

A System of ICT Education for University Employees

(A Solution to the Problems of E-learning System Integration into Education of Employees of the Slovak University of Agriculture in Nitra)

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Abstract

Identification of the aims and needs of the Slovak University of Agriculture in Nitra oriented to its staff's digital literacy has resulted in the project focused on a system of gradual and continual improvement in information technology knowledge and skills. The basic tasks of the project were to define inevitable ICT knowledge and skills for different groups of employees, to make conditions for self-directed learning, to organize courses for the university staff (e-learning and contact learning), to propose testing procedure, tools and questions, and to lay down conditions of obtaining the University ICT Certificate. The first results can be evaluated in about 100 groups of administrative staff. 98% of the employees tested have succeeded.

A short overview of Zope application server and Plone Content Management System based tool ("simExaminer") for e-testing, didactical tests' management, and evaluation is also presented.

Keywords: ICT Education, University Employees, e-testing implementation, e-testing tools

1 Introduction

According to the document "eEurope 2005: An Information Society for All", modern online public services, e-government, e-learning services, e-health services, and dynamic e-business should be available in Europe by 2005. Preparation of the Slovak Republic for the accession to the European Union also included creating conditions for the competitiveness of the Slovak university graduates on the European labour market. Students need to be both well educated in the fields chosen by them and digitally literate if they are to take effective part in tomorrow's knowledge society. In this connection big attention must be paid to the digital literacy of the University staff. Also, a need for modern university operation requires the application of ICT in every field, so an improvement in information technology knowledge and skill concerns all groups of the University employees.

Identification of the goals and needs of the Slovak University of Agriculture in Nitra has been reflected in the project aimed at the proposal of a system of gradual and continual improvement in information technology knowledge and skills. Basic tasks such as defining inevitable ICT knowledge and

skills for different groups of employees, creating conditions for self-directed learning, organizing training courses for the university staff (e-learning and contact learning), proposing the testing procedure, tools and questions, stipulating conditions for the purposes of obtaining the University ICT Certificate have already been resolved.

The following methods and techniques have been used in the project implementation: E-learning materials; E-publishing; Tutorials; Selftests; Electronic communication; CASE method of tools used in database design; Flash tool used for e-learning application; HTML; PostgreSQL; PHP; Zope application environment for testing and tests evaluation.

Zope application environment [4] was chosen as a base for the e-testing tool implementation because of the possibilities of the Rapid Application Development (RAD) in the Python programming language [6, 11] — creation of the so called Zope products. The Plone Content Management System (CMS) [7] adds numerous enhancements allowing for advanced content, users, and presentation management. Data, application logic, and presentation layers (skins) are well separated. User interface is web-based (XHTML pages including form elements). The e-testing implementation is briefly described in section 3.

2 Description of the Project System of ICT Education for University Employees

With regard to workload of employees, financial requirements of commercial ICT courses and a big number of people potentially involved in the education (approximately 1000 employees), an e-learning solution using courses via WWW, tutorials, program support (HelpDesk, FAQ, dictionary of terms) and a possibility of participating in ICT Summer School has been proposed.

The following steps have been implemented at the stage of preparation:

- Initial lectures with information on knowledge required for the University ICT Certificate.
- Making conditions for self-directed learning.
- Tutorials with an opportunity to consult problematic themes and "ICT Summer School" for people with a small or no PC experience have been organized.

To make conditions for self-directed learning was very important. Without sufficient support of learning it would not be possible to reach the effect required. It consisted of the following steps:

- Providing access to the e-learning application on the Internet (own application <http://www.fem.uniag.sk/EIT/>), possibility of HelpDesk services - ICT program support at <https://www.fem.uniag.sk/helpdesk/>.
- Acquiring another ICT e-learning product with the possibility of application running at three regimens (for different types of PC) – access via web browser, CD ROM.
- Publishing the manual “Inevitable PC network skills” and access it together with other materials on the Internet (PDF documents), linking other e-learning materials.

Particular attention has been paid to the proposal of the testing process:

- Choice of the e-testing tool.
- Preparation and publication of test questions – theoretical and practical (320)
- Differentiation of test questions by group of employees. Employees tested have been divided into four groups (administrative staff, other non-teaching staff, employees not using ICT in their work, teachers).
- Preparation of test questions in the form of self-testing.
- Demo versions of the course of examination.
- Laying down the principles of testing.

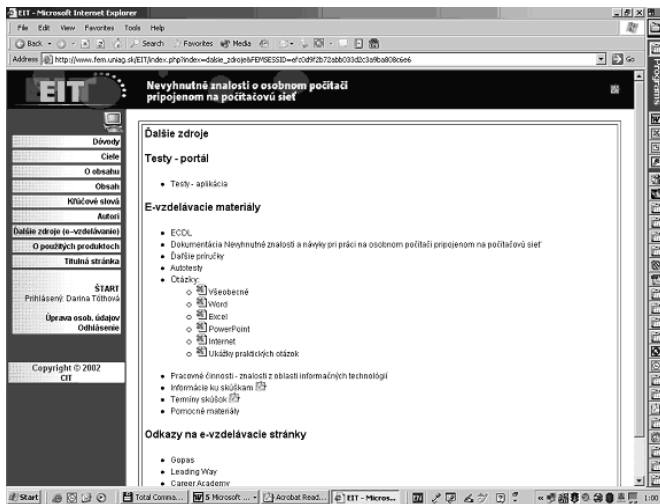


Fig. 1 ICT e-learnig portal

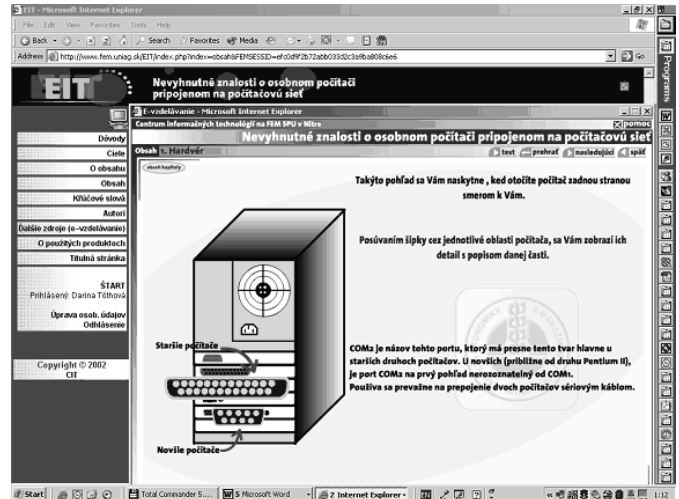


Fig. 2 ICT e-learning application

2.1 Principles of examining process

Since obtaining/not obtaining the University ICT Certificate can influence the work position of the employee, special attention has been paid to the examining process – its exactness and transparency, as well as no disputableness of results:

- Exams are done in terminal rooms (set-up unification, uniform conditions for everyone).
- Anonymity of the examiner and the examinee is guaranteed.
- Identification of employees (personal number, exam password) immediately before exam.
- Guaranteed anonymity if the examinee „Failed“. After obtaining the information by e-mail (this type of communication is used only if it is agreed and signed by the examinee during registration), the examinee has an opportunity to register for the next exam term. Therefore every participant should have an active e-mail address at the University server.

The testing procedure correctness was checked by PhD students. Also, the specialist who technically prepared e-testing was present at the first group testing.

In the event that the examinee fails there are two possibilities of repeating the exam. After checking, the tests are saved into folder and locked.

3 E-testing tool – simExaminer

The e-testing tool was created as a part of the Modular E-learning for a Topic (MELT) project [9]. Preliminarily finished at the beginning of 2003, the development continues. The tool described here is the third major reimplementaion.

Among the product’s features are:

- support for automatic questions-generation from simple text files (the format is based on Zope structural text which in turn is inspired by the conventions for simple

text-mark-up in e-mail and news messages; used parser is easily customizable to meet the adopter's demands), these are actually translated into an object composition; questions are organized into the topics (named or unnamed) grouping the related questions with predefined point value (when not specified the defaults apply, see question-manager role description);

- WebDAV access to some data structures (authorised personal only);
- support for self testing and demo-mode function;
- automatic pseudorandom test forms generation with instant evaluation and results presentation (last one only in self-test/demo mode);
- controlled upload possibilities for files containing answers to questions with open/free-form answers (e.g. solutions to "real" problems);
- automatic and manual (manual correction) evaluation of submitted tests;
- full backup of generated tests and their results while keeping full evaluation history (when and who);
- simple and robust hard-coded test-status-based workflow;
- clean and secured separation of critical data with integrity protection;
- anonymous, and known user-name operation modes:

1st one for self-testing/demo only,

2nd one hides names (actually, all identifiable information) of tested authenticated users before the evaluators, supervisors, and administrators using randomization and secure hashing — relations between tests, users, and the results are available only in a protected way through the application itself,

3rd one reveals real user-names to evaluation and administrative accounts.

- clean separation of privileges according to the intended usage, based on permissions and roles access security pattern of Zope; the permissions of roles can be customized according to demands; typical roles are:

user — anonymous or authenticated user who is being (self)tested,

registrator (supervisor, close support) — takes care of the exam (registration of users, starting and stopping exam, users' assistance) in testing mode

questions-manager — uploads questions and attachments, sets limits (time, number and a size of uploads) for testing and defines defaults (points for questions when not specified explicitly in the questions-file) ;

users-manager — manages users and their test-states (waiting – user can be examined, registered – user is registered for an exam, active/finished/failed/absent

– managed automatically by the application itself without possibility of human intervention) in the test mode;

evaluator — evaluates/corrects test results;

- session tracking — support for securing integrity of submitted tests,
- automatic reload of filled-in form data in the case of an emergency reload,
- many different exams can run simultaneously,
- users examined in an exam can be from different classes/groups (i.e. having different questions-sets).

For more (and more recent) information on simExaminer and related tools, please, visit <http://fzki.uniag.sk/ICT> from time to time.

3.1 Questions and forms processing

Allowed types of questions [3] in didactical tests processed by the e-testing product are as follows:

1. questions with multiple choice answers (including the possibilities of all "right" or all "wrong" choices);
2. questions where two sets of choices must be related to each other (assignment questions);
3. ordering/ranking questions — ranks are assigned to choices;
4. insert questions (only conditionally useful, require exact reproduction of correct answer, i.e. recommended for numbers and unique short strings only);
5. questions with open/free-form answers, i.e. solutions to "real" problems, projects

First 4 questions-types are processed automatically, including evaluation, but there is a possibility of correcting the automatically assigned points (for whatever reasons). Please, recall that the full evaluation history is kept, so the (re) evaluation can be questioned.

The 5th type must be evaluated manually (an evaluator must download/open attached files and then assign points accordingly to in the evaluation form of the particular test). This also means that questions of this type cannot contribute to user's score when included in self-test/demo mode.

Technically, the automatic evaluation of a question is just simple comparison of two permutations of numbers, one generated by the application and the 2nd "generated" by the user when using the select elements in the test form, for the first 3 question-types. The application keeps track of those permutations for every question and also the random selection of questions for each particular generated test. In the keys of the insert question, the user supplied answer is compared with the right one. When user submits the test form containing only automatically processed questions, the transferred amount of data to the application server is very limited. It is also impossible to identify the questions or answers by sniffing an

unprotected connection (however, it is recommended to always tunnel the HTTP protocol over TLS/SSL even in controlled environment). When using the questions of the type 5, the limits for uploaded file sizes must be set reasonably to match the expected answer size and the available bandwidth (it is the responsibility of the system administrator to give appropriate instructions to the questions-managers).

3.2 Used software and hardware

The intranet portal <https://testy.uniag.sk> which uses the described e-testing tool is running on FreeBSD operating system. Main software packages involved are of course the latest stable Zope application server (customized source package), the Plone CMS product (customized source package), and the latest 2.0-family Apache web-server as a transparent https-proxy.

Current hardware platform is an i386 family (P4) PC with RAID-ed discs (software RAID).

4 The first testing experiences and plans

The first group – almost 100 administrative staff (secretaries, student affairs employees) - was tested in April 2004. There was a 10-month period between the workshop with the first announcement and tests. During this period employees could use e-learning applications, HelpDesk services, ICT Summer School, self-testing, etc. 98 % of participants have succeeded.

The second stage will be oriented to a group of other non-teaching staff. The tests are going to be held in June. There is almost the 90% correlation of test questions, differences can particularly be found in the 5th type of questions (solutions to „real“ problems).

Special testing is planned for the third group – the employees who do not use ICT in their work and its usage is not required in terms of their position. In tests for these employees emphasis will be placed on theoretical questions.

The ICT Summer School (contact learning) in summer 2004 is planned for teachers with a small or very low experience in ICT. Excluding the third group, the same e-learning materials will be utilized for all groups of employees. The testing questions will differ. In particular, practical questions will be more oriented towards the needs of learning/teaching process.

Conclusion

The first experiences with the system proposed can be evaluated. Although there were no positive initial responses of the University employees, especially as far as testing was concerned, after the first stage of tests situation changed. Most of the graduates appreciated that the preparation for tests made them improve their ICT knowledge, which was very helpful to their work.

It can be concluded that the preparation and organization of ICT learning and testing was well worth the effort. Successfulness of 98 % has confirmed the correctness of the procedure. Though, this group was likely to be highly

successful, because it consisted of the employees who use PCs in their every day work. As to other groups of employees to be tested, expectations are lesser. The most important output of the project is not receiving the University ICT Certificate but an improvement in ICT knowledge and skills.

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