

Technical Teachers and Technical Teacher Education – Research Results

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Chartered engineers who are new teachers of technical subjects at various educational institutions receive technical teacher education in the accredited bachelor programme at the Czech Technical University in Prague. This paper presents the results of a recent survey in which engineers expressed their opinions on technical teacher education.

Keywords: teachers of technical subjects, technical teacher education, motivation, non-technical subjects, e-learning.

1 Introduction

Graduates from technical universities start their careers in wide spectrum of professions and in various positions, including teaching technical subjects at high schools. New teachers are required to complete a teaching qualification.

Technical teacher education has been organized at the CTU in Prague since 1966. In 1996 this education was made into a bachelor study programme, and in 1997 it gained accreditation from the International Society for Engineering Education (IGIP). In 2001, accreditation was given by the Ministry of Education for the day-time programme and for the distance programme with intensive sessions. Engineers who have graduated in technical teacher education can extend their pedagogical qualifications in a doctoral study programme at the University in Hradec Králové (this programme is organized in co-operation with CTU), or can apply to IGIP to become a European Engineer – Educator.

In the 2001/2002 school year, the department of engineering education of the Masaryk Institute of Advanced Studies launched a study of the attitudes of teachers qualified in engineering education on the following issues:

- Why did they apply for technical teacher education?
- Why did they choose technical teacher education at CTU in Prague?
- Where did they find information about this study programme?
- Had they received any previous education in non-technical subjects?
- Did they feel a personal deficiency in knowledge of non-technical subjects?
- Which non-technical subjects do they prefer?
- Should teacher education for secondary school and university teachers of technical subjects be obligatory?
- How many semesters should technical teacher education last?
- What should be the extent, form, organization and content of technical teacher education?

2 Research results

The questionnaire was administered to 107 teachers with a technical background, 67 male, 39 female, born between 1945 and 1977, teaching experience 0–24 years. The teachers

had mostly graduated from a faculty of mechanical engineering, electrical engineering and civil engineering.

The first item in the questionnaire concerned motivation to study. Twenty-two respondents answered that they had chosen technical teacher education because they were interested in it, for 29 respondents it was a matter of obligation, for 69 it was an opportunity to gain a further qualification, and 6 had other reasons.

Answer	Frequency
interest	22
matter of obligation	29
further qualification	69
other reasons	6

Fig. 1: Why did you apply for technical teacher education?

The choice of technical teacher education at CTU was motivated by the following reasons: previous technical graduation from the same university (73), no tuition fee (30), opportunity to gain a bachelor degree (16), the study programme had already built its own prestige (13), the university is not far from my home town (10), while 14 respondents gave other reasons (recommended by the school management or school head, interest in the teaching profession, an opportunity to find a new job, extending their knowledge in non-technical subjects).

Answer	Frequency
graduate of CTU (or of a similar technical university)	73
no tuition fee	30
bachelor degree	16
has already built its own prestige	13
not far from home town	10
other reasons	14

Fig. 2: Why did you choose technical teacher education at CTU?

In most cases, teachers had received information about technical teacher education from their school colleagues (46 respondents), from colleagues at CTU (27 answers). Seven-

teen respondents learnt about this study programme from the magazine "Učitel'ské noviny", 14 from the internet, and 11 respondents from elsewhere – from their friends, relatives, former graduates of this study programme or by telephone.

Answer	Frequency
school colleagues	46
at CTU	27
in "Učitel'ské noviny"	17
internet	14
elsewhere	11

Fig. 3: Where did you find information about the study programme?

The previous non-technical subject experience of the respondents may be assessed as follows: 48 took some non-technical courses during their university studies, 29 during their secondary school studies, 9 had learned from specialized literature, 7 had been through short-term training, and 39 had never received any non-technical education.

Answer	Frequency
university studies	48
secondary school studies	29
independent study	9
short-term training	7
none	39

Fig. 4: Have you ever studied non-technical subjects?

In the next question, respondents indicated whether they perceived a lack of non-technical education as a personal weakness: fifty-nine answered yes, 36 no, 4 from time to time, 4 hardly ever. Four respondents gave no reply.

Answer	Frequency
yes	59
from time to time	4
hardly ever	4
no	36
no reply	4

Fig. 5: Have you ever perceived the lack of information in non-technical subjects as a personal weakness?

The following question focused on the non-technical subjects that the respondents preferred. The answers were: psychology (57), philosophy (19), sociology (17), educational science – pedagogy (14), and teaching methodology (11). Thirteen other subjects named by the respondents received less than 10 preferences. The 5 subjects named above were also generally mentioned in leading positions.

Answer	Frequency
psychology	57
philosophy	19
sociology	17
educational science – pedagogy	14
teaching methodology	11
communication skills	9
history and technology history	9
foreign language	7
biology	4
educational theory – special pedagogy	2
art history	2
literature	2
political science	2
interpersonal communication	2
geography	1
law	1
ecology	1
theology	1

Fig. 6: If you could choose to study some non-technical subjects, which would you prefer?

In the next item, respondents expressed their attitudes towards obligatory technical teacher education for teachers of technical subjects at secondary schools. Fifty-seven expressed the opinion that teacher education should be obligatory, as technical university studies do not include pedagogical and psychological preparation. Five respondents wrote that technical university studies do not provide a teaching qualification. On the other hand, 12 engineers held the opinion that quality of teaching was an inborn talent. Ten other respondents expressed the view that teaching competences can be gained on-the-job. Twenty-six teachers had no opinion, and 3 gave no answer.

The next question focused on the desirable amount of technical teacher education. One semester was preferred by 4 respondents, 2 semesters by 44 respondents, 3 semesters

Answer	Frequency
technical university studies do not include pedagogical and psychological preparation	57
technical university studies do not provide a teaching qualification	5
a good teacher has an inborn talent for teaching	12
teaching competence is a matter of practical experience	10
no opinion	26
no reply	3

Fig. 7: Do you think technical teacher education ought to be obligatory for teachers of engineering?

Answer	Frequency
1 semester	4
2 semesters	44
3 semesters	15
4 semesters	35
longer	5
no reply	4

Fig. 8: How many semesters should technical teacher education take?

by 15 respondents and 4 semesters by 35 respondents. Five respondents favoured more than 4 semesters.

Time arrangement is also an important factor in the organisation of technical teacher education. Seventy-seven teachers are satisfied with the present arrangements (lectures and seminars are concentrated in one day per week). Conversely, 10 respondents prefer weekly blocks of lectures and seminars. Fourteen respondents would like to have just lec-

Answer	Frequency
lectures and seminars one day per week	77
weekly blocks of lectures and seminars	10
only lectures	14
only seminars	6
other arrangement	2
no reply	2

Fig. 9: What is the most convenient time arrangement for the study programme?

answer	frequency
no	68
not quite	3
maybe	2
under certain conditions	6
yes	23
no reply	5

Fig. 10: Do you think distance learning would be an adequate form of technical teacher education (for instance by mail, with e-contact between learners and teachers)?

tures, and 6 respondents just seminars. Two respondents preferred other arrangement, and 2 gave no answer.

The next item dealt with distance learning and e-learning: "Would distance learning be an adequate form of technical teacher education?" The respondents answered "no" (68), "not quite" (3), "maybe" (2), "under certain conditions" (6), and "yes" (23). Five respondents gave no answer.

Should technical teacher education be obligatory for technical university teachers? 60 respondents answered "yes", 6 answered "no", 32 had no opinion, and 9 gave another

Answer	Frequency
yes	60
no	6
no opinion	32
other opinion	9

Fig. 11: Do you think technical teacher education should be obligatory for technical university teachers?

Subjects	Present number of hours	Frequency of deviations from the present number of hours (up to)									No reply
		less	-15	-10	-5	0	5	10	15	more	
educational science - pedagogy	60	22	1	2	0	62	0	4	0	2	14
psychology	60	3	0	1	0	76	0	4	0	9	14
teaching methodology	60	7	0	2	0	60	0	4	1	15	18
sociology	20	4	0	19	5	56	3	2	0	3	15
philosophy	20	5	0	18	8	50	1	6	0	6	13
communication skills	20	0	0	5	3	52	7	15	0	12	13
biology	20	3	0	10	4	61	2	9	0	5	13
logic	20	3	0	10	4	64	0	2	0	2	22
teaching practice	20	1	0	7	1	62	1	6	0	8	21
informatics	16	4	0	20	2	45	13	1	0	2	20
school management	16	2	2	12	2	44	14	1	3	0	27
educational technology	16	0	2	9	3	45	21	0	3	0	24
technology assessment	12	X	14	16	20	34	2	2	0	0	19
bachelor diploma seminar	12	X	0	3	7	44	6	21	0	2	24
economics of education	12	X	2	2	15	45	4	8	0	1	30

Fig. 12: Attitudes towards the content of technical teacher education

modification (optional study, obligatory study for new teachers, etc.)

In the final question, teachers expressed their opinions on the content of technical teacher education. As a basis for giving an answer, the present structure of courses taught in technical teacher education and the number of hours for each particular course were offered to the respondents. They could accept, increase or decrease the number of hours, remove the course from the given list or add some other course. The opinions are summarized in Fig. 12.

3 Discussion

The respondents are teachers of technical subjects from various technical schools in the Czech Republic. Although most of them are new teachers, a few are experienced teachers who were “sent” to technical teacher education in their mature years. Most are graduates from the “big faculties” of CTU (electrical, mechanical and civil engineering), some graduated from other technical universities (Brno, Liberec, Ostrava), and some graduated from military technical faculties.

The first part of the questionnaire focused on observing study motivation. Two-thirds of the respondents indicate external motivation (“income growth”, “requirement of a further qualification”); 20 % of the respondents indicate motivation by internal factors (“interest”), and the rest provide some other source of motivation. Some respondents chose more than one answer. As expected, external motivation was indicated in most of the answers, especially “an effort to gain another qualification”.

Twenty-two answers falling into the category of internal motivation are an encouraging result, as the questionnaire was anonymous and the respondents were under no pressure to write “socially acceptable” answers.

In the second question, where motivation to study technical teacher education was analyzed, “pragmatic answers” were expected in most cases. The respondents prefer to study at CTU rather than at other educational institutions. There are other reasons, of course, such as the absence of tuition. Some respondents were influenced by recommendations by their colleagues or by the management of their school, and also by graduates in technical teacher education at CTU. Some respondents received the information on internet (ticked by 14 respondents).

The next part of the questionnaire dealt with previous and present experience of engineers in the area of non-technical subjects. The answers showed that more than one third of the respondents had never attended any course in non-technical subjects, and almost one third had studied such subjects only at secondary school. This unfavorable situation may improve slightly in the near future, as most faculties of CTU now require students to take a certain number of credits in non-technical subjects.

In their answers to the next item, respondents expressed their personal feelings on whether their lack of knowledge of non-technical subjects is a weakness. While more than one half of the respondents feel it to be a personal weakness, more than one third do not. Few try to improve the situation by independent study. Some respondents with low non-technical knowledge do not perceive this as a personal weakness. Such

an attitude is generally formulated as “... I am a technician and there is no need to study non-technical subjects...”.

The question surveying the respondents’ favoured non-technical subjects was in an open form, i.e., they were free to name particular non-technical sciences. They generally named subjects from the technical teacher programme (psychology, philosophy, sociology, educational science – pedagogy, and teaching methodology). These subjects attracted most interest. Several other subjects were also mentioned (history and history of technology, a foreign language). With a certain caution, we can conclude that our respondents tend to agree with the content of technical teacher education at CTU.

The next question analyzed the view of respondents on whether technical teacher education should be obligatory for teachers of technical subjects at secondary schools. Almost two thirds of the respondents consider that technical teacher education is a necessity for the teaching profession.

Statements such as “... A high quality technical and professional background is sufficient, or ‘natural talent’, they are adult students after all...” are found in the answers of 22 respondents. Unfortunately, such an attitude can also be heard even among university teachers. The statement “I have no opinion” (given by approx. 25 % of the respondents) is disappointing, given that the respondents are graduates of a technical teacher education programme. Qualitative analysis of the answers shows some ambivalences and contradictions.

Most students prefer either a two-semester or a four-semester study programme. However, the answers range from one to four and more semesters.

A strong consensus was reached on the issue of the time arrangements for the study programme. Most respondents are satisfied with the present timetable (one-day per week), combining lessons and seminars. Fourteen respondents consider that tuition based just on traditional lectures won’t be best.

Recently, members of the academic staff have discussed the possibilities and limitations of e-learning as a form of study. Can e-learning be used in technical teacher education? Most of the respondents believe it is not suitable at all, or that it can be used only to a limited extent. One reason for these negative attitudes may be the mature age of some respondents and their relation with computer technology. The main reason, however, is the character of teacher education, in which personal contact with academic staff and other colleagues is more important than in other fields.

Technical teacher education for university teachers is not yet obligatory. The respondents (graduates from technical universities) mostly consider that some form of complementary pedagogical education is also necessary for university teaching staff. Opinions about the form and extent of such a study programme differed.

Respondents’ views on the subjects that should be studied were of key importance in the survey. Respondents who were recent graduates from technical teacher education mostly chose the subjects that are at present included in the programme. None of the subjects were rejected. Some subjects are more “popular” or are considered “useful” (psychology, communication skills, bachelor diploma seminar, teaching methodology). Logic is perceived as a “difficult” subject, probably because it is intellectually demanding.

4 Conclusions

- to gain a “further qualification” or a “higher income” are leading motives for technical teachers to study teacher education, while “interest” in pedagogical study is less common
- most technical teachers have no previous experience with non-technical subjects
- psychology is the most popular “human science” chosen by technical teachers
- most of the respondents agree that technical teacher education should be obligatory; some have no opinion about the problem
- a timetable involving one day weekly is acceptable for most respondents, but they are not in consensus about the desirable length of the programme (ranging from 1 to 4 semesters)
- most technical teachers consider that e-learning is not quite suitable for technical teacher education
- most also believe that technical university teachers should take some complementary teacher education courses
- some subjects studied in technical teacher education are more popular or are felt to be more useful; others are less

popular or considered less useful. None of the subjects in our present programme was totally rejected.

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