

Technical Teacher Training for Vocational Schools in Estonia

Tii Rütman
Tallinn University of Technology, Estonia

The understanding that in this tiny country – Estonia which has limited natural resources, the only way its people and their good education can be the drivers of the development of society is widely supported up to this day.

According to the Population Census data in 2000, population in Estonia de facto totalled 1,357,000 persons. The standard of education in Estonia is relatively high. In 2002, 16% of Estonians between the ages of 24 and 33 had graduated from institutions of higher education, 27% from secondary schools and 44% from vocational schools ¹.

Estonia has joined the Bologna and Sorbonne Conventions establishing European Higher Education Area, the Lisbon Convention on the Recognition of Qualifications Concerning Higher Education in the European Region and adopted the Recognition of Foreign Professional Qualifications Act, which ensure equal participation opportunities for studies and employment in Europe ².

Estonian educational system consists of basic, secondary (general or vocational), higher and adult education. Basic school is compulsory (9 years) further students attend either secondary general school (gymnasium, 3 years) or secondary vocational school. After satisfactory completion of secondary general education or secondary vocational education, young people may choose either entering labor market or continuing studies at higher education level.

Vocational education institutions offer secondary vocational education in vocational, special and professional areas. The standard period of secondary vocational education training programme after compulsory basic education is at least 3 years aiming at preparing skilled workers. The programme is broader with 50% of general education subjects and specialisation takes place at a later stage.

The standard period of secondary vocational programme after secondary general education (gymnasium) is 1–2.5 years, aiming at preparing skilled workers for higher level. The programme is oriented at preparing for labour market, with 85% of vocational education-related subjects ³.

Vocational schools provide also opportunities to acquire basic vocational education for basic school or general secondary school students, in the scope of the elective subjects foreseen in the National Curriculum for Basic and General Secondary Education and according to the basic vocational education curricula.

The Estonian higher education system is binary and consists of applied higher education institutions and universities. Since the academic year of 2002/2003 general structure of the higher education system is based on two main stages, following the undergraduate -graduate model.

Applied higher education is the first stage of higher education and corresponds to Bachelor level programmes at universities, aims at acquiring the competencies necessary for work in a certain profession or further study in Master level. The nominal length of study is 3 to 4 years, 120 to 180 credits, 1 credit unit= 40 hours = 1.5 European Credit Transfer System credits.

Bachelor studies are the first level of academic higher education with the aim of increasing students` level of general education, acquiring basic knowledge and skills in the specialty necessary to pursue further studies at the master level and for commencing work. The nominal length of studies is generally 3 years, 120 credits few disciplines up to 160 credits. Students have to pass bachelor examination or compose and defend final thesis. Bachelor degree is considered as higher education in Estonia but it does not give full engineering education.

Master studies constitutes the second level of academic higher education during which deep theoretical specialty knowledge and skills are developed further and knowledge and skills for independent work and pursuing studies at a doctorate level are acquired. The admission requirement is bachelor degree or an equivalent level of qualification. The nominal length of studies is 2 years, 80 credits, but along with the first stage of higher academic education at least 5 years, 200 credits. Students have to compose and defend final thesis.

Doctoral studies constitute the highest stage of academic higher education aimed at acquiring knowledge and skills necessary for independent research, development or professional creative work. The general admission requirement for doctoral studies is a master degree. The nominal length of studies is 3 to 4 years, 120 to 160 credits. The degree is a research degree, the candidate has to compose and defend a doctoral thesis – independent scientific research or creative work².

Vocational education training is a rather complex social system. It is located on the edge of two basic activities: learning and working. Vocational education is quite unpopular among students in Estonia. The negative image of vocational education is inherited from the soviet period when vocational education was mainly for less capable pupils, partly because of the trend in society towards higher education and partly because of the assumed lower quality of vocational education. But not all students can continue studies after basic education at gymnasiums today, others must continue at vocational schools.

In upcoming years it is important to increase competitiveness of young people on the labour market, to ensure their social preparedness and to ease access to vocational education. Transfer from school to working life will become more flexible with wider variety of choices. For that the content and quality of vocational education must be improved. Taken the wishes and expectations of the employers, young workers will react quicker and more adequately to the changes in the work character and on the labour market.

Vocational education has been established on a regional principle in Estonia, the students attend vocational schools usually in their region. Most of vocational schools are situated in the cities as there are also better possibilities for employment.

Most of vocational schools are state schools. In October 2004 there were 73 vocational schools, 53 of them were state schools, 3 municipal vocational schools and 19 private schools. In 2004 46 vocational schools afforded technology education and 8 institutions of applied higher education offered engineering and technology education⁴.

The total number of students at vocational secondary schools in 2004 was 28 183 while 1 171 of them studied at private schools and 2 400 at municipal schools. 7 257 of students studied at institutions of applied higher education, 285 of them at private institutions. In 2004 the number of students accepted to vocational schools on the basis of basic education was 6 520 and 76% of them preferred technology education. On the basis of secondary general education the number of accepted students in 2004 was 5 060 and 59% of them chose engineering and technology specialities.

Today about 30% of graduates from basic schools continue their studies at vocational schools, 70% choose to continue at gymnasiums and later at universities. In Table 1 the Prognosis of the Ministry of Education and Research of Estonia is presented of the total number of students and proportion of technology students until 2009 at vocational schools. As it could be seen interest towards technology specialities among students is quite high. Due to the prognosis in 2009 40% of pupils will continue studies at vocational schools after basic education, 60% will continue at gymnasiums⁴ but optimal for Estonia should be if 60% continue at vocational schools, 25% at institutions of applied higher education and 25% at universities.

Table 1 – The Number of Students at Vocational schools

	2004	2005	2006	2007	2008	2009
The total number of students	11 580	11 900	12 100	12 012	11 549	10 617
The proportion of technology students at vocational schools after basic education	76%	76%	77%	77%	78%	78%
The proportion of technology students at vocational schools after gymnasiums	59%	55%	56%	56%	57%	57%

During relatively short period after Estonia's regaining independence at the beginning of 1992 the large-scale industry was closed and there was no need for increasing the number of engineering students. Now the situation in industry has stabilized and along with unemployment the need for skilled employees with technology education is increasing. The popularity of technology specialities has risen lately⁴. Due to this there is a lack of educated technical teachers who could improve the quality of technology and engineering education at vocational schools. This is the most hurting problem in vocational education of Estonia today. Good technical teachers with higher engineering education could improve the low image of vocational education.

The number of teachers at vocational schools was 3 940 in 2003, proportion of technical teachers was 59% of the total number of teachers. The prognosis of the Ministry of Education and Research show that the total number of teachers is decreasing due to the new relation of one teacher per 13 students (until 2002 the relation was 1:9). In 2006 the total number of teachers at vocational schools will be 3 767 while the proportion of technical teachers will still remain 59%⁵.

The average age of teachers is high and rising. The main problem is how to attract young people to technical teacher training studies as the job has a low status and carries unattractive salaries. The former status of two different kinds of teachers – the professional speciality

teacher and skilful foremen (speciality practical teachers) – has been replaced by one, a vocational teacher. Unfortunately this has reduced the quality of speciality teachers especially in technical specialities. The lack of highly educated technical teachers decreases theoretical knowledge of students and this puts an obstacle in their adapting to the changes in their career. According to the statistics of the Ministry of Education and Research of Estonia, in 2004 only 8% of teachers at vocational schools were younger than 30 years, 45% were older than 45 years – the need for technical teachers is increasing every year².

After the restoration of independence in 1992, laws regulating educational life were passed rather quickly, and not all the circumstances were taken into account. All laws dealing with educational matters have been repeatedly amended.

Teacher training is strictly regulated by two decrees: the decree of Estonian Government – “the Basic Requirements for Teacher Training” and the decree of the Minister of Education and Research – “Qualification Requirements for Teachers”. According to the first decree a technical teacher may have at least Bachelors` degree in specialty and must pass special teacher training. Nominal amount of special teacher training is 40 credits, lecture sessions may not overcome 15 credits the amount of teacher practice at school is 10 credits. According to the second decree a technical teacher should have either higher pedagogical education with at least three years of work experience in specialty, or vocational education in specialty, at least three years of work experience in specialty and corresponding pedagogical courses.

Due to contradictions in requirements of these two main decrees regulating teacher training there is a great disorder in technical teacher education. In 2004 20% of technical teachers had vocational education, 3% had secondary general education, the rest had higher education, but last-mentioned teachers had higher pedagogical education and only vocational education in speciality². These technical teachers with higher pedagogical education, trained at Tallinn Pedagogical University learn technical speciality subjects in the amount of 2% (mainly practical training) during their studies (120 credit units) and get mainly pedagogical training after vocational education. Teachers who have passed this training are not technical teachers and they are not able to teach technical subjects. Students at vocational schools will get mainly practical skills and no theoretical knowledge when teachers have only vocational education in speciality.

The requirement of higher pedagogical education for technical teachers (Bachelor degree in education) is quite hard to understand and may be explained by efforts of Tallinn Pedagogical University to educate technical teachers for vocational schools on the basis of vocational education in speciality. Decisions in the field of technical and technology education in Estonia have often unfortunately been made by non-competent persons. In order to improve the quality of vocational education we must have highly educated technical teachers not the graduates of vocational schools who will start teaching at the same school after graduation and additional learning of pedagogy on Bachelor level.

Technical teacher training cannot be classified as within the traditional academic categories. It cannot be compared to Bachelor-, Master- or Doctoral level as the aim of the training is not to obtain certain academic, theoretical level in pedagogy. Technical teachers must not only keep up with the new pedagogical demands but must also keep up with the new developments in the speciality they teach. The pedagogical training is built on the teachers' professional speciality qualification and gives the necessary theoretical and practical pedagogical,

didactical and psychological competencies to enable the teacher to be able to work at vocational school.

Instead of higher pedagogical education the primary requirement for technical teachers must be higher engineering education in speciality after which the candidate has to pass teacher training. Practical skills may be given to students of vocational schools by skilful foremen (practice teachers) who have worked in the field of taught speciality and have gained wide experiences. Persons with higher education in pedagogy but with only vocational education in speciality may not work as technical teachers or we reach the situation that our technical teachers know brilliantly how to teach but unfortunately do not know very exactly what to teach.

Technical teacher training in Estonia has not yet found an adequate form and resources allocated to pre-service and in-service training are clearly below the needs. Due to the small population a reform based on consecutive pedagogical teacher training at least for persons who are already qualified engineering specialists appears to be an obvious parallel and also very cost-effective model for Estonia.

There is no separate technical teacher training system. Universities where most of the technical teachers are educated are autonomous. Technical teacher training is carried out at three universities: at Tallinn Pedagogical University and jointly at University of Tartu and Tallinn University of Technology. The only technical teacher training due to the requirements of IGIP (technical teachers must have higher engineering education) suitable for technical teacher training is the joint program of University of Tartu and Tallinn University of Technology. These two universities are offering flexible technical teacher training opportunities for experienced and highly qualified people in engineering education.

The technical teacher training course is combined of theoretical and practical parts and both parts are supplementing each other. The duration of the programme is 1 year. The practical part is carried out as teaching and observation practice, including supervising subjects in which the participant has been specialised.

At Tallinn University of Technology and University of Tartu a joint technical teacher training with the nominal amount of 40 credit units has been carried out from 2000. Every year about 50 students with higher engineering education have been accepted to the teacher training course. Tuition is free. Students have to pass training in technical disciplines and didactics of technical disciplines at Tallinn University of Technology and pedagogical, methodical and psychological training at University of Tartu.

As it is shown in Table 2 students have to take following subjects at Tallinn University of Technology and University of Tartu, they also have to pass pedagogical practice at school and write and defend their final thesis. Many of the students are having in-service technical teacher education, and are already working at vocational schools.

Students may choose between following fields of engineering:

1. Civil Engineering
2. Power Engineering
3. Geological Technology
4. Information Technology

5. Chemical and Material Technology (Wood Technology, Textile Technology and Food Engineering)
6. Logistics
7. Mechanical Engineering
8. Technical Physics

They obtain knowledge in pedagogical and methodical work of specialty and recruit their professional knowledge. After graduation they receive a certificate of a technical teacher. The technical teacher training programme is planned to give a deeper insight into modern learning theories and an ability to apply these theories in order to get the best possible learning results for students of engineering.

Table 2 – Subjects in the Curriculum of Technical Teacher Training

Subject	Credit Units (1 cu = 1.5 ECTS cu)	Hours
University of Tartu		
General Didactics	2.0	80
Psychology Applied to Work in Teacher Training in Vocational Education	2.0	80
Curriculum Studies	1.0	40
Developmental Psychology for Teachers	1.0	40
History of Educational Ideas	1.0	40
Educational Research in School	1.0	40
Additionally one must choose pedagogical or psychological subjects for 4 credit units (160 hours) from the curriculum of the Department of Education of University of Tartu	4.0	160
Tallinn University of Technology		
Industry in Developing World	1.0	40
Product Development and Innovation	2.5	100
Standards, Quality and Certification	1.5	60
Informatics	3.0	120
Additionally one must choose speciality subjects for 4 credit units (160 hours) from the curriculum of the chosen field of engineering of Tallinn University of Technology	4.0	160
Technical Teacher Practice	10.0	400
Final thesis	6.0	240
Total	40.0	1600

It is obvious that professional learning must always be connected to the context. It is there for of great benefit to get teacher competence as an in-service training. The acquired pedagogical knowledge can be directly applied to praxis. This gives strong basis for building the subject matter knowledge into pedagogical content knowledge and also gives the opportunity to develop the skill to reflect.

The job as an engineering educator differs in many respects from an industrial career. The in-service training gives a good possibility to familiarise the teacher with the educational life and integrate them into teaching community. Taking into consideration the competitiveness of the

industry, it is crucial for engineering educators to be able to recruit teachers with both a relevant education and industrial experience. If the teachers are required to get their teacher training as pre-service training, the teaching career with its modest salaries can never be made attractive enough for the best candidates.

In 2005 the new curriculum for technical teacher training has been completed at Tallinn University of Technology for Bachelor's and Master's studies. Students from gymnasiums and vocational schools with secondary general (gymnasium) or secondary vocational education will be accepted to the Bachelor's studies of technical teacher with the nominal amount of 160 credits (4 years). Tuition will be free.

The studies will consist of 120 credits of Bachelor's studies in chosen engineering speciality and 40 credits of special technical teacher training (engineering pedagogy).

The students will have to pass joint studies in the amount of 55 credit units including:

- Mathematics (10.5 credits)
- Foreign Languages (2.5 credits)
- Philosophy (2.5 credits)
- Law (2.5 credits)
- Selected Principles of Sociology (2 credits)
- Understandable Text Creation (2 credits)
- Rhetoric (2 credits)
- Selected Principles of Psychology (2 credits)
- Communication and Discussion Training (2.5 credits)
- Educational Technology (2.5 credits)
- Fundamental Principles of Engineering Pedagogy (3.5 credits)
- Engineering Education Practical (3 credits)
- Laboratory Didactics (2 credits)
- Technical Teacher Practice (10 credits)
- Final Thesis in Engineering Pedagogy (6 credits)

After the joint studies one may choose between the following 8 specializations:

1. Information and Communication Technology Tuition
2. Civil Engineering Tuition
3. Power Engineering Tuition
4. Logistics Tuition
5. Mechanical Engineering Tuition
6. Wood Processing Tuition
7. Textile and Garment Engineering Tuition
8. Food Engineering Tuition

These specializations have been chosen among the most commonly taught and most popular specialities at vocational schools of Estonia.

The amount of speciality studies in engineering will be 105 credits due to the appropriate curriculum of Tallinn University of Technology.

Students will have to pass pedagogical training practice, write and defend their final thesis in Engineering Pedagogy. They will receive Bachelor's degree in the chosen field of engineering and the certificate of a technical teacher. After graduation it is possible to continue studies on

Master's level in engineering according to the appropriate chosen curriculum of Tallinn University of Technology.

Students who already have Bachelor's degree in engineering or graduates from institutions of applied higher engineering education will be accepted to the Master studies for technical teachers at Tallinn University of Technology.

Master studies will be in amount of 80 credit units, of which speciality studies are in the amount of 40 credit units and teacher training 40 credit units. Speciality studies will be carried through due to the Master curriculum of the chosen field of engineering at Tallinn University of Technology.

Teacher Training in Master Studies include following subjects:

- Selected Principles of Sociology (2 credits)
- Understandable Text Creation (2 credits)
- Rhetoric (2 credits)
- Selected Principles of Psychology (2 credits)
- Communication and Discussion Training (2.5 credits)
- Educational Technology (2.5 credits)
- Fundamental Principles of Engineering Pedagogy (3.5 credits)
- Engineering Education Practical (3 credits)
- Laboratory Didactics (2 credits)
- Technical Teacher Practice (10 credits)
- Final Thesis in Engineering Pedagogy (6 credits)

After graduation they receive Master's degree in engineering and the certificate of a technical teacher.

Teachers with Master's degree in engineering and who have passed teacher training fulfil the requirements of IGIP and may be included in the register of ING-PAED IGIP (International Engineering Educator).

Tallinn University of Technology is planning to start technical teacher training according to this new curricula in September 2006.

Whether this curriculum will be accepted or not depends on the Ministry of Education and Research of Estonia. Regrettably new ideas get rooted very difficultly, especially ideas related to engineering education.

So far the success of Estonia has been gained with the help of highly educated people. But now we have reached the situation that possessing high technology we are in lack of skilled and educated employees. Contradictions between the decrees regulating teacher training have given rise to brain drain of engineers from Estonian education system. Due to this there is a lack of highly educated technical teachers who could improve the quality of technology and engineering education at vocational schools.

The decrees dealing with teacher training should be amended for technical teacher training needs modernization in order to meet the demands of labour market. The main requirement for technical teachers must be higher engineering education in specialty.

Modern man is surrounded by technology while knowledge about technical things allows educated people to be in the position to judge the significance and development of technology. Prof. Dr. Heinrich Ursprung, from Zurich, aptly expressed: “I believe that it is an urgent and necessary task of our secondary schools to convey insights into the world of engineering sciences. Who should be the teachers? Not mathematicians, not humanists or social scientists but engineers”⁶. This would be an interesting and important task also for technical teachers especially at secondary and vocational schools in Estonia.

References

1. Statistical Office of Estonia, [online], Available from <http://www.stat.ee>. 2005
2. Statistical Database of the Ministry of Education and Research of Estonia, 2005, Available from <http://www.hm.ee>.
3. School Network Administration Office of the Ministry of Education and Research of Estonia, available from <http://www.hm.ee/kvb/>, 2005
4. Institutions of Vocational Education 2004, Ministry of Education and Research of Estonia, 2004, pp 50 (in Estonian)
5. Country Monograph: Estonian Vocational Education, Continuing Education and Employment System, European Training Foundation, 2003, pp 97.
6. Ursprung, Heinrich, Technologie als Teil der Allgemeinbildung, Neue Züricher Zeitung, September 5, 1985, Referred in IGIP Report No 26, March 2000.

Biographical Information

TIIA RÜÜTMANN, born in Mach 15, 1959, graduated from Tallinn University of Technology as a diploma engineer in chemical technology 1982, Master of Science in Chemical Engineering 1992, the qualification of ING-PAED IGIP (International Engineering Educator) 2004, working as an assistant of the Head of Estonian Centre for Engineering Pedagogy at Tallinn University of Technology.