are given according to the following courses:

Speciality	*Course*
Mechanical Engineering Technology	Mechanical Engineering Technology
	Precision-mechanics
Engine speciality	Heat engines
	Fluid mechanics
	Heating, ventilating, air-conditioning
	Aeronautical engines
	Railway engines
	Ship engines
	Automotive engines
Chemical machinery	Chemical machinist
	Machinist in silicate industry
	Food industry machinist
Agricultural machinist	
Textile technology	

After finishing their studies the undergraduates obtain the degree of Mechanical Engineer indicating their speciality. Consequently, the course-program gives special knowledge in some selected directions only, without being characterized by overdriven specialization. However, this solution is disputable. At the other two faculties of our University (Electrical Engineering, Chemical Engineering) no specialization of this kind exists and this gives the leaders of the University various problems. These are e. g. the number of the educational staff of the department compared to the number of students, the size of the area required for this purpose, the number of lecture-hours delivered by the staff, and other questions. In this country mechanical engineering instruction also takes place at the Technical University of Miskolc, but only Mechanical Engineering Technology. Their plans of instruction equal ours, in principle, but significant differences are to be found in practice. Thus, the number of hours devoted to practical workshop trainings is far more and, in general, other practical training is also more.

We have taken over very much of the system of engineering education from the Soviet Union, and consequently many similarities to it can be found.

The difference is the greater specialization tending towards narrower fields, which follows from the circumstance to be found in the Soviet Union. Also great differences are caused by the fact that in the Soviet Union the school system comprises ten classes. This serves as a basis for the enrollment to the university. (It must be noted that the latest school reform in the Soviet Union, as well as in many other countries, has brought essential changes, e. g introduction of compulsory physical labour etc.)

We are in ideal connection with the higher technical systems of the People's Democracies. The data at our disposal show that the specifications of other countries which are similar to ours, as e. g. Czechoslovakia and Bulgaria have different specialization to ours, that is, the number of the specialities are more. It was of interest, the insight into the two-stepped higher technical education of Poland in the preceding years, with the title "magister" for the second step. The greater number, respectively larger volume of the workshop practice and the production practice in the program of studies of the Bulgarian mechanical engineering technology was striking. It was new, but quite logical, that in many countries the period of study for individual specialities was quite different. The difference may sometimes be a whole semester. The endeavour to develop a more uniform (homogenous) educational system from the primary schools to the universities, could be observed.

The study and use of certain systems and programs of the higher technical education from the western countries could also become useful in many way. The Eidgenössische Technische Hochschule, Zurich, has always been an institute of good repute for the Hungarian engineers. It is interesting from the aspect of mechanical technological education that the industrial administration and production technology are compulsory subjects in the 6^{th} semester, and the practices of these subjects are compulsory in the 7^{th} semester as well. The students of classes III. *A*. and III. *B*. are obliged to have workshop practice for nine months.

On the engineering education of the European countries we have comprehensive information from the material of a congress held in London. We consider this study as a long-needed one, and we have made use of it often in the course of our daily work. Otherwise, it contains many references, comparisons with the higher technical education of the Soviet Union, too.

England has a quite different specific engineering education system. The technical high schools (universities) give the fundamental education only, the practical education is the task of the works (plants) and the engineering societies. During the five years the productive work and the theoretical learning alternates. (Sandwich-system.) The period of the theoretical education is three years.

In the American engineering education we find the instruction of the fundamental subjects, set up in the foreground in such a way that the interest of the students is directed towards the laboratories and experiments. The program of study is arranged so that to a lecture-room practice one hour, and a laboratory practice three hours, two hours learning at home is necessary. Thus the average student has an educational burden of about 53 hours per week. Perhaps the demand seems exaggerated that the assistant-professors have to have clear picture of the higher technical education and the applied study programs of the various countries. However, if we — for the sake of comparison — refer to industrial analogies, the necessity of information will immediately be evident. That is for the comparison of the industrial products, the engineers of the plants have to know the solution and finishing methods of various foreign industrial products. From these cases the assistant-professors have to know of the foreign engineering educational systems as well, independently of the fact that they very often have problems on the naturalization of a diploma, in which they have to take part.

Arranging the practice material

Practice must have an organic connection to the theoretical subject. By practice the theoretical material is to be deepened, its individual parts are to be practised. Practice has to promote the understanding of the theory, and, in certain cases, it has to make new development acquainted as well, that is, practice supports and completes the theoretical material, the lectures, the text-books and lecture notes. Starting from this conception, the subject matter of instruction is yearly determined.

In the preceding part of this study the requirements of the knowledge of the programs of study has already been mentioned. Remember that for the composition of the material for practices the knowledge of the subjects of the preliminary studies and the finished practices are essential. This is perfectly solved by the program, edited each year by the university. It contains, beside the programs of study, the programs of the individual subjects, lecturers etc.

The composition of the technological subjects is a very difficult problem. It is difficult not only because it touches the quick development in technology — first of all — in the technological methods, but also on account of the weightiness of the processes as well. The aim of the Eidgenössische Technische Hochschule, Zurich, can be accepted according to which: "it is not right to give scientific prescriptions, the students must be introduced into the atmosphere of the experiments and the researches, and they must be educated to scientific thinking."

Every place of work demands such a specialized amount of knowledge and to such a high degree, which the university instruction is not able to provide during the course of normal education. At our University this is realized by giving fundamental technological instructions.

To be able to compose the material for the practices we must constantly observe the special periodicals, especially the congresses, exhibitions, industrial fairs held abroad, or the reports on those, in order to enlighten the students on subjects connected with the machines, processes to be applied in the future. At present such a problem is the advancement of the automation and that, as to whether the hydraulic, pneumatic, electrical or electronical systems are sufficiently spread.

In the framework of the subject mechanical engineering technology it is not sufficient to make known the technical solutions or their practice, but it is also necessary to show the economic aspects of the problems. Here references are made to the article of V. P. JELJUTIN, minister of the Higher Education of the Soviet Union, according to whom: "the economic points of view should also be instructed in every course". At our Department the best basis for refreshing our lecture material is the geading of periodicals. Some responsible members of our scientific staff ret all the incoming periodicals. These are examined according to their various themes and the characterizing data are to be noted in the different diaries. The administrative personnel of the Department prepare cards of the individual themes taken from these diaries. Thus, it may be said that from day to day we can find the most important literary data according to the individual themes. Of course, it is completed by the documentation observer service of the National Technical Library. In our Department there are persons responsible for the individual subjects, whose task is to manage the problems arising in connection with the individual subjects, e. g. composing the practical training material on the subject. The practical material is confirmed by the lecturer of this subject. The names of collaborators to lecture on these subject are recommended by the person responsible for the subject at the meeting of the Department, where finally the Professor decides, who are to be chosen. The collaborators are chosen for their practical work according to the principles of specialization, that is, the instructors of the individual subjects should be the same. However, if new colleagues come to the Department, they take part in the instruction of all the subjects in connection with the Department, and only after this preliminary work are they appointed as constant instructors on one of the subjects, first of all, taking their scientific interest into consideration. It is thought to be absolutely right to use the so-called pedagogical lead-up system, that is, if a subject is lectured on or practiced through more semesters; in that case the same course-leader should lead all the instructions. As one of the persons responsible for a subject, the author follows this principle. On the diurnal section we succeeded in realizing this principle to the full extent, but in the correspondence course — on account of the proportional distribution of those working on the evening occupations — this was not successful. We have no essential literary data relating to lead-up. Nevertheless, it promotes the recognition of the students to a great extent and thus they can individually be dealt with. On the above-described basis we compose the material for practices and choose the course leaders. After this let us look at the division of practices. For this it is necessary to know the program sketch of the lectures.

Subject of mechanical engineering technology (diurnal section)

semester VIII	lectures 2 hours
	practices 2 hours
semester IX	lectures 6 hours
	practices 4 hours

The subject is preceded by the mechanical technology-encyclopedia and the theory of metal cutting tools, as preceding studies, beside the other fundamental subjects.

The material of the lectures :

Mechanical engineering technology semester VIII

Basic data necessary for planning the technological processes; economy. Choice of the work-pieces, or of the prefabricated products. Measuring basis. Machining faults. Technological documentation. Forming the outer cylindrical surface. Machining of the bored holes and hole systems. Machining of the plane surfaces. Machining of the profile surfaces. Machining methods of the high-precision surfaces.

Mechanical engineering technology semester IX

Unification (typifying) of the technological processes. Machining of the threads. Machining on single-spindle automatic lathes. Machining on turret-lathes. Machining on automatic lathes. Machining of the shaft-connections. Production of cylindrical gears. Machining of bevel gears. Machining of multi-axle work pieces. Automation of the technological processes. Modern technological processes. Technology of mounting. Planning of the shaping and mounting works. The technical inspection. Machining of non-metallic materials. Prevention of accidents.

The material of practices :

Mechanical engineering technology semester VIII

Week 1	Lecture room practice I.	Lecture on a standard problem
Week 2	Lecture room practice	Lecture on a standard problem
Week 3	Lecture room practice	Distribution of problems
Week 4	Measurement exercises	Measurement of working strain

Week 5 Workshop practice	Clamping of work-pieces, adjustment of tools, demonstration of turning (Koleszov-method, bevel-turning etc.)
Week 6 Design exercise	Consultation on the problems
Week 7 Design exercise	Consultation on the problems
Week 8 Design exercise	Consultation on the problems
Week 9 Workshop practice	On the basis of operation sheets made turning exercises
Week 10 Design exercise	Consultation of the problem
Week 11 Design exercise	Consultation of the problem
Week 12 Design exercise	Consultation of the problem
Week 13 Design exercise	Consultation of the problem
Week 14 Design exercise	Presentation of exercises and designs.

Mechanical engineering technology semester IX

Week 1 Lecture room practice	Lecture of sample lesson II
Week 2 Consultation of problems	Previewing practice of turn lathe
Week 3 Consultation of problems	Previewing practice on superfinish and planetary thread milling
Week 4 Consultation of problems	Contact-initiated discharge machining, centerless grinding practice
Week 5 Presentation of exercises and designs II.	Design exercise
Week 6 Factory visit	Analysation of the machine-stock and exploitation of machinery
Week 7 Lecture room practice	Lecture of sample lesson III
Week 8 Factory visit	Inspection of automatic lathes
Week 9 Consultation on problems	Workshop practice on the taking over of machine-tools
Week 10 Consultation of problems	Workshop practice on taking over machine-tools
Week 11 Consultation of problems	Blocks, production of blocks, worm-gears. Workshop practice
Week 12 Consultation of problems	Presentation of typifying results of plants.
Week 13 Consultation of problems	Design exercise
Week 14 Presentation of exercise III	Design exercise.

Note: In preparation to above practices for this semester: Efficiency measurement of machine-tools. Vibration measurements with oscillograph.

Tooling practice and inspection. Handling of parts from machine to machine. (Automation.)

The material and methods for practice

As one can clearly see from the above-mentioned, our students are given three problems. The theoretical material contains the costs vs. piece number for the different technological processes (Fig. 1). Of course, our instructions are not only in principle, but are demonstrated practically, too (Fig. 2).

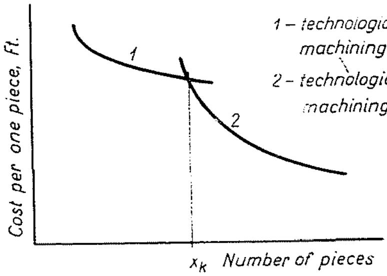
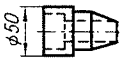


Fig. 1



Work piece
Material: dural 40–45 kg/cm²

Lot size	Type of machining	Cost per one piece, German pfennig	Dividing per cent			Economy per cent		
			Mate-rial	Wage	Over-head	Wage	Over-head	Total
5	Lathe	87 43 138 Total: 368	32,3	16,2	51,5	100	100	100
50	Turret lathe	87 11 35 Total: 133	65,4	8,3	26,3	25,6	25,3	49,6
5000	Automatic lathe	85,5 3,5 23 Total: 112	76,3	3,1	20,6	8,1	16,6	41,8
5000	Machining on automat and work piece stamped	54 1,2 6,5 Total: 61,7	87,7	1,7	10,6	2,8	4,7	23

Material — Wage — Overhead costs

Fig. 2

It should be mentioned that the proportion of material, wages and overhead costs are different according to the different countries. Still, we use as far as possible the newest data, on account of the "better conclusive force" of these foreign statements.

The three problems arise from the above-discussed economic considerations. Problem I is for minute piece numbers, so we may use universal machines, problem II is for an increased number of pieces: turret machining can be used, problem III is for a still greater number of pieces: automatic machining can be used. On the basis of these,

Problem I: Operation planning of an axle for machining on centre lathe.
Problem II: Operation planning of a part for machining on turret lathe.
Problem III: Operation planning of a part for machining on automatic lathe.

We determined the division of practices according to the calendar, and at the beginning of the semester, we make it known for the whole of this period. In general, the technical literature finds it necessary "that by the planning, exercises should follow the lectures a semester later". In our subject this principle can not be realized, however, because of this it does not suffer any disadvantages. Nevertheless, we begin the practices a week later than the lectures. This period is absolutely necessary for the undergraduates to get to know the aims of the subject and to be able to understand the fundamental concepts which are to be applied during the practices.

In the first three weeks we give a standard problem to be solved. But it is not a lecture in the strictest sense of the word, it is rather a lecture room practice. Though there is no doubt that the instructor plays the chief role, still the students do not look on at the lecture passively, but they themselves take part in the solution of the problems. During this time we get the first impressions of our undergraduates, their interest, preliminary studies, practical sense. During the practical examples we construct the production plan of a part. We are in close connection with the lecture. We also state, that: "theory and practice are two sides of the same problem, it is necessary to refer to it during the lectures and practices. During the practices we must refer to the theoretical knowledges, in the theoretical lectures we have to refer to the practical experiences."

As mentioned above, we consider economics thoroughly. During the "lecture" on the standard example we determine the reproduction of the parts. Taking the fact into consideration that we have to produce minute number pieces, we use free-hand forging. But let us draw attention to the fact that the allowances (material to be removed latter) are greater by this process, than by die forging, where expensive dies, consisting of one or more parts, are to be produced. Thus, the economic problem, discussed and mathematically established at the lectures, is more comprehensible for the students.

At practical trainings all of these come only after they had been discussed at the lectures, and are not forgotten by the students yet.

The literature related to the subject suggested to the leaders of the practical trainings to make detailed programs. The author experienced that even this is insufficient and the practice leader must not enter into practical trainings without numerically presolved examples. The author makes many marginal notes, and on the basis of his experiences, he tries to avoid extemporization during the course by using his memo code notes. The practice-leader must thoroughly think over in every detail the whole material of the lecture.

For the first lecture one must prepare oneself with special care. The success of this first lesson has a decisive effect on the whole semester's work. Because of the character of the subject, it is very advantageous for students to have factory practice. It will be evident on the first lecture, on whom among the students we can build during the semester. But on the practices we have to take care that the whole student's group should take part in the work, not only those, who have come from technical schools, or those, who have already had factory practices.

During lecture room practices we have to demand careful notations. The concrete practical example makes it necessary to write down many data. This greatly slows down the speed of the lectures.

We have many occasions to refer to fundamental subjects. Thus e. g. when giving these data it is necessary to fix the essentials of the material more accurately. Such is tensile strength in annealed and in tempered state. (Earlier, we spoke of tensile strength in general only.) We determine the allowances for forging on the basis of the nomograms published in the Magyar Szabvány (Hungarian Standard). Then we need the weighted average of the axis diameter as well. We should not omit to set down its mathematical formula as memento in one of the limited parts of the black-board.

It is a commonplace, but we must mention the decisive effect of personal behaviour. Thus at the beginning of the lectures the assistant-professor has to be on time. If one or two students come late, the punctuality of the instructor has such a self-disciplinary effect that none of them will hardly ever be late from them on. The instructor should show a good example in his outword style and appearance as well. Outword style is not essentially the bourgeois' concept, it is a demand of cultural level. It is usual to appear at the lectures in lounge-suits, in the lecture room and planning practices in white work coats, during the workshop practices in blue work coats.

For production planning, in accordance with conventions, we mark the machined surfaces with red colour, the clamping of the piece and its basis with blue colour. In general, many instructors like to use coloured crayons for the lectures and practices. Doubtless, it makes the black-board more decorative and promotes the understanding of the diagram. So the students must sketch all these, and if they have no coloured crayons, the diagrams do not come out well in their copy books, sometimes worse, then if the lecturer had used no coloured pastels, the possibilities of one coloured chalk (line thicknesses, dotted lines, etc.) are often far better in such a case. Consequently, the author draws on the black-board with coloured pastels only in that case, if he is convinced that all the students possess the necessary coloured pencils.

In the week 4 measuring exercises are organized. This is necessary because the students have no knowledge relating to the measurements of deformation, although they had already learned mechanics. (Deformation of rotating parts.) In advance of the preparation we determine the material, dimensions and technological data of the part to be applied. Measuring itself is quite simple. The purpose is merely to make the student himself sensible to the arising deformation in that case, when turning between the lathe-centres, when putting into chucks and supports with centre, and when turning the axis to be examined without centre, gripped only by the chucks. The students observe with surprise the $^1/_{10}$ mm deformation, and notice that the method of chucking and the applied depth of cut now determine (apart from other factors) the tolerable measure differences (tolerances). During preparation we must carefully examine, what kind of workshop practices had already been done by the students and what were their preliminary studies.

The following week a demonstration practice is organized. The preceding week the students had measured, now the instructors demonstrate the technological solutions, which might be problematical according to experiences (e. g. cone turning, ball turning, standing rest, moving rest, tool-block with four tools etc.).

The students get the problems to be solved the third week. Each of them gets an individual one. We obtain the drawings from plants and factories and every few years we replace these with new ones. The problems are so different, that no identical ones are to be found in the same group, not even in the whole class. Thus the students, when working in the workshop, put questions from the aspects of their own individual problems, too.

The weeks following our practices proceed according to the methods of the designing exercises. The leader must take with him the necessary standards, normsheets, some special books relating to the subject, periodicals, catalogues of machines etc. for the practice.

During practical training correction and consultation of the designs take place. Taking the fact into consideration that the preparation of the production plan is quite a new problem for the students, they usually have many questions. In connection with the plan they have to make the cutting tool and the measuring instrument necessary for an operation. The students experience difficulties when "planning" or choosing a standard tool, if the standard gives a variety of different measurements. If they do not want to choose at random, they must determine the forces arising and the technological data. Thus, their opinion changes on the question as to "why to learn computation methods, when the tools are standard in any case". In the issued problems to be solved (it is still only the first problem), even the standard number is given. In the case of non-standard solutions the titles of some books will be given. All of these are in Hungarian. But to the practices we also take books in foreign languages. This has a stimulating effect from the point of view of the necessity for learning languages. When the students use technical literature, they feel certainty in the fact, and so are informed on technical problems.

In the periodicals one very often finds articles, which the students can use in practice. From among these the instructor takes with him the most useful ones only.

During the practical trainings the leaders must occupy themselves individually with each student. This is only possible, when the number of the students in one group is not more than 10—12. In spite of the fact that the students work on individual problems, common problems, faults arise. At each lecture these are summarized on the black-board, accompanied by sketches. For those who fall back in their groupwork, individual limits will be given for at least a part of their work, which will be supervised on the following occasion. This method proved as almost perfect not only by the author, but also by the other instructors.

During consultation much attention is to be paid to the external appearance. This refers not only to the finished plans which others find important, but also to the rough drafts presented. The engineer very often speaks by using sketches. Therefore, we have to demand a good sketching ability. So it seems unnecessary to organize (closed-room) written exercises in the IV and V academic years, except if the material of the practice is not in close connection with the theoretical lectures. In solving his problem the student also advances in learning the theoretical material. Thus in this case the closed-room written exercise proves to be unnecessary and can be regarded as a secondary school method.

Meanwhile we insert a workshop practice. The students work on machine tools on the basis of operation sheets. At the same time during the lectures they hear of technological documentation, and in the workshop they accomplish their work according to this documentation. Thus they have opportunity to get to know these new kind of prints, and to observe the data those contain. They will be in need of this, when solving their own problem. During the lectures the system of providing drawing with numbers are taught, for engineering drawing the students have earlier learned the folding of the drawings. We pay great attention to the providing of drawing with numbers for solving the problems. Thus the preproduct (tools, jigs and fixtures, gauges or other inspection instruments) get a number derived from the drawing-number of the part. We collect these drawings in files to facilitate the storage. The drawings are to be presented, folded to standard dimensions.

The criterion for the qualification of the task is very severe. Only that student can get a "sufficient" qualification, whose production plan ensures that the part will not be rejected. The best qualifications are given to the most acceptable papers from among the technological variations.

In addition it must be mentioned that during the semester we give one or two instructing films instead of lectures. We have positive experiences in this field. The instructive film, however, always has to present processes in movement. It is not practical to project stationary pictures, e. g. devices, machines which do not move. This can be quite solved by wall pictures, tables. However, it is not practical to present too many films, as this becomes uninteresting to the students and causes lack of discipline.

The methodological problem in the planning exercises is the use of demonstration instruments. Our Department has 40 wall-cases, in which one can find problems already solved, standards and other aids. At fixed times the students can use the library belonging to the Department, where the necessary works can be found in many copies. Pictures of technological processes are to be seen on the walls. These several hundreds of pictures also help the students in their work. On the corridor of our workshop demonstration instruments are placed in cabinet. The technological operations of pistons, gear boxes, etc.

In IX semester our practices give greater possibilities by the greater number of hours. At the first lesson, as in the former semester, we work out a standard problem. Here the problem is the tooling of turret machines. The students listen to the theoretical considerations at the lectures, and when doing lecture-room-practice, they see solutions in connection with concrete examples. This is followed by the demonstration exercise, when *the same part is produced before them, which had already been solved during the lecture room practice.* The production is of demonstrative character (the production is not the object) and there is a slow-down when and where it is necessary. Till we did not introduce this method, we had great difficulties, but in this way the students, understanding the circle of problems, do high-level exercises.

Later on, the character of the planning exercise comes to the fore. The four hours per week gives them possibility to spend an hour weekly, not only on the usual problems of the year, but to demonstrate the more difficult details of the lecture in practice. This can be achieved perhaps most concretely in electroerosive spark machining. During lecture the electrical scheme and the necessary theoretical knowledge in connection with it are taught. When practizing, a carbide tip is bored, and so the process will become entirely known. The question may arise, why the students do not do the work. No doubt, this would be more advantageous. But often this is impossible because of the great number of students. In spite of this, such a demonstration of the theoretical material is useful, because the students make examinations from two very important subjects at the end of the semester.

We obtained interesting experiences in the course of the turret operation planning. Here, among others, we demanded the sketch of the tooling. But this did not give sufficient ensurance for practical realization, because the unfolded sketch of the tooling did not show the spatial arrangement of the applied tools. Therefore, we now demand the orthogonal front views of the drum sides (see Fig. 3), but in the case of capstan lathes we require the orthogonal views of the hexagonal plates as well. This means that the students essentially have "to set" the machine on the drawing-sheet which, otherwise, could not be done in the workshop, on account of the individual problems. Of course, the students have to apply "real" tool-boxes and tools, that is to

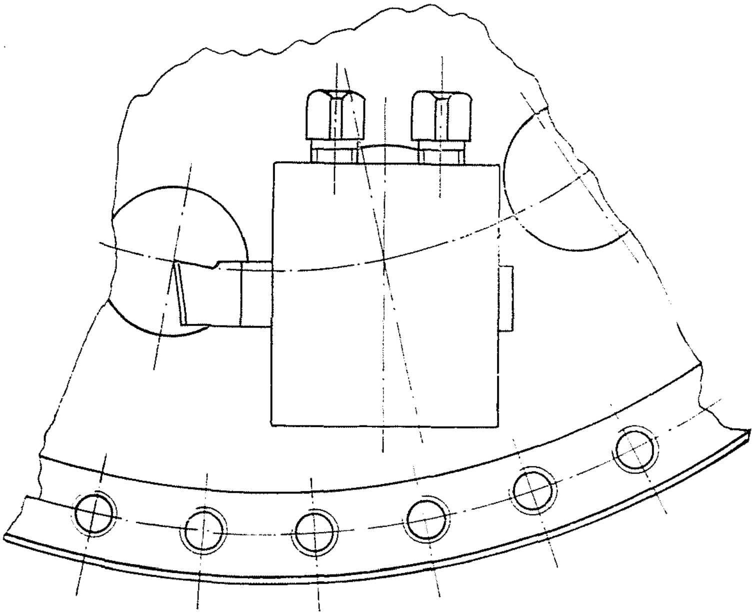


Fig. 3

say, they use standards and factory catalogues. The complaint often arises that it is not possible to tool up the turret drum from the assortment in hand, so they wish to apply the tool boxes constructed as standards and transformed them by themselves. The reply to this is: "The firms, which produce these machines (turret lathes, automates), have been known since decades. And if they give these fittings to the machines, evidently, these make the production of even the most kinds of parts possible. You have to try to transform either the production, or the tooling-up." On the next occasion in most cases the students appear with correct, reasonable solutions, and they are almost ashamed not to have found it earlier. Here we have occasion to emphasize, how much more expensive it is to produce standard elements individually, or in little series for each work, when those elements could be obtained cheaper;

commercially, thus the tool shops would be disencumbered, which in any case are a bottleneck of the factories.

The detailed correction of the exercises belongs to the methodology of our practices. The assistant-professor checks the result of the calculations when correcting, he sees to the correctness of the data, and for production plans he also gives the more advantageous variation. He demands to know the sequence of the operation as well. The students get back the corrected exercises for re-inspection. This is verified by their signature on the file. This detailed correction has the result of having no objection made in connection with the marks. All the exercises of the student will be available to the examiners. The detailed correction facilitates their surveying work.

In the technical literature there were discussions as to whether or not the students should be compelled to undergo a re-examination for planning exercises. We think it as possible and this is promoted by the fact that after VIII semester during the summer holidays the students could make these exercises; after semester IX when making preparation for the diploma plan, that is to say, when they have more time for it. But such an omission is very rare, only illness could be the possible cause for it.

In recent times in many countries the form of the better practical instruction for the students is searched for. In connection with this, works are organized, in the sphere of the university. This is very much demanded by the character of our subject. Without explaining here, in detail, we may simply say that the instruction of training-shop-system has many advantages over the simple instruction and practice in (industrial) production.

During the course of practice we also organize visits to factories instead of lectures. These visits should be prepared, because it often happens that machines (machine-production lines) of high capacity do not constantly run. During maintenance time (service), however, the students would not see just those things, for which the visit to the factory was organized. We have to choose, with great care, the factories to be visited. The visits help to get to know the composition and quality of our machine park as well, which the graduated engineers are very much in need of.

Taking into consideration the applied methods, we have no great abundance of literature data. Therefore, it is very fortunate that in some question (e. g. to educate the students in the use of the technical literature) our co-department of the Technical University at Miskolc follows similar lines to ours in practice.

This chapter can be ended by emphasizing the responsibility of the instructors by the following quotation:

"From among all the institutes of public character the universities and colleges, as the educational establishments of the highest degree, are, first of all, responsible for the fact that such a new, really constructive type of scientifically-learned men should grow up, who would be able to meet all the requirements and to support the burdens created by the new historical age and imposed on us."

Unity of professional instruction and education

The professional instruction should not be used as an end in itself. The obtained results must be given to the service of society. This necessarily means that the professional knowledge must not be imparted to the students as an end in itself, but in its completeness, that is, in its social relations as well. Man all his life was influenced by his surroundings. The especially decisive age is that between 18—25 in which, on account of his age, he forms his own opinion of the world, and of society. Therefore, in our work we must ensure, our students having the correct view of life, should be fond of the working people, and should find their own place in the new society. And this is not instruction anymore, this is — education. Instruction and education cannot be separated, they must be taken as closely connected to each other.

At the Vth Congress of the German Socialist Unity Party, ULBRICHT summarized the essence of socialist education:

"The over-all development of personality, education to solidarity and collective activity, education to the love of work, education to a fighting activity, providing a theoretical culture of a high level and a general culture of aesthetical character, development of all the intellectual and physical abilities, that is, the formation of the socialist consciousness in the interest of the people and the nation."

This program of the assistant-professor demands an extraordinarily divergent and manifold activity. Of course, not only from him, but from all the instructors of the university, from the social organs, from the workers and instructors of the colleges as well.

"The educational activity in school organizations demands, first of all and necessarily, the existence of a firm, homogenous and disciplined collective of pedagogues. Only after forming such a collective can we speak of unified and gradually-increasing requirements."

Our Department gives instructions on many subjects, and so, we have an influence on the students of each semester. Therefore, to harmonize the requirements, to discuss the problems and to form a common standpoint is very important. We do this at the department-meetings. We very often set up methodological-educational questions, the discussion of which is definitely useful.

One of the important qualifications of the socialistic man is independence and effective activity. Therefore, during practices we attribute great significance to their being taught independence. Each student gets individual exercises which we do not help him to solve. We criticize his solutions, mainly in the direction that engineering work necessarily requires the satisfaction of many points of view. And in course of this it must be weighed, which are the primarily-important requirements, and which are to be taken as unimportant. We instruct them to manifoldly analyse the questions and not to accept any kind of solution, because it was "recommended by somebody", but to become convinced of its worth and to try to defend their own solution. These sort of practices make the students unconsciously more independent, preparing them for their industrial jobs and for defending their diplome-plan as well. In our department the student is not obliged to defend the exercise made during the year before a large committee, but during the consultation we apply criticizing and discussing methods.

We regard the emphasizing of the correlations as very important. We shall explain the correlations between the exercise and the fundamental subject, as well as between the latter and the national-economical relations of the technological activity. We have many problems in getting technology scientifically recognized. It can not be solved by putting more differential-equations into our lecture-material, by so doing, the situation would become even worse. We do demand the theoretics in fundamental subjects in all applications on a high level. Our experiences gained in this connection show the production-engineers as not being inferior to the designing engineer, but if he does not apply the fundamental subjects in his work, he becomes a technician. We are of the opinion that with the spreading of electronic computers the application of the mathematical methods will be promoted in such fields, too, where at present a great number of variables, taking part in the processes, complicates the problem. In connection with this problem let us see the following examples:

In a cutting-tool shop, twist drills of different diameters but of the same material, are produced. In the shop the heat treatment is a serious problem. They wish to progress in techniques and to apply modern processes. Obviously, this solution is the task of the production-engineer. What data are available? The dimensions of the drills to be produced and the characteristics of the material. The relation between the exposure time and dimensions of twist drill is to be looked for. The production engineer has learned metallography and heat treatment, technical thermodynamics and — in the course of mathematics — nomography. On the basis of these, the above-named problems can be solved. According to the completed nomograms, the heat treatment could also be carried out by unskilled workers. The finished solutions are shown to the students.

Another good example is in connection with casting. Since thousands of years man produced, by casting, work pieces. The process developed in practice. When making moulds the ingates were cut to trapezoid cross-sections. This was made in the same way for thousands of years. Then, theoretically trained technologists began to examine what caused the high percentage of reject. The conclusion was made in course of this that, among other things, the cross-section of the ingates and other ventings produce unfavourable possibilities, turbulences occurred, and thereupon, many kinds of causes for rejection came into existence. What did they do? They applied the rules of the fluid mechanics in a special position (the contact between metal and sand). Thus, theory developed the practical process followed during many thousands of years.

Polygon machining and gearing processes demand the adoption of geometrical, kinetic and kinematic knowledges; the tsatisqical method of the dimensional inspection devices demand the knowledge of mathematical statistics, the technological correlations require nomographical knowledge. Without giving further examples we could say that the special theoretical problems of technology are sufficiently complicated (dimensional chain, basis choice), if we take, as an example, a piece requiring 200—300 operations.

All this is to be systematically implanted into the students, if possible, "painlessly". The students should be convinced that it was not useless to learn so much mathematics, mechanics and other fundamentals. On the other hand, they should be convinced that by this fundamental high grade education of production, engineers in the interest of our industry and in the interest of our whole country is to be promoted.

The other problem is emphasizing the correlation between various aspects in the National economy. It often occurs that our students apply a greater tolerance than is prescribed in the standards. In this case we always explain that this causes higher costs, checks the increasing of the standard of life, and makes it more difficult to supply the branches of the National economy with materials. The significance of the technological discipline should also be sufficiently emphasized. In connection with this we should point out that the application of higher technological data, than was originally planned, resulted in an increased use up of the tools, decreased the length of time of production uptil the maintenance of the machines, and endangers the quality of the production. One may say, technology is not everlasting and is not unchangeable, but it can technically and economically develop with the help of theoretical knowledge, and our purpose is only to accelerate this development.

The effect of the co-operation of the socialist countries is dealt with in detail, especially with the advantages of specialization and the establishing of lot sizes in the Council of Mutual Economic Aid and by this applicability of a more economical technology, etc.

This is to be considered a political attitude. "The correct political attitude essentially means our bearing and fight for the progressive system, it means the adoption of the aims of the system". We must be aware of the fact that our students will already be working under the socialist-communist social system. The novel tasks were determined by V. I. LENIN as follows:

"Before you stands the task of construction and you can only solve this by acquiring all up-to-date knowledges, and when from receipts, prescriptions and programs to hand you are able to make communism into such a living power, which could unify your personal work; if you are able to make communism a guiding principle of your practical work."

To develop such qualities is a difficult task. It is necessary "in the interest of developing these most excellent qualities, we must have a constant, systematical and ideological educational effect on the generation which is growing up."

If we think and speak of the future, "we must not take the future in a general sense, as a development in time; but we must refer to it as a concrete social phenomenon and relation. We understand future, as the future of mankind, and this is socialism."

In our work we endeavour to accept the words of NOVOTNY: "The most important duty of our educational work is to awaken the youth to the consciousness of its obligation towards society, socialist patriotism and the friendship among peoples." The question may arise, how would it be possible to attain all this, who will help the instructors to rightly realize this?

"In those institutes of education, where the primary organizations of the Party help the work of juvenile organizations with concrete instructions; these organizations are the valuable helpers of the educational staff in communistic education, and mobilize the youth to the realization of its principal tasks: to learning well and to the discipline of labour." In this regard we are very fortunate. Among the fellow-workers of our Department there is a member of staff belonging to the Party organization of the Faculty, there is a member of the Party Committee of the District, and we may turn to any one of these members of the Party group, at any time, in political and in other problems too.

We must rely on our educational work in the student's group, as a community and also on the juvenile organization. We hold conversations with the representatives of the students on two occasions in each semester, we listen to their observations and put problems to them, the solution of which we ask from the students. At present such a problem is that our students should not take a job during the time of diploma planning, however great is the allurement of the plants. The activists of the juvenile organizations transmit, such and similar request to the students, so that they should support our work. They are even fond of these various tasks, because the characteristic of their age wishes to have such activities. We can especially rely on these communities in the problem of study discipline. Namely, this is the self-education of the students. "The special task, determined by the characteristics of the age of life, of every kind of education; — thus the task of disciplinary education, too — in the juvenile age is to arouse just this claim of self-education, to make conscious its purposes, to make clear its methods."

The discipline of study is a decisive factor. We must not tolerate any kind of indiscipline. "From the beginning we must endeavour to develop such a moral; according to which, 'not to learn' and to be undisciplined is a disgrace."

At the same time this should not be too rigid. One must get to know the students. Often such events occur, which make their work impossible (e. g., death etc.). We must treat the students who have bodily infirmity similarly too. We ourselves are not of the opinion that it is correct to educate to discipline using the administrative method. It is our belief that the lecture or practice of good quality attracts the students. In spite of this, if I perceive, that there is a significant absence at the lecture (first days of spring), we have roll-call. We must not allow "twittering" to interfere with the work. In this case also administrative methods are needed.

The solution of educational questions constantly occupy us. The literature, in this field, gives us many useful advices and experiences. Our engineering periodicals do not deal at all with special methodological problems of instruction. Also in the Soviet Union this question is about to be solved by calling upon the editorial offices of the technical periodicals to publish papers dealing with the methodological problems of instruction concerning special academic subjects.

The personal education is the most effective. We have to take very great care of all our actions, we must be natural, and at the same time give a good example. The English engineering education system bases its success on personal education. Each student has his own tutor. The professors and the lecturers invite their students also to their homes, in this way they get into closer contact with them. We also endeavour to take part in the programs, and at cultural gatherings of the students. We have to get to know the circumstances in the students' hostels (colleges), because often also these influence the success of our work. It has occurred that in some of the students' hostels (colleges) there was no suitable possibility for drawing, and we had to take measures *in situ.*

One of the greatest problems of the graduated specialists in their manner in dealing with people, how to form proper relations. This is a problem at the other universities, too. To solve these problems, we make use of every occasion during the practices. The production engineer is often in contact with the workers, as these are the executors of his conceptions and plans. "The instructors have to educate their student, besides estimating labour, to be able to collaborate with their co-workers and to treat and care for the manual workers."

One of the most ill-famed diplomats of the bourgeois world, TALLEYRAND professed: "the language was given to men to be able to hide their thoughts with this." We pedagogues however, have the task to prepare our students for life. We must do our best, so that our students should continue with the least possible jolts, and without breaking their work, which they had begun at the university. Our well-esteemed and greatly liked professor, who died some years ago, Á. G. PATTANTYÚS demanded the instructor to be a whole man, and as such to have the following characteristics:

sense of duty
precision
reliability
sincerity
modesty
general culture
professional knowledge.

To become such a man, we must greatly improve. We have to show ourselves to the students in good spirit also in that case, when we are very tired, or have worries, because the students are not responsible. They would like to study as much as possible. And it is very interesting, even after such a bad beginning tiredness disappears during the lecture and everything goes on quite well. This means, to have a profession one realy likes to do, and to which he has disposition and ability.

We must develop our ideological knowledges. The results of these courses are, to a great extent, dependent on us. We must not fall back on our students in activity, in making life more beautiful. We have to take part in social life, in the work of the scientific societies. This also helps to form the right standpoint.

It can easily be seen, on the basis of the above-stated, that the character of the assistants is of decisive significance. In spite of this, according to the old practice, it is the lecturer who inscribes the mark into the registration book of the student (index), though he has very little influence on it. At the universities of medicine the name of the practice leaders must be inscribed into the registration book (index). It would be good thing to introduce this at our university, and so also to acknowledge with it the importance of the activity of the assistant and to increase his sense of responsibility.

Summary

In the introduction of this paper, taking into consideration the Methodological Fundamental Principles, it determines the character of practice. The practice is complex, its backbone is composed of three planning tasks. These are: the production plan of the work piece at universal machines, the planning of the turret lathe, and the operation planning of the work piece on automatic lathes. The distribution of all three tasks is introduced by standard exercises according to the individual subjects. During the practices the students make deformation measurements, they cut on the basis of operation instructions and attend different demonstration practices. On these they see technological solutions (taper-turning, spherical turning etc.) and processes (electric spark assisted machining, planetary thread cutting, centerless grinding, fine surface finishing, etc.). They carry out the measurements relating to the taking over also of machine tools. The students get back the planning exercises corrected in details, to inspect them. The basis of the marking is constituted by the planning exercises, but the work relating to the measurements is taken into consideration as well. The criterium of the qualification is that the piece of work should not be rêjected, respectively, that the planned production order should be economical. Further development of practices is planned.

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