THE NEW APPROACH FOR TECHNOLOGY ENHANCED AND COMPUTER ASSISTED LEARNING IN TEACHING AT THE FACULTY OF MATERIALS SCIENCE AND TECHNOLOGY

Štefan SVETSKÝ, Oliver MORAVČÍK, Eva ODLEROVÁ

Authors: ***Štefan Svetský, PhD., Oliver Moravčík, Prof., Dr., Eva Odlerová, Assoc. Prof., PhD.***
Workplace: ***Slovak University of Technology in Bratislava, Faculty of Materials Science and Technology in Trnava, Institute of Engineering Pedagogy and Humanities***
Address: ***Paulínska 16, 917 24 Trnava, Slovak Republic***
E-mail: ***stefan.svetsky@stuba.sk, oliver.moravcik@stuba.sk, eva.odlerova@stuba.sk***

Abstract

The BIKE - Batch Information and Knowledge Editor, have been developed at the Faculty of Materials Science and Technology in the previous years. This in-house software produces browsable outputs which are readable by common internet browsers. The default outputs are directed into OPERA and Internet Explorer. Especially OPERA is user friendly and very suitable for students and teachers with lower informatics skills. At the beginning, this editor was used as a supporting informatics tool for technology enhanced learning in bachelors courses of engineering study. Now, some diploma works were performed in order to investigate if the use of the BIKE could support solving a transfer of cultural heritage; learning styles; e-learning production; as well as building the personal engineering information systems.

Key words

knowledge processing, technology enhanced learning, computer assisted learning, engineering education, personal information system

Introduction

In context of research - thematic ICT priorities in FP7, the technology enhanced learning approach was investigated at the Slovak University of Technology - Faculty of Materials Science and Technology (FMST) in the recent years. This approach is based on a batch knowledge processing using the pre-programmed environment which works as the Batch Information and Knowledge editor (BIKE). Just as, e.g. MS Word - editor enables working with texts, the BIKE enables working with knowledge in the role of a basic element within engineering education. The experiences obtained from the technology support for engineering education were presented within faculty's publications in USA, AUSTRALIA and EU [1, 2, 3]. A list of about twenty papers is mentioned within the references in [4], where five years of research of technology enhanced learning implementation in teaching at the faculty are presented.

Some aspects of technology enhanced learning in bachelors teaching

Technology enhanced learning (TEL) is complicated by the fact that it is an interdisciplinary field. Education has its own distinctive content (curriculum, course of study, syllabus, engineering content) and their educational and teaching practices that take place in a real environment (classroom, teaching space, library). On the other hand, the digital technology has its own Internet and communication technologies and informatics tools (hardware, software, Internet). If one combines a real environment in the classroom with a virtual learning environment (this contains learning material), the educational and informatics approach should be optimal balanced. However, common approach for technology enhanced learning is mostly technology – driven. In contrast, the TEL approach at the FMST is both educational and technology – driven. It comes directly out from the nature of knowledge as an essential element of education. Thus, using the BIKE the various outputs were generated for the teaching support, e.g., learning materials for courses of study, supporting e-libraries, tailored internet forums, and other personalised applications.

Figure 1 shows an example of the learning material for Bachelor Programme in Chemistry created by a teacher using „Zapisnik". The Zapisnik is a pre-programmed stand-alone application of the BIKE which works on teacher's computers or computers in the classroom. For example, by clicking on the scrollbar menu, in the right window a learning issue is shown which is related to infrared emitters (source: Heraeus Noblelight Infrarot Newsletter, http://heraeus-noblelight.com). This study material serves students to better explain how to use infrared radiation technology in industrial practice (e.g. in surface treatment).

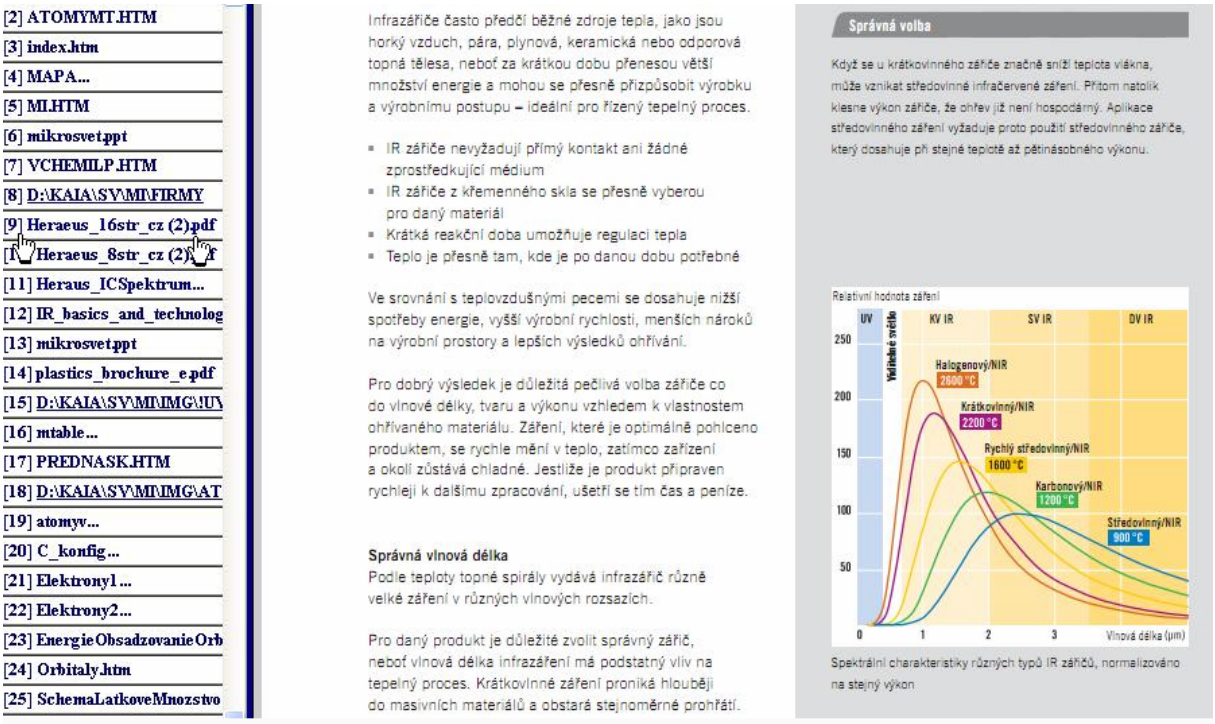

Fig. 1 *The example of a course of study learning material created using Zapisnik*

The mentioned course of study learning material was implemented in teaching by means of integrating classroom instruction with e-learning material and virtual library placed on faculty's server. The BIKE is also suitable for integrating such blended learning with the

knowledge management, as well as for solving an interplay between two type of professional knowledge - *content knowledge* and *pedagogical content knowledge*. These specific issues are exhaustively discussed e.g. in [5]. However, it must be noted, that performing the blended learning at an university is very complex. For example, experiences within Turkish higher education system showed that faculty members' problems with blended teaching resulted „in the identification of three categories: *instructional processes*, *community concerns* and *technical issues*" [6].

Using internet browsers in classroom

The BIKE is basically a desktop database application. If you want a teacher and students to browse the course of study learning material both off-line and online, there is very important what type of browser should be used. The long-term experience with various browsers shows that OPERA and Internet Explorer are most suitable for this purpose. The OPERA enables users to work with many html - pages in the same window. Also this browser has a specific feature „*session*" which is optimal for personalised surfing and retrieving information. The Internet Explorer is likewise suitable due to its compatibility with the Windows Explorer. Although the BIKE can work with various internet browsers, these two browsers are used as default values. In the following figures you can see some examples of learning and teaching applications of OPERA browser, mainly for these activities:

a) simple or batch internet retrieving for semestral works and projects, or diploma works,
b) setting out the paths to self - evaluating tests or engineering calculations,
c) setting out a combination of optional off-line and online links,
d) „multi-browsing" the learning and training material.

Figure 2 illustrates an example of a use of sessions - the advanced features of OPERA browser. This screen was captured from a computer in classroom at a faculty's detached workplace. In the following figure you can see a menu with fifteen sessions (on the left side). Seven of them were created by students (results of their internet retrievals) and rest of them by the teacher (setting up the learning material or tests for the courses of study). The teacher or students can open the appropriated session in every time. On the right side, you can see the selected calculation area (Electrochemistry - Nernst equation).

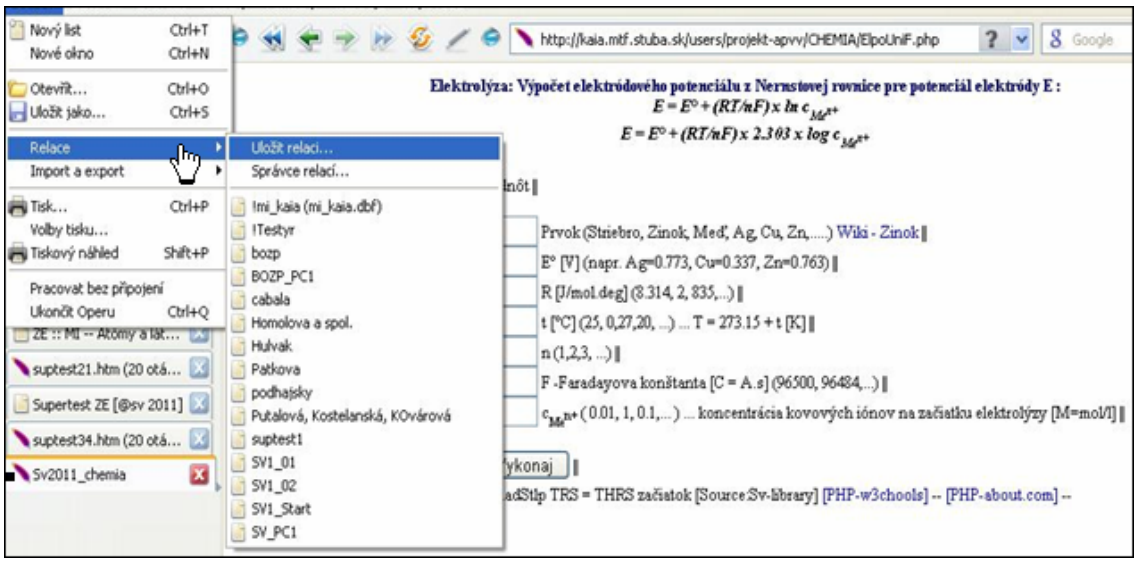

Fig. 2 *The example of using sessions in OPERA browser (captured from classroom computer)*

Figure 3 shows an example of result of the batch internet retrieving. This means, that these four keywords: *photosynthesis, photosynthesis energy, photosynthesis dark stage, photosynthesis chloroplasts,* was given by a student in the Zapisnik environment for his / her retrieving. In the following figure you can see the search result directed into twenty opened windows of OPERA browser by using IxQuick and Google search engines.

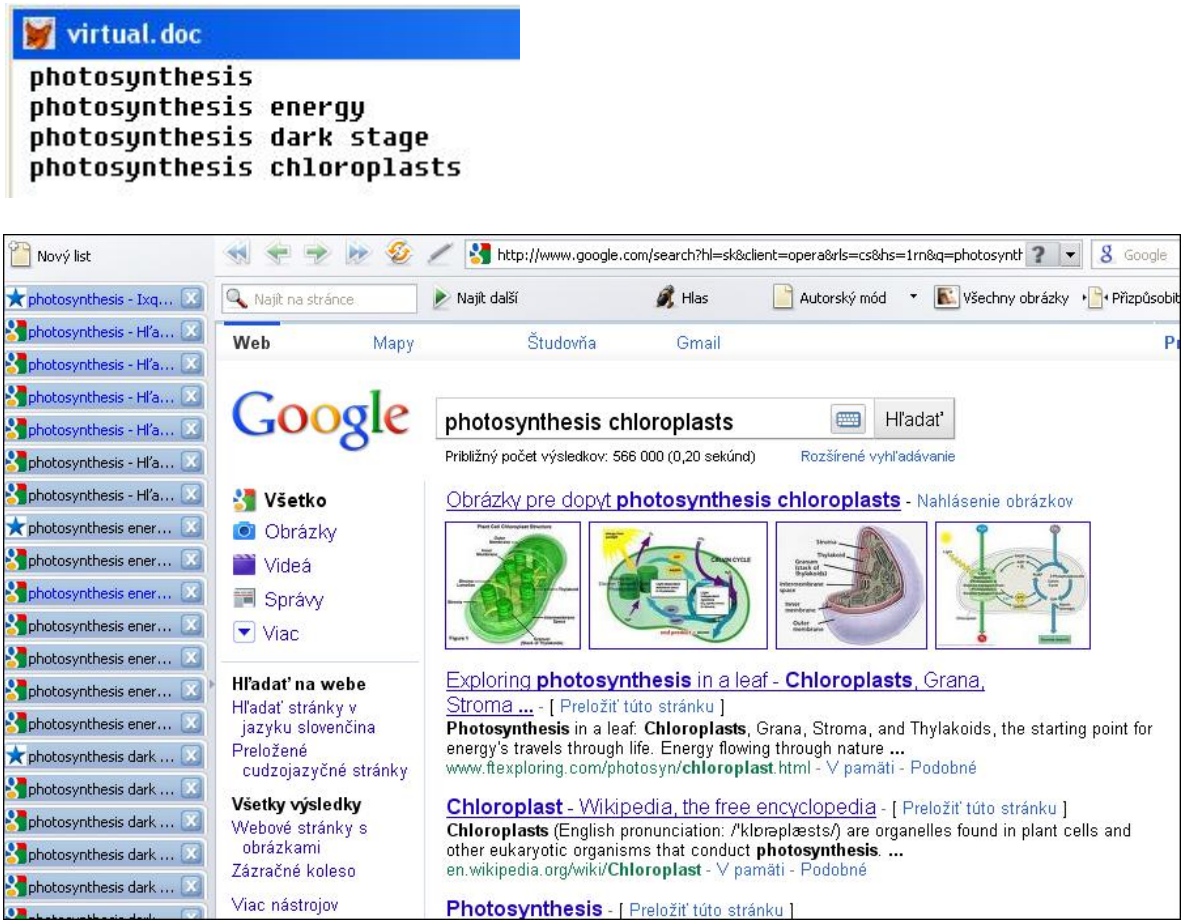

Fig. 3 *The example of a use of the batch internet retrieving in OPERA browser*

Using computer assisted learning for diploma works

The BIKE works as the pre-programmed environment for knowledge processing. Using this editor, the several tailor made applications were written for pedagogical purposes in bachelors teaching environment in the previous years. Now, the five diploma works were performed using Zapisnik in order to investigate if the students are able to solve and design it for dedicated pedagogical issues, as follows:

- solving the transfer of culture heritage from the pre-internet stage (1950-1985) into engineering teaching,
- solving the possibility of computer support of learning styles,
- designing the teaching materials for screw thread,
- designing the information system for cutting fluids,
- designing the information system for occupational health and safety.

Figure 4 shows the navigation area for a small social network used for communication between the teacher and students (see the blocks FORUM and !Resers).

Fig. 4 *The navigation area used for communication between the teacher and students*

Figure 5 shows the another example – selected from the information system for cutting fluids created by one of the students using Zapisnik. By clicking on the item [4] of the main menu and [6] of the submenu (e-library with papers), a student can read the published paper „*The Cutting Fluids Testing in the Machining Technologies*“, as you can see on the right.

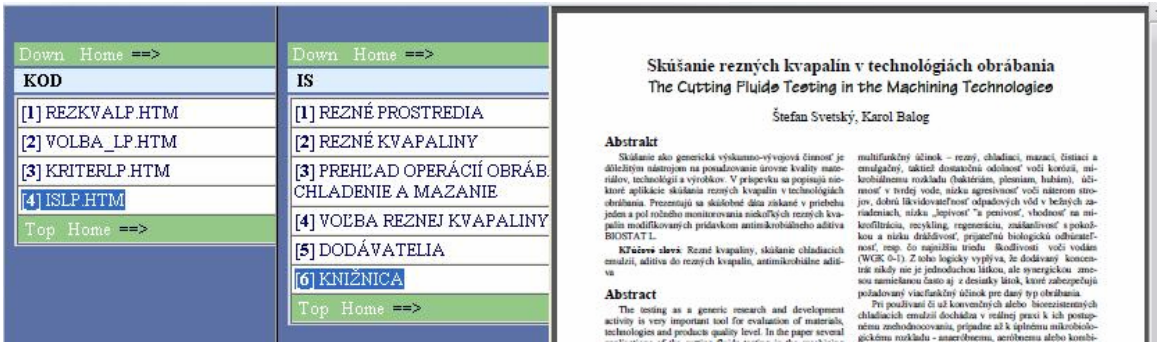

Fig. 5 *The example from the information system for cutting fluids created using Zapisnik [7]*

Figure 6 shows the another example from solving the transfer of culture heritage (engineering content) from the pre-internet stage (1950-1985) to the nowadays bachelors teaching. The following figure illustrates a learning material which was selected from the older engineering books in support for teaching Chemistry course of study. The transferred content is from the book: Andrlik, Chemistry for high schools, 1953).

Fig. 6 *The example from solving the transfer of culture heritage created using Zapisnik [8]*

Measuring students‘ feedback

When implementing the technology enhanced or computer assisted learning, it is always important to monitor and meassure a students‘ feedback. However, the main goal of this empirical research was focused on if the BIKE software can be used or modified for educational purposes. In spite of this, the informative evidence of students‘ feedback was obtained via independent internet search service (NAJ.sk). Table 1 presents results of the monitoring of visited pages, this means that students visited around two thousands learning pages monthly. It must be likewise noted that only *Environmental protection* (70 students) and *Chemistry* (5 students) courses of study were taught in this school year 2010- 2011, while the teaching of *Occupational health and safety* and *Semestral projects* was already terminated in the previous two years. Thus, surprisingly, the „older pages“ were still visited by students at detached workplace. The statistics in the Table 1 give a positive evidence that learning material produced using the BIKE is actively used by students. Of course, the data results in Table 1 give not any evidence about the technology impact on student learning outcomes.

THE STRUCTURE OF VISITED PAGES BY STUDENTS
ON JUNI 2011

Table 1

VLE – learning material – e-libraries – calculation area - feedback network (forums)	**Visited pages on Juni 2011**
Environmental protection	1890
Occupational health and safety	187
Semestral projects	102
Chemistry	107
Diploma works	103
Domains: svti.sk – kaia.mtf.stuba.sk :: 20 -50 visitors daily	***source: naj.sk***

Conclusions

In this paper it has been shown how the computer support was implemented within bachelors study at the FMST. In this context, some aspects of technology enhanced learning were briefly discussed. Several examples were presented as well, which demonstrate the captured outputs screens of learning materials created using the BIKE, an in-house developed software, including its stand-alone application Zapisnik (exe-file). A novel approach was presented on the examples how internet browser OPERA is used in the classroom. Likewise as the BIKE (by teacher) and Zapisnik (by students) were used in five diploma works for the first time. Also the positive results from the monitoring of visited pages by students obtained via the internet search service was shown. The Zapisnik was successfully used in the classroom for integrating classroom instruction with e-learning material and virtual library which is placed at the faculty’s server. In the presented case, the BIKE editor can be considered as the universal informatics tool which enables a single user (teacher, student, researcher) to combine technology-driven and educational – driven approach. Thus, the BIKE can be presented and further developed as the pedagogical software tailor made for teacher or student as a single user.

References:

[1] SVETSKÝ, Š. et al. The Implementation of the Personalised Approach for Technology Enhanced Learning. In *WCECS 2010: Proceedings of the World Congress on Engineering and Computer Science 2010*. Volume I. San Francisco, USA, 20-22 October, 2010, pp. 321-323. ISBN 978-988-17012-0-6

[2] MORAVČÍK, O. et al. Experiences with the Personalised Technology Support for Engineering Education. In 2*1st Annual Conference of the Australasian Association for Engineering Education & 2010 Fall CDIO Collaborators´ Meeting*. Sydney, Australia, 2010, pp. 532-538. ISBN 978-0-646-54610-0

[3] SVETSKY, S., MORAVCIK, O., TANUSKA, P. Some aspects of the technology enhanced learning in engineering education. In *Proceedings of the Joint International IGIP- SEFI Annual Conference 2010*, 19-23 September 2010.

[4] SVETSKÝ, Š., MORAVČÍK, O., RUSKOVÁ, D., BALOG, K., SAKÁL, P., TANUŠKA, P. Five years of research of technology enhanced learning implementation in teaching at the Faculty of Materials Science and Technology. In *Research papers Faculty of Materials Science and Technology Slovak University of Technology in Trnava*. Trnava: Alumni Press, 2011. (v tlači).

[5] Yu-chu YEHA, Ling-yi HUANGB, Yi-ling YEHC. *Knowledge management in blended learning: Effects on professional development in creativity instruction.* [online]. Computers &Education. Volume 56, Issue 1, January 2011, Pages 146-156. [Cit. 2011-06-01]. Available at http://www.sciencedirect.com/science/article/pii/S0360131510002320#sec2>

[6] Mehmet Akif Ocak. *Why are faculty members not teaching blended courses? Insights from faculty members.* [online]. Computers & Education Volume 56, Issue 3, April 2011, Pages 689-699. [Cit. 2011-05-11]. Available at <http://www.sciencedirect.com/science/article/pii/S0360131510002964>.

[7] BLŠŤÁK, R. *Návrh informačného systému pre voľbu a aplikácie reznýchkvapalín.* Diplomová práca. Trnava: MTF STU, 2011.

[8] KYSELICOVÁ, Z. *Možnosti riešenia digitalizácie - počítačového spracovania kultúrneho dedičstva nahromadeného v knihách, učebniciach a tlačených publikáciách.* Diplomová práca. Trnava: MTF STU, 2011.