

# Some Aspects of Computer-Supported Teaching When Teaching Bachelors

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The state of the art of TEL (technology-enhanced learning) is characterised by a technological-driven approach. Learning management systems or learning courses for management systems are mentioned as frequently used basic tools for this purpose. However, these Internet technologies are not suitable for the personalized support of teachers on client desktop computers. In this paper, an education-driven approach is briefly explained. The driving force is the sustained development of the in-house e-learning software, which allows bulk handling of unstructured information and knowledge in computer support of nonstructural teaching activities for teaching bachelors. The similar multipurpose pre-programmed environment or the paradigm of batch knowledge processing is not yet described in the literature. Some examples of personalized computer support of teaching are also mentioned.

*Keywords:* computer-assisted learning, e-learning, TEL (technology-enhanced learning), engineering education

## Introduction

Within a period of five years of empirical research on TEL (technology-enhanced learning) implementation in teaching at the Faculty of Materials Science and Technology of the Slovak University of Technology, a pre-programmed environment for “batch knowledge processing”, was developed. This includes a personalized virtual learning environment and a set of Web-pages for various engineering courses of study. This was tested and directly applied in the teaching of bachelor students. The field of TEL is part of the calls put forward by the European Union’s 7th Framework Programme in the area of ICT (information and communication technologies), where the research priority is focused on “How information and communication technologies can be used to support learning and teaching” (TeLearn-European Research on Technology-Enhanced Learning, n. d.).

At the beginning, there was an idea to equip research and development staff (knowledge workers) with informatics tools for personalised working with huge amount of information, e.g., for “self-e-learning” (Svetsky, 2007; Svetsky, Moravcik, Tanuska, Rehakova, & Ruskova, 2008). Thus, a knowledge base and information sources structure, associated activities and outputs were designed to be solved. For this purpose, a database application was developed as an “all-in-one” support tool for generating browser-based e-learning applications, performing personal Internet retrieval, creating a combined virtual online/offline learning

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environment and the support of content management, etc. (Svetsky, Moravcik, & Tanuska, 2010; Divjak, Begicevic, Moravcik, & Svetsky, 2010).

In this context, the introduction of an entirely new paradigm of batch processing of information and knowledge was needed, because in a conventional DBMS (database management system) the data are processed in another way based on a relational model (Moravcik, Svetsky, Hornak, Sobrino, & Stefankova, 2010; Moravcik, Svetsky, Sobrino, & Stefankova, 2010). This gradually resulted in the development of the pre-programmed environment of BIKE (batch information and knowledge processing) that was used for support of the engineering education of bachelors. For students and other teachers, it is available as a standalone Zápiskník/WritingPad (as geniusv.exe), which is installed on computers in a classroom. The existence of such an informatics tool allowed teachers to solve the first stage of processing the knowledge flow between information sources and the “knowledge” database tables. In this stage, various types of learning materials and libraries with browsable pages and documents were produced.

However, the creation of tools and solutions only for processing the content was not sufficient for the needs of teaching, because this technology-driven approach did not take into account the pedagogical aspects of education and the key role of the teacher. It was found that the processing of knowledge (engineering content) also needed to address the flow of knowledge among the produced learning materials (tailored for courses of study) and among individual educational activities. This required more education-driven TEL approach than the previous technology-driven one. In other words, the technology-driven approach for TEL was expanded with educational aspects. From an informatics point of view, the next solution showed a need to understand the information and knowledge processing in order to support teaching and learning activities, such as “automation”. When programming is focused in this direction, it became clear that when dealing even with the simplest activities a large number of alternatives are available. If one takes “the automation of teaching and learning activities” into account as an individual interdisciplinary issue, the solving represents a “never-ending story” (Svetsky, Moravcik, Schreiber, & Stefankova, 2011a; 2011b). In this paper, some examples, i.e., applications of personalized support of teaching are presented.

Currently, the BIKE environment allows individuals (teachers, students, and researchers) (Svetsky, Moravcik, & Odlerova, 2011; Svetsky, Moravcik, Ruskova, Balog, Sakal, & Tanuska, 2011):

- (1) To design and produce a large amount e-learning of training materials from one’s own personal know-how, such as, printed materials, electronic media, and also the multilingual Web-environment by the use of educational content and Internet services;
- (2) To solve the support of teachers in developing their personal preparation for teaching and related e-learning tools (tutorials, self-evaluation tests, interpretation of the scheme, a personal information system, the digitization of printed books, and the transfer in teaching material for a given study program);
- (3) To automate all kinds of educational activities—teaching, testing, evaluating, and grading of students, publishing, making retrieval, administrative activities, and the data transfer from AIS (academic information system/learning management system);
- (4) To create a personal virtual learning environment and use a communication forum that acts as a personal social networking among students and teacher for feedback, sharing information, instructions, but also for a common research space where participants can store information from the survey of literature (particularly students working on diploma theses);
- (5) To automate, i.e., streamline the activities of individuals in the Windows environment (the additional features to the operating system, searching in the database, directories and files, to archive files by incorporating certain features of the file manager, and editing programming languages—HTML, PHP/MySQL).

With the multipurpose environment of BIKE (it is only on the author's computer), or it is parts of the diary, which is installed on personal computers, teachers and students can use all five categories and all possible types of learning (face-to-face, blended-learning, active learning informal learning, and life-long self-study). For these reasons, it can be understood as a specific type of personal "Mindware" (personal external storage), but also as a supplement to the operating system of Windows.

It may be noted that despite several years of intensive research, a similar paradigm of batch knowledge processing could not be found in the literature and on the Internet described when working with conventional RDBMS (relational database). No identical or similar multi-purpose software package that provides many activities at once, such as dozens of dedicated software routines, can be found. This multifunctional environment of BIKE gives added value to traditional teaching, which brings a synergistic power factor in terms of educational materials for the creation of new materials, new innovative ways of teaching and self-study. By using BIKE from beyond the established computer and pedagogical practices, it is quite difficult to explain its function. This is one of the reasons for the differences of evaluators when peer-reviewing, where someone classifies it as a tool for knowledge management, and some as soft-computing.

Listed below are some of the solutions implemented by using the BIKE environment within teaching and personal support of the activities of the teacher.

### Producing E-learning Materials

As was mentioned above, the BIKE or WritingPad enables individuals (teachers and students) to create teaching and learning materials. Figure 1 shows two examples of e-learning material created in the AIS on the left, and by the BIKE development environment on the right. As it can be seen, the e-learning material created by BIKE is more friendly.

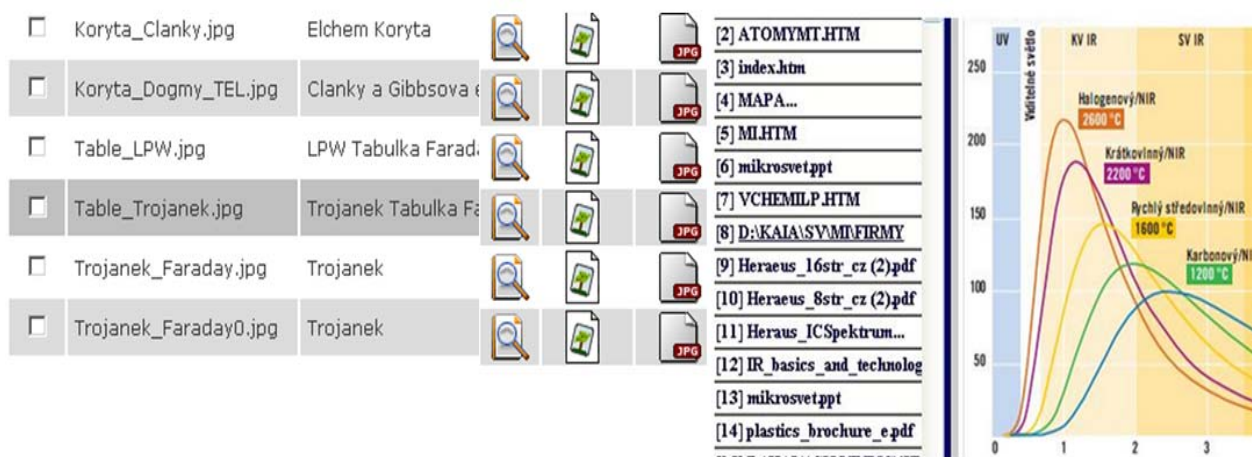


Figure 1. Examples of e-learning materials.

### Batch Internet Retrievals

Another specific example from the practice may be the implementation of batch Internet retrieval using the WritingPad or BIKE. Figure 2 shows an example of batch retrieving, the result is for photosynthesis by the use of the following keywords: photosynthesis, photosynthesis energy, photosynthesis dark stage, and photosynthesis chloroplasts. This was made by students.



Figure 2. Example of batch retrieving (a screenshot within OPERA).

### Personnel Preparation by a Teacher

In teaching practice, a teacher needs to prepare various types of materials for teaching, administration, testing, publishing, and communications with students, etc.. In this case, the BIKE or WritingPad enables the teacher to automate activities. The following screenshots show some examples from engineering teaching (calculation, communications forum, tutorial for teaching language programming, and blended learning) (see Figures 3, 4, 5, and 6).

2	IDEALNY_PLYN	
6	PHP LOG	
8	VCHEMIA	
10	VCHEMIA	Zadanie štandardných hodnôt
11	IDEALNY_PLYN	$V^0 = RT^0 / p^0$
13	IDEALNY_PLYN	idealny_plyn Plyn (dusik, vodik, kyslik, vzduch)
15	MI Spektra	R [J/mol.K]
16	ATOMY	p <sup>0</sup> [Pa] (at, atm, torr, mm vodného stĺpca,...) (1 t [°C] (0,25, 0,27,20, ...) ... T° = 273.15 + t [K] V° [m <sup>3</sup> ]

**Chémia: Stavová rovnica => Výpočet mólového objem**

$$V^0 = RT^0 / p^0 \text{ [m}^3\text{]}$$

Figure 3. Example of virtual space for calculations (ideal gas).

<p>environmentalistiky SVET ALL SCHEMY 2013-04-01 ZE</p>	<p><b>SCHEMY</b></p> <ul style="list-style-type: none"> <li>Ukážka semestrálnej práce z r. 2011/2012</li> </ul> <p>&lt;== ENVIRONMETALISTIKA</p>
<p>[11] [Hľadanie v jednom zdroji: Angie site:youtube.com] SVET ALL Angie site:youtube.com,dna site:en.wikipedia.org 2013-03-30 ZE</p>	<p><b>INFO: vzdelávacie zdroje, napr. študenti zatiaľ našli pre DNA =&gt; dna site:nobelprize.org</b></p> <ul style="list-style-type: none"> <li>[Stránka Nobelovej ceny - obsahuje primárne, t.j. kvalitné informácie] - majú tam aj luy, napr. k</li> <li>[Hovornaci glosár -z amerického inštitútu nahovorili základné pojmy, napr. č</li> <li>WIKIPEDIA o DNA</li> <li>[En] - [Cs] - [Sk] - [De] - [Fr] - [Ru]...</li> </ul>
<p>[12] [TTS Počítač číta vložený skopirovaný</p>	<p><b>Text-to-Speech Synthesis / Syntéza ľudskej reči (Epos 2.4.86)</b></p> <ul style="list-style-type: none"> <li>[Slovensky] [Cesky]</li> </ul>

Figure 4. Example of communication forum: Teacher-students.

TASK 15.04.2013
ABOUT c++ OOP
ABOUT Pointers
DPMTF Studenti
for - if - else
Fred Schwarz Pointers
Fred Schwarz Pole 3-rozmerné
Fred Schwarz Celsius to Fahrenheit
2013 Tankista - trieda Class Studen
2013 Zapisovanie čísla z klávesnice
Konštruktor 1 deklarácia a implem
CLASS eng

```

int main() {
for (int i=1;i<=52;i++){
cout << "-- " << meno;
};

alebo len:
for (int i=1;i<=52;i++){
cout << "-- " << " Leskoviansky ";
};

float x=13.11;
int v=0;

```

Figure 5. Example of tutorial for C++ teaching (clicking on user menu launches DEV-C++ environment).

Ukážka

Schéma pracovísk

Encyklopédia Britannica s na

VEGA - projekt

Ukážka

Schéma pracovísk

Encyklopédia Britannica s na

VEGA - projekt

Figure 6. Example of blended learning.

## Conclusions

In this paper, some aspects of computer-supported teaching from the teacher's point of view are discussed. The education-driven approach is emphasized, i.e., technology must adapt to the teacher's needs. The history of implementing TEL at the Faculty of Materials Science is briefly described. This resulted in the development of the personalized desktop tool, so-called BIKE, which supports teachers in their daily teaching and learning activities, based on "automation".

This multipurpose tool or preprogrammed environment allows pedagogues to produce a large number of e-learning training materials to create materials and tools in the teacher's personal training course and automate all types of teaching activities in the classroom-based automation of sub-activities, which can create a personal virtual learning environment and communicate with students via a personal social network—It can also automate work on the PC in the Windows environment. This tool meets the needs of the teacher and students, one can create engineering content one wants from the menu and the user can choose what is needed to



automate self-study or teaching.

All these functions automatically improve the quality and effectiveness of teaching. Integrating science and educational engineering content and activities can bring a synergistic effect, i.e., the individual can create the entirely new educational set of materials and the teacher can create a completely new type of teaching that within one hour will have multiple applications simultaneously (e.g., presentation of subject matter, self-evaluation test, index entries in the communication forum, making calculations, etc.). This would not be possible without the integrating of informatics.

The paper presented some outlines of the outcomes realized when teaching bachelors. The more variable attitude while learning in the case of using BIKE was shown in comparison with a case where the e-learning is provided with the use of the faculty's AIS.

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