

The Informatics Tools Development and Testing for Active Learning

Stefan Svetsky, Oliver Moravcik, Peter Schreiber, Jana Stefankova

Abstract—In this paper, the development of informatics tools and their testing for active learning support is described. The tools - programming scripts, optional menus, and tailored applications, are a part of the developed “Batch Information and Knowledge Editor”. They are selected by a teacher from the knowledge editor’s menu, and in the classroom are used directly for performing active learning at the university’s detached workplace.

Index Terms—technology enhanced learning, active learning, knowledge processing, informatics tools

I. INTRODUCTION

Knowledge represents a key element in a framework of any teaching and learning activity. Within the implementation of technology enhanced learning the pre-programmed desktop environment has been developed which enables a teacher or student to have a personalised working experience with knowledge. In this context, the desktop environment works as the “Batch Information and Knowledge Editor” (BIKE). At the beginning (2006-2007), the desktop environment was used at the detached university’s workplace mostly in conditions analogical to blended and distance learning [1]. Afterwards (2008-2010), by using the BIKE, the further off-line and online learning materials were created (tutorials, forums, e-libraries), including a set of outcomes (e.g., Writing pad-standalone, e-learning material, WEB-pages, templates, quizzes), this was tested for active learning in some courses of study [2]. The pre-programmed environment that works on a teacher’s computer enables the building of both adaptive learning material and also the ability to select tailored informatics tools (programming codes, optional menus, and tailored applications). The first teaching experiences showed that the varying content of courses of studies requires various approaches and a combination of these informatics tools when supporting active learning in the classroom [3].

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II. INFORMATICS SUPPORT FOR ACTIVE LEARNING

The teachers and bachelor’s students, in general, need any personalised informatics tools applicable to information and knowledge processing. In addition, today’s teacher or individual user must work on their computers with a huge amount of knowledge in conditions which are characterised by attributes such as multipurpose, multilingual, multiformat and multiwindow. This state-of-the-art automatically requires working with “knowledge packages” which are to be batch processed. In terms of this, however, an actual ICT tools level is too low, including software for personal computers. Therefore, the above mentioned pre-programmed environment BIKE has been developed at the Slovak University of Technology - Faculty of Materials Science and Technology (FMST) in recent years. It must be emphasised that the BIKE is neither a course management system nor content management one. This universal environment exploits “knowledge tables” for batch knowledge processing and provides for browsable outputs or study material (readable with common internet browsers). It also enables internet batch retrieving, text processing, and many other pre-programmed actions in order to enhance and automate teaching and learning. Thus, the BIKE serves as a starting point in the support of active learning where each of the informatics tools can be used as the “active element”. A selection of the active elements combination can be applied by a teacher or individual students for solving various learning issues with a more effective personalised approach (computer enhanced active learning support).

In this paper, there is not enough space to explain a basic principle of active learning. It must be noted that the main focus of the active learning techniques are aimed at the students (they do something). In addition, from a practical point of view, as mentioned in a page of California State University’s, this reference describes approximately 30 techniques of active learning, e.g., “One Minute Paper, Active Review Sessions, Concept mapping, Quotations” [4]. Thus, if we want to solve ICT support for active learning in general, we need engineering content (to be taught), students (learners), classrooms with computers (offline or/and online), and then we can select one or more from the 30 techniques. The core of the solution is then to investigate which steps in common active learning techniques are repeatable, and what can be “automated via computer”. In this context, the BIKE provides for a large “active” area with supporting elements as shown in the portfolio (see their listing in table 1) which can support students to be “cognitive active”. For instance, the traditional method “one minute paper” can be simply

performed by using a “forum”.

Furthermore, from an informatics point of view, the system support for active learning is briefly illustrated in figure 1. which displays the informatics support which is based on the BIKE (as a database application) by which a large palette can be produced of the outcomes in cooperation with the operating system (Windows), common browsers (Internet Explorer, OPERA), internet applications (PHP/ MySQL application), and freeware or other commercial software (e.g. MS Office, Text To Speech applications within language support). All this works on a teacher’s computer - authors of BIKE autonomously, and from other commercial software in a nondependent way (all is free of charge). In addition, because the editor uses a “natural language text”, this is most useful when solving an interplay between the so called tacit and explicit knowledge.

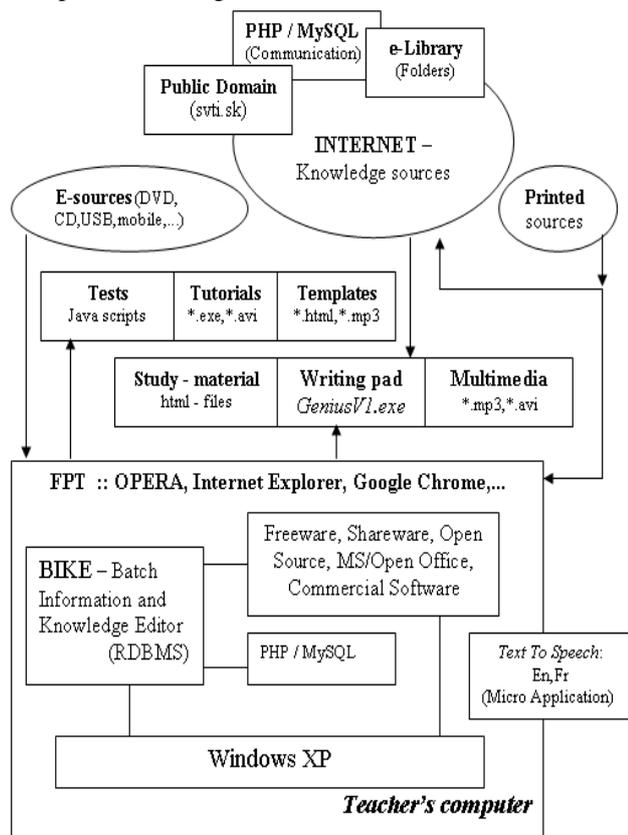


Fig. 1. The schema of the informatics support for active learning on a teacher’s computer (PHP application using MySQL is only on the author’s computer and university server).

III. THE IMPLEMENTATION OF ACTIVE LEARNING INTO ENGINEERING COURSES OF STUDY

The developed informatics tools were tested in some engineering courses of study and are displayed in table 1 (Environmental protection – Occupational health and safety – Semestral projects I-II-III). In this case, the combination of the informatics tools listed in the table (see the first column) was used by teachers and students for performing many tasks of technology enhanced learning. Some of them were also investigated as the “active elements” for active learning, especially for writing semestral projects and works which included their language support. It must be emphasised that the described informatics tools (scripts, menus, tailored applications) are different than other ones when using

common learning, course management systems or e-learning tools. In these tools, there are features preferred that are typical for file managers, Intranet or WEB 2.0 technologies, however, the BIKE or its stand-alone version *Writing pad* (geniusV1.exe) works as a desktop application on teachers’ computer and on computers in the classroom.

Technology enhanced learning is based on two levels – *informatics* (tools) and *pedagogical* (content). After providing the bachelor’s students with the set of informatics tools the next steps were focused on content processing. The practice showed, from an active learning point of view, that the content is especially important. If there is no pedagogical content appointed, then no action can be made by the students. Further, the practice also showed that if some computers in the classroom were online the bachelor’s students did not concentrate enough on solving their tasks. They had a tendency to have unruly behavior (they visited other WEB-sites on the Internet during teaching). Likewise, the students were not able to employ the tailored internet forums in an efficient manner although the forums were programmed for each course of study due to better feedback between teacher and students. Naturally, these problems

TABLE I
 THE INFORMATICS TOOLS TESTED FOR THE VARIOUS ENGINEERING COURSES OF STUDY

Self - developed informatics elements, menus and applications	Engineering courses of study		
	Environ-m ental protection	Occupat. health and safety	Semest. projects
e-Learning material	+	+	+
WEB – pages	+	+	+
Off-line pages	+	+	-
e-Library	+	+	(+)
Templates	+	+	+
Quizzes	+	-	-
Tutorials	+	-	-
Digitalisation of the printed sources	+	-	-
Internet retrieving:			
- batch retrieving	+	+	(+)
- search in Wikipedia	-	-	+
Forum I (password)	+	+	+
Forum II (hidden)	+	-	-
Language support:			
- Text To Speech (TTS)	+	-	-
- WEB pages	+	+	+
e-mails	+	+	-
LCMS - University’s information system	+	+	+
Audio	(+)	-	-
Digital Camera	(+)	(+)	-
Mobile	(+)	(+)	-
(*) Semestral work	+(*)	+(*)	+(**)
(**) Semestral projects			
- Reading room (active learning)	-	-	+
* + tested	(+) partly tested	- not tested	

wouldn’t have arisen in the case of simple computer aided support.

On the other hand, now that there are developed informatics tools at our disposal one does not know which of them are convenient for active learning support. Thus, the generalisation was made that a shared element of the engineering’s courses of study could be semestral work with fixed content. This was then unified with the MS Word

template together with detailed instructions, e.g., with document structure, how to write English and German abstracts, etc. Likewise, the directions for applying internet batch retrieving were given. The first results showed that by comparison with the traditional active learning methods the other methods could be developed when applying the computer enhanced learning support. Such active learning can consist from the various methods, e.g., inclusion of batch retrieval when being applied by students within their semestral works as illustrated in figure 2. For this batch retrieving, the five keywords were given in the Writing Pad, as follows: *occupational health and safety - risk assessment machinery - glossary risk assessment - risk assessment ppt - OHSa risk assessment* Figure 2 shows the internet retrieval made by a stand - alone machine which resulted into twenty opened windows within the OPERA browser.

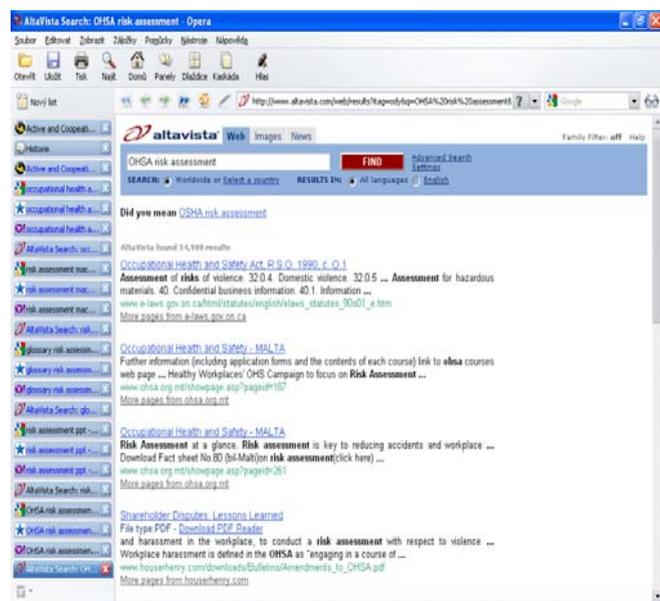


Fig. 2. The example of templates for the multilingual support

Figure 3 shows a popup menu which is displayed when you click on Google Translate multilingual (left), Systran (centre) and scanned passive sentences (right) from the book "English for researchers c- Dušeková, L., Bubeníková, L., 1971".

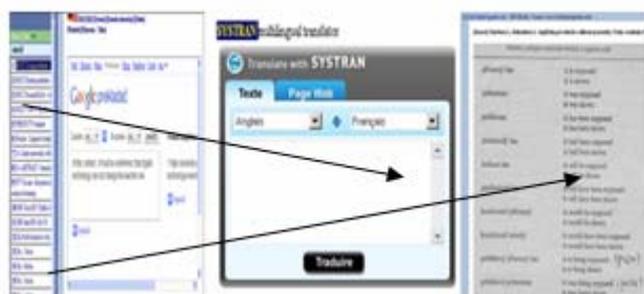


Fig. 3. A multilingual support example

It must be also underlined, that the informatics skills of the bachelors students were not sufficient enough for testing the self-developed informatics tools. Thus the testing in the classroom was very time consuming.

Therefore for the next development it is very important to prepare students for routine handling and mastering the informatics tools in order to process the pedagogical content within the required time for active learning. Likewise, they should enhance their skills for engineering content processing. With respect to this issue, bilateral collaboration regarding ICT support was also performed [5].

Examples of output screens of the tested informatics tools are shown in the next two figures. These computer screen examples are presented in different environments (the database application and the SAFARI browser).

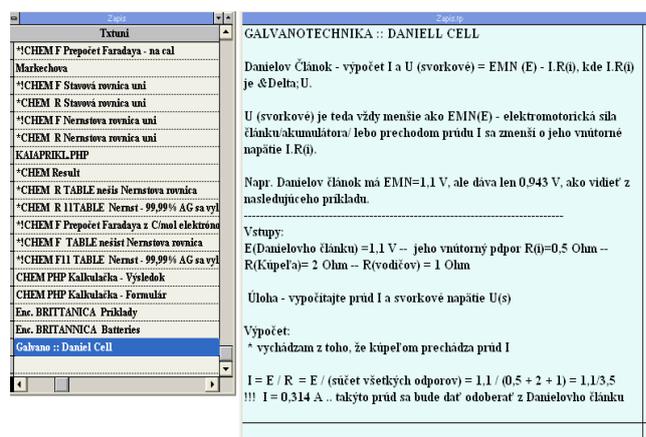


Fig. 4. An example of teaching material in the database application environment (Chemistry : Daniel cell)

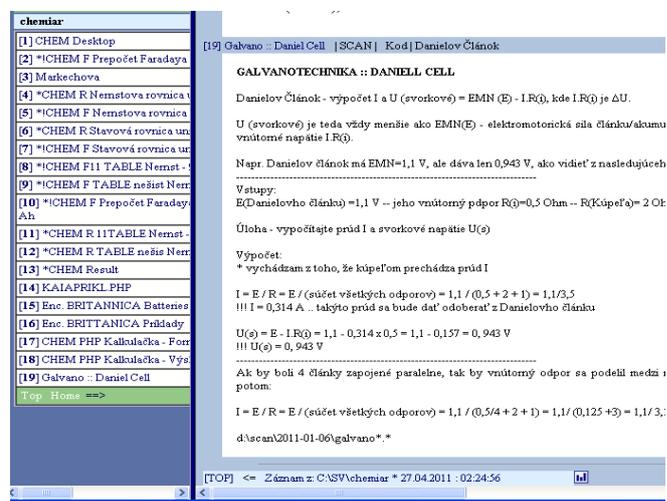


Fig. 5. Example of the same teaching material in SAFARI (Chemistry : Daniel cell)

Figure 6 shows another example – the Forum I output screen. This Internet application - network was programmed due to better feedback from the teacher and students.

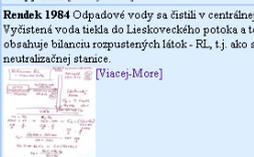
19	2011-03-21	SVET	Cvičenie 21.3 - Práidat	ALL	VÝPOCTY ku Z/Skuske ZE	
20	2011-03-21	DFM	Semestrálna práca	ZE	Práca	INFO: Chovancová, Florišová, Repková - Znečisťo
21	2011-03-19	DKM	FOTOSYNTÉZA	ZE	Práca	Velacková, Košťálková, Tmavský [Viacej:More]
22	2011-03-18	SVET	Technológie - areál bývalej ZTS Dubnica, š.p.	ALL	ZTS	
23	2011-03-18	SVET	Písomka na pondelok + samohodnotiaci test	ALL	ZE	Písomka [Klidnité] Samohodnotiaci test [Auto-Test] [Viacej:More]
24	2011-03-18	SVET	Témy semestrálnych prác	ALL	SEMFRACE	Témy prác znečisťovanie vody, pôdy a fotosyntéza s sú porovnanie fotosyntézy a bunkového dýchania, Ekosystém a technológie, globálne znečistenie. syst

Fig. 6. Example of the communication Forum I screen

It should be emphasized that the TEL approach at the FMST is based on *empirical* research that comes from matters which are dealt with directly in teaching and the technology adapts to one's needs within a specific educational situation (see the mentioned examples of screens). Thus, the approach respects the synergy of teaching content (e.g. engineering's curriculum subjects), educational activities and technologies.

IV. CONCLUSION

The set of the informatics tools has been developed within the implementation of *personalised technology enhanced learning for engineering education* at the FMST SUT. Some of these tools were selected and tested for active learning.

Basically, there are two ways for active learning informatics support. *Firstly*, it can be selected by any common active learning technique and investigated as to *which of the informatics tools within the BIKE* (knowledge editor and generator) *can be applied*. For instance, if the "one minute paper" technique was chosen as the active learning method, then it would be automated by selecting the feedback forum from the menu of the active elements (informatics tools) in the table.

However, such an approach has not been implemented in the field of ICT support yet, because the informatics tools commonly described and used are mostly internet applications focused on content management, or learning and course management systems. In addition, only the technology - driven approach is preferred nowadays. Hence, they are not practicable for active learning support.

When using the BIKE the main strategy of the informatics support is based on the developing informatics tools which are tailor made for a pedagogical - engineering content. In context with this, many developed "active" informatics tools were tested for some engineering courses of study (used by approximately 200 students this year).

The practice showed that the testing of issues such as the semestral work writing, the reading room, the use of internet batch retrieving and multilingual support can result in an *innovative active learning practice*. This means that due to a synergic effect entirely new material and techniques can be created. It would not be possible to do it without computers. Besides, the mentioned automation it is the *second method for active learning informatics support*.

Finally, it must be emphasised that the next development still requires the further refinement of all the methods that

have been used so far and also the enhancement of students' informatics skills, as well.

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