

Development of Teacher Competencies in a New Learning Environment in Higher Education

András Benedek

Department of Technical Education
Budapest University of Technology and Economics
Budapest, Hungary
e-mail: benedek.a@eik.bme.hu

György Molnár

Department of Technical Education
Budapest University of Technology and Economics
Budapest, Hungary
e-mail: molnargy@eik.bme.hu

Abstract— The development described in this paper aims to form a service-oriented teaching-learning model supporting the modernization of education, which can be the pillar of a gradually established university specific Competence Centre. The goal of the programmes of the Competence Centre conceived last year and being developed is to ensure that university lecturers and teachers, as well as research workers can fulfil the demands of an extending international/European higher education learning environment. The competence development necessary for 21st century university lecturers focuses on such key areas as Lifelong Learning approach and Information and Communications Technology literacy. The authors present the practical realization of the above mentioned development at Budapest University of Technology and Economics following the emergence of a concrete demand. Specifically, the service-oriented organizational and operational frameworks of teaching-learning were established in a way that allows the actual use per organizational unit or respectively person, the success of the participants as well as the satisfaction of those initiating the training to be determined. The main conclusion is that the results of the e-learning-based training programs developed within the framework of the research are a good pedagogical indicator of the transformation process when the further training of teachers in an institution of higher education of significant traditions, an „up-to-date training of trainers” is being developed, and based on the experiences the process is getting institutionalized. The concrete use of the research is the development of the trainers’ professional competencies, attitude formation and efficient knowledge transfer. The innovation frameworks necessary for the development of the lecturers’ competences were provided by the learning and development environments of the Institute of Applied Pedagogy and Psychology as well as the e-learning material developers of the co-department.

Keywords- *Competence; e-learning support systems; Moodle system; teacher training.*

I. INTRODUCTION

The specific, final form of the Technology Transfer Project as a training program was initially proposed as a concept of a training framework within the process of modernizing education, characterized as follows:

It was recommended to develop of an in-house training system relating to the BME (Budapest University of

Technology and Economics) Research University Program, with the emphasis on its horizontal elements (human resources development, support for the recruitment of teaching staff, raising standards of educational achievement), which would provide a suitably flexible learning framework for innovatively minded teachers.

The innovational background was to be provided by the Department of Technical Education (MPT) and the Centre for Learning Innovation and Adult Learning of the GTK Institute of Applied *Pedagogy* and Psychology (APPI), as well as by the current “Trainer Training” TAMOP project, while the Institute of Continuing Engineering Education (MTI) would provide the infrastructural organizational background at university-wide level.

The institute’s specialised e-learning environment development server also has such software packages as Wimba Creator and Adobe eLearning Suite Extensions, along with electronic learning environments which vary across the training forms and programmes, while providing similar services (Moodle- Modular Object - Oriented Dynamic Learning Environment, Mahara [11], LimeSurvey [12]). Progressive methodological developments (the introduction of on-line forums and online examinations) are realized in the Institute of Applied *Pedagogy* and Psychology framework in conjunction with the operation of the Moodle e-learning system. The experience thus accumulated is important for implementing and broadening the range of opportunities for autonomous learning and for ICT supported teaching applicable in teacher’s own practice. The Institute of Applied *Pedagogy* and Psychology is at the forefront of current practice in education innovation and open, distance learning and information and communication technology assisted learning (e-learning), as well as other innovative training employing unconventional methods [1]. In developing a training program which meets these requirements, the internationally successful Web 2.0 model, was found to provide a good fit, as depicted in the jigsaw below. It is obvious that the web 2.0 content management is provided by a special content creation tool (CCT) in addition to the content management systems (CMS). A student management system (SMS) is also applied to help student activity, while a financial-accounting

system (AS) has been formed to manage administration and statistical tasks.

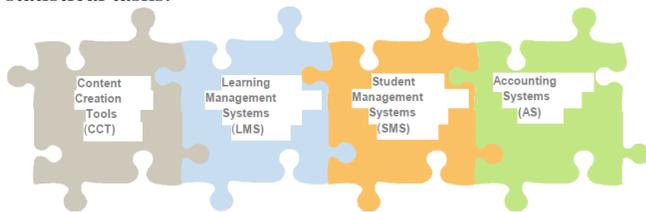


Figure 1. Web-Education system in Europe, Source [8]

II. BODY OF PAPER

A. Antecedents

The aim of the development was to establish a service oriented teaching-learning model, furthering the process of the modernization of education, upon which a BME-specific Competence Centre could gradually be built – responding to the needs of departments, institutes and faculties. The objective of the programs offered by the Competence Centre is for the university’s teachers and researchers to be able to meet the challenges arising from expansion into the international, European Higher education sector. The training covers the following major fields of competence required to function as university teachers in the 21st Century:

- Lifelong learning
- Teaching in a modular system
- Developing student centred methodologies and materials
- The use of alternative teaching methodologies
- Effective learning, and applying presentation techniques which support individual study
- The use of collaborative and networked study methods
- The application of suitable styles of verbal and non-verbal communication
- Using modern presentation techniques
- Familiarity with methodological opportunities afforded by ICT and incorporating them into the teaching process
- The development and application of new evaluation methods
- The application of ICT based information and knowledge management systems
- The practical application of modern forms of educational organization

In the medium term, the basic system of the in-house continuing vocational training recognized at university-wide level is a flexible 100 hour program, adaptable to the needs of the individual, which current plans indicate is to be reviewed and revised at 5 year intervals. A third of the program hours (30-35) are contact hours of theoretical and practical work in small groups, assisted by an electronic learning environment (Moodle), while the other two thirds of the course (65-70 hours) are to be realised individual preparation and professionally supported consultation. The Moodle [3] system to be used – which is used by more and

more university departments – is according to international sources can be applied to “blended learning” type support for students and teachers. Currently, within our institute, with nearly 50 courses and 10000 users we have several years of experience in supporting online training, combined tutoring, online examinations and consultations, operating forum systems and E-portfolio applications.

The integration of the developed e-learning course modules into the Moodle system did not imply either content, or methodology, or technology problems. The Moodle is ready for the management of the course materials, so it is developed in accordance with the methodological structure of e-learning. The course materials were prepared in SCORM format, making possible the integration of the video elements as well.

The service oriented teaching-learning organizational and operational frameworks were designed to allow the monitoring at the level of organizational units and of individuals of course participants’ usage levels and achievements, and the degree to which the courses satisfied their needs. The evaluation and financing models of the development take this as their basis. Any given time period – over a whole academic year – can be employed flexibly, and, depending on the subject chosen, its nature and complexity may comprise 5-20 contact hours. The actual achievement of course objectives per academic year, measured against an internal credit system is recognised by the issue of certificates. Course participation alone is not a sufficient criterion – students’ progress is also relevant, as is the measurement and evaluation of their acquisition of the target competences, along with effective support for the teacher’s self-development.

B. The process of electronic teaching materials development

As an atypical form of teaching, e-learning requires that teaching materials go beyond the traditional digitalised or digitally authored materials, and that they be authored in an e-learning environment. In the course of preparing these electronic materials many factors play a role, which do not arise when creating simple written documents. Electronic teaching materials contain multimedia elements (e.g., spoken narration, animation, simulation tasks, highlighted notes etc.), which are difficult to express in writing alone.

Furthermore, in many cases electronic teaching materials are produced by personnel who are not in fact competent in the details of the subject matter presented. A major problem arising from this is that of how a specialist in a particular field – the content provider – can convey to the personnel who are producing the materials – the materials developers - what should feature in the teaching materials. The creation of electronic teaching materials – due to the factors outlined above – requires an effective quality control process:

Firstly, the materials developers show the *content authors* what possibilities are available in electronic teaching materials, and give them a written description of

the development environment. For this, it is necessary to use the appropriate terminology and review the range of available options. Following this they jointly write the so-called script (synopsis) of the teaching materials, on the basis of which the materials are produced. The most important attribute of the script is clarity; that is to say, the material developer should know exactly where the materials will be used, and what will feature in them. The next stage is the process of checking and editing, professionally, in terms of content, and linguistically. It is important that even at this stage the script be precisely written enough that the editors will know, even without having produced electronic materials, what will feature in the materials and how. The professional and linguistic edits are then reviewed by a further editor, who accepts or rejects them as appropriate. Next, the rough materials are produced, which comprise the:

- Written texts,
- Images,
- Studio recordings,
- Video materials and animated sequences required for the teaching materials.

The best solution is for the rough materials, or a large proportion of them, to be prepared by the content authors / script writers themselves, or for them to supervise this preparation. This also greatly aids the work of editors and proofreaders, and there is less chance of the type of mistakes which arise when materials are being developed. During the next stages of the process one of the most notable tasks is tackled, pedagogically speaking, that of curriculum development. In the last stage in the process, the electronic material is subjected to the further editing and testing, to determine how much it conforms to the script.

It can be seen in this process that the key to materials development is an appropriate script. The script has to be in all regards exact and unambiguous, especially as its narrator may in many cases have little idea of what he is saying. He will thus be scarcely able to correct or supplement any unclear or questionable material. The diagram below gives a general overview of electronic teaching materials. This kind of overview is vital, to make the content developer aware of the possibilities and limitations of electronic teaching materials.



Figure 2. Electronic Study Material, Source: Internal teaching resource

Once the electronic teaching materials have been uploaded the lesson screen appears in a new window, which is composed of several parts:

- Frame, other lesson-related information (1.)
- Notes on content (2.)
- Text (theoretical) information (3.)
- Video window (flash animation, interactive task(s)) (4.).

C. Real world realisation

The strategic aims of the program were achieved in several developmental phases. The first phase, in mid-2011 (April-August) the topic areas of the Technology Transfer Project – with the agreement of the participants – were set out in brief training modules (maximum 10 hours). These courses partly consisted of contact hours with full or partial e-learning support (for individual preparatory work and practice). 6 of the 11 modules present and order the general characteristics of innovation, which then link into a module on product development. The technology development projects being pursued at the BME (Budapest University of Technology and Economics) serve as case studies of innovation in the other 4 modules demonstrating how innovation can be supported by knowledge transfer. The modules focus on the application of the results of innovation and the establishment and development of suitable business models for practical application of innovation. The topics of e-learning modules actually developed were:

- Fundamentals of Project Management
- Starting businesses, spin-off firms, Raising capital, Economic Analysis of investments
- Syntactic metal foams - metal matrix composites reinforced by special particles
- Laser soldering
- Fundamentals of Product Development Management
- Intellectual Property Rights, industrial copyright, patents
- Preparing and managing tenders/applications
- Innovation management
- Marketing, business, image building

The specific tasks were devised in the following process:

1. Finalizing the task specification and clarifying its financial aspects
2. Selection and recruitment of technical writers/course advisors collaborating on the project
3. Skills training for technical authors
4. Collection of professional materials necessary for E-learning material development
5. Creation of E-learning modes: early summer pilot stage (4 modules)
6. Moodle framework development and downloading of pilot course materials
7. Briefing course advisors on on-line consultations and tests

8. Announcing and initiating pilot courses
9. Uploading the complete course materials onto Moodle and commencing the training – the final test and validation of the teaching materials
10. A brief (6-8 minute) video (in VCAM format) was prepared for each module, functioning as a freestanding lesson, supplementing the written materials, which together make up an individual work (downloadable, executable), which is embedded in the e-learning materials.
11. The supporting framework for the courses was completed (Moodle) [4]
12. The teaching materials were uploaded onto this, connected to the Google Analytics statistical services, which allows the courses to be monitored. The visual interface:
http://visibleexpression.co.uk/mythemes/aardvark_mak_eover.zip
13. Information relating to the course applicant, and the relevant application form was placed on the electronic learning environment delegated for educational support of the project, which can then be used to help draw up an adult education contract.

An average of 2 A0 sheets worth of “course materials” are prepared per module, and these e-learning study materials, which are suitable for individual study, are accessible to registered users in an inclusive manner on the electronic framework, along with 10-20 related test questions per module. Course participants and teachers alike will have access to Forums for the duration of each module, which are moderated by the technical author and provide opportunities to conduct consultations and to exchange experience. This links in with the course ending, examining/knowledge checking process, allowing for evaluation of the course and statistical analysis. Coordinating activities are included in the above processes, as are monitoring and evaluation (quality control), along with administration required for the course (course registration, approval, signing contracts, certificates of achievement, collating statistics). The figure below shows the opening page of the Moodle system which facilitated this e-learning.



Figure 3. Opening page of the Moodle LMS of the Technology Transfer Development, Source: own photo

The study pages of the individual modules can be found under the course category headings, and within them the lessons. The screenshot below shows the contents of one lesson.



Figure 4. First lesson of the course of the Moodle system, Source: own photo

The following screenshot shows the video recordings embedded in a lesson, which the student can stop or replay at will.



Figure 5. Opening page of the Moodle LMS of the Department, Source: own photo

III. CONCLUSION

Students who have successfully completed any one of the 9 e-learning-based training modules gain skills which will afford them greater mobility and measurable knowledge, as well as in future years supporting the Lifelong Learning concept. 1466 out of 1965 students successfully completed the selected module. A notable outcome of the programmes was the co-operation between teachers from different faculties and the effort the put in to develop an effective way of conveying knowledge. The participants were able to select the most appropriate training programme for their particular competency set, and to immediately apply the knowledge and practical experience thus gained in their teaching practice. The success of the training programmes of this project is also evinced, from a

pedagogical standpoint by the process of transformation in which a higher education institute with long traditions is moulded by the further professional training of its academic staff, and on the principle that experience is systemized suggests that this may lead to this process becoming institutionalised. Beyond allowing teaching materials to be downloaded, the Moodle system also facilitates communication between students and teachers, measuring of their activity levels, the functioning of public forums, and implementation of monitoring and evaluation in an electronic environment. The patterns of usage of the system are shown in the following two diagrams, from November 2011 – February 2012, which clearly shows, for instance, the peak date of online test completion on December 12 2011. It can also be established on the basis of Google analytics statistics, that on December 5 2011, 1023 people visited the courses' study pages to study the online study materials contained therein, preparing for the final exams.

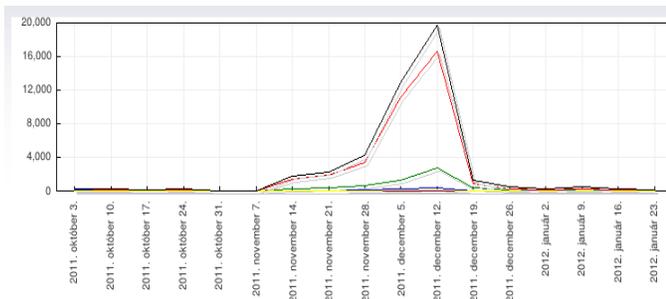


Figure 6. Student and teacher activities of Technology Transfer course, Source: own photo



Figure 7. Statistical indicators of TT modules with the aid of Google analytics.

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