Bánki Donát Faculty of Mechanical Engineering

Institute for Engineering Education

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1 Introduction

A significant step in the development of Hungarian vocational education and technical teacher training was made in 1970 when several colleges, with Department of Pedagogy, Bánki Donát Polytechnic, among them, simultaneously launched technical teacher training according to the particular profile of the institution.

The Institute for Engineering Education (IEE) at Bánki Donát Faculty of Mechanical Engineering, Budapest Tech Polytechnical Institution, is the legal successor of the Department of Pedagogy and Teacher Training at Bánki Donát Polytechnic. Therefore, with the legal predecessor taken into account, it has 35 years of experience in technical teacher training, ie in college level technical trainer training and technical teacher training as well as in the further education of technical teachers. Following the integration of colleges (ie the establishment of Budapest Tech) and as a result of inter-faculty cooperation, IEE extended technical teacher training beyond the mechanical engineering course to light industry, information technology and technical management courses, too. In the latter courses engineering-based postgraduate technical teacher training is organised in the form of distance training.

IEE pays a special attention to encourage the scientific activity of students with outstanding abilities. Its well equipped laboratories are open to students, where, beyond basic training, there is an opportunity for higher level professional work with trainers' guidance and assistance. The results of this are manifested in good achievements at faculty and polytechnic conferences organised by the Scientific Circle of Students (SCS) as well as in high quality theses. IEE projects promote training and research alike. Due to the activity of training material development, there are self- and internationally-authored books, study aids and electronic syllabuses to support the entire spectrum of technical teacher training.

2 Educational Profile

Technical Teacher/Trainer Training at IEE

- ❖ Technical Teacher Training

Technical teacher training at Institute for Engineering Education serves for preparing teachers to the area of vocational training. The aim of technical teacher training is the pedagogical and psychological training of students of teaching and engineering. This training enables students to teach to many levels. On one hand those technical subjects that are in accordance with the special engineering qualifications at secondary-level technical training institutions and other special schools, and, on the other hand, to manage subject-related laboratory practicals and other, theoretically high-standard, technical training practicals. Technical teachers, due to their high level education and professional training and with respect to the universal human and national values, are able

- to solve problems and fulfil tasks in the area of safety engineering, mechanical engineering, light industry engineering, information technology and technical management,
- to keep pace with the development of culture and science,
- to teach at high level,
- to develop their pupils' knowledge and abilities and to form their personality, this way preparing them for their chosen profession and for life long learning.

The transfer to market economy necessitated basic structural changes in industry. These changes entail the continuous development of products and technologies. Firms and companies in the labour market need a flexible and well trained workforce. It is an important task to train and retrain this workforce as well as providing continuous professional development for them. Well trained technical teachers are able to satisfy these needs. Students of the technical teacher training course study subject-matters of Pedagogy, Psychology, Methodology and Educational Technology in parallel to their engineering training. With their degree in technical education they are entitled to teach either at technical secondary schools and apprentice schools or in industrial training and retraining. Furthermore, they can participate in organising and managing courses for companies. If they decide to work as engineers they can utilise their pedagogical and psychological background when working in teams or co-operating with other partners.

Technical teacher training is coached for all faculties of Budapest Tech by Bánki Donát Faculty of Mechanical Engineering.

The structure, inner proportions and pedagogical programme of the teacher training attached to the safety engineering, light industry engineering, information technology and technical management courses are equivalent to those of the courses paired with mechanical engineering. Differences can be tackled in the content of the final exam according to the characteristics of the engineering training programme.

The duration of the technical teacher training course is 2 additional semesters added to the engineering course in full time training. (It extends to 8 semesters altogether when paired with mechanical engineering, light industry engineering and information technology. The total duration of studies is 9 semesters when technical teacher training is paired with safety engineering and technical management.)

The chances of technical teachers to find employment in the labour market is enhanced by the fact that they receive two separate degrees (B Eng and B Ed) after completing their studies in both courses.

We have experienced positive feedback on our students' competence not only from the field of vocational training but also from companies in recent years. It is so not only because technical teachers are prepared for industrial training, but also because they make excellent engineers due to their sophisticated manners and ways with partners and they well utilise their psychological and communicative background in developing companies' inner and outer relations.

- Postgraduate Technical Teacher Training Course

The postgraduate technical teacher training course is organised as a distance training course and recruits students already having a B Eng. degree. The pedagogical programme, content, proportions of the training and the credits of the modules are equivalent to those of full time technical teacher training.

- Technical Trainer Training

The professional areas of technical trainer training are similar to the engineering areas of technical teacher training. The content of the technical module of the training is harmonised with the engineering assistant (B Tech Hon) training of the Polytechnic. Technical trainers due to their studies will be able to participate effectively in vocational training organised either at schools or by the labour market participants in various forms of training and retraining in the area of workshop and laboratory practices.

Receiving diploma at the end of their studies, students will be qualified as vocational trainers concerning their specialised technical profile.

The duration of the technical trainer training is 6 semesters in correspondence course. It extends to 8 semesters on BSc level of the Bologna-style training.

Organisational Background of Technical Teacher Training

- Institute for Engineering Education

The tasks of the Institute are wide ranging. The Institute for Engineering Education directs and organises technical teacher and technical trainer courses in harmony with the basic technical courses. The major profile of the Institute comprises psychology, pedagogy, didactics, communication, methodologies, educational technology, multimedia etc.

- Educational and Teaching Practice

The following 6 vocational schools (Technical Secondary Schools) support practical training: Arany János Mechanical TSS, Egressy Gábor TSS in Precision Engineering, Ganz Ábrahám Bilingual TSS, Jelky András TSS in Light Industry, Kossuth Lajos TSS, and Katona József Technical and Business Secondary School.

- Laboratories

The Laboratory for Educational Technology and the Multimedia Laboratory provide technical background for technical teacher training in the form of open laboratories. The Video Editing Studio and the Technical Service Unit also support technical teacher training. Besides, they provide service for all institutes within the building of Bánki Faculty.

Further Education

The Institute for Engineering Education takes an active role in the in-service training programme which was launched in 1997 by the Ministry of Education. It contributes to the programme in information technology for public education by basic, as well as information technological and multimedia training, and grants professional qualifications according to the National Training List (NTL). When setting topics for training, the Institute has kept sight of the fact that practising teachers should be equipped with up-to-date knowledge which they can make good use of in the course of their everyday teaching and research activities. It is considered to be an important issue that educational and methodological applications of rapidly developing information technology be made available to practising teachers. Our short- and long-term programmes have been accredited. The Ministry of Education has supported our programmes by providing modern multimedia based computers.

In 2002 the Institute for Engineering Education elaborated programmes for a specialist examination in pedagogy on technical teacher and IT teacher courses.

Co-operation between IEE and IHM – Initiating TTT on Master level

As a result of the procedure for institutional accreditation in the field of technical teacher training, the Institute for Engineering Education (IEE) at Bánki Faculty and the Institute for Human Resources Development and Methodology (IHM) at Kandó Faculty both were given the highest (international and excellent) level

qualification. Both Institutes have contributed with high degree of activity in the Bologna process, working together towards their shared aim of restructuring vocational education in Hungary. As a result of this, wide-ranging professional consent was reached, standardising the requirements for the qualification of vocational trainers on BSc level and that of technical teachers on Master level, respectively. Our shared application to the Hungarian Accreditation Committee for starting Technical Teacher Training on Master level is in progress.

3 Research and Scientific Activity

Research & Development

At Budapest Tech research in vocational training and engineering education is organised around IEE and IHM as scientific workshops. As a result of a 15-year multimedia developing activity, they have become internationally known professional workshops of research and development.

Topics for R&D at the Institute for Engineering Education are as follows:

- Using virtual learning environments in technical teacher training,
- Analysing the effects of using VLEs in the teaching-learning process,
- Examining new results of Information and Communication Technologies when developing electronic training materials; E-learning,
- Methodological aspects of using electronic training materials,
- Comparative analysis of curricula,
- Methodology of teaching technical subjects,
- Developing competences in technical teacher training,
- Comparative analysis of various forms of technical teacher training,
- Methods for forming and developing algorithmic thinking in technical training,
- Problems of adult education,
- Methodological questions of developing problem-solving thinking,
- Links between visuality and verbality – consequences for education,
- The role of illustration in learning,
- Special problems in vocational education,
- Vocational training and vocational teacher training in Europe.

The Impact of R&D in Education

Due to the activity of developing teaching-learning material to make immediately good use of our R&D results, we have self-authored books, syllabuses and electronic training materials to support the entire spectrum of technical teacher training:

Tóth Béláné: *A gépelemek tanításának módszertani kérdései*, 193 p. 1996

Tóth Béláné: *Segédlet a módszertan tanulásához* (electronic)

Tóth Béláné, Tóth Ádám Balázs: *Az oktatástechnológia alapjai*, 183 p. 2000

A. Toth, B. Toth, J. Ibbetson: *Teaching and Learning in English*, 192 p. 1994

Pentelényi Pál: *Az algoritmikus szemléletmód kialakítása és fejlesztése a tanítás-tanulási folyamatban*, 128 p. 1999

Pál Pentelényi: *Development of Algorithmic Thinking*, 112 p. 1998

Pál Pentelényi (ed.): *Virtual Learning Environments*, 131 p. 2006

Tóth Péter: *Fejezetek az informatika tantárgy tanításának módszertanából*, 108 p. 1996

Tóth Péter: *Multimédia I.*, 65 p. 1999

Tóth Péter: *Multimédia II.*, 68 p. 1999

Tóth Péter: *Gondolkodásfejlesztés az informatika oktatásában*, 60 p. 2004

Tóth Péter: *E-learning anyagok CD-n (Oktatástechnológia, Egyedi médiumok szerkesztése, Multimédia szerkesztő modul)* 2004

Gombocz Jánosné: *A pedagógia alapkérdései*, (electronic)

Gombocz Jánosné: *Kommunikáció*, 40 p. 1999

Suplicz Sándor: *Pszichológiai értelmező szótár*, 20 p. 2002

Suplicz Sándor: *Útmutató a pszichológia tanulásához*, (electronic)

Suplicz Sándor: *A pszichológia története*, (electronic)

Suplicz Sándor: *Tudat, Összefoglalás a tanulásról*, (electronic)

Suplicz Sándor: *Ösztönzés, Motiváció*, (electronic)

Suplicz Sándor: *Rasmussen modell*, (electronic)

Suplicz Sándor: *A problematikus diák*, (electronic)

Suplicz Sándor: *Álláskeresés*, (electronic)

Papp György: *Bevezetés a logikába*, 53 p. 1998

Seregélyesiné Szuh Katalin: *Etika*, 30 p. 1996 (electronic)

Seregélyesiné Szuh Katalin: *Iskolajog*, (electronic)

Simon Béláné: *Didaktika*, 140 p. 1999

Simon Béláné: *Útmutató a didaktika tanulásához*, (electronic)

Simon Béláné: *A szakképzéssel kapcsolatos ismeretek összefoglalása*, (electronic)

Simon Béláné: *Felnőttek szakképzése*, 44 p. 1998

Simon Béláné: *Mérnökpedagógiai eljárások az anyag- és gyártásismeret tanítás-tanulásához*, 181 p. 2002

Fialáné Dér Zsuzsa: *Egy kis Internet*, 65 p. 1998

Fialáné Dér Zsuzsa: *A web-programozás oktatása*, 80 p. 2002

Varga Lajos: *Kvantitatív módszerek a pedagógiai kutatásban*, 65 p. 2002

Varga Lajos (ed.): *Virtuális tanulási környezetek a mérnöktanárképzésben és a műszaki szakképzésben*, 140 p. 2006

National and International Projects

- Projects co-ordinated by the Institute

Involvement in projects helps both research and training. The following have been the most significant of projects administered by IEE and its legal predecessor:

Preparing the Accreditation of Competence-based Education of Technical Trainers. MKM Project 1994-95. Results: proposal for curriculum, 7 essays, 6 publications, 2 conference papers.

Cooperation between Hungarian Technical Teacher Training and the Association for Teacher Education in Europe. TEMPUS CME project 1994-95. Results: Comparative analysis – technical teacher training in 9 European countries, ATEE publication presenting the work of the project team.

Staff Development in Technical Teacher Training. TEMPUS CME project 1995-96. Results: Strategies and models for developing human resources for technical teacher training – European dimensions, 6 essays, 8 publications, 2 conference papers.

Multimedia Development in Education. PFP project 1997-98. Results: preparing the training material for Multimedia as an optional subject for prospective technical teachers; developing infrastructure, 3 essays and 1 publication.

Development of Technical Teacher Training. PFP project 1997-98. Results: developing training materials in the fields of educational system, adult education, educational technology, methodology of teaching IT, communication, as well as the roles of teachers and the competences concerned; 5 essays, 2 publications.

Technical Teacher Education Restructuring. TEMPUS JEP project 1996-99. Results: exploring the effects of the engineering assistant (B Tech Hon) training produced on technical trainer training; developing new blocks of training material; 3 books for students, 5 essays.

Using Virtual Learning Environments in Technical Teacher Training. ITEM project 2003-04. Results: elaborating VLE-based modules for technical teacher training in Hungary, developing and disseminating the applications of VLEs as good opportunities for E-learning; 2 blocks of training material for E-learning and 17 theses.

Developing Training Materials from the Fields of Multimedia and Educational Technology. Apertus project 2004. Results: elaborating electronic training material consisting of 3 modules (basic knowledge, editing independent medium, multimedia editor); methodological help and recommendations concerning each module.

Virtual Electronic Learning in Vocational Initial Teacher Training. Leonardo project 2002-06. Results: elaborating teacher training modules in English using VLEs for Hungarian, British, Finnish, and Portuguese students; creating forms of students' trans-national collaboration; publishing training material in Hungarian and English languages.

- Contribution in other projects

Beyond the national and international projects listed above, IEE has taken part as a contributor in the following international projects:

Life Long Learning in Technical Teacher Training. Leonardo project 1999-2001.

Enhancing Engineering Education in Europe. SOCRATES/Erasmus project 2000-2004.

Teaching and Research in Engineering in Europe. SOCRATES/Erasmus project 2004-07.

Vocational Teacher Trainees in Practice. SOCRATES project 2004-06.

Collaboration with Partner Institutions and Professional Organisations

IEE is closely engaged in scientific workshop and project activities with the following partner institutions and professional organisations home and abroad:

- Scientific professional relations on national level

Collaboration in R&D with scientific workshops in Hungary:

Institute for Applied Pedagogy and Psychology, BUTE

Department of Technical Teacher Training, Széchenyi István University

Department of Pedagogy, University of Pécs

Institute for Teacher Training, DF

National Institute for Vocational Training

National Institute for Adult Education

Association of Teacher Trainers

Subcommittee for Teacher Training, Pedagogical Committee, Hungarian Academy of Sciences

Department of Comparative Pedagogy, Hungarian Pedagogical Society

The prominent teachers at IEE hold leading posts in the Subcommittee for Teacher Training in the Pedagogical Committee, Hungarian Academy of Sciences and at the Department of Comparative Pedagogy, Hungarian Pedagogical Society.

- Scientific relations on international level

Tampere Polytechnic (FI)

FCT/UNL (PT)

University of Huddersfield (UK)

Fontys PTH (NL)

Technological Educational Institute of Crete (GR)

Berufspadagogische Akademie des Bundes in Innsbruck Tirol (A)

Hammen Ammattikorkeakoulu Ammatilinnen Opettajakorkeakoulu (FI)

Technische Universitat Dresden (DE)

Otto-von-Guericke-Universitat Magdeburg (DE)

Anglia Polytechnic University (UK)

Universita degli Studi di Firenze (IT)

SEFI (Société Européenne pour la Formation des Ingénieurs)

ATEE (Association for Teacher Education in Europe)

IGIP (Internationale Gesellschaft für Ingenieurpädagogik)

SATTTI (Strategic Alliance of Technical Teacher Training Institutions)

The head of IEE regularly performs the duties of section leader at IGIP conferences. At the European Association for International Education (EAIE) conference (Barcelona, 1997), the World Conference on Continuing Engineering Education (WCCEE) conference (Budapest, 1998) and the Working Group on Continuing Engineering Education SEFI seminar (Uppsala, 2003) she was entrusted with working group management. From 1996 she has been an ATEE

representative in the organisation Strategic Alliance of Technical Teacher Training Institutions. She is a founder member of the new SEFI statutum (2006).

Publications

Here we need to restrict ourselves to listing only a few important publications. The selection allows a look into the publishing/disseminating activity related to the VELVITT (http://velvitt.banki.hu) Leonardo project, coordinated, and successfully completed this year, by IEE. The title of the project is Virtual Electronic Learning in Vocational Initial Teacher Training.

Ágnes Tóth, Pál Pentelényi: *Virtual Electronic Learning in Continuing Technical Teacher Training*, In: Conference Proceedings of the 9th World Conference on Continuing Engineering Education, IACEE, May 2004, Tokyo, Japan, pp. 525-528

Tóth, A., Pentelényi, P., Tóth, P.: *New Methodologies and Models in Engineering Education*, In: SEFI-2004 Conference Proceedings, Valencia, pp. 479-484

Palásti, B. K., Pentelényi, P., Tóth, P.: *Problem Solving-based Engineering Education*, In: World Congress on Engineering and Technology Education, Guarujá/Santos, Brazil, 2004, On CD-ROM, pp. 274-278

Pál Pentelényi, Péter Tóth, Ágnes Tóth: *Preparing for Being Ready to Make Good Use of VLE Possibilities*, In: Cecilia Sik Ladányi – Brigitta Oláh (eds.): First Central European International Multimedia and Virtual Reality Conference, Veszprém, 2004, pp. 155-159

Ágnes Tóth, Pál Pentelényi, Péter Tóth: *Virtual Electronic Learning in Vocational Initial Teacher Training*, Proceedings of Jubilee Conference in Budapest Tech, Budapest, 2004, pp. 57-68

Pál Pentelényi (ed.): *Virtual Learning Environments – Training Material,* Ligatura Kiadó 2006, p. 131

Varga Lajos (szerk.): *Virtuális tanulási környezetek a mérnöktanár képzésben és a műszaki szakképzésben,* Ligatura Kiadó 2006, 140 p.

Pál Pentelényi, Ágnes Tóth: *A Brief Review of VELVITT,* In: VELVITT Conference Proceedings (ed. László Kadocsa & Péter Ludik), Dunaújvárosi Főiskola Kiadói Hivatal 2006, pp. 5-10

Sándor Suplicz: *Psychological Aspects of E-learning,* In: VELVITT Conference Proceedings (eds. László Kadocsa, Péter Ludik), Dunaújvárosi Főiskola Kiadói Hivatal 2006, pp. 66-70

Péter Tóth: *Hungarian Experience with the Common Module Delivery,* In: VELVITT Conference Proceedings (eds. László Kadocsa, Péter Ludik), Dunaújvárosi Főiskola Kiadói Hivatal 2006, pp. 33-49

Additional publications in connection with the topic in question:

Pál Pentelényi, Péter Tóth: *Pedagogical Aspects of E-Learning Based Education*, In: Proceedings of 5th International Conference on Virtual University, Bratislava, 2004, pp. 211-215

Tóth, P., Pentelényi, P.: *Az analógiás tudástranszfer szerepe a problémamegoldásban*, In: A IV. Országos Neveléstudományi Konferencia – Tanulás, kommunikáció, nevelés. Magyar Tudományos Akadémia Pedagógiai Bizottság. Budapest, 2004, p. 154

Péter Tóth, Pál Pentelényi: *New Learning Styles and Teaching Methodologies in Engineering Education*, In: Tóth Lajos (szerk.): "30 év Győrben" Jubileumi Tudományos Konferencia, Győr, 2004, pp. 350-359

Péter Tóth: *Some Pedagogical Aspects of the Electronic Syllabus Application*, In: microCAD 2003 International Scientific Conference in Miskolc, Section R: Humanities, Miskolc, 2003, pp. 67-72

Pentelényi, P., Tóth, P.: *A gondolkodás fejlesztésének lehetőségei az informatika-oktatásban*, Magyar Felsőoktatás, 2003/7. 49-50 pp.

Tóth, P., Pentelényi, P.: *Complex of Thinking-development in IT-based Education*. In: F. Bontempi (ed.): System-based Vision for Strategic and Creative Design. Vol. 3, A. A. Balkema Publishers, Lissie, 2003, pp. 2113-2118

Tóth Péter: *Az információs és kommunikációs technológiák szerepének vizsgálata néhány európai ország oktatási rendszerében I. Nagy-Britannia*, MultiMédia az oktatásban Konferencia, Dunaújváros, 2002, pp. 215-225

Tóth, P.: *A problémamegoldó gondolkodás fejlesztésének módszerei*, In: Műhelytanulmányok, Budapesti Műszaki és Gazdaságtudományi Egyetem, Budapest, 2002, 85-93 pp.

Ágnes Tóth: *Retraining Technical Teachers for New Communication and Information Technology Skills*, In: Lifelong Learning in Technical Teacher Training (ed. L. Kadocsa), Dunaújváros, 2001, pp. 79-81

Tóth Péter: *A multimédia szerepe a tanárképzésben a Bánki Donát Műszaki Főiskolán*, In: Interdiszciplináris pedagógia. Kiss Árpád Archívum Könyvtára, Debrecen, 2001, 134-139 pp.

In connection with this topic 3 PhD dissertations and 4 SCS papers were written under IEE guidance over the last 3 years. Interdisciplinary PhD research into pedagogy and information technology is related to the doctoral schools of Vocational Pedagogy at BUTE and Pedagogy at ELTE.