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DISTANCE LEARNING, SIMULATION AND COMMUNICATION 2009

Proceedings

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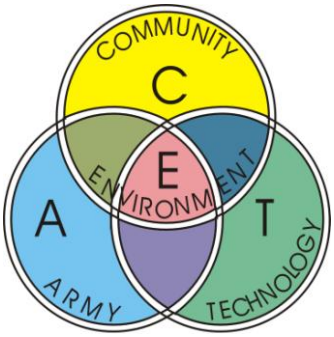
Brno, Czech Republic
May 6, 2009

International Conference

DISTANCE LEARNING, SIMULATION AND COMMUNICATION 'DLSC 2009'

held as a part of

CATE 2009
(Community – Army – Technology - Environment)



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on May 6, 2009

as an official technical accompanying programme of the International Exhibition of Defence and Security Technologies and Special Information Systems

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Conference objectives:
Experience and information exchange in the field of

- the current status and potential of distance learning and e-Learning method in the preparation of military professionals,
- using the computer modelling and simulation in command and control process,
- current and perspective communication systems.

Conference programme:

Wednesday May 6th, 2009

07 : 00 – 08 : 50	Presentation of participants
08 : 55	Opening of the „Distance Learning, Simulation and Communication 2009“ Conference
09 : 00 – 12 : 45	Presentation of papers
12 : 45 – 13 : 45	Lunch
13 : 45 – 17 : 15	Presentation of papers
19 : 00 – 23 : 00	Networking Evening at the Starobrno brewery

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Place:

- Business Centre, pavilion E, 2nd floor, premises of Veletrhy Brno a. s., Výstaviště 1, 647 00 Brno.

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Conference web:
http://www.unob.cz/idet/en/sdv.aspx
http://www.unob.cz/idet/sdv.aspx (for the Czech participants)

CONTENT:

TEAM-WORK FOR STUDY GROUPS AND INDIVIDUALS USING COLLABORATION TOOLS

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Abstract: *The paper deals with effective approaches for utilizing modern collaborative tools for team-work in educational process. Nowadays educational approaches require blended approaches to study and research, especially for military students and distant attendees of specialized courses. Research team leaders manage military student groups involved in research projects and need to effectively communicate with them during their entire study (including military training program period usually organized in military training facilities). Specialized courses spread across longer period of time are difficult to accomplish without regular interaction between attendees and instructor. The paper shows how to effectively share ideas, materials, meetings, calendar and communication between task driven groups led by teacher / instructor both on-line and off-line. The approach is currently used by authors to keep separate working spaces for diploma works and working with student research groups. Microsoft Groove 2007 is used to provide virtual space for collaboration with or without specialized server applications. Collected results and recommendations from the use of the collaboration tool are provided.*

Keywords: Network collaboration, team-work, teacher – student communication.

INTRODUCTION

Educational process and research work in military environment requires technical innovation to improve effectiveness of communication, sharing of documentation and creation of learning organization environment. Today's market offers a lot of technologies allowing people to share content and collaborate in networked environment for example Wikipedia (1) Google docs (2) etc., content sharing – Facebook (3) sharing of ideas – blogs, video conferencing or instant messaging and e-mail exchange. Those tools are very popular and commonly used. To achieve true effective action in multiple distributed working groups we need a tool, which will integrate above-mentioned capabilities and in the same time solves on-line and off-line interactions, invitation of group members into virtual working groups, role based privileges etc. Tools for e-learning – LMS – Learning Management Systems are used at universities for a long time and created basis for distance learning approaches to education. Common feature of LMS is web based client – server application with data stored in central database, centralized user management, where users are categorized as teachers and students in study groups or administrators. LMS usually requires on-line connectivity to use offered services and commonly not support concurrent modification of documents with versioning. Significant constrains are in separation of communication to working group and ad-hoc working group creation. LMS approach to distance e-working puts significant administration load both to student and teacher which ends in longer time scale in decreasing of productivity of the team.

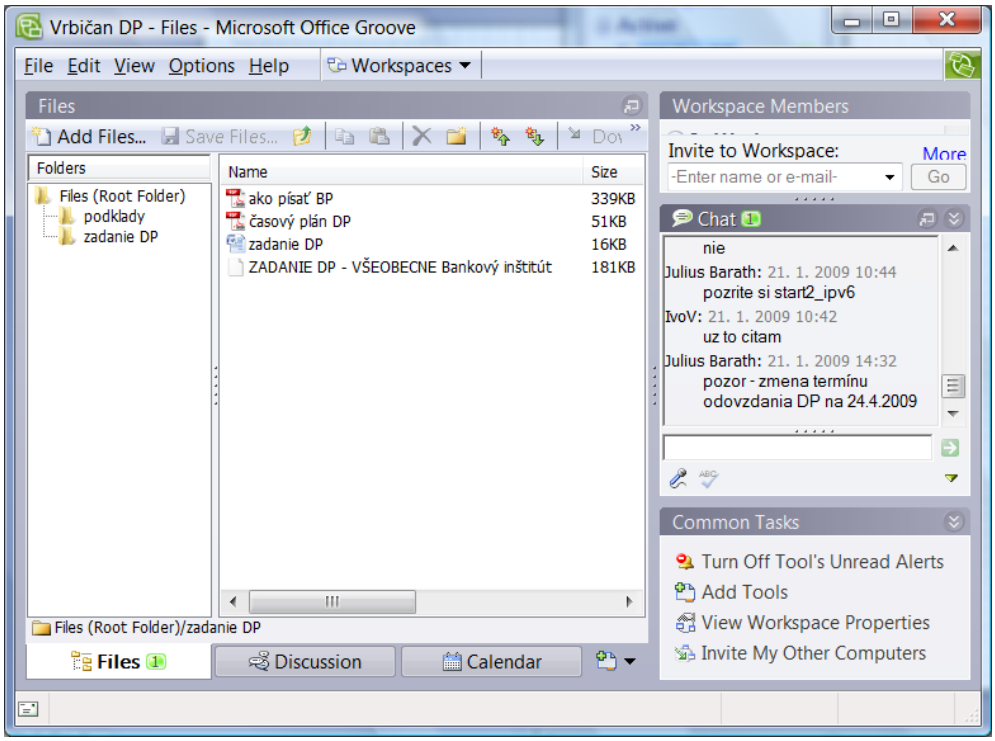
To improve effectiveness and overall awareness in distance teamwork Microsoft Office Groove 2007 was chosen. The product is appropriate for teams between 2 and 50 members

with option to be integrated with Microsoft Windows SharePoint Services 3.0, Microsoft Office SharePoint Server 2007, Microsoft Office InfoPath 2007 and Microsoft Office Communicator.

1. SOFTWARE FOR COLLABORATION

Office Groove 2007 is the client software that enables individuals to work as teams within collaborative virtual workspaces. Office Groove 2007 enables teams to accomplish collaborative tasks, even when team members work for different organizations, work remotely, or need to work offline. Individual workers can use the Office Groove 2007 client software to form a team by creating workspaces, adding tools and data, and inviting other Groove users to join the workspace as team members. As team members collaborate in a workspace, Office Groove 2007 works in concert with Office Groove Server Relay to keep each team member's copy of the workspace synchronized, even if no two users are online concurrently. The data within each Groove workspace is always protected by 192-bit Advanced Encryption System (AES) encryption, whether it's stored on a team member's local disk, being transferred between client workspaces on the network, or being temporarily stored on Office Groove Server Relay.

From a user's perspective, Office Groove 2007 client software consists of five key elements: the launchbar, the workspace, tools, presence and communication, and alerts. The launchbar is the starting point for using Groove and provides easy access to a user's workspaces and contacts. A workspace is intended for a small group of approximately 2 to 50 members. Common projects and tasks executed in a Groove workspace might include document reviews, project-specific meetings, threaded discussions, reviewing and sharing published content, tracking tasks or issues, and collecting or aggregating structured data - Picture 1.



Picture 1. Working place.

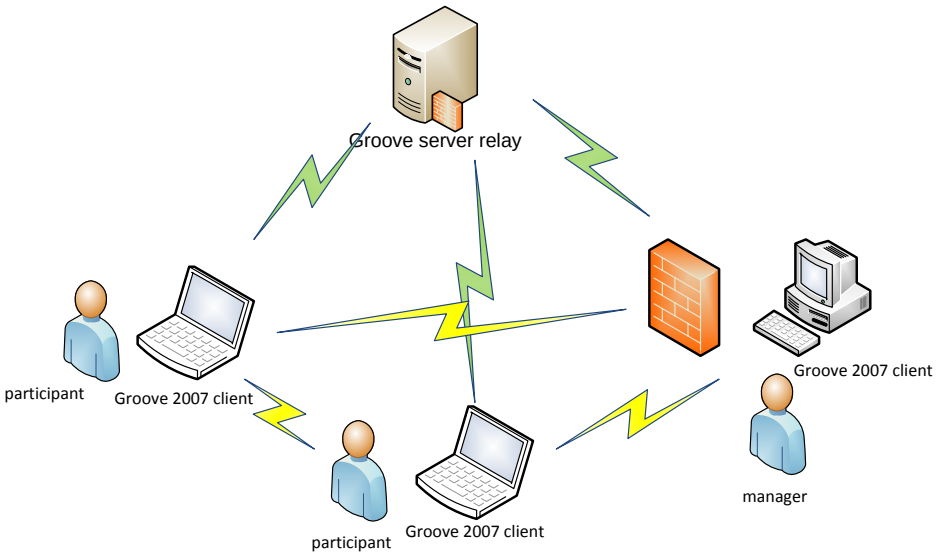
You don't need special network or domain privileges to create a new workspace or accept an invitation to join an existing workspace. Any user can create a workspace and send an invitation with Groove instant messaging or e-mail to prospective members. Furthermore, any Groove user can accept an invitation, join the workspace, become a team member, share information, and collaborate on a project without IT or network affiliations with other Groove members. This functionality is what enables dynamic team collaboration, even if team members are from different organizations or share no common infrastructure.

When you join a workspace, a copy of the workspace is transmitted over the network and stored on your computer. Office Groove 2007 can receive an initial copy of the workspace from any member who is online when the workspace invitation is created if the invitation is sent via Groove messaging. After the transmission is completed and a locally stored copy of a workspace is ready, you can enter the workspace and begin working with other members.

If a workspace member changes content in the workspace, a "delta" is created, representing a logical unit of workspace synchronization. The tool used to make changes determines what a delta contains. For example, a delta could be drawing a line in the Sketchpad tool (a shared whiteboard application that can be added to a Groove workspace), changing an entry on a calendar, adding a member to the workspace, or the binary differentials between a changed file and the previous version.

When a delta is created by a user, Groove first updates the user's local copy of the workspace, then sends the delta to the rest of the members for execution in their local copies of the workspace. When all members' copies of the workspace have introduced the delta, the workspace is synchronized. Though each member keeps a delta log locally with the associated workspace, Groove includes built-in logic to conclude that, after a delta has been executed by all members, the delta can then be deleted from the log.

If you are online, changes are synchronized in near real-time (using a proprietary protocol, Simple Symmetric Transmission Protocol (SSTP), using TCP port 2492). If you're offline when deltas are executed by other workspace members, those deltas are sent to queues in your designated Office Groove Server Relay. The deltas are then consumed whenever you reconnect to a network and can establish a connection with the Office Groove Server Relay. In this way, all members' copies of the workspace can be updated or synchronized regardless of the network status of any single user at the time a delta is sent. Above all, once a member saves a change to a workspace, Office Groove 2007 and Office Groove Server Relay carry out the transmission of the delta and subsequent synchronization automatically and transparently to all members - Picture 2.



Picture 2. On-line and off-line peer to peer communication.

In Office Groove 2007, a role is an access control mechanism for permitting users to perform tasks in a workspace and activities with individual tools. There are three built-in roles: manager, participant, and guest. By default, workspace creators are managers and those invited to workspaces are participants. Default permissions for each role can be changed by a manager. A manager can invite others as managers and a member's role can be changed by a manager (4). For more in deep information about the product see (5) (6).

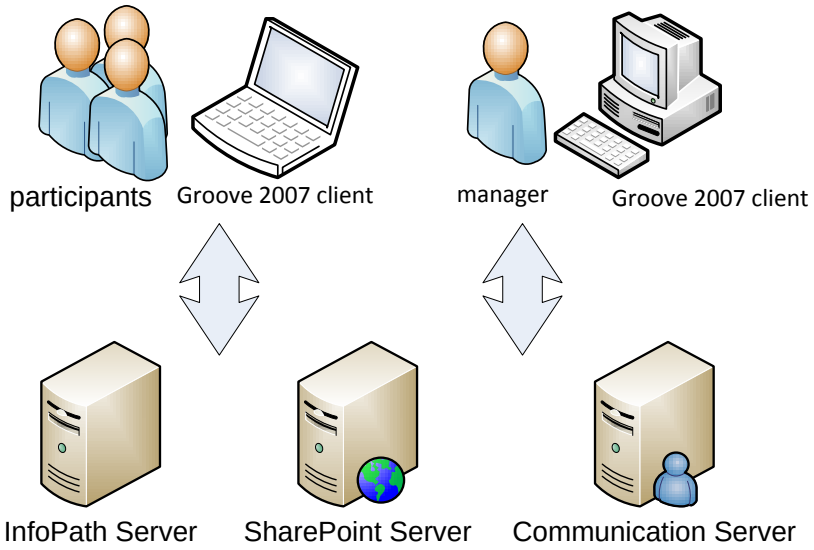
2. BENEFITS AND PRACTICAL EXPERIENCES

The product is currently used at Department of Informatics to cover two types of teamwork:

- diploma work supervisor and student,
- teacher and group of students working on scientific project.

Typical tasks covered by university teacher are education and scientific research. Diploma works and leading of scientific student groups are middle and long term activities requiring on-line and off-line interactions with participants, consultations and document sharing. Typically, after receiving work assignment students create time schedule starting from exploration of facts, research, experiments and ending with summarizing of final report (work). During all of those phases they collect materials, make decisions about next steps, verify achievements and propose conclusions. Flexible communication with teacher or supervisor significantly improves quality of final product. Common shared space allows sorting available electronic documents, extending the library both from student and supervisor side, forming appropriate and relevant study portfolio for the research. At the same time, shared space provides place for storing time schedule, guides for writing the final document and actual version of the final document. Teacher (supervisor) has an actual view of progress achieved by the students and can revise the final document writing from the very early stage using revision tools of word-processing application. The application then provides automatic and secure distribution of updates to all group members regardless of their actual state (on-line or off-line). Use of integrated warnings and reminders together with communication and messaging capabilities of the product significantly reduces time of feedback cycles. Moreover, integration of Microsoft Groove 2007 into university network allows publication of documents into document storage of Microsoft SharePoint space. The SharePoint extends

capabilities of the solution by reliable archiving, versioning, indexing, search capabilities and more - Picture 3.



Picture 3. Groove 2007 and specialized servers.

The product itself can be customized by user via introducing calendar, discussion, meetings, issue tracking, files and other extensions. In case of research teamwork the meeting folder is the ideal place to record meetings and store minutes from in-present meetings. The folder allows tracking of attendance, assignments and status of tasks assigned to team members. Team members are informed about agenda of the meeting and can go back to the history of all meetings. If team members are on-line, they can use voice communication and chat window to interact. In case of off-line communication chat is still available (message will wait for participant) but there is also e-mail with attachment capability. E-mail in Groove 2007 is distributed only between team members and does not use SMTP protocol for transport, which increases privacy and security.

Introduction of the product into real operational environment faced some challenges mostly focused on inability of people to work and communicate remotely. Communication capabilities of teachers were oriented to use mobile phones and in case of students to instant messaging using ICQ or SKYPE. Such communication (without document sharing) leads to use of short sentences to describe ideas, long time on-line sessions to solve issues and low overall efficiency. Sharing of ideas between team members was problematic and students had problem to finish assignments in proper quality and in time. The supervisor had inaccurate view of status of the final work and global understanding and team awareness was low resulting in loosing students from scientific projects. In a very early stage of the project team leader initialized face-to-face meeting with team members and practical problems of low efficiency were discussed. Input from students is as follows:

- insufficient cross-communication,
- access to common resources from anywhere required,
- insufficient awareness of actual status of the work,
- lack of experience in remote teamwork and collaborative document creation.

After discussion we agreed to utilize Microsoft Groove 2007 application as a collaborative tool. Few days after installation and practicing the product became integral part of our

computer desktops. From approximately one year experience we can conclude, that the product significantly improved our productivity and helped to finish assignments in adequate quality and in time.

CONCLUSION

Teamwork and concept thinking together in distributed networked environment require tools for effective collaboration in distributed environment allowing sharing documents, ideas and communication on-line and off-line on the peer-to-peer basics or with interconnection to (university) infrastructure and resources. To follow modern trends in distance learning (working) we need to achieve spread of trust in e-working with accent to secure and reliable sharing and synchronization of workspaces between team members.

To achieve effective collaboration between students and teachers we used Microsoft Groove 2007 with following key features.

1. Bring the team, tools, and information together in one place.
2. Customize each workspace for the team's unique needs.
3. Collaborate with colleagues, partners, and customers — with one product.
4. Stay productive anywhere, online or offline
5. Stay in sync, automatically and efficiently.
6. See who's working on what, when.
7. Synchronize SharePoint document libraries with Office Groove 2007.
8. Create a form with Microsoft Office InfoPath 2007; share it with Office Groove 2007.
9. Make the most of impromptu encounters with Microsoft Office Communicator integration.
10. Work with international teams in their own languages. (6).

Microsoft Groove 2007 proved to be an effective and reliable collaborative tool which significantly increases productivity of work in distributed environment and supporting idea of building trust in e-working environment.

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USING DRUPAL ON EDUCATIONAL PROJECT

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Abstract: *Drupal is a highly successful open-source Content Management System. It is well-respected for its robustness, its flexible and immaculate code, and its seemingly infinite capacity for extension and customization. Its main advantages are wide social network, which is still improving the system and makes an effort to approach it to general public, personalization and security.*

Educational project require that a lots of things to be made quickly and easy like structuring your site's content, optimizing for search engine compliance and friendliness, allowing your site to be indexed and searched effectively, allowing multiple users to edit your site, localizing your site for multiple languages, managing discussion forums and implementing polls for user feedback.

In this article will be presented an example of Drupal functionality and the use of a software module.

Keywords: eLearning, educational software, computer-assisted learning, information technology, project based leasing.

INTRODUCTION

Drupal is a highly flexible and powerful tool and as such should be used by those with knowledge of HTML, CSS, web applications and at least a vague notion of how databases (such as MySQL server) function. While you don't have to actually know PHP and SQL to make it function, a working knowledge of LAMP tools and utilities is helpful for using Drupal. Drupal is powerful, but it is also complex. For administrators and developers, there can be a steep learning curve.

Drupal allows you to manipulate information over the web by publishing or editing various content types. The publishing mechanisms will be different, according to a certain type of content. In Drupal any type of content is located in a "node". As a consequence, the content is classified according to nodes types. The default nodes types are page used to publish static content that rarely changes and story used to publish time dependent information like news, announcements. The difference between these two types of nodes is represented by the fact that, by default, pages cannot be promoted on the homepage and also do not allow users' comments as compared to stories. By enabling certain modules, supplementary content types will be available.

Drupal can be used for creating dynamic learning communities to supplement the face-to-face classroom or as a platform for distance education classes. Academic professional organizations benefit from its interactive features, and the ability to provide public content, member - only resources, and member subscription management.

DRUPAL CONCEPTS

Drupal's design goals include both being able to run well on inexpensive web hosting accounts and being able to scale up to massive distributed sites. The former goal means using the most popular technology, and the latter means careful, tight coding. Drupal's technology stack is illustrated in Figure 1.

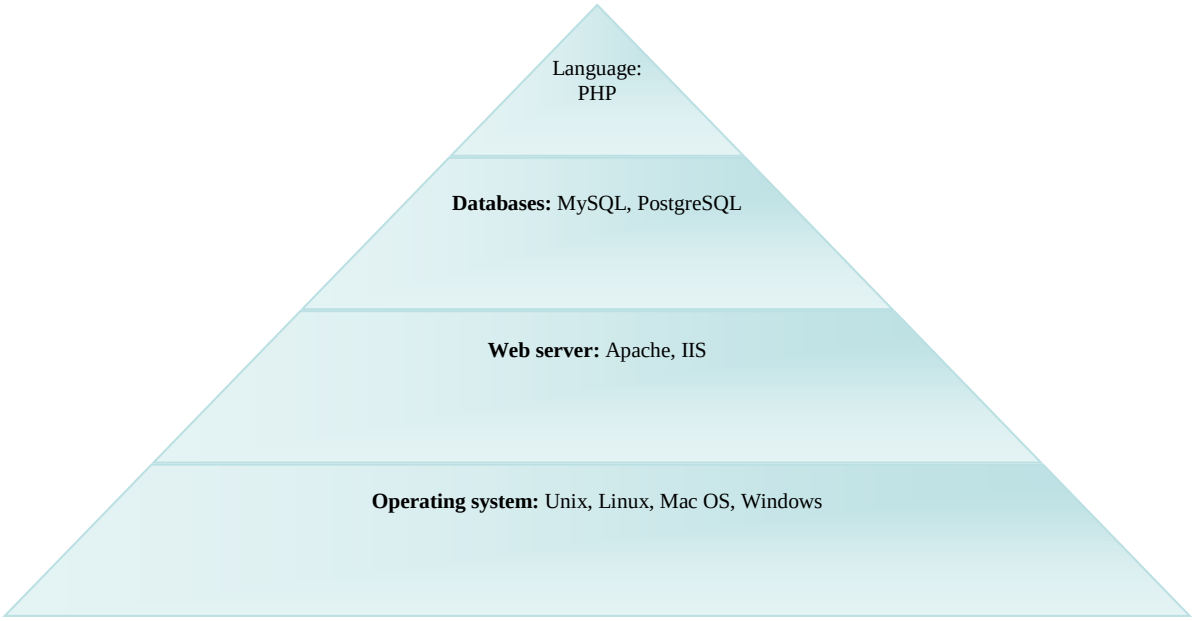

Figure 1. Drupal's technology stack

The operating system is at such a low level in the stack that Drupal does not care much about it. Drupal runs successfully on any operating system that supports PHP. The web server most widely used with Drupal is Apache, though other web servers including Microsoft IIS may be used. Drupal is written in PHP. PHP has gotten a bad reputation, because it is easy to learn so much PHP code is written by beginners. Like many programming languages, PHP is often abused or used to quickly hack systems together.

A lightweight framework makes up the Drupal core. This is what you get when you download Drupal from drupal.org. The core is responsible for providing the basic functionality that will be used to support other parts of the system. The core includes code that allows the Drupal system to bootstrap when it receives a request, a library of common functions frequently used with Drupal, and modules that provide basic functionality like user management, taxonomy, and templating, as shown in Figure 2.

Drupal is a truly modular framework. Functionality is included in *modules*, which can be enabled or disabled, some required modules cannot be disabled. Features are added to a Drupal web site by enabling existing modules, installing modules written by members of the Drupal community, or writing new modules. In this way, web sites that do not need certain features can run lean and mean, while those that need more can add as much functionality as desired. When we think of content in this context, we typically think about text objects like news articles or blog entries. This concept of a generic text-based piece of content is captured in Drupal with the term node**.** A node, in Drupal parlance, is a generic object for representing textual content. Nodes are stored in the database and retrieved as needed. Among other things, all nodes have:

- A unique **Node ID (nid);**
- At least one **Version ID (vid)** used to track revisions;

- Creation and modification dates, as well as identifying information for the user who worked on the node;
- Metadata such as publishing state (status), language of the node (and translations);
- Title;
- Body.

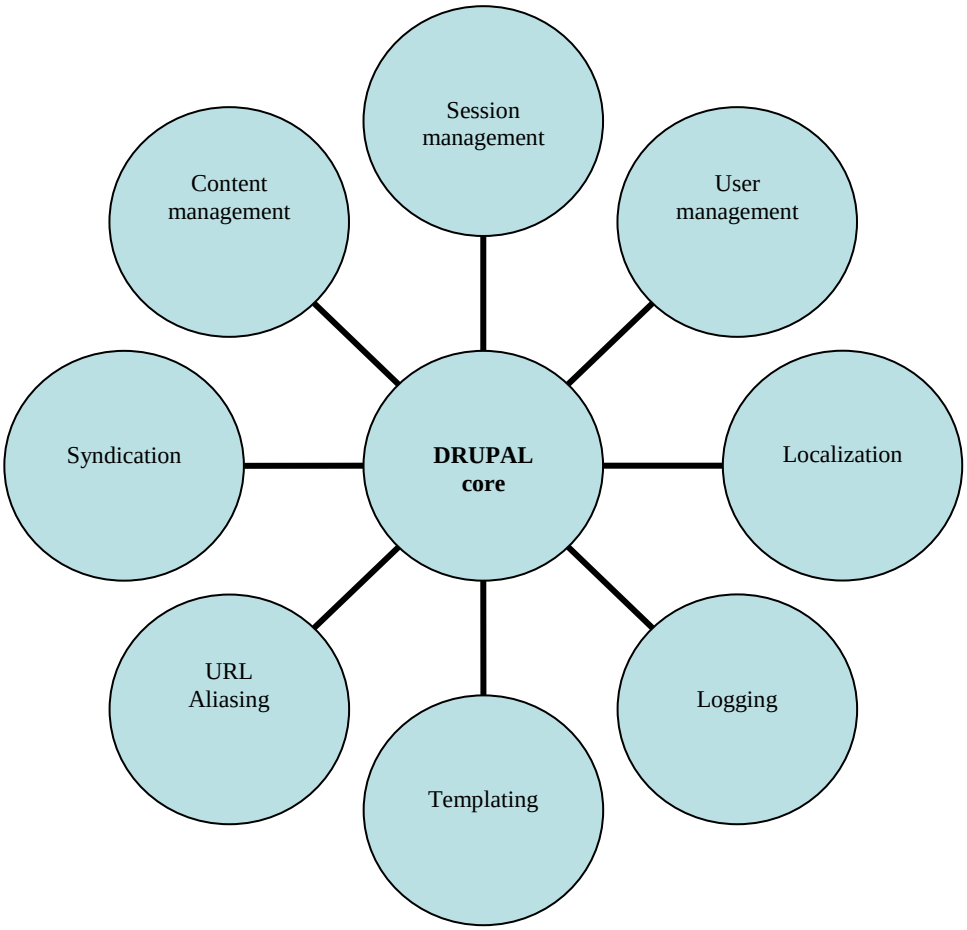

Figure 2. An overview of the Drupal core

While most article-like content is based on the node, one major text component stands out as an exception - the comment. A comment is usually implemented as a user-level feedback mechanism attached to stories, pages, blog entries, and similar articles. When you create a new page, for example, you have the opportunity to allow or disallow user comments. If comments are enabled in read/write mode, users will be able to comment on articles.

Another important type of object in Drupal is the user. User records are maintained using this object type. Just as with comments and nodes, user data is stored in the database, and drawn out during processing. Information about a user is used for purposes such as authentication, determining preferences and permissions, and logging.

Permissions are closely linked to the user object. Drupal provides a role-based mechanism for granting permissions to collections of users. In a nutshell, a user belongs to a role, and permissions are granted to (or revoked from) a role.

Thus, when checking access to a resource, Drupal loads a user object, finds the user's roles, and then finds the roles' permissions.

The term block is equally important. While a node is used to store and present articles and "larger" pieces of content, a block is used to present smaller bits of content. For example, navigational menus, daily quotes, polls, and search boxes are often presented using blocks.
A block is not a type of content. Actually, it is a unit of abstraction (a placeholder) used primarily to display other content. Administrators can use the blocks editor to determine where blocks are displayed on a themed page. From the developer's perspective, blocks are an important part of module creation. Defining a block in a module is a matter of selecting content to display, and then passing it on to the correct formatting tools.

Drupal has a sophisticated menu system whose main purpose is the construction of navigation. The primary method of submitting content over the Web is through HTML forms. While the ubiquity of forms makes life easy for the web user, the dearth of good forms processing tools usually makes form development a joyless chore for programmers.
However, forms processing is one area in which Drupal excels. The Forms API (FAPI) provides a programming interface that takes the pain out of form development. Using the FAPI, developers can provide a single form definition and let Drupal build and display the form, collect the results, and even validate and escape form data. Drupal even provides forms caching and advanced AHAH (Asynchronous HTML And HTTP) features.
As Drupal development has progressed, the Forms API has got better and better, and the Drupal 6 version exhibits many improvements.

A list of the most popular Drupal modules, a short description of what they do:

- **Drupal Event** - helps you to keep track of certain events. In the same time is provides API in order to allow other modules already installed to work with the saved data.
- **Drupal Views** - Views is a Drupal module that provides designers a flexible control opportunity on how lists of content (traditionally hard-coded elements) are presented. Using this Drupal module you can sort the default front page view and the default taxonomy/term view differently, you can restrict /tracker to posts of a certain type, you can provide "unread forum posts", and a lot more.
- **Drupal GuestBook** - This module allows you to create a site guestbook as well as individual user guestbooks, also assign an intro text on every guestbook, define text message format.
- **Drupal Gallery** - With Drupal Gallery you can integrate Gallery2 to your Drupal website. With the Gallery module you can add photos and videos to your web pages. Please note that before installing this module you should first download and install Gallery2 on your hosting account.
- **Drupal CCK** - With the Content Construction Kit (CCK) you can create and customize fields using a web browser. In Drupal CCK allows you to create custom content types in core and add custom fields to any content type.
- **Drupal ImageCache** - With Imagecache you will be able to setup presets for image processing. In case an ImageCache derivative doesn't exist the web server's rewrite rules will pass the request to Drupal. Drupal hands it off to imagecache to dynamically generate the file.
- **Drupal Devel** - Devel is a helper tool for Drupal developers and inquisitive admins. With this module you can have a summary of all database queries for each page request printed at the bottom of each page. The summary includes how many times each query was executed on a page, and how long each query took.
- **Drupal Pathauto** - With Pathauto you can automatically generate path aliases for nodes, categories, users, and other kinds of content. This modules does not require to manually specify the path alias.
- **Drupal TinyMCE WYSIWYG Editor** - or advanced editing of your Drupal site content use TinyMCE WYSIWYG Editor. This Drupal module integrates Moxiecode's

popular TinyMCE WYSIWYG editor into any Drupal site. Since its installation is not easy, less technical Drupal 5 users should consider using the TinyMCE Automatic Configuration module.

- **Drupal Ecommerce** - This module is mostly used for selling goods and/or services. Some of the features it includes are payment and shipping components, transaction and payment workflow and reports, sales summaries, shipping notifications, donations functionality.

CONCLUSION

Software advantages:

- Open source software with a wide range of modules offering all sorts of functionality.
- It has an active and productive open source community.
- It has limited core functionality. Most of the functionality is offered as separate software modules (plug-inns). It is easy to construct the functionality you want by either choosing an already offered module or by programming one by your own.
- Drupal.org has a good semantic approach with the separation of taxonomy, tagging logics, semantic view/search and the actual content.
- Drupal has already a big variety of modules offering Web 2.0 functionality.
- Drupal has already a variety of import/export modules that make it less hard to extract content or metadata.
- It has interoperability functionality for many popular services like YouTube, creative commons, facebook, Flicker, google API.
- Very flexible tuning of content types and metadata fields.

Software disadvantages:

- Highly modul based software that needs testing of the modules concerning how interoperable they are.
- Some key functionality that should be included as core functionality is made as modules.
- Drupal.org is written in an object oriented language (PHP 5), but many of the modules are not necessarily written in an object oriented manner.
- Flexible construction method of content types gives less focus on performance.
- Drupal is a CMS and not a repository software with the sufficient stability and security for long term preservation, for our requirements. (But flexible export / import functionality makes is easy to preserve content in an external repository).

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TEACHING EVOLUTION OF HARDWARE AND ARCHITECTURE OF DIGITAL SYSTEMS AT THE ERA OF LESSONS HOURS REDUCTION.

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Abstract: *In this article I would like to describe the main changes in teaching process of hardware and architecture of digital systems within last ten years.*

Keywords: education, studies, lessons hours' reduction, single chip processors, PCL, FPGA.

INTRODUCTION

In this article I would like to describe the main changes in teaching process of hardware and architecture of digital systems (A&HW) within ten years. Big lessons hours reduction was characteristic for this epoch. On the other hand new skills and themes were required to add. I don't want to criticize or comply; the only one I want is to describe this phenomenon.

1. MY STUDIES

I had been a student of the Military Academy in Brno from 1995 to 1999. I was taking three semesters of computer architecture during this time. These lessons were considered as main skills for the next consequential study as diagnostics, both single chip processors and PC architecture. The main characteristics are in detail in the Table 1.

period	1995 - 1999
number of semesters for A&HW	three
number of lessons per semester A&HW	90 -> total 270
ratio of lectures	50 – 60 %
ratio of exercises	20 – 30%
ratio of laboratory exercises	10 – 20%
ratio of seminars	5 – 10%
the main focus	- basic architecture of digital systems, - arithmetic, Boolean algebra, - combinatorial logic, - sequential logic, - state machines, - integrated circuits - technology TTL, CMOS, ECL, - memories ROM, RAM, CACHE, - processors, architecture 8080, Z80, - processors, architecture x86, - supporting circuits, - protected mode, DMA, IRQ - A/D and D/A, analog processing.
students freedom	none (fix curriculum)
previous lessons	- materials of electrotechnics, - basics of the electrotechnics, - theory of the circuits I, - theory of the circuits II, - electronic measurements, - electronic components,

consequential lessons	- diagnostic and HW, - single chip processors,
system of education	rarely practical, based on memorizing of knowledge and theoretical exercises
technical education support (tools)	old unreliable kits, without any innovations,
the quality of lectures and materials to study	excellent
valuation	exam, classified credit
time load to the students – theoretical	medium
time load to the students – practical	medium

Table 1. Main characteristics of studies of hardware and architecture of digital systems during my studies.

2. PERIOD 2005 – 2008

After having finished my engineers studies I have started with my doctoral studies and during this era I was giving lessons of single chip processors. This epoch was very rich in changes of teaching, transformation of our school and faculty. It was a time of finding the way how to do things better. In the end the departments of informatics and the special communication systems have been joined together. Engineers' studies were reduced and replaced to bachelor studies with possibility of extension to master studies.

This era was very difficult for us. We tried to find a new way how to teach. At the beginning we only cut off some lectures and we reduced the rest of them. Unfortunately a chain of lectures was interrupted and we lost the continuity of methodical education. Finally we decided to rebuild our courses to be more suitable for students. We prepared a new system based on students' freedom. The main characteristics are presented in the Table 2 and Table 3. The main changes have started in 2006 when two new programs were added: programmable logic and single chip processors.

period	2005 – 2008
number of semesters A&HW	one
number of lessons per semester A&HW	60
ratio of lectures	60%
ratio of exercises	15%
ratio of laboratory exercises	20%
ratio of seminars	5%
the main focus	- basic architecture of digital systems, - arithmetic, Boolean algebra, - combinatorial logic, - sequential logic, - state machines, - memories ROM, RAM, CACHE, - processors, architecture 8080, Z80, - processors, architecture x86, - supporting circuits, - protected mode, DMA, IRQ.
students freedom	none (fix curriculum)
previous lessons	- electronic components, - basics of the electrotechnics, - electronic circuits, - electronic measurements,
the consequential lessons	none
system of education	based on memorizing of knowledge and theoretical

	exercises,
technical education support (tools)	without some innovations,
the quality of lectures and materials to study	only number of lessons reduction, an imperfect product of compression
valuation	exam, classified credit
time load to the students – theoretical	medium
time load to the students – practical	low

Table 2. Main characteristics of studies of hardware and architecture of digital systems during 2005-2008.

The students made their choice at the beginning of semester. They could choose from the proposed themes (theory of architecture, single chip processors, FPGA). From 2006 to 2008 we've been teaching all themes chosen by different groups of students. The ratio of time given to lectures and laboratory practice has increased to labs. Now we don't extinguish between labs and theory in one lecture. Students are required to study some theory topics by themselves during the whole semester to be prepared for each lesson, not only for given laboratories. Both new topics (single chip processors and field programmable gate architecture) require good theoretical knowledge of background, work with materials in English and individual work of the students. On the one hand we needed to reduce the number of lectures, on the other hand we required more time for study of datasheets, hardware structure and new programming languages as Verilog or VHDL for FPGA.

3. YEAR 2009

period	current 2009
number of semesters A&HW	one
number of lessons per semester A&HW	60
ratio of lectures	40%
ratio of exercises	10%
ratio of laboratory exercises	48%
ratio of seminars	2%
the main focus	- basic architecture of digital systems, - arithmetic, Boolean algebra, - combinatorial logic, - sequential logic, - state machines, - processors - single chip processors / FPGA
students freedom	three programs : 1.) fundamental (theoretical / old), 2.) single chip processors, 3.) programmable logic (FPGA).
previous lessons	- electronic components, - basics of the electrotechnics, - electronic circuits, - electronic measurements,
the consequential lessons	none
system of education	based on work experience, minimum memorizing of knowledge and theoretical exercises
technical education support (tools)	new students' kits and equipment
the quality of lectures and materials to study	completely new rebuilt lessons, still not perfect documentation and study materials
valuation	project, exam,

time load to the students – theoretical	high
time load to the students – practical	high

Table 3. Main characteristics of studies of hardware and architecture of digital systems – current teaching.

We worked with single chip processors of three different producers (Cygnal, Freescale, Microchip), we tested low and high level programming languages (assembler, C language), and we are still not able to say which of them is the best for educational purposes. It is very influenced by student skills and their former experience with programming languages.

After many years of teaching we've found, that for the students the best processor is anyone with good IDE software, i.g. Processor Expert made by UNIS (Czech company) for Freescale processors. With this software it isn't necessary to go through hundreds of pages of datasheet and to take care of configuration while programming.

Unfortunately we found other problems, which are physical realization and PCB layouts. Lessons reduction doesn't take place only in our department. We can see decreasing level of students' knowledge. Now it's very difficult to find students who are able to "connect a led to the battery" correctly.

We found that FPGA are not suitable for education any more. We focused on single chip processors and at the end we extend our course about PLC (programmable logic device). First group (single chip processor) is useful only with good supported software, which is able to generate initial source code, check cross-references on hardware components and offers possibility of software simulation. Second group (PLC) seems to be very efficient for education. PLC is well-done product where hardware is offered and ready to use. PLC software offers multilanguage programming from the simplest (block diagrams) to the most difficult (programming language C). Students are guarded against enormous studying of literature about system itself. Market offers a lot of modules (input, output, interface) without waste of time for evaluation and other expenses. In the Table 4 there is a proposed structure of the subject for 2010.

period	from 2010
number of semesters A&HW	one
number of lessons per semester A&HW	40
ratio of lectures	30%
ratio of exercises	10%
ratio of laboratory exercises	58%
ratio of seminars	2%
the main focus	- minimum of arithmetic, Boolean algebra, - minimum of combinatorial logic, - minimum of sequential logic, - single chip processors / PLC
students freedom	two programs : 1.) single chip processors, (with supporting SW) 2.) programmable logic controller (PLC).
previous lessons	- electronic components, - basics of the electrotechnics, - electronic circuits, - electronic measurements,
the consequential lessons	none
system of education	based on work experience, minimum memorizing of

	knowledge and theoretical exercises
technical education support (tools)	new students kits and equipment,
the quality of lectures and materials to study	completely new rebuilt lessons, still not perfect documentation and study materials
Valuation	project, exam,
time load to the students – theoretical	extremely high
time load to the students – practical	high

Table 4. Main characteristics of studies of hardware and architecture of digital systems – proposed structure.

CONCLUSION

Due to lessons hours' reduction and low level knowledge of students we have to find the best solution how to deliver the maximum knowledge to the students. We think the best way for both sides is to use available final product with good software support. On the other hand we have to enquire time to individual study from the students, because it's necessary to extend practical lessons and there's less time for teaching the theory. Forty hours ... it is truly the minimum acceptable for education. Next reduction will be dangerous for the whole course and especially for the students.

IMPROVING E-LEARNING SYSTEMS

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Abstract: *E-learning is the solution to the training and communication challenges that the Internet economy has created. Cost-effective online learning and communications are helping companies to build their competitive edge in the knowledge-based economy. This paper presents the most important aspects of the e-learning systems and methods to improve their functionality.*

Keywords: e-learning, quality, education, learning management system.

INTRODUCTION

E-learning refers to education that is enhanced by or delivered via the Internet. It began in corporate training departments, schools, and universities as a supplement to standard teaching methods. Today, it encompasses a rich set of solutions that can be used throughout an organization, from corporate communications and marketing to technical documentation, customer support, quality control, manufacturing, engineering, public relations, and analyst relations, to share information and experience.

E-learning can give employees the ability to turn change into an advantage by tapping existing knowledge resources and packaging them in a more accessible, customized, learner-centric format.

1. LEARNING MANAGEMENT SYSTEMS

The learning management system (LMS) is the most popular e-learning system, which normally provides course centered managements and is rather weak at learner centered managements.

LMSs range from systems for managing training records to software for distributing courses over the Internet and offering features for online collaboration. In many cases, corporate training departments purchase LMSs to automate record-keeping as well as the registration of employees for classroom and online courses. Student self-service (self-registration on instructor-led training), training workflow (user notification, manager approval, wait-list management), the provision of on-line learning, on-line assessment, management of continuous professional education, collaborative learning (application sharing, discussion threads), and training resource management (instructors, facilities, equipment), are dimensions to Learning Management Systems.

LMSs are based on a variety of development platforms, from Java EE based architectures to Microsoft .NET, and usually employ the use of a database back-end. While most systems are commercially developed and frequently have non-free software licenses or restrict access to their source code, free and open-source models do exist.

A *learning content management system* (LCMS) is a related technology to the learning management system, in that it is focused on the development, management and publishing of the content that will typically be delivered via an LMS. An LCMS is a multi-user environment where developers may create, store, reuse, manage, and deliver digital learning content from a central object repository [4].

The components of an LCMS are:

- content authoring/editing
- the ability to acquire and ingest externally developed assets
- a centralized learning repository (Shared Documents Library)
- assessment development
- versioning and history
- metadata / taxonomy support
- support for publishing of web, CD, print, presentation requirements associated with e-learning or ILT
- standards support
- development process management
- a dynamic delivery interface; and,
- student administration tools.

2. E-LEARNING IN A COMPANY

The last years have witnessed the explosion of the Internet from a small network linking scientists into the largest forum for the exchange of ideas humanity has ever seen. To compete effectively today, businesspeople must absorb vast amounts of information about new products, markets and the competition.

Employees need to be able to quickly learn new skills and assimilate new information, but traditional training methods are not flexible enough to address the growing gaps in skills and knowledge. The solution is that the employers use an online learning environment for their employees.

Old learning models do not scale to meet the new world learning challenge. E-learning systems can enhance traditional teaching methods and materials, such as classroom discussion, textbooks, CD-ROMs, and non-Internet computer-based training. A web-based learning environment consists of the following elements [2]:

- **Content objects**: Material can be developed in a modular format, divided into *objects* that are pulled from a database and presented together based on the results of assessment testing. The result is a personalized learning path, so the learners get only the information they need

- **Communities**: Learners can develop online communities for providing mutual support and sharing information

- **Online expertise**: Mentors or experts can be available online to provide feedback and direction to learners, answer questions and facilitate discussions

- **Opportunities for collaboration**: Online meeting software permits synchronous, collaborative learning across geographic distances

- **Multimedia**: On-demand audio and video technologies can present material in a stimulating fashion to actively engage learners

In its many forms, e-learning offers a multitude of invaluable benefits for employers and employees:

- **Personalized learning experience**: Self-service learning options let students proceed at their own pace, select a content type and delivery vehicle based on individual preferences, and assemble content modules appropriate to their needs

- **Reduced costs**: Companies can reduce, or even eliminate, travel expenses for training; eliminate classroom costs; reduce the time employees spend away from the office and their normal duties

- **Access**: Users can access content anywhere they have an Internet connection. This means e-learning content can reach an almost unlimited audience and students are unconstrained by time zone differences

- **Collaborative learning**: E-learning allows for the sharing of knowledge and peer support

- **Accountability**: Grading, testing, assessment and certification tracking are automated so that all participants - learners, developers, and content owners - can be held accountable for their responsibilities in the learning process.

3. MONITORING ACTIVITIES

In order to monitor didactic activities, a web based learning system should be designed to have three kinds of feedback: *to the student*, *to the teacher* and *to the system itself*. Immediate test results represent the first and more direct one for to the student; the others are achieved through log files analysis.

Log files tracks information about each student, as well as statistical information about all students; personal information includes: which courses have been chosen, which kind of paths

have been chosen, which related topics have been actually studied, the time spent; the knowledge achieved, the number of access to the system.

Global information includes: the number of registered students for each course, the ratio between this number and the total number of students, the number of students which decrease the access or abandon a course, data about satisfaction and comprehension level, also coming from performance analysis.

Reports coming from these logs allow feedback for the teacher, which can eventually recalibrate exercises or modify the lessons design and content, acting on the domain databases or on course materials, whereas the system updates and improves students and teachers profiles as well as course generation.

4. MINING E-LEARNING WEB SITES

The companies using on-line learning environments and tools have very little support to evaluate learners' activities. In [3] the author presents a few data mining techniques that can be used to enhance web-based learning systems for the educator to better evaluate the learning process.

The web-based learning environments include course content delivery tools, quiz modules, virtual workspaces for sharing resources, logbooks, etc. In the virtual classroom the educator provides resources as text, simulations and moderate discussions.

It is very difficult for educators to keep a track of the users' activities on web site. It is also hard to evaluate the structure of the course content and its effectiveness on the learning process. For learners, it would be useful if the system could automatically guide their activities and recommend on-line resources for improving the learning.

Web-based learning systems rely on web sites to provide access to resources and applications. Every request to a Web serves is recorded in an access log file, registering a time stamp, the resource requested. The log files keep the track of the users' activities on web site. They are used to extract patterns of users' behavior and help in the learning evaluation. The log files need a transformation phase before being used in data mining algorithms.

The most important steps for web log data transformation are the following: remove irrelevant entries, identify access sessions, map access log entries to learning activities, complete traversal path, group access sessions by learner to identify learning sessions.

Unlike the e-commerce applications, a learning session can span over days with different accesses. Many pages in e-learning applications are dynamically generated by script requests such as quiz pages, conference messages, etc. Mapping access log entries with local learning activities consists of replacing script calls with their assigned parameter values with concrete activities. This is a task that assumes thorough knowledge of the application scripts and their respective parameters and requires a mapping table provided by the application designers.

Completing the traversal paths consists of inferring cache hits and proxy meddling based on the structure of the web site and how pages are efficiently linked together. Finally, integrating the cleaned click streams with existing data about learners can be very valuable. Such data

can be profiles of the learners, their qualitative and quantitative evaluation, so on. Combining the grades associated with completed activities with the sequences of events leading to these activities can help discover appropriate patterns that can help discriminate between sequence of activities that yield good results and sequence of events that are not as effective [3].

5. CONCLUSION

The main challenge of the last generation e-learning systems is to provide courses tailored to different students' backgrounds. Research to create an adaptive environment able to just-in-time craft the best path for each student must be done.

The student can perform exercises and tests related to whole course or to a part of a course; such exercises are generally performed at the end of lessons, even if this is not mandatory. The role of exercises is fundamental for: feedback purposes and educational reasons. Thus on one hand a student can verify his acquired knowledge, while on the other the teacher can evaluate the student learning and the quality of the followed path.

Web usage mining is a process of extracting useful implicit patterns from the usage of the Web. The patterns can be used for a statistical analysis on a web site or to determine the most accessed pages or sections.

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THE ROLE OF FEEDBACK IN DISTANCE LEARNING SYSTEMS

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Abstract: *In this paper we describe the multilevel feedback system within the Cisco Networking Academy Program (CNAP), specifically the Cisco Certified Network Associate (CCNA) Exploration course. The CNAP provides on line courses, interactive tools, and lab activities. The main goal is to prepare individuals for Information and Communication Technologies (ICT) and networking careers. We introduce possible feedback relations in multi level feedback hierarchy. Actual examples of feedback information for students, instructors and the CNAP creative team are presented.*

Keywords: distance learning, feedback, feedback relations, CNAP, CCNA, Cisco.

INTRODUCTION

This paper describes the role of feedback in distance learning on a practical example of the worldwide e-learning program CNAP (Cisco Networking Academy Program) of Cisco Systems, Inc. [1]. CNAP is a comprehensive e-learning program that enables students to develop valuable information and communication technology skills for increased access to opportunities in the global economy. This project started in 1997 and CNAP has grown to reach a diverse population in more than 160 countries. All students receive the same high-quality education, supported by on line content and assessments, performance tracking, hands-on labs, and interactive learning tools.
The Regional Cisco Networking Academy (CNA) at the Armed Forces Academy of General Milan Rastislav Štefánik was established in 2000. At this military institution CNA students usually come from signal and CIS units of the Armed Forces of the SR.

1. CURRENT CISCO CCNA EXPLORATION CURRICULUM

The basic course, which is provided by our Regional CNA is Cisco Certified Network Associate (CCNA) Exploration course (this CCNA version 4 course started in 2008), which is divided into four semesters [Figure 1]. Each semester takes about 2 or 3 months, depending on current personal and facility resources. Throughout one semester all the students have to attend two obligatory one-week meetings. Obligatory meetings are base elements of the CCNA courses, because they connect theoretical lectures with practical training on real network facilities. Each semester includes approximately 10 chapters (depends on a particular semester).Based on our experiences it is possible to say that more than 80 % of studying time is in distance learning form. For these purposes global e-earning system for studying and assessments based on network technologies was created. With utilization of computer learning and training programs and connections with trainers the students are continually able to solve various technical problems and to continue individually in their study. A very important part of this process is feedback, which is in the case of CCNA relatively comprehensive, with more functional levels.

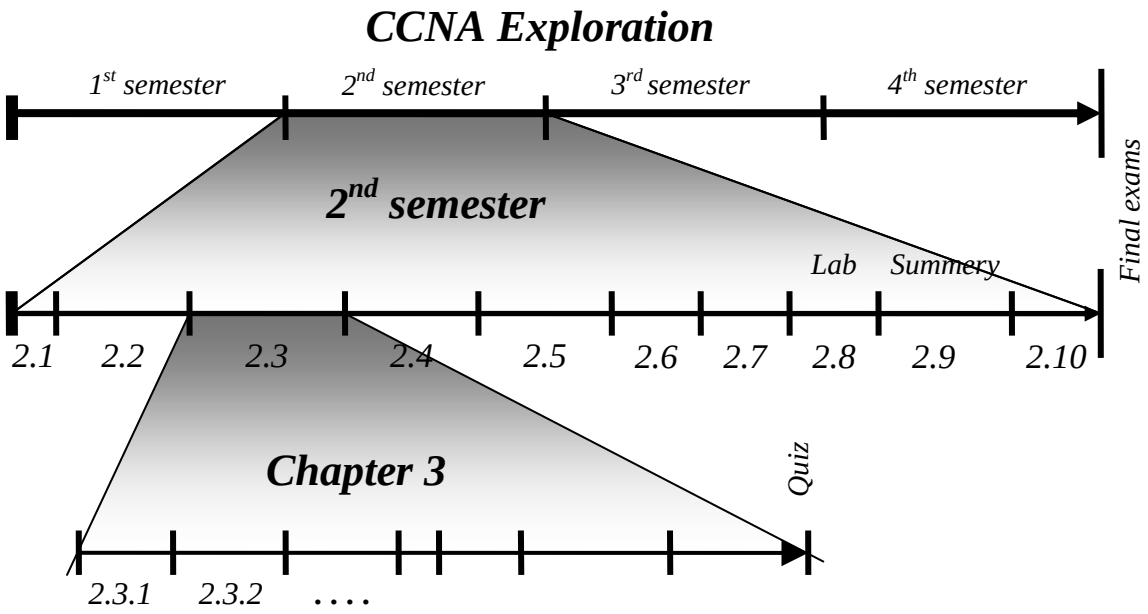


Figure 1. The agenda of CCNA Exploration course [1]

2. THE LEVELS OF FEEDBACK

The feedback is considered as the type of information that the users (both teachers and students) receive from the system as a result of actor's actions. In general, the feedback in e-learning occurs not only in the assessment process, but can also be provided to users during navigation through learning materials, communication and collaboration with other students, in the process of work with personal information and managing the courses (planning, enrolling, completing), etc [2]. In the case of CCNA we can consider the following active participants in feedback processes: The CNAP creative team, which creates and consequently in post-process modifies the study guides and training labs. Based on evaluated final results of all CNA the CNAP advisory team is able to improve the whole CNAP program. Thereafter we can consider the following feedback levels:

1. Student
2. Class
3. Instructor (teacher)
4. Local (Regional) CNA
5. CNAP creative team.

The structure of feedback relations is more complex and is introduced in Table 1. What is the meaning of these relations? Small examples:

- Relation C-I means that the feedback achieved from final results of the whole ***class*** (cumulative errors in individual test questions) can improve the ***instructor's*** interpretation of particular problem in future
- Relation S-S means that a ***student*** can obtain during or in the end of the chapter (or practical lab) feedback which gives him information about the level of correct understanding of the problems; consequently the ***student*** can react.

	Student	Class	Instructor	Local CNA	CNAP team
Student	**S-S**	**-**	**S-I**	**S-LNA**	**S-CNAP**
Class	**-**	**-**	**C-I**	**C-LNA**	**C-CNAP**
Instructor	**-**	**-**	**I-I**	**I-LNA**	**I-CNAP**
Local CNA	**-**	**-**	**-**	**LNA-LNA**	**LNA-CNAP**
CNAP team	**-**	**-**	**-**	**-**	**CNAP-CNAP**

Table 1. Description of the feedback relations

In Table 1 the relations which are practically useful for everyday praxis are underlined. But the information availability from feedbacks is accessible for all relations.

2.1 The relation on student level

The basic relation is the S-S relation, which is on level 1 and is dedicated for a ***Student***. For practical purposes it is better to divide this level into two categories, based on the type of study. Theoretical studies are in the first category and practical labs are in the second category. Both of them provide feedback for improvement of student's knowledge.

1. Feedbacks during chapter study:
Drag and Drop Activities
Summary quizzes – The basic problems understanding
Short off line quizzes [Figure 2]
On line chapter final exams [Figure 3]
Personalized feedbacks from on line chapter final exams [Figure 4]

2. Feedbacks during labs and training:
The level of correct completion of a task (E.g. in %) [Figure 5]
Continuous indication of physical connectivity (Packet Tracer simulation tool) [Figure 5]

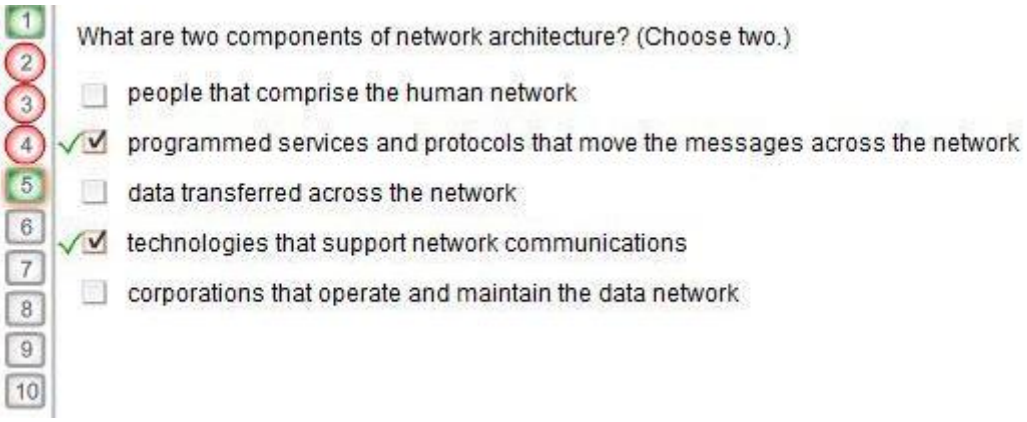
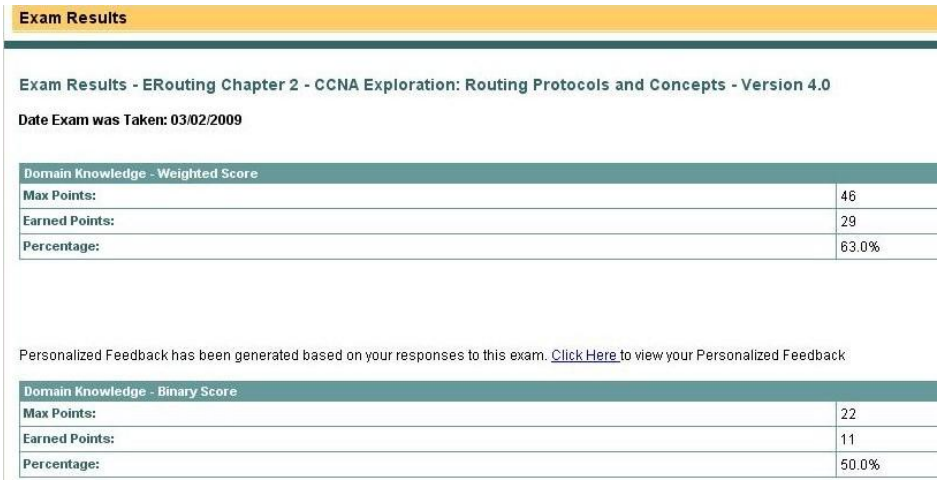


Figure 2. Feedback from a short off line quiz



Exam Results

Exam Results - ERouting Chapter 2 - CCNA Exploration: Routing Protocols and Concepts - Version 4.0

Date Exam was Taken: 03/02/2009

Domain Knowledge - Weighted Score	
Max Points:	46
Earned Points:	29
Percentage:	63.0%

Personalized Feedback has been generated based on your responses to this exam. Click Here to view your Personalized Feedback

Domain Knowledge - Binary Score	
Max Points:	22
Earned Points:	11
Percentage:	50.0%

Figure 3. The result of the on line chapter final exam

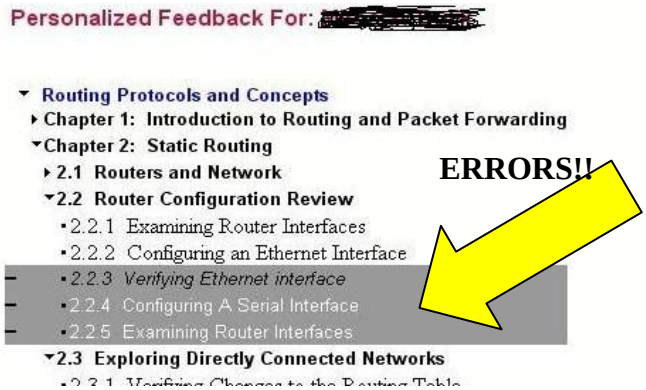


Figure 4. Personalized feedback of the on line chapter final exam

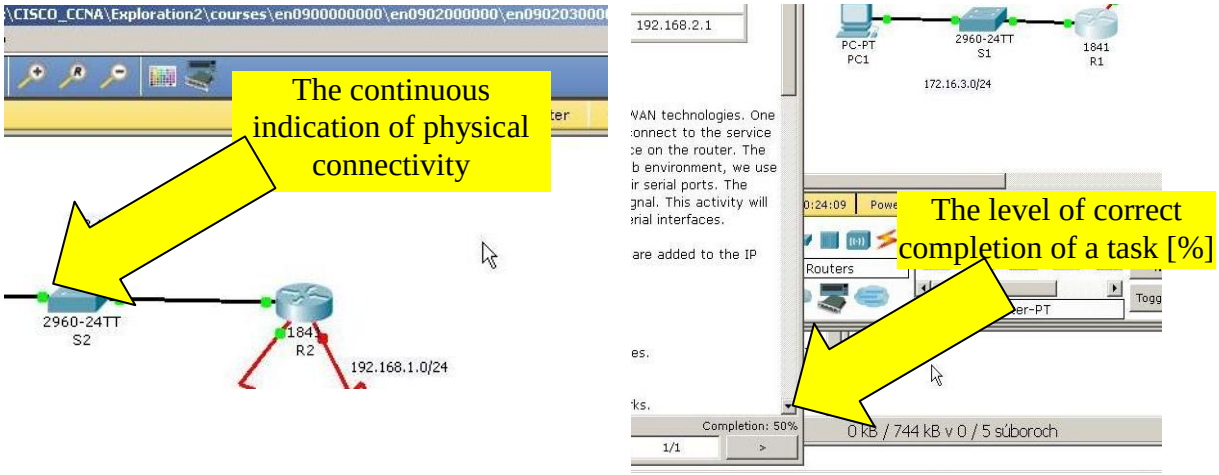


Figure 5. Continuous indication of physical connectivity and a level of correct completion (in %) as a feedback for students

Based on the results of study given by the personalized feedback [Figure 4] a student has several alternatives. In Figure 6 there is an example of an on line chapter final exam, where the result is not good. It is clear that the intensity of errors in the student's chapter on line final exam is too high to continue in the next chapter and therefore it is necessary to repeat the study of the whole chapter.

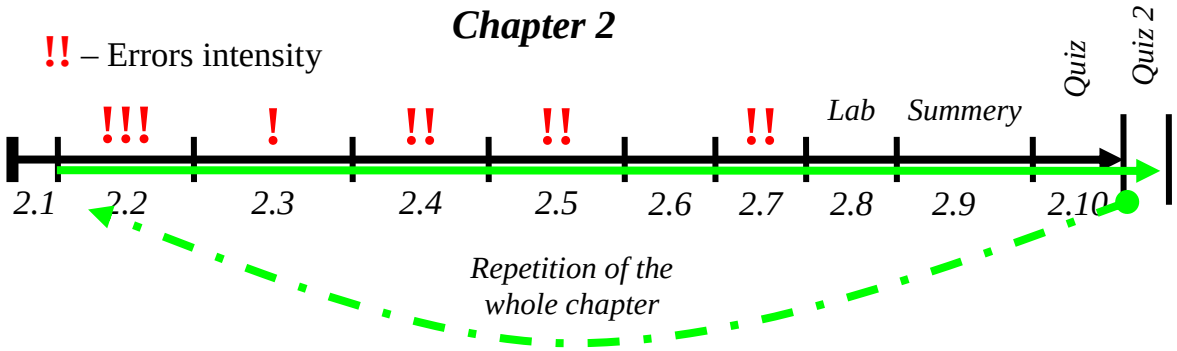


Figure 6. Repetition of the whole chapter study in the case of high errors intensity

In Figure 7 there is an example, where the result of a student is better and the score of the on line chapter final exam advices him/her to repeat only the parts 2.4 and 2.5 of the chapter 2.

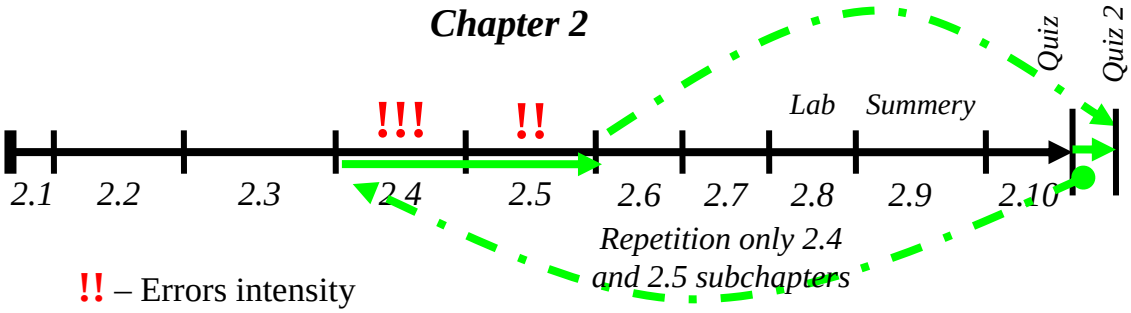


Figure 7. Repetition only of the part of chapter in the case of low errors intensity

2.2 The feedback utilization by instructor

An instructor has direct feedback from all on line activities and live personal training and exams in the laboratory. For solution of particular problems student's initiative is essential. For these purposes today's modern communication resources such as E-mail, ICQ, Skype and telephone should be recommended.

Let us look, for example, at distance consultation Packet Trace lab. Student can send the Packet Trace source file (model of network) to an instructor and they can both consequently discuss the problem in real time using Skype.

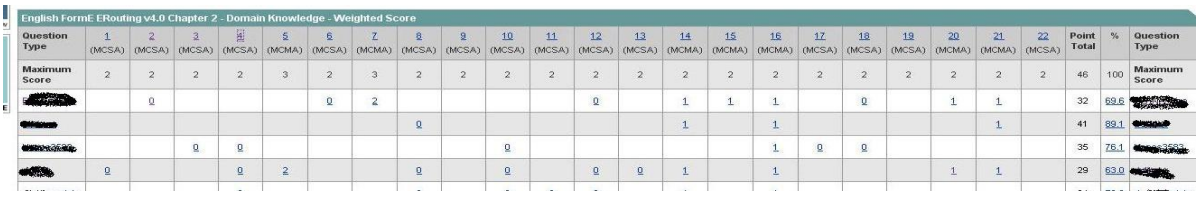


Figure 8. The view of errors by individual items in an on line chapter final exam

But the main role of the instructor lies in feedback interpretation of individual students and consequently feedback interpretation of the class as one group [3]. For these purposes the instructor has the same basic information about individual student's results as they have. For particular evolution of the process of study the instructor can use other comprehensive feedback tools:

- The complex assessment of all on line exams including particular errors [Figure 8]
- The summary of the whole group by student in % [Figure 9]
- The cumulative errors in individual test questions of whole group [Figure8, 9, 10]
- The complete summary of lessons, semesters (individual, group) [Figure 9, 10]

	EWAN Chapter 1	EWAN Chapter 2	EWAN Chapter 3	EWAN Chapter 4	EWAN Chapter 5	EWAN Chapter 6	EWAN Chapter 7	EWAN Chapter 8	EWAN Final Exam	CCENT Practice Certification Exam	CCENT Practice Certification Exam	CCNA Practice Certification Exam	CCNA Practice Certification Exam	EWAN Course Feedback	Skills	Custom Scores	Weighted Percentage	Grades	Eligible for Certificate	Eligible for Letter	Result	
Weight (Totals 100)	7	7	7	7	7	7	7	7	7	7	7	7	7		9	0						Weight (Totals 100)
View Item Information																						View Item Information
Pista8585	87.2	77.8	84.4	77.8	83.0	82.9	83.7	78.6	81.0	-	-	-	-	✓	100	0	60.5		✓	✓	P	Pista8585
cizmart	80.9	82.2	93.3	84.4	83.0	78.0	86.0	88.1	86.7	-	-	-	-	✓	100	0	62.4		✓	✓	P	cizmart
erikkristofik	91.5	80.0	95.6	86.7	83.0	87.8	81.4	76.2	87.6	-	-	-	-	✓	100	0	62.9		✓	✓	P	erikkristofik

Figure 9. The complete group assessment summary after whole semester

2.3 Feedback utilization by Local CNA and CNAP creative team

The task of the Local (Regional) CNA and CNAP based on feedback utilization is different. CNAs can use feedback materials for local program improvements. The main way is influence on instructor's teaching quality. Utilization of feedback within CNAP creative team level is more complex. The main task is general improvement of the CNAP worldwide program. This program can be influenced by more elements - the results of students, the progress in information and communication technologies, the demands of the job market, etc. But this area is out of the scope of this paper.

Select All | Deselect All

CCNA Exploration

Class Name	Course	Primary Instructor	Start Date	End Date	Status	Class ID	Print Certificates	Print Letters	View	Actions
s1s0801	Network Fundamentals 4.0 English	[redacted]	07/01/2008	10/04/2008	Historical	3469690			Gradebook Roster Assessment Home	Edit Delete
s1s0802	Network Fundamentals 4.0 English	[redacted]	22/09/2008	27/10/2008	Historical	3546311			Gradebook Roster Assessment Home	Edit Delete
s2s0802	Routing Protocols and Concepts 4.0 English	[redacted]	21/10/2008	22/11/2008	Historical	3555566			Gradebook Roster Assessment Home	Edit Delete
s3s0802	LAN Switching and Wireless 4.0	[redacted]	19/11/2008	20/12/2008	Historical	3563425			Gradebook Roster	Edit Delete

Figure 10. An example of the information about graduated classes

CONCLUSION

Feedback utilization seems to be a promising aspect of the e-learning systems personalization. In this paper we have analyzed various feedback relations from the perspective of different feedback levels in CNAP. There were discussed mainly student and instructor feedback possibilities in CNAP program. We overviewed our experience with feedback in the new CCNA curricula that could be used in the user (group) learning process. The differences between individual and group feedback utilization are underlined.

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USAGE OF MOODLE AND ADOBE FLASH FOR ARCHITECTURE AND HARDWARE DESIGN

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Abstract: *Education relied mainly on text learning sources in the past. But today we can use modern technology. Interactive elements significantly contribute to education and help better understand the learning/teaching process. We need an appropriate tool, but not a complicated one, for creating interactive education support. And we need a suitable learning management system for communication with students and for providing them with learning sources. These two requirements are fulfilled by Adobe Flash and LMS Moodle.*

Keywords: flash, Moodle, education, education support, interactive.

INTRODUCTION

Today we cannot imagine education without interactive parts and other modern methods. This idea is more important for specialized subjects like architecture and hardware design. It is more complicated to teach subjects which large volume of information. It is even more important in computer branch. Using animation and simulation we can create educational objects which are more interesting and popular.
In the past, mostly only text learning sources were available. The students had to visualize all the things which they were reading about in the text. This type of education was only for students with very good imagination, but it was not about others aspects of education. Today we can create models and simulations. The students can better imagine things with animations or interactive banners. We can distribute learning objects by using a LMS (learning management system). This material is better accessible and more attractive for students than books or textbooks. The education could become more efficient, but learning objects must not be functionless, chaotic or unsightly. Students are discouraged to continue in their studies and abandon it. Mostly they return to the text or other materials. We need very appropriately developed learning environment and very good graphic environment for credibility of our materials. We can create remotely controlled laboratories and remotely administrate systems.

1. USAGE OF ADOBE FLASH AND MOODLE

If we connect Adobe Flash and LMS Moodle, we get a powerful help for modern tutoring. It can be used for preparing special courses like architecture and hardware design. And we can use it for running more courses than in case of traditional face-to-face teaching.

1.1 Adobe Flash

At first sight Adobe Flash looks like a program only for professionals. And many people think that Adobe Flash is a very complicated program. But the truth is the opposite. Of course professionals using Flash are respected and their work looks like magic. But normal users can achieve success and acknowledgement too. And it is not necessary to use Flash for the main part of their work.

1.1.1 Adobe Flash Properties

In this chapter some basic properties of Adobe Flash (in next text only Flash) are examined. Flash is used usually for an easy creation of web-animation, interactive banners and so on. It is included in a package of Adobe products called Adobe Suite. But Flash can be also distributed separately [1].
Flash is based on vector graphics. It is an advantage, because final animations are too small and are of a very good quality. And we can adapt vector graphics very easily. It is very important for instruction. The subject Architecture and hardware design is usually devided into small parts corresponding to the structure of processors or other circuits [2]. If we want to assemble these parts, it can be easily achieved by vector graphics. We can connect every part to other parts. It is very important if we want to show students the components from which processors and cuircits are assembled. Certainly, it applies only to graphic models. In Flash we can create small size interactive banners which have always the same appearance. Every Flash animation has the same size in all web browsers. If we create some diagrams, it shoud be displayed without any shape deformation.
The disadvantage of vector graphics is that it uses high processor performance. This type of graphics displays every part of animation as vectors, and the processor has to complete the sum of these vectors. Consequently, if the graphic is complicated, the processor performance is higher. The circuits are not so much demanding on the processor performance because we do not create complicated graphics animation. Tutors need good access to students and the best way is via the Internet. Flash application has to take it into account. Using Flash we can create web pages. In comparison with HTML, the advantage of Flash is that we can create very nice animation more easily than in Javascript or in cascading style. And if we want to use data it is easier than using PHP. We do not need to be familiar with a large number of programs, programming languages and technologies if we want to create good animation or banners.
One of the advantages or disadvantages could be loading Flash animation by web. Web pages with Flash animation are loaded in en bloc. After loading the animation runs fluently and depends on processor utilization. This is a problem when the Internet connection is slow. Users get annoyed if they must wait long until the loading is finished. And they would rather find other sources for their study. The same problem is in case we have an old computer with a low processor. Animation is jerky and it looks unsightly. But if users do not have a problem with connection and the processor, the animation runs continuously and properly. Next disadvantage is the necessity to have Flash plugin installed. And if this plugin is not available, the Flash animation does not open. But if we are connected to the Internet, this plugin is installed automatically. Flash is not a good application if want to create some specific projects, for example, in case we want to create project with a great amount of text or with many tables. But we can import text documents and table documents into Flash from some other applications.
Another disadvantage could be initial price. However, it will be removed after first successful projects. The price is compensated by professional appearance of projects. We can create in Flash everything that we want without using of a large number of programs and programming languages. It is a very good tool for education support.

1.2 LMS Moodle

If we have all materials for lessons prepared we need to make it available for students. The best and easiest way is using the Internet. We can use LMS Moodle in this case. LMS Moodle (Learning Management System) is a suitable tool that supports communication among tutors

and students (discussion forums, chat), distribution of learning objects and testing. It can be used within private nets as well as within the Internet. [3]

1.2.1 Properties of LMS Moodle

Moodle is free software with open source code. It can run in Unix, Linux, Windows, Mac OS X, Netware and in other systems with PHP support. The data are stored only in one database. The word Moodle was at first an acronym for Modular Object-Oriented Dynamic Learning Environment. It is interesting for programmers.
The main page of Moodle is usually divided into a left, middle and right column. [4]. In these columns are blocs (some menus and summaries) and the middle column offers the user content. Each course can be divided into sections. The organization of each section depends on the course organization. For example, it can be sorted by topic (one section is one topic or one chapter) or by time (on section is one week). The tutor is responsible for designing courses. He prepares study materials, for example, some text materials (web pages, word documents, powerpoint presentations) including multimedia (audio and video records) and interactive materials (Flash application or Java applets).
Moodle puts great emphasis on students' activities. Moodle was developed to support special activities, in which each student builds his knowledge in cooperation with his/her classmates. They are all in interaction – online. The tutor can adapt rules or materials on demand. This is a good way for group projects. Every student can create a part of a project and discuss and share it through Moodle with the tutor other students.

CONCLUSION

We can replace a lot of education text today by easy schemas, easy animations or interactive banners. We need this replacing primary in special subjects like architecture and design hardware. It is the right way for a better approach to students. We need a suitable tool for creating learning objects, but not a very complicated one. This tool is Adobe Flash. Using Flash we can create many schemas, diagrams, basic circuits, and we can show basic principles by animation. These materials are very well adaptable, modifiable and they have low size. Flash offers a very user-friendly environment. Teachers can fully concentrate on their subject fields and do not need to work with any complicated software. Lots of teachers use Flash today.
The second problem is connected with sharing education materials. If we want to distribute these materials to students, it is not a good idea to send them by e-mail. We need a suitable learning management system which allows tutors to create a structured system of teaching sources. LMS Moodle fulfils all requests. It becomes a powerful tool, especially in connection with Flash. We create some basic texts and add Flash interactive banners or animation.
The project on e-learning module creation has started as special research at our department. There has been an idea to create new courses for our department in LMS Moodle.
I hope that tutors interested in new teaching methods would like to be familiarized with new tools and new techniques to support their classes.

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APPLICATION METHODS E-LEARNING AT EDUCATION GIS

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Abstract: *Geographic Information Systems (GIS) are comprised of computer hardware, software, geographic data and other organizational data sets. With a GIS, you can link information (attributes) to location data, such as people to addresses, buildings to parcels, or streets within a network. You can then layer the information to give you a better understanding of how it all works together. You choose what layers to combine based on what questions you need to answer to provide you with location intelligence. Location intelligence is the astuteness to provide outcomes that are meaningful, actionable and can provide organizations with competitive business advantage and improved business decisions. Education GIS introduces students to the capabilities and applications of geographic information systems using ArcGIS software. The system is an organized connection of technical and programmed equipment, area information and service based on geoinformation technology. The scaled system of products for processing and use of geographical information ArcView provides basic knowledge about GIS essentials, basic functions of GIS with characteristics of depictions and maps, advantages of GIS database, principles and importance of coordination systems and map projections use.*

Keywords: GIS, C2, Moodle, ESRI, ArcGis, ArcView.

1. PROLOGUE

Geographic Information Systems (GIS) [2] and geoinformatics are todaythe most dynamic developing information technologies ever. Especially in the last year GIS became the past of being information systems in such areas, as today's economy of ground and environment, geodepartment (geography, geology, geophysics, geodesy), banking, marketing, humanities or demographic study, army, medicine or biology in consequence of lokalization ofobjects and phenomena, but also public administration.

The important areas of its study and applications in status quo:

- Acquiring of digital geodata in terrene,
- Global positioning and navigation systems,
- Analyse and appreciation of distant exploration of earth data,
- Geographic information systems
- Intergration of knowledge systems and GIS
- Evolution and application of geostatistical methods,
- Systems for decision support,
- Numeric simulating models and prognostic models for space-processes,
- Application of multimedia metods,
- Digital cartographic systems,
- Threedimensional visualisation, virtual of reality.

The focuses of activities with geographic information systems: Cartographic – work with cartographs, analytic – analysis and synthesis of informations and database – saving and management data. To typical geographic oriented anlytic tool GIS appurtenant to query database, to superimposition of information layers, for of map algebra, for analysis of surfaces, for accounting of analysis and for analysis of networks.

Information technologys related to GIS:

- Systems for computer cartography – CAM (Computer Aided Desing),
- Systems for management of informations – AM/FM (Automated Maping&Facilities Management),
- Systems for analysis of frames primarily from distant exploration of earth – DIPS (Digital Image Processing System),
- Database systems – DBMS (Database Management System),
- Systems for work with digital models of terrain.

The following of practice must be kept:

1. Modeling and simulation of processes,
2. Interence of data maping (slot),
3. Query language about database.

2. TEACHING GIS

At the Academy of Armed Forces in Liptovský Mikuláš [6] will GIS be taught as a tool for getting to know physical – geographic and socio – economical field, with an accent on military. Until now this education was only for informatics students (VKIT), and it is also planned for students of management, for students of PSSS, and also in next branches and courses.

The main teaching will be based on the system of managing courses (CMS) – Moodle. It is a software packet for creating of courses based on internet presentations. One of general advantages of Moodle in comparison with other systems is its accessibility because it is generated as an Open Source project. The complex system provides teaching materials in all application molds, i. e. script, pictures, video, sounds, etc. There must be followed education and didactic principles – complexity (following up the syllabic structure), activity (interactivity and multimedia – quality with utilization of communication tools), individualisition (as a style of study), adeguacy (information is clear and adequate), didactics based on constructive principles and the progress from analyses to synthesis.

Texts courses are divided in to basic parts – introduction, aims of study, time chart, solo expository script, summing-up, tests, layouts, glossary of concept, literature, references, additions.

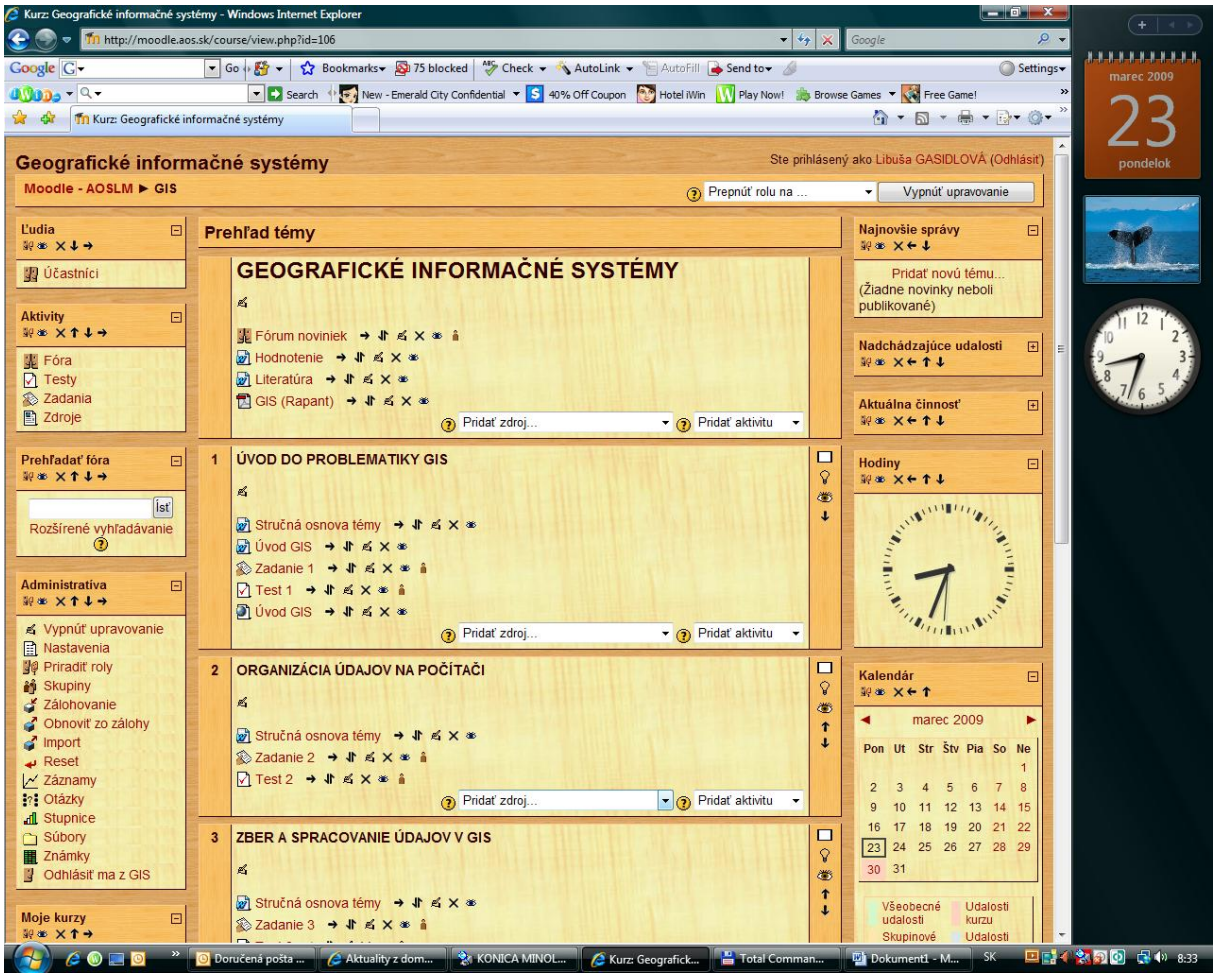

Fig. 1: Introductory page of the GIS subject in Moodle of AOS at the department of Informatic in L.Mikuláš.

Teaching will be held on the platform of products of American multinational corporation ESRI (Environmental Systems REsearch Institute), i.e. ArcGis. At present on this platform i tis also suaved and operated Military information system about territory (VISU), his architecture and the data model, with gradual trailers exposing and students step by step they will be familiavised with ground functionalism of ArcView. The ground user interface is the product ArcView in version 9.2 and consists of a group of products ArcGis for different applications [4]:

1. ArcGIS 3D Analyst,
2. ArcGIS Business Analyst,
3. ArcGIS Data Interoperability,
4. ArcGIS for AutoCAD,
5. ArcGIS Geostatistical Analyst,
6. ArcGIS Military Analyst,
7. ArcGIS Network Analyst,
8. ArcGIS Publisher,
9. ArcGIS Schematics,
10. ArcGIS Spatial Analyst,
11. ArcGIS StreetMap Europe,
12. ArcGIS StreetMap USA,

13. ArcGIS Survey Analyst,
14. ArcGIS Tracking Analyst,
15. ArcPress for ArcGIS,
16. ArcScan for ArcGIS,
17. Job Tracking for ArcGIS (JTX),
18. Maplex for ArcGIS,
19. Military Overlay Editor,
20. MrSID Encoder for ArcGIS

The manuals of ArcGis can serve as another font of information ArcGIS: Getting Started with ArcGIS, Using ArcToolbox, Using ArcCatalog, Using ArcMap, Editeng in ArcMap, Building a Geodtabase, Exploring ArcObjects, Managing ArcSDE Services.

ArcView
Sofware firms ESRI is visualized in GIS [1] industry standard. Broad range of products can be used for needs of all types of agencies, from smallest businesses with one employee up to biggest businesses with global effect.

ArcGIS
Graded system of products for processing and exploitation of geographic information for differently big groups of users and their different demands. The family of products of ArcGis is created by seria of ArcGis Desktop (ArcView, ArcEditor and ArcInfo), ArcSDE in the role of port for relational geodatabase and application server for location and delivery service of geographic data and services on the Internet.

ArcViewGIS
The most widespread GIS desktop software is oriented primarily on desktop mapping.

ArcExplorer
Freely spreadable browser of GIS data.

ArcIMS (Internet Map Server)
Products enabling publication of GIS data through internet.

ArcSDE
GIS port in DBMS, by help of which it possible to compile and share multi-path space-database in arbitrary relation database system (DBMS), as ist Oracle, SQL Server, Informix, DB2 or Sybase.

ArcView 9 is a new component of ArcGis and the product consists of three applications, that are closely cooperative and use the Windows interface:

ArcCatalog
Application focused on scanning, organization, distribution and documentation of GIS data of different forms. By easily manageable interface of ArcCatalogue the user contents of GIS database can overlook very quickly and simply. Simply it is possible to say, of that is an analogue Explorer for geographic data.

The moving in the directories of ArcCatalog structure is intuitive and simple.
The structure of the ArcCatalog is comprendious:

- a window of catalogue three – provides view on organization catalogue,

- hold window – displays a selected item, user can choose three different views on the item – contents, preview or metadata look.

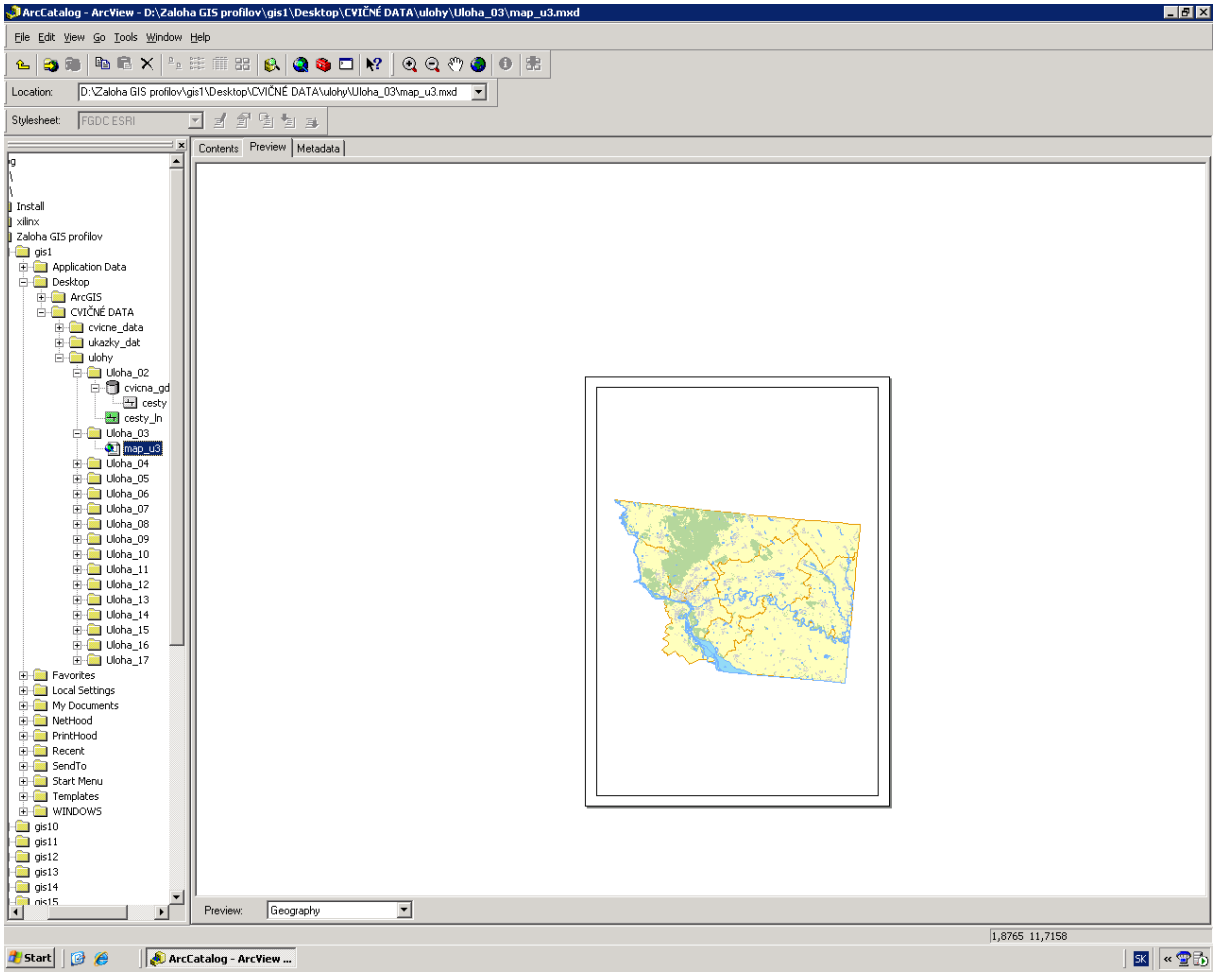

Fig. 2: Cartography in ArcGis

Different forms of data are displayed with different icons. By scaning the item (directory, coverage, dataset, geodatabase, tables, ...) in the imply window the user has a possibility to extract from three different scenes:

- contents of selected item (Contents) – depicts the message of the item,
- presentation of data (Preview) – puts up the data in the image geographic or table format,
- presentation of metadata (Metadata) – puts up the „data about data“, descriptive information about data.

ArcMap
Application used for creation, editing, browsing, quering, and analysis ofgeographic data, as mell as for composing and maps. ArcMap visualizes central application on the desktop section of ArcGis, because it provides a variety tools for creating and editting of space and editting tabulator data, and enables the creation of high quality map products. The basic structure of ArcMap is:

- Contents - list of all map layers, their check box indicates their presentation, where order of layers in contents is important, because layers at the top contents are mapped above the ground layers.
- Layer – it presentats geographic data, but it does not contain independent data, because in a layer there is written a place of deposition of data and the style of their drawing up.
- Tool bar - include the most application tools.
- Data scan (frame) - by data scans (frams) is frequently used unabled to combine layers, that the user wants to display together, fast data scan (dat frame – which is being worked with) is marked bold with script.
- It makes enables switching of tape data look and graphic (layout) look. (look with scale with north star, name and legend).

3. APPLICATION GIS IN THE ARMED FORCES OF SR

It is necessary at last shortly mention actual application loaded in the Armed Forces of SR and it is C2 SYS-TS „The system command and control on tactical rank“, whose integral part is made also by the implementation of GIS[8]. C2 SYS-TS of Ground Forces of Military SR serves as integrate and automatized system of management and commanding for securing of processes of command and control (C2) in military operations of ground forces of Military SR. The objective of construction of system for ground forces is turn on automation technologies for commanding places on the level of battalion, company, platoon, automatize operational-tactical tasks with use of digital map records, make activities of officers of headquarters of battalion more effective, scheduling and commanding of operations with the premise, that C2 SYS_TS will be the ground structure element of systems command and control (Command and control – C2) Ground Forces Military SR on tactical rank, by the distribution on tactical -operational rank.

The possibilities of the system:

- Graphic presentation of situation, the use of digitized, raster and vector map foundations, topographic data DMR-2 (DMR-3, digital model relief), digitalized aerial scans and plans of cities.
- Draw of in damp run over digitized map details, its allocation over network, group work and eventual printing in line with APP6A (basic document for development, scheduling and command operations of Ground Forces in the course of NATO).
- Modeling, simulation and calculations ofproportion of streughth, assesment of linear visibility, scheduling of migrations, creating, data processing and distribution formalized combat documents.
- Automatized change of information between command places, call documents organization and formalized documentation ADaTP3 and administration of data path.
- The transference of changes in drawing situation of real time and display on indiviual places of command.

- Utilization of GPS for determination of self locality of command places, enabling the commander to monitor move ment of own troops in the draw of combat situation at real time.

System C2 SYS-TS will be a component of system MOKIS as another information systems as are ŠbIS, ADMIS, LOGIS. Security domain folloving up the transmission tools of stabilite communication network of the department and building the mobile communication network in Military SR – MOKIS.

Basic idea is utilization of single type network for transmission of data, spoken and video information e.i. technology IP data network (MOKIS and SDRRS) and VoIP and utilization based on a component approach based on the architecture oriented on Office (SOA – Service Oriented Architecture) to support interoperability, flexibility and adaptibility.

The mentioned system is fact a component of key destination areas transformations of NATO, e.i. costruction of networks oriented on capability of Aliance (NATO Network Enabled Capability – NNEC [7] with the aim of gaining the information propotency and dominace in determination.

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THE ADVANCED DISTRIBUTED LEARNING AND TRAINING (ADL/ADT) IN THE MINISTRY OF DEFENSE DEPARTMENT OF MILITARY AND CIVILIAN PERSONAL PREPARATION

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Abstract: *This paper discuss conditions and chances of Advanced Distance Learning and Advanced Distance Training implementation in the military background. Examples of the technology and methodology implementation of Advanced Distance Learning and Advanced Distance Training arts into Czech Army are discussed as well.*

Keywords: E-learning, Advanced Distance Learning - ADL, Advanced Distance Training - ADT, Learning Management System - LMS, LMS MOODLE, Accredited Courses, Military Training.

INTRODUCTION

Technology is changing the way we live, work, and play. It comes as no surprise that it is also changing the way we learn. The advent of the Internet is changing just about every facet of our daily lives. The Internet is bringing about a paradigm shift in the way how people learn. The future forecasts grow of e-learning courses significantly over the next decade. While this paradigm shift is opening up many new business opportunities, it is also causing great concern for traditional training settings. Instructional Designers need to change the way they design instructions. Instructional materials are being designed in terms of reusable objects versus entire courses or lessons.

1. EDUCATION AND TRAINING OF THE MILITARY AND CIVILIAN PROFESSIONALS

Along with this paradigm shift there is a strong focus in the training materials producers toward establishing “open” standards that would enable the distribution of learning over the Internet and World Wide Web. In fact the Advanced Distributed Learning (ADL) initiative was established in 1997 to examine these issues. Before this time, there were several groups establishing such standards, including The Aviation Industry for Computer Based Training Council (AICC), the IMS Global Learning Consortium, and the Learning Technology Standards Committee (LTSC) of the Institute of Electrical and Electronics Engineers (IEEE). The ADL initiative pulls these separate groups under one common umbrella.

At the core of all these efforts is the concept of reusable objects. While this concept is new to training, it is not new in other areas. This theory is based on the object-oriented paradigm of computer science. The concept is to build components or objects that can be reused in multiple contexts. This concept, when applied to the field of computer science, greatly

reduced the time it took to create programs. The idea is that a producer can go to a list of objects that are already created and simply insert one into his program. These objects are developed one time, tagged and stored, and then used and reused as necessary. However, these objects must interact, so while they are independent entities, they must also be able to be combined with other objects in order to form a meaningful concept. Therefore, there is a need for a common definition of objects and properties, so that objects may be used interchangeably.

All of these developments have stirred a great debate in the "e-learning" market concerning labeling these objects. Terms such as "Instructional Objects", and "Learning Objects" have started to appear in a significant number of "e-learning" publications. There is, however, no common definition of these terms; and what is even worse, there is no common context in which these terms are used. The Learning Technology Standards Committee defines a "learning object" as an entity, digital or non-digital, which can be used, reused or referenced during technology supporting learning. There exist more definitions:

- a three-part definition:
    - a learning objective,
    - a unit of instruction that teaches the objective,
    - a unit of assessment that measures the objective,
- "pre-scripted elements that simplify programming",
- "any digital resource that can be reused to support learning".

The ADL initiative in the Shareable Content Object Reference Model (see SCORM - version 1.1) uses the term Shareable Content Object (next abbreviation - SCO). A SCO is defined as a self-contained chunk of instructional material. It is a collection of one or more assets that utilizes the SCORM runtime environment to communicate with a Learning Management System (next abbreviation - LMS). It will be defined later as representing the lowest level of granularity of content that can be tracked by a LMS. While all of these definitions are quite different in size as well as context, the purpose is quite clear: to break training courseware up into smaller chunks that can be reused so that "e-learning" courses can be constructed quicker and easier than traditional Computer Based Training lessons.

While this debate rages on within the e-learning market, other providers are battling the same issues. Specifically, developers and manufacturers of major systems are required to provide technical information about these systems. In the course of development, front-end analyses are routinely conducted. These analyses efforts frequently result in large amounts of data that are published as technical manuals. The concept of Interactive Electronic Technical Manuals (next abbreviation - IETMs) started to appear as early as 1987. Making the technical manuals electronic made them easier to use, and less expensive to update. In fact the European Association of Aerospace Industries, AECMA has set up a Technical Publications Working Group that is developing the guidelines for IETMs. This working group is struggling with many of the same issues as the training community, including "reusable objects" and Meta-data tags for these objects. Looking at the work of AECMA and ADL, as well as the movement to a web based platform by these two industries, it became evident that there is a great deal of overlap in the requirements of these two industries.

1.1 Rapid Decisive Operations (RDO)

Future framework of conflicts is planned as join operations. RDO is a concept for conducting future joint operations. It focuses on the adversary, identifying its "critical capabilities" in order to bring the appropriate measure to bear "to achieve the desired political/military effect." RDO recognizes and leverages the military's role as one instrument of national

power, considering a broader range of actions by a broader range of agencies than those available to just the military. Thus,

- "at the national and theater strategic level of the NATO will attempt to influence and deter an adversary by using diplomatic, economic, and information operations, supported by relevant military flexible deterrent options. If deterrence fails, RDO provides the capability to rapidly and decisively coerce, compel, or defeat the enemy in order to accomplish our strategic objectives…"

Learning, defined as "the acquisition of knowledge, skills, behaviors, and attitudes (through the integration of education, training, and performance support)," is the key to enabling RDO. Learning focuses on what the student or trainee knows as the result of the intervention rather than the time allotted to learning, the number of trainees present, incident of attendance, or other common, but irrelevant, metrics. Advanced Distributed Learning (ADL) leverages the use of technology to ensure learning is available when and where needed.

1.2 Advanced Distributed Learning

ADL is "an evolution of distributed learning that emphasizes collaboration on standards-based versions of reusable objects, networks, and learning management systems...." In addition to the obvious match between the networked collaborative training required for RDO C2 concepts and the definition of ADL, ADL promises other technologies for RDO concept support and pedagogic support for RDO knowledge requirements. The following services and technologies are significant items, together with suggested application to RDO concepts: learner-centric learning (LCL), intelligent tutoring, embedded training devices, collaborative learning, distributed simulation, and performance assessment. In practice these are not distinct techniques and often overlap or are used concurrently to enhance learning. For example intelligent tutors can be defined as:

- educational technology that mimics the best known way of teaching: 1-on-1 tutorial,
- simulations that enable automated directed, active learning of complex skills,
- knowledge-based systems that automate teaching strategies and/or exemplary task performance,
- adaptive instructional systems that can change behavior dynamically to meet the needs of individual students.

What is the goal of LCL? Studies have shown that learning interventions focused on decreasing the "learning gap," the difference between the learning objective and the learner's current state of knowledge, by targeted instruction to address that gap, speed student learning. Moreover, as the DSB noted, "what amounts to individual tutoring… does more than reduce the time to learn. It greatly increases the level of knowledge or skill in the student." In particular, the "2-sigma" difference, shown in Figure 1, refers to studies showing that tutored students perform in the range of two standard deviations better than their classroom counterparts.

Organization Wide Learning (OWL) is an example of a LCL system. OWL uses the learner's own actions over a period of time to determine the learner's current level of knowledge. As indicated in Figure 2, the average user knows only a portion of the knowledge of the peer group and a fraction of the total possible application functions.

ADL will enable Joint Force operations and RDO in four areas:

- ADL technologies and services are necessary to train, educate and support Joint Force conduct of RDO.
- ADL technologies and services can support and advance knowledge management (KM) initiatives necessary for the success of RDO.

- ADL performance support tools should serve a dual purpose, or at least be integrated, with decision aids used for RDO functions.
- ADL strategies should be used for engender innovative thinking since innovation is a conspicuous attribute in the RDO documentation.

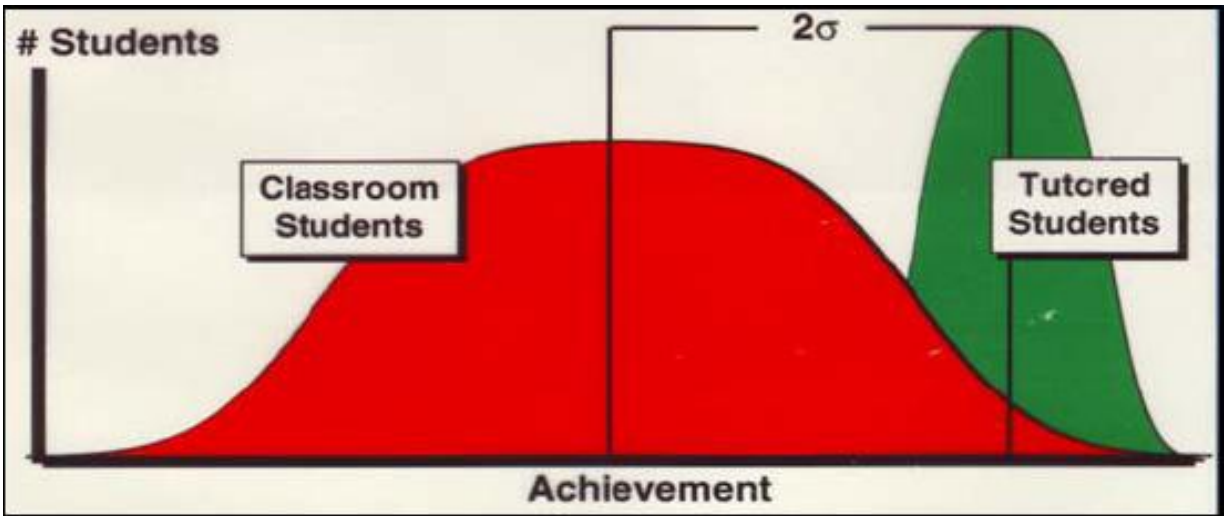

Figure 1: "2-sigma" difference scheme

1.3 Situation in the Czech Ministry of Defense

In the Czech Army do not exist ADL/ADT systems applicable for general application. There are isolated activities concentrated inside of the University of Defence, but neither there is not coordinated effort form technology and methodology point of view.

In 2004 year grew up an initiative for constitution ADL/ADT research team. In 2007 year exploratory project DISTANCE was confirmed by MoD. The VR GROUP a.s. won this project as a main investigator and Faculty of Informatics from Masaryk University became as a fellow investigator. In the project team act 25 experts from VR Group, MU, LTC and CIS Dept. from UoD, FI MU and CSTT.

The essential goal of this projects consisted in development of knowledge and design prerequisites for an accelerated introduction of the ADL/ADT (advanced distributed learning and training) in the process of preparation of military professionals both in its horizontal and vertical level. Main goal was finding the most suitable software and hardware technology for organizing and using of the advanced distributed learning environment. Partial aims of this project were design and verification of the effective structure and content of the one-term lessons. Very important partial goal of this project was minimize time of contact lessons and quantity limit of the mentors as well.

On December 2008 project DISTANCE finished and at the end of the March 2009 results were defended. Analytical and methodological part of the project contain 9 preliminary projects:

1. Preliminary project ENGLISH - MOODLE;
2. Preliminary project PHYSICS - MOODLE;
3. Auto-regulation of the tuition as essence of the ADT/ADL self - education;
4. ADL/ADT for tuition and training in the NATO countries;
5. Criterions incorporate ADL/ADT into education and training;
6. Applications ADL/ADT for education and training of the Czech Army professionals and experts;

7. Applications ADL/ADT for education and training in condition of the Czech Republic;
8. LMS as a software foundation for E-learning operation;
9. Analyses of the open-free LMS.

In sum 7 pilot projects was achieved:

1. Pilot project PHYSICS - Implementation e-learning into tuition of the accreditation Physics courses;
2. Pilot project ENGLISH - self-reflexion and auto-regulation of the learning embedded into e-learning tuition of the english courses;
3. Pilot project TECHNOLOGY - LMS and authoring tools for e-learning operation;
4. Pilot project TELEKONFERENCING - Hardware and software for telepresentation and distance learning;
5. Pilot project - TACTICAL SYMBOLS;
6. Pilot project - Select chapters from distance education and e-learning;
7. Pilot project - Auto-regulation assistance for students tuition.

Integral parts of the project are 5 operational specimen:

1. operational specimen - WAVE Course;
2. operational specimen - Select tasks of the English tuition;
3. operational specimen - primary course of the tactical symbols positional symbols;
4. operational specimen - Select chapters from distance education and e-learning;
5. operational specimen - exemplary chapters of the course Auto-regulation assistance for students tuition.

Parts of the project result are 3 methodologies:

1. Proposal for preparing system of the ADL/ADT providers in the Czech Army and proposal for preparing system of the ADL/ADT users in the Czech Army;
2. Proposal of the ADL/ADT methodology centers organization structure in the Czech Army including characterization of this system;
3. Methodology of the ADL/ADT courses generation and operating.

CONCLUSION

The results of project DISTANCE, especially the methodologies, are usable as groundwork of the setting MoD education and training policy. The pilot project and operational specimens are guides for implementation of distance learning technology for education and training of the Czech Army professionals and employees.

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NEW WLAN TAXONOMY PROPOSAL

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Abstract: *The purpose of this paper is to describe "New WLAN taxonomy proposal". Security is one of the most used terms at this time and wireless technology is branch that can utilize it. This article will present the proposal for safety analysis of wireless local area networks (WLAN).*
The contribution will be systematically divided into two main parts. The first part will be pointed out to a proposal security analysis. The second part will be focused on reduced security analysis proposal, which reduction will consist of restrictive conditions for further security analysis.

Keywords: wireless LAN, IEEE 802.11, security taxonomy.

INTRODUCTION

Information technologies process more and more information with great value. If we talk in the context of information technology for processing information, then we understand that the use of these technologies for storage, transfer, evaluation and presentation of information.

Since many of information have a significant value, must be protected so:

- Only authorized persons have an access to information.
- To treat only the correct information.
- That could be determined who is created, changed or removed.
- That has not been disclosed by uncontrolled manner.
- To be available when needed.

If we then talked only about the transmission of information, currently there has been a huge expansion of wireless technology and is still more emphasis on security. The concept of security we heard in our surroundings increasingly, because in addition to we heard also how many wireless networks someone unlawfully entered, and subsequently carried out an unauthorized activity there. Therefore, the unauthorized person does not enter the wireless network, it is necessary to secure the network.

1. SECURITY ANALYSIS PROPOSAL

In case we want to prepare countermeasures for wireless local area network WLAN we have to identify many steps we call security analysis and leads to proposal of mentioned countermeasures.
The first one investigates wireless network assets and security targets, the second analyses threats affecting assets and security targets and the third one proposes a solution of the threats mitigation. In case we want to decompose security analysis in more details we get to five important steps. All steps are on figure 1:

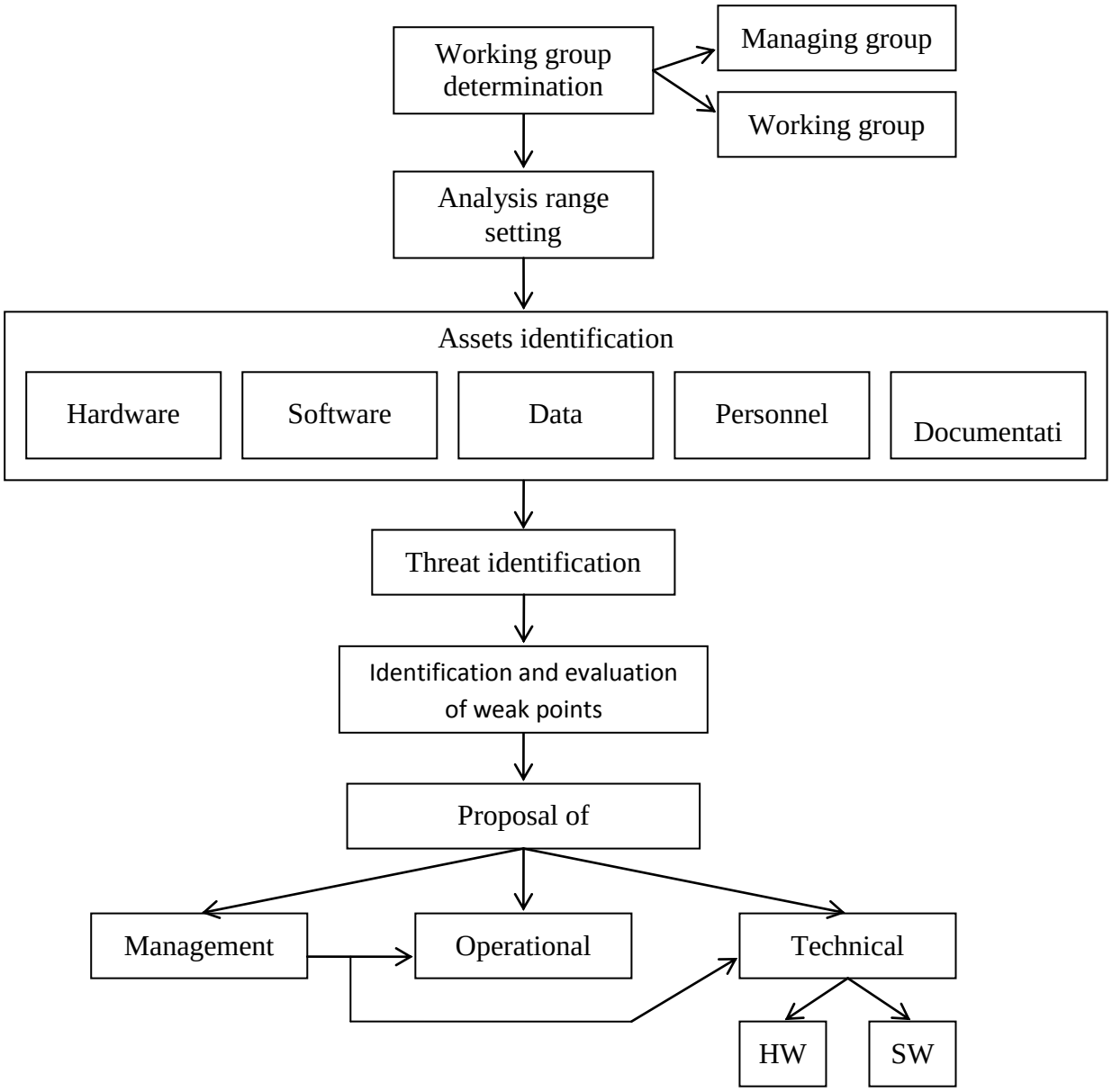

Figure 1. Security analysis process

1. Working group determination – establishing of managing and working group.
2. Setting of analysis range – directly pointed our attention towards range of analysis.
3. Assets identification – all assets is possible divide into five parts:
    - Hardware (computer, network equipment, peripheral devices, etc.).
    - Software (operating systems, programs, etc.).
    - Data (information, password, key, etc.).
    - Personnel (personnel who has an access to assets).
    - Documentation and directive (HW and SW documentation and security directive).
4. Threat identification – identifying of all threat that affecting assets.
5. Identification and evaluation of weak points - identification and evaluation of all weak points that are important for mitigating of security threat.

6. Proposal of countermeasures – applying of countermeasures to specific threats and vulnerabilities.

2. REDUCED SECURITY ANALYSIS PROPOSAL

Whereas the number of assets for subsequent analysis of threats is very large and in other parts a reduction to three basic assets: to the hardware, software and data. These three assets will be analyzed from three main aspects namely in terms of loss of confidentiality, authenticity (integrity) and availability. Subsequently, the security analysis will aim to a plan of security measures that define the responsibility for certain actions to facilitate of wireless network security.

For a simplified methodology of the threats analysis will be defined basic concepts.

Basic concepts

Surroundings: the subject or object, which is not part of the information and communication system.

Assets: the essential elements of information and communication system, which has a certain value.

The threat: the possibility of using vulnerability of information system (IS) and communication system (CS) to attack the assets. Threats can be divided into objective (natural, physical, technical or logical) and the subjective, based on the human factor. Subjective threat can be further divided into intentional and unintentional.

The risk: a threat poses a risk. The risk we understand the likelihood of vulnerability of IS and CS.

Security features:

- Confidentiality,
- Authenticity (integrity),
- Availability.

Confidentiality: ensuring that information is accessible only to those authorized to have access

Integrity (authenticity): hardware, software and data may be modified only by authorized operators. Must be ensured verifiability of origin information.

Availability: must be ensured that the availability of legitimate operators. The same is true for IS services and CS.

Methodology proposal

The proposed methodology is based on an analysis of initial threats and starting to gradually etching in and specification of threats, which in a result creates a tree. The summit of the tree

is the highest threat and a threat to the security of wireless local area network. The aim of further analysis is the determination of individual assets or groups (such as hardware, software, data) and individual aspects of security (confidentiality, authenticity and availability) are examined partial threats for those assets and the relevant aspects on the basis of known or likely targets of attacker.

For the methodology is needed to the identified threats were absolute (ie order not to miss any threat and that, if possible, do not overlap each other). Any threat that is identified in the information system (IS) and communication system (CS) is under these rules systematically decompose to further split the threat to level, which defined the details of the description of CS and its surroundings. Lowest threats, which may no longer be decomposed can be called elemental threat.

Using the elemental threats can be by sententional calculus create a multi (hierarchical) model, describing the threat from mentioned the elemental to the final. Using the elemental threats can be defined and made up the so-called compound threats, which are due to a logical combination of elemental threats. Secretariat of sententional calculus allows efficient and easy register of compound threats. Each threat is clearly encoded, so that they contained code of hierarchically higher threat. This ensures clarity and the connection between threats.

Assets can be divided into three basic parts:

- hardware required for data processing in the IS and data transmission in CS,
- software required for data processing in the IS and data transmission in CS,
- data.

Hardware
Hardware required for data processing in the IS and data transmission in CS. It means all the technical elements that are part of the wireless network (such as processors, memories, the active elements of WLAN, etc.)

Software
Software ensuring the protection of the IS and CS using the software, particularly secure operating systems and application equipment (application program, operating system, etc.)

Data
Data are in the IS and CS center around the events. Because of data, the system builds and operates. Because of their sensitivity is also IS and CS protected and secured. Data in the concept of WLAN means such as data stored in the database, results, final outputs, input data, transmitted data, etc.

Next will be described the proposed methodology of the threats analysis. The summit of the tree is the threat to security of WLAN. It is located under the sub-threats by assets - the threat to the security of hardware, the threat to the security of software and the threat to the security of data. They mark the first layer of threat. Under each of these threats are present four sub-threats under security features. Sub-threats are as follows:

- the threat to the confidentiality of assets,

- the threat to the authenticity (integrity) assets,
- the threat to the availability of assets.

They are marked as the second layer threat. For coding on the second layer of threats are used the following rules:
H.AB
Where

- the symbol H represents the threat,
- the symbol A = H / S / D represents the asset, and
    - H = WLAN hardware,
    - S = WLAN software,
    - D = data WLAN,
- B = the symbol represents a safety function assets, and
    - D = confidentiality,
    - I = authenticity (integrity),
    - P = availability.

Root threat (i.e. threat to the security of WLAN) and the threat of the first layer is not due to their universality in the methodology used. Starting threats in the proposed methodology will be the threat of the second layer.

After that we have all important assets and threats that affecting it. Proposed threat analysis is possible summarize into next six steps.

1. Compile description of wireless local area network on security viewpoint. Identify security relevant information (e.g. assets, HW, SW, data),
2. Define nine sub threats for each asset. Defined sub threats are not elementary.
3. For all threat that is not elementary define sub threat. Sub threats cannot be in same surface. Then we can find next sub threats.
4. In case we identifying threat that is not defined like elementary, go to point number 3.
5. By supposed target of attacker analyse from elementary threat compose threat. Those threats describe by sententional calculus.
6. Describe objectivity (probability) of elementary threats.

CONCLUSION

Security is one of the most used terms at this time and wireless technology is branch that can utilize it. Importance of connection between security and wireless technology we can see very closely in our lives and our business. This is a reason why I focused this article on these two aspects and analyze a new possible approach to wireless network security taxonomy and propose a new threats analysis methodology. Proposed threat analysis defined basic steps pointed to final proposal of countermeasures.

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MATHEMATICAL COMPETENCES DEVELOPMENT USING E- LEARNING – RESEARCH CONCEPT

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Abstract: *The article presented main assumptions, ideas and doctor thesis' conceptions about development of mathematical competences with the help of e-learning . It is being done at pedagogical department of University in Ostrava. Findings were also presented, which were aimed at students and teachers. Of higher education schools of Silesia district in Poland. They referred to knowledge and use of modern IT and communication technologies in education and distance learning.*

Keywords: mathematical competences, e-learning, IT technologies in education process.

INTRODUCTION

The usage of Information Technology in Polish schools are becoming more and more popular. The number of teachers who notice huge benefits coming from modern technologies supporting teaching and learning process is still increasing. Using them during some classes can not only be helpful in improving some skills and achieving more and more IT competences, but also helps us show complicated mathematical and its related fields' issues more clear.

In modern society, where knowledge is very important, possibility of getting new skills and information is becoming essential. E-learning has become a very popular form of acquiring knowledge lately, because of the fact that we are able to study at most prestigious universities around the world, regardless where we live and develop traditional teaching methods, making them more effective.

The feature of distance learning is the fact, that every student becomes a member of society and takes responsibility for his/her learning, as well as the other members' learning process.[1] Prof. B. Siemieniecki understands e–learning as a distance learning with the help of electronic media. He claims in his research:

> *This is interactive method of teaching, where latest IT achievements were used, all information are send by the internet and computer networks LAN, often with support of Audio,video and CD materials.*[2]

E-learning is not popular method of learning among high schools education system in Poland, what research results show.

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1. THE RESEARCH RESULTS AIMED TO TEACHERS AND STUDENTS OF HIGH SCHOOLS IN KATOWICE

The survey consisted of 21 questions. It can be divided into two main groups, because of kind of information they brought:

- Initial questions brought general information about respondents
- Following questions were connected with the usage of IT technologies in education.

Final questions were about the level of e-learning knowledge among teachers and students.

The survey was carried out among teachers and students in Katowice. Next one is being planned and aimed to other Silesian teachers as well as other regions of Poland. Similar research is being taken into consideration among students and teachers of Czech high schools in Ostrava.

130 students and 120 teachers were questioned during the survey. The research was conducted through the internet and personally.
There were 40 men (33,3%) and 80 women (67,7%) among teachers and 60 men (46,15%) and 70 women (53,85%) among students questioned during the survey. When we mean the age of questioned: 40 (30,76%) between 16-17 years of age and 90 (69,24%) between 18-19. Most teachers were between 46-55 – 45 (37,5%) and 36-45 – 30 (25%), so they were mostly experienced ones.

Table 1 shows us clearly that most 70 (58,34%) respondents graduated from University.

Type of Academy	**Number of teachers**	**Rate**
Traditional University	70	58,34%
Pedagogics	30	25%
University of Technology	10	8,33%
Other Academies	10	8,33%
Summary	**120**	**100%**

TABLE 1. Type of Academy
Source: Own research

Next questions was about broadband of the internet connection. Almost 117 (90%) students and 114 (95%) teacher state, that they have got internet access.
Around 104 (80%) students and 84 (70%) teachers are happy with their computer skills.

Another question was connected with popular computer programs useful when they prepare before classes. These are the results:

Programs	**Number of teachers**	**Rate**	**Number of students**	**Rate**
I do not use any programs	0	0%	0	0%
Microsoft Word	50	41,66%	35	26,92%
Microsoft Excel	30	25%	25	19,23%
Microsoft PowerPoint	20	16,66%	40	30,76%
Utilities for database	5	4,16%	5	3,84%
HTML editor and a tool	10	8.36%	15	11,53%
Other software and applications	5	4,16%	10	7.72%
Summary	120	100%	130	100%

TABLE 2. Computer programs useful in preparation before classes
Source: Own research

Summarizing the results, we can notice, that both teachers and students during their preparations before classes use Word, Excel and PowerPoint. There are no people who do not use computer programs at all, what proves that everybody sees the benefits of using them.

Then, they were questioned about educational programs they used during mathematics classes

- teachers

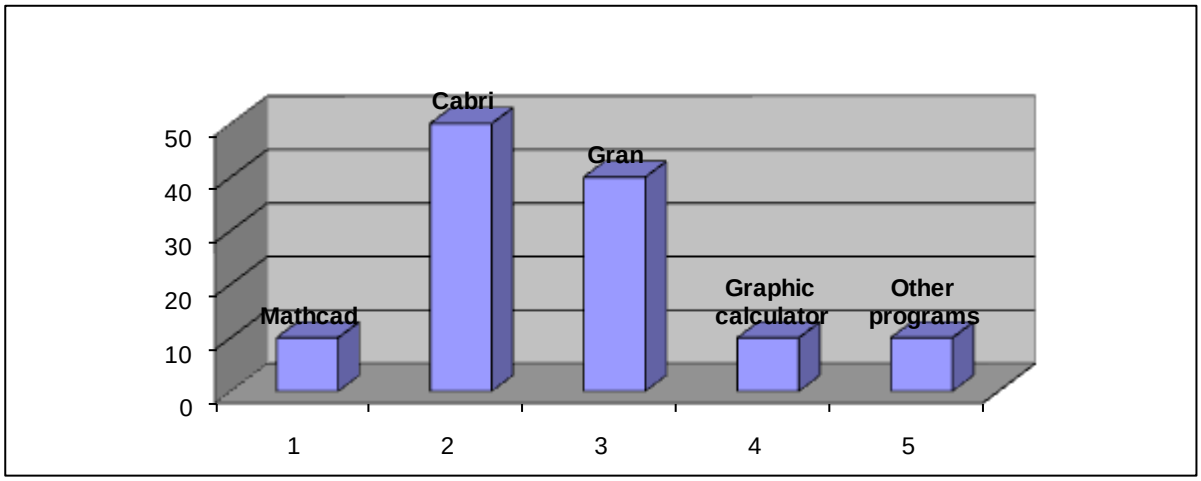

Chart 1. Educational multimedia during mathematics classes
Source: Own research

- students

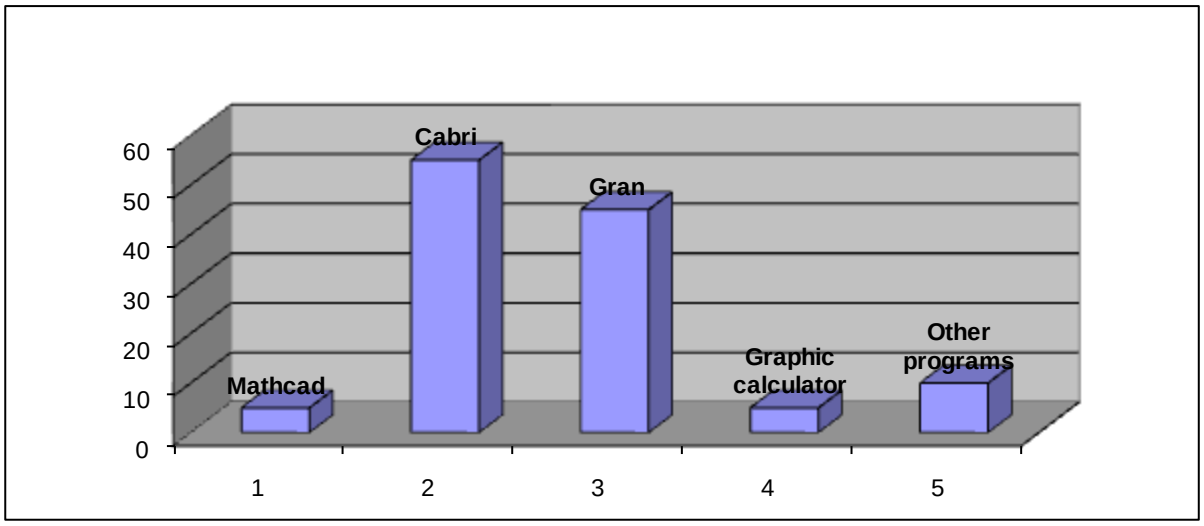

Chart 2. Educational multimedia during mathematics classes
Source: Own research

The most popular programs used by surveyed are Cabri and Gran.

Next question was connected with e-learning, teachers and students were asked, for what kind of people e-learning seems to be the best solution.

Answers	Number of teachers	Rate	Number of students	Rate
Disabled people	40	33,33%	20	15,38%
People living abroad	50	41,69%	40	30,76%
People who work and do not time to study	5	4,16%	5	3,86%
Day school learners	10	8,33%	5	3,86%
Extra mural learners	10	8,33%	40	30,76%
Evening classes learners	5	4.16%	20	15,38%
Summary	120	100%	130	100%

TABLE 3. People, for whom e-learning is the best solution
Source: Own research

Most teachers 40 (33,33%) admit, that e-learning is suitable for disabled, and 50 (41,69%), that for those living abroad. 40 (30,76%) students claim, that it is proper way of learning for extra mural learners, the same number of students say, that it is useful for people living abroad.

Then people were asked about the popularity of distance learning in Poland. 84 (65%)students state, that it is not popular form of learning, but 55% teachers claim, that interest among learners seems to be quite moderate.

Another question was connected with their own learning preferences. The vast majority: 97 (70%) students and 90 (75%) teachers prefers mixed form (traditional plus the internet). Final question was about advantages and disadvantages of distance learning.

Answers	Number of teachers	Rate	Number of students	Rate
Individual pace of learning	10	8,33%	20	15,38%
Possibility of learning regardless of the place and time	70	58,33%	50	38,46%
Lifelong learning possibility	20	16,68%	30	23,07%
Lower cost of education	10	8,33%	10	7,71%
Learning from home	10	8,33%	20	15,38%
Summary	120	100%	130	100%

TABLE 4. Distance learning benefits
Source: Own Research

Surveyed 70 (58,33%) teachers and 50 (38,46%) students say, that the most important benefit of distance learning is the possibility of learning regardless of the place and time.

Answers	Number of teachers	rate	Number of students	rate
High internet costs	10	8,33%	10	7,71%
Lack of computer skills	10	8,33%	10	7,71%
Lack of motivation and self learning skills	30	25%	50	38,46%
Lack of personal contact with a teacher	50	41,66%	40	30,74%
Lack of personal contact with other learners	20	16,68%	20	15,38%
Summary	120	100%	130	100%

TABLE 5. Obstacles connected with e-learning
Source: Own Research

Surveyed state, that the biggest problem while distance learning, is lack of contact with a teacher and lack of self learning motivation.

Eventually, respondents were asked, whether e-learning is used in their own schools. Only 10% students took part in IT e-learning courses conducted by Information technology teachers, and 15% teachers took part in IT and English postgraduate courses.

2 THE MAIN CONCEPT OF RESEACH IN DISERTATION THESIS WITH TOPIC MATHEMATICAL COMPETENCES WITH E-LEARNING UTILIZATION

To define the range of mathematical competences, we should think, what and whom teaching-learning process is typically connected with.

According to W. Kopaliński, "competence is features, range of powers(…);range one's knowledge, skills, responsibility(…)".[3] but personal competence means, owning rights, power of attorney to act, to decide, having proper qualification to judge and evaluate(…)".[4]

Lifelong learning issue was noticed and appreciated by European institutions –European Parliament and Council of The European Union, which advise European countries, to take action to develop key competences, which are very important in Lifelong learning process. 8 key competences were defined, they are essential to self – realization and personal development, to be an active citizen, full social integration and employment. They are as follows:

- Native language speaking;
- Foreign languages speaking;
- Mathematical and basic scientific and technical competences;
- IT competences;
- Ability to learn;
- Social and citizenship competences;
- Initiative and entrepreneurship;
- Awareness and cultural expression

We should focus on mathematical competences, well defined by Mogens Niss. According to his opinion, it is *ability to understand, judge, implementation and use of mathematical activities in mathematical and non mathematical context(...) Mathematical competence consists of two abilities except knowledge. First is ability to ask a question and to answer*

[3] Kopaliński W., *Słownik wyrazów obcych i zwrotów obcojęzycznych*, Państwowe Wydawnictwo „Wiedza Powszechna", Warszawa 1967, s.201

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them, according to a given topic, to extent and use of mathematics. Second is based on understanding and usage of mathematical language and tools".[5]

The main objective of PhD thesis work is to prove, that the use of e learning has got influence on development of mathematical competences. Special e learning course will be developed to prepare for compulsory mathematics matura. It will be placed at Silesian University website: (http://moodle.weinoe.us.edu.pl) in Cieszyn or author's own administrated website. During the course, some educational programs will be used, connected with teaching and learning mathematics issues. About 120 High school students from Silesia district will take part in the research. They will be divided into two groups: experimental and test group. Experimental group will be using computer programs to learn mathematic unlike test groups. Then, preliminary research will be conducted (preliminary check of the quantity and quality of knowledge in the different areas of mathematical competences).

After the course a test will be done. Area, range and number of questions will be exactly the same. (Similar to matura examination). In the next stage, the author will do distance research to examine sustainability of knowledge. Research will be done after six weeks time. Finally, after choosing proper statistical method, research will be analyzed.

CONCLUSION

The article presented main assumptions, ideas and doctor thesis' conceptions about development of mathematical competences with the help of e-learning. It is being done at pedagogical department of University in Ostrava. Defined the concept of key and mathematics competences. Findings were also presented, which were aimed at students and teachers of higher education schools of Silesia district in Poland. They referred to knowledge and use of modern IT and communication technologies in education and distance learning.

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KNOWLEDGE SYSTEM IN C2 AND NEC CONCEPT

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Abstract: *The paper deals with the first phase of project called Knowledge Management of NEC concept in the Czech Armed Forces. The idea of knowledge system execution is mentioned. Formal language of Topic Maps is presented as selected tool for implementing knowledge system in command and control processes. The inputs and outputs of Czech C2 system were chosen to implement the first and the second prototype of ontology.*

Keywords: knowledge, command and control, NEC, ontology, C2.

INTRODUCTION

The article deals with the army project "Knowledge Management of NEC concept in the Czech Armed Forces". It should create a system support of NEC concept.

Finding, saving and using of knowledge is not currently supported in the Czech Armed Forces. Knowledge is usually strongly coupled to a particular person and it is not ensured that knowledge will remain in the army after retirement. This fact should be changed by using knowledge system and approaches that are connected to these systems. The project is focused on methodologies, methods and tools that can support knowledge management in the NEC. Main outputs should be the ontology of command and control system and the security ontology in NEC scope.

1. KNOWLEDGE SYSTEMS

General idea of knowledge systems is based on concept of three processes:

- find information;
- understand information ;
- use information.

In the NEC concept these processes should support the decision making process in the high level of command and control. These processes describe at general level the main goal of NEC concept.

Processes mentioned above must be designed and supported by particular technology to:

- search adequate information on one demand;
- deliver the right information in right place in the right time;
- analyze information to disclose a new association;
- organize information structure to get readable navigation.

The concept of NEC is modeled by four domains: physical, information, cognitive and social. The networked units get data from the battlefield in the physical domain. Unit interconnection increases information sharing and units cooperation in information domain. Architecture of sharing information is not strictly hierarchical but spread and information is available for everyone. Shared information and collaboration increase quality of information and shared knowledge of situation in cognitive domain. Shared knowledge enables self synchronization of units in the social domain. A supported unit doesn't have to ask for help a supporting unit. The supporting unit starts this process by its own.

The similar approach can be seen in a knowledge system. There is also concept of data, information and knowledge that are created, shared and used. Data creates picture of reality. Information shows data in consequences and association. Knowledge is suitable and early visualized information. Knowledge system creates new knowledge layers that contain information that are relevant to the user requests. The both worlds (NEC, knowledge system) use the shared knowledge.

2. ONTOLOGY AND KNOWLEDGE SYSTEMS

Ontology is a core of the designed knowledge system. It defines a correct and exact interpretation of individual themes. It creates universal language in the problem domain and enables saving our knowledge. Ontology can be created by ontology languages or by Topic Maps. Ontology languages, for example Ontology Web Language (OWL) [2], are designed to formal depict the problem domain in pre-defined way, based on the XML standard. It can be used to identify new relations and consequences in the problem domain that were hidden before. OWL can be also easily processed by computers and process of searching new association can be automated.

Topic maps is an alternative way to interpret knowledge but was originally optimized for human interactive work. Topic maps are designed to interpret knowledge, not to search a new one.

The main concept of topic maps is based on:

- Topic (theme) – alias for the subject that we want to represent in the computer. One topic represents only one subject.
- Subject – part of the real world that is depicted by theme.
- Instance – internal attribute of theme that is stored directly in topic maps or external attribute that is connected to external source via http.
- Association - express the relation between topics. It can have type and number of instances.

In the project of "Knowledge system in C2 and NEC concept" was decided to use the Topic maps to create an ontology. The main reason was the intuitive and natural way of its design for human being.

3. IMPLEMENTATION PHASES

Implementation of knowledge system based on topic maps can be described by the picture on Figure 1. Available and suitable resources must be found. Then the analytic tools can support process of searching the key words. In the case of non digital data, this must be done by human being. Output of this process is finding base with main themes that are essential for selected problem domain. Then the knowledge base must be created. It comprises design of Topic Maps. After that, the software can deliver the knowledge that is demanded by end user – commander.

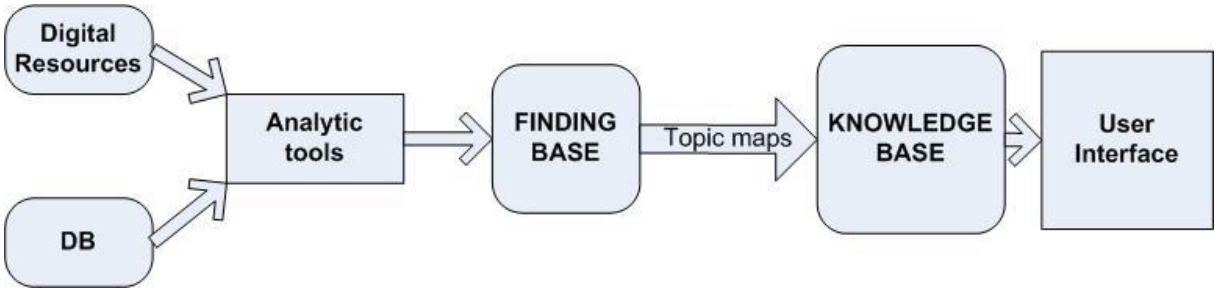

Figure 1. Basic principle of creating of knowledge system with Topic Maps.

First phase of implementation will comprise these steps:

1. Create complex index of key words with SW support of NEC Feasibility Study [1].
2. Create complex index of key words from the Executive summary of NEC Feasibility study.
3. Choose the relevant themes.
4. Omit non relevant themes.
5. Create association with the SW support between themes.
6. Create topics maps.

After this phase we will have knowledge layers that can be easily navigated and offered to end user – commander. At that moment there will be the first prototype that will show us the potential benefits of trivial knowledge system. After this phase the second prototype must be created. It will be based on indexes from all inputs and outputs in the Czech C2 system.

The main input and output data in C2 system:

- gatherer for command and control process;
- operation order;
- partial order;
- combat report;
- briefing plans I-VI;
- reconnaissance plans I-IV;
- common operational picture;
- database of friendly forces;
- formal messages.

CONCLUSION

The project of Knowledge Management of NEC concept in the Czech Armed Forces tried to show the potential benefits of knowledge system implementation at the tactical level view – C2 system and in the operational view – NEC concept. The main implementation issue is to get the relevant input data and be able to create the association among main topics. It will need cooperation with the experts in the C2 a NEC domain. Tovek software solution can support all phases of design and implementation of this project.

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JOINT VIRTUAL TRAINING IN THE ARMY OF CZECH REPUBLIC

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Abstract: *This paper informs about distributive simulation interconnection, it reveals first planes and ideas, the federation architecture, and how to help in implementation of the High Level Architecture standard for joint training in the Army of the Czech Republic.*

Keywords: HLA, DIS, distributed simulation, virtual simulation, constructive simulation, training.

INTRODUCTION

There are various (by purpose, starting date of routine operation, or common standards implementation) simulation systems in the Army of the Czech Republic (ACR) training facilities. Taking part in multinational activities (from live to computer assisted exercises, peace-keeping as well as humanitarian and combat operations) the ACR demand for interoperability in ways of doing the business lead in strong standardization effort in the simulation area. Ground Forces and the Air Force did not build common training network because of traditional focus on pilot individual training that was of little use to harness into growing simulation centers covering the whole spectrum training needs of Ground Forces (GF). In fact, high dynamics of flight trainer parameters and state variables is still a challenge to transfer within one network, exceeding campus area. Especially when the GF commander and staff simulator is running brigade level exercise in high detail.

1. DISTRIBUTED SIMULATION

Training simulation systems have showed their potential in improving commanders' leadership skills before they will take the responsibility for lives and real equipment. Growing promptness of simulators and their ability to help various scenarios assessment, even in combat zone, suggests their usage as a part of decision support systems. In such complex environment, simulation systems will be able to work with both fictitious data and classified intelligence information, and the interface between C2 and SIM systems must be automated.
In this paper, we limit the scope to only one important feature of contemporary simulation systems – their distribution. It helps to build extensive scenarios without having to use extremely powerful grid computers; sound standard for network interface also supports reusability of legacy models, well validated, though created long time ago for various purposes. Interconnection of existing simulators or simulations can create new complex simulation environment. It will save costs, and, as well create a new possibility in training process.

The Czech Armed Forces currently use Distributed Interactive Simulation (DIS) standard to create the distributed simulation environment. In 2008 Czech Armed Forces accepted the High Level Architecture (HLA) standard. The HLA is expected to fully replace legacy standard DIS, especially in technologically advanced countries. The HLA shows its power in

distributed environment with high number of entities, WAN networks, and dissimilar simulators interconnection. The Czech Army will have to implement HLA standard in near future. Otherwise, the cooperation in international exercises based on simulation technologies will be affected.

2. THE RESEARCH PROJECT GOAL

Distributed training environment is currently used in the Centre of Simulation and Training Technologies (CSTT) in Brno and Vyškov in the Czech Republic. The CAX training with the constructive and virtual simulations is employed in Brno; live simulation together with virtual simulation is deployed in Vyškov.

Virtual training environment is aimed only to the ground forces in the Czech Armed Forces. Although there are another simulation centers on Air Force bases in Čáslav and Náměšť nad Oslavou, equipped with ALCA 159 combat aircrafts and JAS-39 GRIPEN supersonic fighters, there is no joint training environment for ground and air forces. The current project "Distributed simulation with the HLA standard in the Czech Armed Forces" is focused on creating of a prototype of joint training environment with the Air Force simulator and Ground Forces simulator.

The project is divided into following phases:

- Analysis of JAS 39 GRIPEN HLA interface.
- Analysis of possible open-source Runtime Infrastructure (RTI) HLA solution.
- Design of simulator connection based on HLA.
- Federation design based on Federation Development and Execution Process (FEDEP) and Base Object Models (BOM).
- HLA-based simulator interconnection implementation.

The method of object analysis and design supported by the UML language will be used in the development phases. The diagram of uses cases, class diagram and interactivity diagram will be used as project tools.

3. THE PROTOTYPE ARCHITECTURE

State of the art in the field of distributed simulation is defined by DIS, HLA and Test and Training Enabling Architecture (TENA) standards. The TENA is concentrated on Live Simulation world and HLA is widely used in the Virtual and Constructive Simulation. The HLA standard has currently more implementation then DIS in the large training environments with heterogeneous training facilities. The HLA is selected as the main architecture approach together with the Federation Development and Execution Process (FEDEP methodology) and Base Object Model (BOM) in this project.

The HLA standard is composed of:

- Run-Time Infrastructure (RTI),
- Interface specification and
- Object Model Templates (OMT).

RTI is the software layer with responsibility for all communication between simulators. Interface specification defines communication between simulator and RTI layer in formal way. OMT defines functionality of simulations models.

Number of different RTI was tested to gain an experience and to help in future choice. These libraries and FEDEP methodology create FEDERATION that ensure fully interoperable training environment. The FEDEP utilizes the BOM that brings reusability and possible reconfiguration of models (these are called FEDERATES).

The full-mission simulator of supersonic fighter JAS 39 GRIPEN is currently used in Čáslav Air Force Base training facilities. The simulator vendor, SAAB Training Systems, declares its HLA compatibility. This simulator is the first FEDERATE in the whole architecture.

The second FEDERATE is prototype of low cost simulator of terrain vehicle UAZ in version 1.0. It has not implemented the HLA interface yet.

The third FEDERATE is visualization station that will create the common operational view on the synthetic environment. It has not implemented the HLA interface as well.

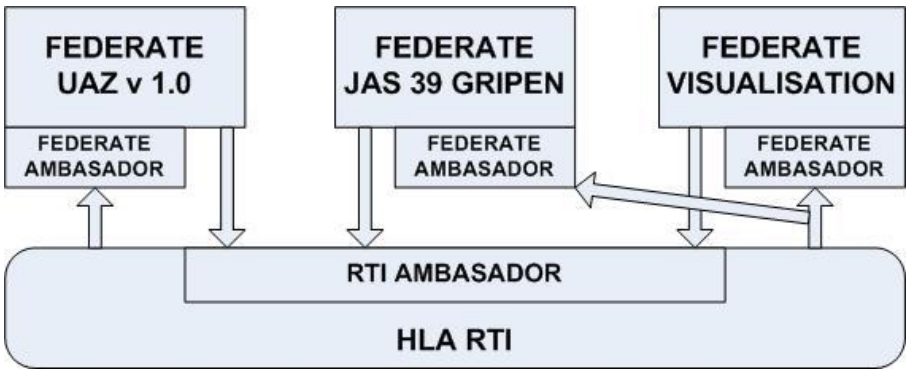

Figure 1. Architecture of proposed FEDERATION

CONCLUSION

In current phase of project, we deal with niche technology problems to show the HLA ability to replace today mainstream distributed simulation standard – DIS. Not all necessary steps were tackled here because any working federation that will be in routine use must reflect many aspects. After resolving all technical details there might still be a barrier in minds of Air Force and Ground Forces commanders and users because their operational areas are different, there are different views of joint effort procedures, we still have no common operation picture. This project is the first step to enable the joint audience to discuss and to go ahead.

EXPERIENCE WITH BLENDED (DISTANCE) LEARNING STUDY MATERIALS

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Abstract: *Distance education does not replace traditional classrooms or get rid of the difficulties and barriers of traditional classrooms, but it does provide the potential to provide greater service to more individuals seeking learning opportunities.*

The ability or capability to learn is a complex psycho-physiological trait, which develops over a process of learning from certain innate prerequisites for learning. Other determinants that may influence the course and result of learning are for example previous learning experience, personal attitude to learning, willingness to learn, interest in learning, influence of superiors and fellow-workers, applied methods of education, the character and structure and arrangement of teaching materials, etc.

Blended learning appeals to students who seek specific learning not readily available in traditional programs, who may not be located near an institution, or who, for a variety of reasons, may wish to complete their degree by an alternative delivery system. This delivery system is not appropriate for everyone. Students who are self-motivated, independent learners will thrive in this environment.

The education and training process at the University of Defence is markedly military oriented. It develops the students in independence, creativity, endurance, devotion and self-discipline. The studied branches of human cognition are explained primarily with respect to military applications. However, the graduates are generally educated at university level ready for wide range of career positions both in military and civilian lives.

The aim of this paper is to give information about education process of mathematics of military officers in blended (distance) study, and moreover, to present a new multimedial study material prepared at the Department of Mathematics and Physics, done with the support of the grant of MSMT 110/2007.

Keywords: blended learning, distance learning, electronic learning, interactive CD, multimedia study materials.

INTRODUCTION

The education and training process at the University of Defence is markedly military oriented. It develops the students in independence, creativity, endurance, devotion and self-discipline. The studied branches of human cognition are explained primarily with respect to military applications. However, the graduates are generally educated at university level ready for wide range of career positions both in military and civilian lives.

The aim of this paper is to give information about education process of mathematics of military officers in combined study, and moreover, to present a new multimedial study material prepared at the Department of Mathematics and Physics.

1. LEARNING PROCESS

1.1.Electronic Learning

Electronic learning (or e-Learning or eLearning) is a type of technology supported education/learning (TSL) where the medium of instruction is a computer technology, involving particularly digital technologies. E-learning has been defined as "pedagogy empowered by digital technology". In some instances, no in-person interaction takes place.

E-learning is used interchangeably in a wide variety of contexts. In companies, it refers to the strategies that use the company network to deliver training courses to employees. In the USA, it is defined as a planned teaching/learning experience that uses a wide spectrum of technologies, mainly Internet or computer-based, to reach learners. Lately in most Universities, e-learning is used to define a specific mode to attend a course or programmes of study where the students rarely, if ever, attend face-to-face for on-campus access to educational facilities, because they study online. (http://en.wikipedia.org/wiki/E-learning)

1.1.1 Goals of e-learning

E-Learning lessons are generally designed to guide students through information or to help students perform in specific tasks. Information based e-Learning content communicates information to the student. Examples include content that distributes the history or facts related to a service, company, or product. In information-based content, there is no specific skill to be learned. In performance-based content, the lessons build off of a procedural skill in which the student is expected to increase proficiency.

1.2 Blended learning

Blended Learning is the process of incorporating many different learning styles that can be accomplished through the use of 'blended' virtual and physical resources. Learning styles refer to the many ways in which people learn, through blended learning this can be accomplished by creating a variety of learning assignments and activities with the use of technology and instructor and peer interaction.

1.2.1 Goals of Blended Learning

Blended learning appeals to students who seek specific learning not readily available in traditional programs, who may not be located near an institution, or who, for a variety of reasons, may wish to complete their degree by an alternative delivery system. This delivery system is not appropriate for everyone. Students who are self-motivated, independent learners will thrive in this environment.

1.2.2 Role of a teacher (instructor)

The instructor can also combine two or more methods of delivery of instruction. A typical example of the delivery method of blended learning would be a combination of technology-based materials and face-to-face sessions used together to present content. An instructor can begin a course with a well-structured introductory lesson in the classroom, and then to proceed follow-up materials online. The term can also be applied to the integration of

elearning with LMS using computers in a physical classroom, along with face-to-face instruction.

The role of the instructor is critical, as this requires a transformation process to that of learning facilitator. Quite often, with the onslaught of baby boomers going back to school and pursuing higher education the skills required for technology use are limited. The instructor then finds him/herself more in the role of assisting the student with computer skills and applications, accessing the internet and encouraging them to be independent learners. Blended learning takes time for both the instructor and learner to adapt to this relatively new concept in delivering instruction.

1.3 Distance Education or Distance Learning

Distance education, or distance learning, is a field of education that focuses on the *pedagogy* and *andragogy,* technology, and instructional systems design that aim to deliver education to students who are not physically "on site". Rather than attending courses in person, teachers and students may communicate at times of their own choice by exchanging printed or electronic media, or through technology that allows them to communicate in real time and through other online ways. Distance education courses that require a physical on-site presence for any reason including the taking of examinations is considered to be a hybrid or blended course of study.

1.3.1 Goals of Distance Education

Distance education is a method of education in which the learner is physically separated from the teacher and institution sponsoring the instruction. As with any type of education there must be a teacher, one or more students, a curriculum that the student can learn from and the teacher can teach from. The teacher must still teach the student, assess, give guidance, and be prepared for test. All of this is accomplished through two-way communication. If materials are provided to the learners, they are structured in a way that helps with learning at a distance.

1.3.2 Different types of Distance Education

In the early days of distance education the teacher would travel to very remote sites and teach a class, or corresponded with the students through the mail. Teachers would later go on to use the telephone, or with the invention of the fax machine the fax machine. This all has been a method of reaching remote students for some time. The students would receive the course instructions then do the assigned tasks and return them to the instructor for grading or reassignment.

With new technology the quality of distance learning has improved much better. A teacher now can reach a student over a hundred miles away in only a few seconds with e-mail. Also with computers and new forms of video, and audio there has been an increase in time effectiveness and the delivery of information. Audio and video with the help of networks, fiber optics, and satellite has brought to distance learning a classroom that look just like regular classrooms because teachers and students can interact with two-way video and one-way video with two-way audio systems. There is also computer software that uses computer conferencing, e-mail list, and discussion boards. This is very useful to a learner who has difficulty scheduling a specific time and or place for course work.

1.3.3 Generations of Distance Education Technologies

	First Gener.	Second Gener.	Third Generation	Fourth Generation
Time Frame	**1850s to 1960**	**1960 to 1985**	**1985 to 1995**	**1995 to 2005 (est.)**
Media	➢ Print (1890+) ➢ Radio (1930s) ➢ Television (1950s and 1960s)	➢ Audiocassettes ➢ Television ➢ Videocassettes ➢ Fax ➢ Print	➢ Electrical mail, chat sessions, and bulletin boards using computers and computer networks ➢ Computer programs and resources packaged on disks, CDs, and the Internet ➢ Audio conferencing ➢ Seminar and large room videoconferencing via terrestrial, satellite, cable, and phone technologies ➢ Fax ➢ Print	➢Electrical mail, chat sessions, and bulletin boards using computers and computer networks plus high-bandwidth transmission for individualized, customized, and live video inter-active learning experiences ➢Computer programs and resources packaged on disks, CDs, Internet ➢Audio conferencing ➢Desktop videoconferencing via terrestrial, satellite, cable, and phone technologies ➢Fax ➢Print
Communication Features	➢ Primary one-way communication ➢ Interaction between faculty and student by telephone and mail ➢ Occasionally supplemented by onsite facilitators and student mentors	➢Primarily one-way communication ➢Interaction between faculty and student by telephone, fax, and mail ➢Occasionally supplemented by face-to-face meetings	➢ Significant broadband communication from faculty to students via print, computer programs, and videoconferencing ➢ Two-way interactive capabilities enabling asynchronous and synchronous communication between faculty and students and among students ➢ Internet good for text, graphics, and video snippets	➢Two-way interactive real-time capabilities of audio and video ➢Asynchronous and synchronous communication between faculty and students and among students ➢Full 30-frame-per-second digital video transmission with databases of content resources available via the Internet and World Wide Web ➢Lengthy digital video programming available on demand

Table 1. Generations of Distance Education Technologies

2. EDUCATIONAL MATERIALS OF THE UNIVERSITY OF DEFENCE

The University has to accept the role to prepare all its study materials like Self Instructional Material (SIM), which has a crucial role to play in relation to the standard and performance of Distance Learners. The experienced experts has to develop such Study Materials using their experience and expertise to prepare the lessons as if a live teacher is present in the lesson itself in order to help the distant learner to obtain all the learning experience as if he/she is in a classroom. The pursuit of the University is to make the Study Materials self-explanatory, self-contained, self-directed, self-motivating and self-evaluating while the student goes through the learning process.

However, it should be noted that the study materials on different subjects represent the course materials in abridged form. Therefore these study materials are only supplementary to text-books and not substitutes for textbooks**.** As such, students are advised to read the relevant textbooks in order to acquire detailed knowledge of the subjects while preparing for examinations.

During semester there is no possibility to explain and practise everything of educational schedule of given subject because of various reasons. Some chapters are left for individual selfstudy and thus it is necessary to create a good quality educational support.

Nowadays the Department of Mathematics and Physics has got its own textbooks for the whole course of mathematics requlars students. Moreover, students of the University of Defence have a great advantage because they get all required educational material for free.

There is still lack of specially formed literature for students of distance study and doctoral study. Thanks to cooperation of the University of Defence with Ostrava and Opava universities and thanks to ESF and MSMT grants we managed to create some textbook for both composite and distance education.

The aim of the these grants has been and still is a compilation of study materials so that they can enable individual studies and thus minimalize the number of contact lessons with the teacher. The compiled texts could be used by students of all sorts of study. Students of composite and distance types of study can use them for selfstudy, regular studentscan improve their learned knowledge can with its help improve.

Last but not least aim of these projects is enabling to improve qualifications of wide range of people who could not start their university studies immediatelly after school leaving exam because of various reasons.

2.1. Interactive CD-ROM

The subject experts prepare study materials for the courses. Study materials are prepared as a help for the students to prepare themselves for the examination. Study materials with model questions and guidelines will be supplied to students. Contact programmes will supplement the study materials. In the frames of mentioned above projects, the following materials were created by staff of Department of Mathematics and Physics, Faculty of Military Technology of the University of Defence in Brno.

- standard didactic texts in printed form,

- e-learning study material, accessible on the Internet,
- test exercises for individual subjects in which student can check to which extent they mastered the problems done in the class
- multimedia CD.

The first CD covers basics of differencional and integral calculus of a function of one variable and the second CD differential calculus of function of more variable. The title page of second CD is on the folowing picture.

Picture 1. Multimedial CD

2.2. Teaching experience

In the school year 2006/07 the Department of Mathematics and Physics published the first multimedia study material. It was a multimedias CD "Integral calculus of function of one variable". This material originated thanks to cooperation of the University of Defence with VŠB – TU Ostrava and thanks to ESF grant number CZ.04.1.03/3.2.15.1/0016 „Operational programme of Development of Human Resources – Educational Support with Prevailling Distance Components for Subjects of Study on Theoretical Basis". The same year also a textbook for both composite and distance education was printed. For futher information about the project go to:http://www.studopory.vsb.cz.
Students of school year 2006/2007 were in the first lesson of mathematics informed about the opportunity to use the first CD with above mentioned interactive form of textbook, except for regular printed textbooks (these textbooks are available for all our students free of charge). Teachers thoroughly explained the CD content to students, its installation and all possibilities

it offered – i.e. especially the greater number of solved and unsolved examples, interactive tests and animation. Each student got his/her own CD free of charge. During the whole semester students were given homework from the CD and they were repeatedly informed about the possibilities of particular chapter in the electronic form of the textbook when encountered in the class.

These students used the interactive CD, which includes the above mentioned titles of didactic texts, as a study aid that completes and extends the material taught at ordinary lectures and traditionally lead seminars. The CD contents with its well made visual and typographic sites suitably complemented the didactic texts and not always perfect notes from lectures and seminars.

Students positively evaluated not only the synoptic text of both textbooks but also a lot of tests and pictures as well as interestingly made animations. Those students who actively worked with the electronical text achieved better results because they got better idea and notion about given theme thanks to the pictures and animation. They also positively accepted checking tests and questions that helped them to show the level and quality of learned knowledge.

Because of good experience from the first multimedia CD another multimedia CD "Differential calculus of function of more variables" was created a year later. This CD and texbook were done due to cooperation with Silesian University Opava, grant MSMT 110/2007.

2.3. Examples

The next pictures show how the text is created.

Picture 2. CD content

3. CONCLUSION

The potential use of distance education within all disciplines is the tremendous as this application to higher education evolves within our culture. Distance education does not replace traditional classrooms or get ride of the difficulties and barriers of traditional classrooms, but it does provide the potential to provide greater service to more individuals seeking learning opportunities.

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POSSIBLE 'ROADBLOCKS' IN DISTANCE LEARNING DEVELOPMENT

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Abstract: *The paper deals with certain possible 'roadblocks' on the way of the successful distance learning (DL) development in the Czech Republic with regard to the University of Defence (UoD) environment. It presents views of authors from two different UoD departments – Department of Communication and Information Systems (CIS) and Language Training Centre (LTC). The survey of possible 'roadblocks' of DL development covers main problem areas only. The authors hope, that it can become a basis for discussion of all teaching process participants.*

Keywords: course, distance learning, e-learning, motivation.

INTRODUCTION

The growing importance of distance learning (DL) is the prominent attribute of education at the beginning of the 3rd millennium. The acquired level of technical development makes it possible for majority of people in developed countries to utilize methods of education based on computer networks and multimedia. The important role is played especially by e-learning.

By DL we understand (in this article) any form of education realized at a distance, where a student and a teacher are not in the direct face to face contact (F2F). This education can be accredited as well as non-accredited, e.g. various courses, that can be fully realized on the DL basis. Some methods and approaches of DL can be used as a support of full-time and combined study form that are used at the UoD.

1. POSSIBLE 'ROADBLOCKS' IN THE DISTANCE LEARNING DEVELOPMENT

In spite of the undisputable success that was achieved in the field of the DL and its promising prospects, authors want to draw the users' attention to certain possible barriers that might influence the DL successful use and application.

Possible 'roadblocks' in DL development can be as follows:

1.1 Violation of the student privacy

One of the DL tendencies is the creation and use of new LMSs that have more and more sophisticated tools for collection of data concerning individual students. These tools are used more and more frequently, even though it is not often clear how to reasonably utilize all collected data. This fact can have some unpleasant consequences [6].

Above all, in this case we can indisputably speak about the intrusion into the students' privacy and, what is more, the detailed collection of data concerning their study activities is carried out without their being aware of that. According to research in the former Military Academy in Brno, the considerable correlation between the level of students' computer literacy and the privacy requirement in the DL was found [1], [2], [3].

1.2 Incorrect interpretation of data concerning studies

The other problem can be caused by potentially incorrect interpretation of the gained data. To give an example, the time spent by a student at one of the chapters can be qualified at least in two entirely different ways. The longer time can mean that the chapter was written in an inapprehensible way and, as a result, reading and understanding it is more time-demanding, or, the chapter is very well written, a student often returns to it as it permanently gives him/her new information and motivation.

Unsubstantiated monitoring of duration of single students connection can cause and provoke stress as a result of the useless performance pressure, which can influence the students' motivation in a negative way.

1.3 Influence of tests and self-tests

Tests and self-tests should be an organic part of DL and have an important role in it. To make the best of them, students should be familiar with their purpose and the rules of their use. The important factor is their number, proportion, orientation and methodology of application.

Self-tests should be prepared with great caution, their results should provide students with profound information as to what extent they mastered the subject-matter of the single part or of the course as a whole. Their results should serve only for students' needs and should not be stored.

Test application in DL should totally eliminate the possibility of cheating. Otherwise, the validity of DL could be degraded.

1.4 Improper use of adapted and individualized study materials

The idea to adapt study materials for the individual students' needs is very tempting. In the university environment, the problem how to test the study style and the personality of a student is very complex. The reason is that students can be more complicated personalities and they cannot be objectively and profoundly assessed by the chosen or applied psychological test. Superficial assessment of a student, his/her qualification as a concrete study type and a consequent providing him/her with the material adapted in one way only can be very risky.

Students should not be deprived of the right to choose study materials by themselves and according their wish. They mostly know what works right with them.

1.5 Underestimation of socio-cultural differences

Socio-cultural differences of the target group must be respected and their implementation into study materials guaranteed [5]. It is one of the key motivation elements. The importance of

this aspect is growing in the process of accreditation of study programmes in foreign languages. Insensitively chosen examples can demotivate some target groups and even, which is worse, provoke inadequate students' reactions.

1.6 Lack of research in the proper study environment and ergonomics areas

DL requires research and creation of recommendations in the proper study environment and ergonomics as well as mental hygiene areas. Studying on-line provokes increased load, which consequently can result in certain specific health problems [8].

1.7 Inefficient exploitation of sources

According to great financial demandingness of the high-quality DL study materials development, fast amortization of the needed equipment and ensuring its high reliability, it is essential to utilize the existing limited sources in an optimal way.

Uncoordinated approach of the financial resources provider (state) to the study materials development makes the DL system more expensive. The European Union and the Czech Republic put money in many projects and DL study materials development is one of them. The authors think that results (outputs) are not centrally made public and accessible for study purposes in our country; legislative framework concerning spread of information about projects results (outcomes) is missing.

Willingness or, on the other hand, unwillingness to share created materials and knowledge resulting from projects financed by the state is of great importance for further DL development.

2. UNIVERSITY OF DEFENCE AND DL POSSIBILITIES

It is possible to develop DL methods successfully at the UoD in Brno. The first attempts to utilize DL elements at the UoD resulted from the co-operation of the former Language Department (now LTC) and Automated Command Systems and Informatics Department (now CIS Department). The outcomes of their co-operation were for the first time presented at the ITEC Conference in Amsterdam (2005) [4]. In that time the Study Portal of UoD was used for electronic study support and as a source of study materials [7].

According to a very large target group and a permanent language study support at the UoD, quality results were soon achieved. The main attention was focused on English language studies. They were subsequently presented at other conferences (e. g. ITEC London 2006 [10], Cologne 2007, Stockholm 2008). UoD paper by dr. Eva Stankova at ITEC 2008 in Stockholm 2008 was awarded as the 'Best paper of ITEC 2008' and she was consequently invited to the U.S. for the Florida I/ITSEC 2008 conference.

At the UoD DL elements are also utilized by other departments, e.g. the Mathematics and Physics Department. The Department of Communication and Information Systems (CIS) uses k209moodle LMS [9].

The CIS Department pays great attention to study privacy. Students can download study materials to local computers and can use and read them without any sort of monitoring.

In future we can expect that DL elements will be implemented in the accredited study programmes (in full-time as well as in the combined form of study). The same steps can be expected in case of some special courses organized by the UoD.

Foundation of the UoD centre for utilization of all existing sources and references would be very beneficial.

CONCLUSION

The Czech law recognizes three types of accredited study programmes (full-time, combined, distance). Distance study programmes accreditation needs meeting considerably strict requirements. That's why these programmes in the Czech Republic are quite exceptional. Some DL elements are mostly used as a support in a full-time and a combined study forms.

The proper implementation and utilization of DL elements at the UoD shows that this approach is effective, that it encourages, motivates students and teachers in this perspective direction.
The possible 'roadblocks' in DL development mentioned in this paper may become a basis for further discussion. The authors of the paper believe that they can be overcome.

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MODERN EDUCATION IN AREA OF DATABASE AND OPERATING SYSTEMS

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Abstract: *High-quality education in the area of database and operating systems needs a conformable academic background. The Silesian University in Opava, School of Business Administration in Karvina has an education portal that offers possibilities for publishing electronic study materials, webcasting papers, computer animations, and takes control of the education process with electronic courses. This environment is used for training in course "Database Systems" and "Operating Systems". The courses are guaranteed by the Department of Informatics in the Bachelor study program Managerial Informatics. Effective resolution of repeated student queries requires creation of a multimedia study tutorial in this environment. Adobe Captivate serves as good example of a suitable multimedia simulation product.*

Keywords: Database and operating systems, education, grid computing style, Oracle, UNIX

INTRODUCTION

The university environment must provide positive conditions for information technologies development, taking the needs of business subjects into consideration; therefore, informal cooperation between representative celebrities from all disciplines must exist. The Czech Republic's membership in the European Union brings a new call for innovation processes and results in a rather complicated situation. A good example of this situation is the excellent cooperation within the implementation of the Oracle database system in the education process of students and other interested persons at our faculty. I focus on the application "Oracle Enterprise Manager Database Control". This product serves as a tool for effective administering, monitoring, and optimizing Oracle database systems. The main product advantage is the use of the World Wide Web environment, so that the user does not need to know SQL commands to work with the database system.

Background for high-quality education builds an authorized environment for shared experiences and creates an availability of tutorials, tools for on-line access to study materials and animations, access to modern products and documentation, equipment, such as hardware and software, and HR demands. The correct education of all software products uses access to new versions of products, documentations, and, of course, needs global communication with experts, and support methods of virtualization and visualization. This situation is visible with implementation of Oracle database system, and UNIX operating system in education process. Interested participants are supported by a wide activities portfolio such as working seminars, specialized webpages for the Oracle database community system, and other products such as Oracle Wiki, blogs, personal distribution of the Oracle magazine, panel conferences, and meetings.

1. ACADEMIC BACKGROUND AND COOPERATION

The Silesian University in Opava, School of Business Administration in Karvina runs an education portal (URL: elearning.opf.slu.cz). This portal offers possibilities for publishing electronic study materials, webcasting papers and animations. This environment is used to open up information and correct methods in database processing within the frame of the

course “Database Systems”. The students gain knowledge of database design and practical experience with SQL. The Oracle database system has its place here. Likewise course “Operating systems” uses this environment for knowledge many variants, different tools, and utilities that can be leveraged to perform of tasks. Some of these utilities build simple commands and other tools are in form scripts to solve problems. There is a large collection of UNIX variants. I centered into operating systems Tru64 UNIX, AIX and OpenSolaris. The UNIX has evolved into a powerful, flexible, and versatile operating system. Implementation of operating system OpenSolaris to education were realized with cooperation with University of Ostrava on base virtualization. The key is to install VMware Player and to run virtual machines on Windows PC with pre-installed and pre-configured operating system and applications. Excellent conditions for our courses creating project FRVŠ 1075/2009 “Modernization computer classroom for practice education with support technologies virtualization”, now.

Effective resolution of repeat student queries and user-supported software packages needs the creation of multimedia study tutorials. The selection of acceptable software must respect integration of intuitive manipulation components and maximum flexibility. As a suitable environment for creating multimedia simulations, we chose Adobe Captivate. The benefit of the application in education is how effectively students can work with the computer program. Adobe Captivate outputs easily integrated comments, text descriptions, or clips. The resulting application uses high quality output format and enables standard web browser usage. The multimedia simulation creation method uses unpretentious sequence activities: recording the action in the selected software, editing of output recordings, final file generation, and multimedia simulation start using a web browser.

The multimedia study simulation is based on automatic actions recorded by the tutor on the computer monitor. The text description is appended into select actions automatically. Adobe Captivate generates an SWF–type file after recording and editing the termination. The SWF file contains all recorded actions done by mouse movements, user reactions on the keyboard, descriptions, and commentaries performed by video. The view of the Adobe Captivate working environment for editing is presented in Figure #1. The figure displays a fragment scene of Oracle Enterprise Manager for user system privileges modification.

The correct education of all software products needs access to new versions of products, documentation, and to global communication with experts. Communication is important from the share experiences point of view and special theme knowledge. The same principles are useful and irreplaceable for every teacher of information technologies. The Oracle database system requires the same. The Oracle corporation supports interested people in a wide range of activities, such as working seminars, specialized webpages for Oracle the database system community and other products, Oracle Wiki, blogs, personal distribution of the Oracle magazine, panel conferences, and meetings. The conferences and meetings take place in various destinations.

The Oracle magazine distribution is realized in electronic mail form. The subscriber can download this magazine in PDF file to the computer. The reader can click, drag, or use the scrollbars to move the page, read the issue online, download it for later use, perform keyword searches of the entire magazine, send e-mail articles to colleagues, and click on links in the ads to go directly to an advertiser’s site. A specific e-mail address is used for subscription-related questions and for any editorial comments, questions, or suggestions. The specialized webpages are used for distribution of free software versions of products like Oracle XE –

Oracle DB Express Edition, Oracle JDeveloper, and Oracle SQL Developer. The other webpages are used for distribution of wide spectrum documentation like the Oracle database system or Enterprise Manager concepts. The centre of these webpages is http://www.oracle.com/technology/index.html.

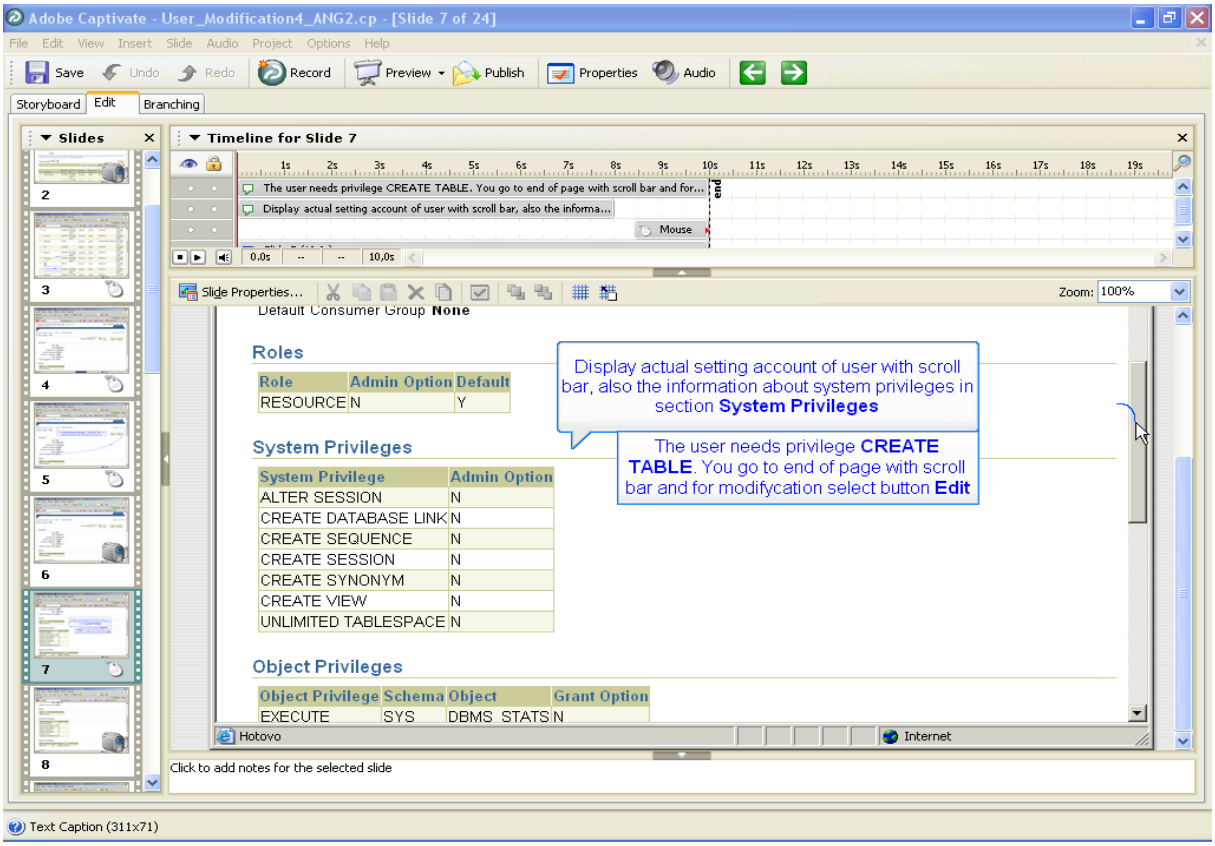

Figure 1. Editing shot in the Adobe Captivate environment.

2. VISUALIZATION AND DATABASE PROCESSING

Modern databases use flexible and effective methods to manage information and designed applications. *Oracle database is the first database designed for enterprise grid computing, the most flexible and cost effective way to manage information and application.*[6] This architecture helps to create springy information systems. The computing groups of independent hardware and software components are connected, and reintegrated on request of dynamic changes of business domains using grid architecture. The Oracle products use Enterprise Manager Grid Control for most comprehensive management. The management provides for new changes, and speedup innovation, and transformation in organizations. Oracle database offers many options to extend the database power in performance, availability, security and data warehousing areas. For this Oracle offers an up-to-date database system Oracle Database 11g.

The Oracle Enterprise Manager supports service for monitoring, and managing of database services, other administrator services, performance tracking, and analysis of problems encountered. The environment is divided into several areas: Home, Performance, Availability, Server, Schema, Data Movement, and Software and Support. For example Server card is devoted to zones of Storage, Database Configurations, Oracle Scheduler, Statistics Management, Resource Manager, and Security. Oracle Enterprise Manager is environment

[6] Oracle Database Concepts [on-line], [cit. 5.2.2009].
URL: http://www.oracle.com/technology/documentation. Page 1-1.

which helps database specialists to do commonly jobs in World Wide Web environment without SQL statements.

This environment is useful to database users and administrators. Hereafter environment Enterprise Manager helps with database configuration, automate the layout of datafiles, control files, and redo log files. The logical and physical structures do primary element Oracle database. Physical structures do files which can be seen from operating system. These files store data on disk. Logical structures create Oracle database server. Primary logical structures are tablespaces. The tablespaces contain physical files. The Enterprise Manager in section Storage views database storage structures as control files, tablespaces, temporary tablespace groups, datafiles, redo log groups, and so on. *A database consists of one or more tablespaces. A tablespace is a logical structure, consisting of one or more datafiles or tempfiles.*[7] The sizes of datafiles in tablespaces create at full storage capacity of tablespace. Every Oracle database includes SYSTEM and SYSAUX tablespace. Tablespace is generally online and her users can to access for information in tablespace. The important tablespace is SYSTEM, because holds information about data dictionary. The data are composed in tables, and views as other data of database. The base tables are grand tables for store information about associated database. These tables read, and update Oracle, data are cryptic. User-accessible views display and summarize information from base tables of data dictionary. These views break information from base tables and users often using views rather than base tables. Oracle users can not alter rows and schema objects in SYS schema, because these operations strike at data integrity. The list existing tablespaces of active database displays Figure #2.

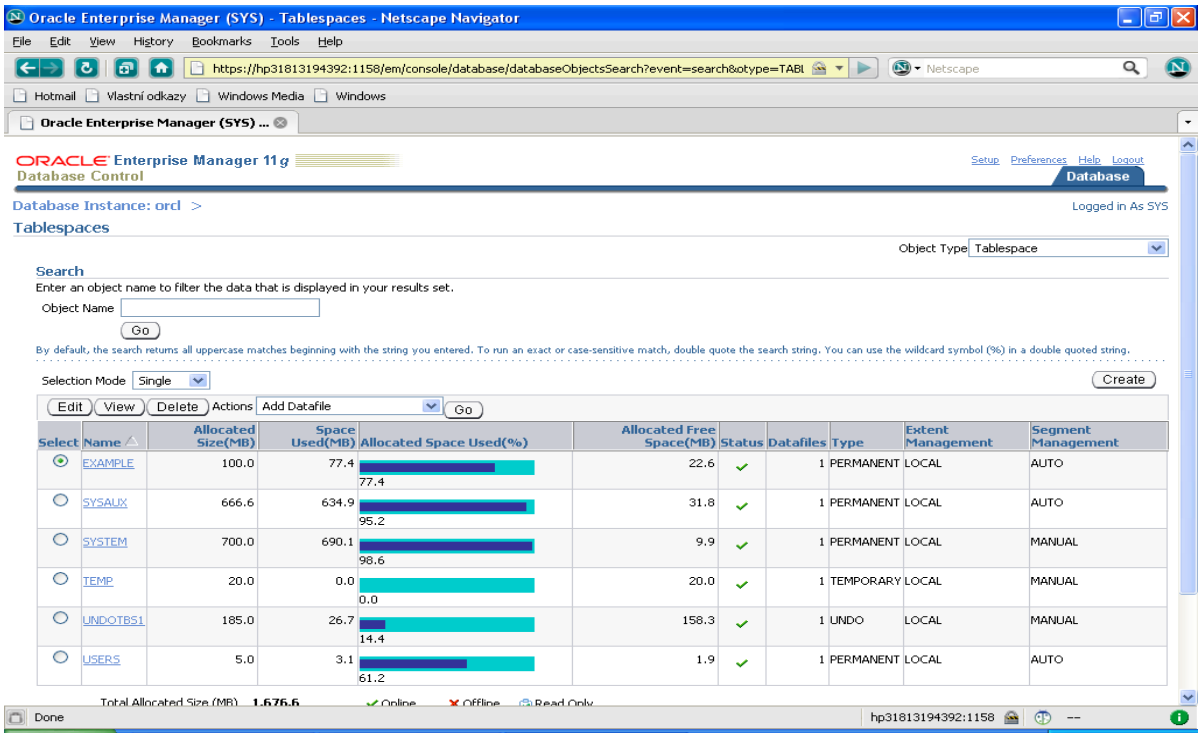

Figure 2. Oracle Enterprise Manager: Database Control – Tablespaces.

Oracle database has a physical datafiles, a control file and a complex redo log files. The datafiles take in all the database data. In between characteristics of datafiles belongs to that

[7] Oracle Database 2 Day DBA [on-line], [cit. 10.12.2008].
URL: http://www.oracle.com/technology/documentation. Page 6-5.

datafile is associated with only one database, some characteristics of datafiles are possible set to let automatically extend when the database have out of space, and datafiles form a logical unit of database storage do a tablespace. Modified and new data of users are not immediately writes to a datafile. For reduce quantity of disk access and for increase performance data are pooled in memory and written in the datafiles all at once. The storage of data determines database writer process (DBWn).

CONCLUSION

The university environment must provide good conditions for information technologies development, taking needs of business subjects into consideration; therefore, informal cooperation of representative celebrities from all areas must be available. The good exercise in this situation is excellent cooperation within the implementation of the Oracle database system in the education process of students and other interested persons at our faculty. The effective resolution of repeat student queries and user-supported software packages needs creation of multimedia study tutorials. As a suitable environment for creating multimedia simulations, we chose Adobe Captivate. The multimedia education from the Oracle database system environment is published in the tutorial portal of the faculty and publicly open webpages maninformatics.googlepages.com/index.

All around the world, there are potential users worried about problems with implementation, financial, and HR demands of Oracle use. The aim of education is to help students and users to utilize needed products. Oracle database systems and UNIX operating systems show high-level quality and performance. The applications do not have to be a privilege of large companies and institutions. The benefit of Oracle and UNIX is that smaller and dynamic firms can reach higher standards of quality. Every user should have the privilege to know about the availability of IT.

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LIST OF FIGURES

E-LEARNING IN MILITARY USE - CISCO NETWORKING ACADEMY

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Abstract: *The paper describes purpose, structure and some selected experience with the eight-year Cisco Networking Academy project implementation at University of Defence, Brno, Czech Republic.*

Keywords: e-learning, CNA, Cisco Networking Academy.

INTRODUCTION

Eight years ago, the Regional Cisco Networking Academy, created as a part of the today's Communication and Information Systems department, has started its activity. It is engaged both in theoretical and practical education on several IT areas; the most famous are computer networks and computer security.
The theoretical part of education uses e-learning method and tools; we picked up quite broad range of real experience during the period mentioned.
This program called Cisco Networking Academy has been created by the Cisco Systems originally for internal using more than fifteen years ago. It has become very popular among employees and consequently at universities. For this reason Cisco decided to release it for the public, also because the lack of well trained networking specialist had appeared.

1. AVAILABLE COURSES

The original project has been extended over time. It started with computer network topic, but several other courses have been added like Information Technology Essentials, Unix, Java, Structured Cabling Systems etc.
We have chosen to teach following courses at our RCNA:

- Cisco Certified Network Associate v4 Exploration (CCNA); or more practical version CCNA v4 Discovery
  - Network basics
  - Routing protocols theory and use
  - Switched and wireless LAN
  - Global network access
- Cisco Certified Network Professional (CCNP)
  - Extended routing
  - Remote access
  - Multilayer switching
  - Troubleshooting
- Fundamentals of Wireless LAN (FWL)
  - Wireless LAN technology
- Network Security (NS)
  - Network security 1, routers

    - Network security 2, firewalls
- IP Telephony (IPT)
    - IP telephony

As an important contribution of CNA participation we got hardware equipment for free, but much important is fact, that we also have got access to the information sources and especially to the really working e-learning system.

2. STUDY

The combination of introductory talks, distance self-study and eventually selected tuition is the most usual form of study. Special emphasis on practical training is a core of the program. The studying materials called Curricula are stored on the central server together with student database and evaluation systems. The communications is accomplished using web browser in English, but other "UN" languages (i.e. Russian, French, Spanish, Chinese and Arabic) can be chosen; some other "non UN" languages (however not Czech) are available. The studying materials called Curricula can be downloaded by instructors and installed on the local site. If necessary, virtual classrooms in the Internet environment can be organized. The Webex Video Conferencing system is another alternative for the distant learning.
The education is divided into blocks called semesters (there is no direct reference to the university ones). The number of semesters is different in particular courses. For example, both CCNA and CCNP consists of four semesters, NS two semesters etc.; each semester includes approximately from seven to ten chapters. The instructors usually introduce into subject using delivered presentations (in the open form, i.e. free for their own changes, supplements and so on). The chapters can comprise of texts, flash animations, interactive animations, sounds, voice records including transcriptions etc., there is simple quiz on the every chapter end.
The hierarchical system of Cisco Networking Academies has been established. It is consist of Cisco Academy Training Centres (CATC), Regional Cisco Networking Academies (RCNA) and Local Cisco Networking Academies (LCNA).

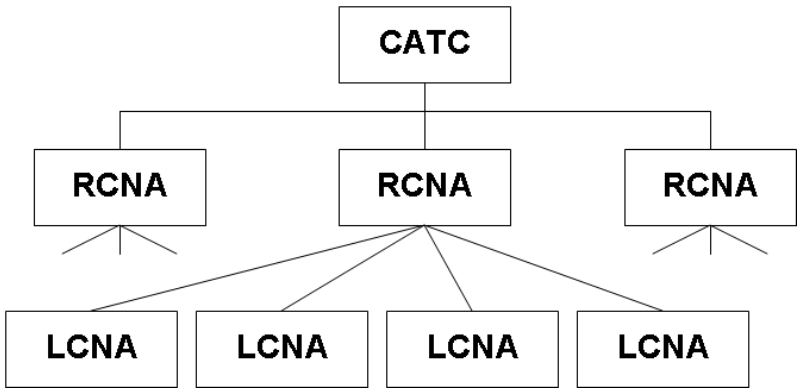


Figure 1. Cisco Networking Academy system structure

Immediate teaching is LCNA instructors' duty; they studied at some RCNA. It should be mentioned that RCNA can also act as LCNA (as we are). There are six RCNAs in the Czech Republic; their instructors were mostly prepared at CATC Vienna, Austria.
We ourselves had to attend the courses above in student role (better say as instructors - candidates) and passed all tests including skills ones. It took several months of hard work.

3. SUPPORTING TOOLS - PACKET TRACER

Packet Tracer (in the latest 5.1 version) is Cisco Networking Academy's comprehensive networking technology teaching and learning software. Its features, including powerful simulation, visualization, authoring, assessment, and collaboration capabilities, can help students and teachers collaborate, solve problems, and learn concepts in an engaging and dynamic social environment.
Packet Tracer makes both teaching and learning easier - instructors and students can create their own virtual "network worlds" for exploration, experimentation, and explanation of networking concepts and technologies.

- Instructors can demonstrate technologies and configurations using Packet Tracer to teach complex CCNA-level networking concepts, making it extremely useful for lectures, group and individual labs, assessments, troubleshooting and modelling tasks, homework, games, and competitions.
- Students can design, configure and troubleshoot networks using Packet Tracer's versatile simulation and visualization environment, which also provides the opportunity and flexibility for additional practice outside of the classroom environment.

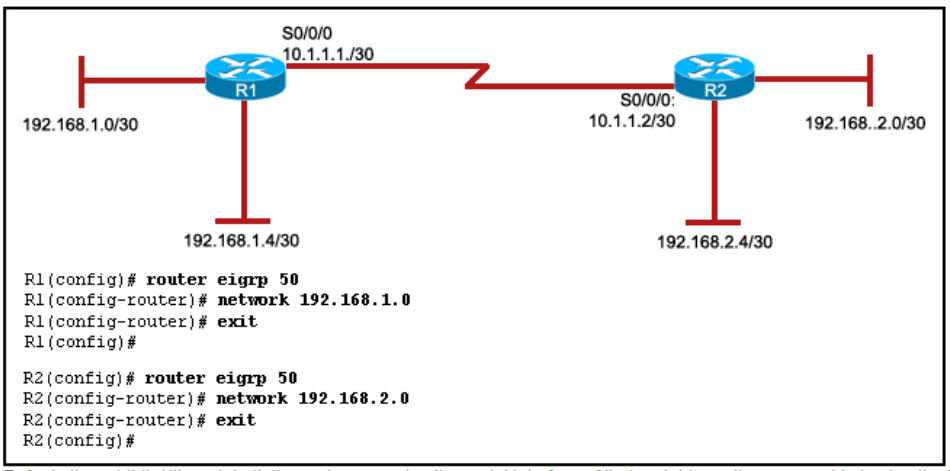
The usage of Packet Tracer is intuitive, student inserts object by clicking on the icon (it can represent router, switch, hub, link, computer etc.). By the help of next click on its icon student can get information regarding selected object, but also access to its command line. Moreover, if the object represents a modular device, the appropriate module can be inserted. Of course, it is necessary to switch off device at first and after inserting to switch device on and wait for system boot.
The whole configuration task, i.e. network topology, device type layout, settings etc. can be stored into file for later use. There is another very useful feature – the individual device configuration file content can be transferred into and used in real box. A quite complicated network setting can be prepared and tuned by this way.
The Packet Tracer has much broader exploitation. Instructor can prepare partially or mistakenly configured tasks, which should be completed or troubleshooted by students. Next, the time limit for the task finalisation can be applied and automated evaluation carried out.
Packet Tracer software is free both for CNA instructors and students.

4. EXAMINATION

The core of examination is the set of tests after every chapter (about twenty questions/tasks) and especially final test (approximately fifty problems) on the semester end. Student selects single correct answer from multiple choices (four to six) - MCSA, or multiple answers (two or three) from multiple choices (five to seven) - MCMA. The problem situations are depicted in textual or graphic form. There are also flash animations to complete or pro per sequence sorting etc.
The chapter test questions are delivered in randomly permutated order to each student. The final test arrangement is slightly more sophisticated. There are several set of tests, each set consist of two or three test. It is possible to select:

- one common test for all student
- mixture of tests from the same set
- mixture of tests across different sets

In either case, each student gets randomly permutated order of questions. Instructor can see correct answers and of course students' answers; students can see items according instructor's decision. That item range can spread from the link to the subchapter which consists incorrectly answered topic to the question full text including correct answer(s).
The test result is measured in a percentual efficiency. There are two points of view: binary score, which counts only entirely correct answers or nothing (for example, if three true answers are possible, all must be chosen), and weighted score, which adds point for every correct answer (two points in case of MCSA, one point for every partial answer when MCMA).
The testing system is open for an individual approach; it is for example possible to put in instructor's own criteria, practical skills results etc. The only compulsory requirement for semester passing watched by the testing system is a final test and feedback. It is instructor or institution responsibility how to exactly dispose of testing system.
The total student proficiency is formed using weighted score; each percentual test result participates by certain proportion on final result. The weights can be modified; some instructor decided to assign 0 % to the chapter tests and take into account only final test result, their own test results and skills.



Refer to the exhibit. Although both the routers can ping the serial interface of their neighbors, they are unable to ping the Ethernet interfaces of other routers. Which two statements are true for this network? (Choose two.)

- ☐ The administrative distance has been set to 50 on both routers.
- ☐ R2 is learning about network 192.168.1.0.
- ☑ R1 is learning about network 192.168.2.0.
- ☑ The **network 10.1.1.0** command has not been run on both routers.
- ☐ Autosummarization is enabled on both routers.

Reset View

Scoring Rule For: correctness of response

Option 4 and Option 5 are correct.
1 point for each correct option.
0 points if more options are selected than required.

Max Value = 2

Figure 2. Test question example

5. EXPERIENCE

As mentioned, CNA program is used for more than eight years at the University of Defence (including Military Academy period). Many practical pieces of experience have been obtained

and derived. The CNA is one of the rare, really exploited e-learning systems, proved by the worldwide community.
First, it is necessary to plan the education process very carefully, to fix terms for students and take strict care about their keeping. E-learning form of study cannot replace teacher's role and fiction that student will prepare themselves is naive. Some subjects are relatively difficult to understand and need guidance; otherwise the process of understanding is ineffective.
The next and very much discussed topic is the course content creating. It is very exacting and time-consuming procedure, probably much more painful than conventional lesson preparation. The subjects which are relatively unchanging like language basics, elementary mathematics or classical physics, will not need to change for some period. But the information technology is another case. The CCNA course, for example, underwent three substantial renovations during last eight years (and minor changes are pursued at least yearly). Some large areas were omitted, others were transferred from CCNP courses after radical adaptations and many brand new themes have appeared.
The content development is a large-team job, starting with theoretical cogitations through solution itself to the debugging including test and supplements setting. The new version was being proved for some time with the help of volunteers. After then it was made accessible for CNA community, but still many errors were found on the beginning, but not only. It is hard to imagine that the same work could be done by individual, such as lecturer, together with her/his principal duties.
The final experience is University of Defence specific: our students have, in contrast with their civilian colleagues, guaranteed job after graduation. Their motivation is slightly for this reason. Students at civilian universities have to ask for CNA study admission (and wait several months, because there are limits); moreover, they are also sometimes asked to pay small fee (which significantly improves study fruitfulness).
We use CNA program for extension of our standard lessons and partially for the other courses now. Another asset is good personal contact with several universities in the Czech Republic and abroad. As a RCNA, we have to take care of our thirteen LCNA, which are constituted at universities and more often at high schools. Especially the contact to the high schools, which are sources of our potential students, appears as very important.

CONCLUSIONS

The e-learning methods have their place in a general education system. According my opinion, it always will act as supplemental method suitable for some specific situation. It can not, without losing of quality, replace conventional tuition led by experienced pedagogue. Especially in the Czech Republic, where are conditions like: short distances allowing easy transportation, low teachers' work costs and finally still not fully developed broadband connection, is a massive e-learning implementation a question.
The e-learning system build up could be done relatively fairly, but its long-term maintaining is a full-time job for professional.
The Cisco Networking Academy is an example of well designed and reliably working e-learning system.

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THE IMPORTANCE OF COMPUTER ALGEBRA SYSTEMS IN PART TIME AND DISTANCE STUDY

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Abstract: *The abilities of contemporary CAS (Maple, Mathematica, Matlab and others) have increased substantially, they are able to realize symbolical evaluations, visualize complex plane and space objects, to perform complicated numerical evaluations, and so on. The amount of lessons in the part time and distance form of study is rather small, teachers have only limited possibilities to make students acquainted with more complicated problems, applications of various topics and to practice more thoroughly routine procedures. That is why the use of CAS in teaching can increase considerably the quality of preparation of students in this form of study and help them understand better new subjects.*

Keywords: Maple, Computer Algebra System, part time study.

1. PART TIME STUDY AT UNIVERSITY OF DEFENCE

Faculty of Military Technologies proposes this form for students of both bachelor and master study. Some disadvantages of this form comparing full time study are:

- students must cope with the same amount of stuff in one third of the time,
- some students coming from the previous job (not directly from the school) have a low level of knowledge of mathematics as they had forgotten a lot of things,
- the study is mostly individual without everyday possibility of tuitions with a teacher.

From this point of view the use of computers and some of Computer Algebra Systems (CAS) is almost unavoidable, for CAS

- enable visualization of many mathematical concepts,
- can decrease the amount of routine evaluations, which is important in part time form of study,
- can display three-dimensional objects.

In the last few years, the role of Computer Algebra Systems (CAS) in teaching of mathematics has increased substantially. Among the most important representatives of CAS it is possible to name e.g. Mathematica, Maple and Matlab. Till recently the only program of this type the teachers of our department could use was Mathcad. This program is oriented namely to engineering evaluations and its abilities to support topics from the basic course of mathematics are limited comparing the above mentioned CAS.

With respect to our previous experience with Maple (we used it among other things for the preparation of illustrations in several textbooks) and to the fact that this year we managed to obtain concurrent licences of Maple, which would enable the use in laboratory tutorials, we decided to prepare as a part of the specific research necessary materials both for tutorials and lectures in mathematics.

Let us ask the question what the Maple program can offer to students.

- rich libraries containing definitions of thousands of commands,
- examples of the usage of all commands,
- definitions of mathematical concepts in English, which can be used by students studying mathematics in English,
- a lot of teaching materials even in Czech.

What we would like to propose to students:

in lectures:

- to enliven the lessons with 3D "movable" plots,
- to increase the quality of the graphical expression of teachers,
- to help students gain the visual idea about some concepts,
- to include short animations.

in tutorials:

- to support the idea about what was in fact evaluated,
- to enable quick checking of results,
- to reduce routine evaluations.

in tutorials with computers/Maple:

- to solve problems which cannot be tackled by elementary methods,
- to solve more complex problems,
- using simple instructions and problems to let students solve them individually,
- to demonstrate methods and capabilities of numerical mathematics, mention weak points of numerical solutions,
- to give simple examples showing "bad behaviour" and wrong solutions of CAS, to emphasize the need of theoretical knowledge necessary for understanding and solving such problems.

at home:

- to imploy the possibilities of Maple to practise some algorithms (e.g. Gaussian elimination method, integration methods etc.).

What we can now propose to students in part time form:

At this moment we have at a disposal three textbooks available for part time or distant form of the study. They were prepared in the cooperation with VŠB-TU Ostrava and Mathematical Institute of Silezian University Opava. They exist both in a version appropriate for printing and a version determined for displaying on a computer monitor. The subjects involved in these textbooks are differential and integral calculus of functions of a single variable and differential calculus of functions of several variables. Among other things they contain 3D "movable" plots prepared with the help of Maple. These plots and also further multimedia elements serve for better understanding and practising of studied topics.

CONCLUSION

With respect to mathematical abilities of students it would be reasonable to use CAS more often in teaching and to enable students to work with them also during their individual preparation for tutorials and examinations. But the utilization is limited by the number of licences and the lack of classrooms equipped with computers.

2. SOME EXAMPLES FROM TEXTBOOKS

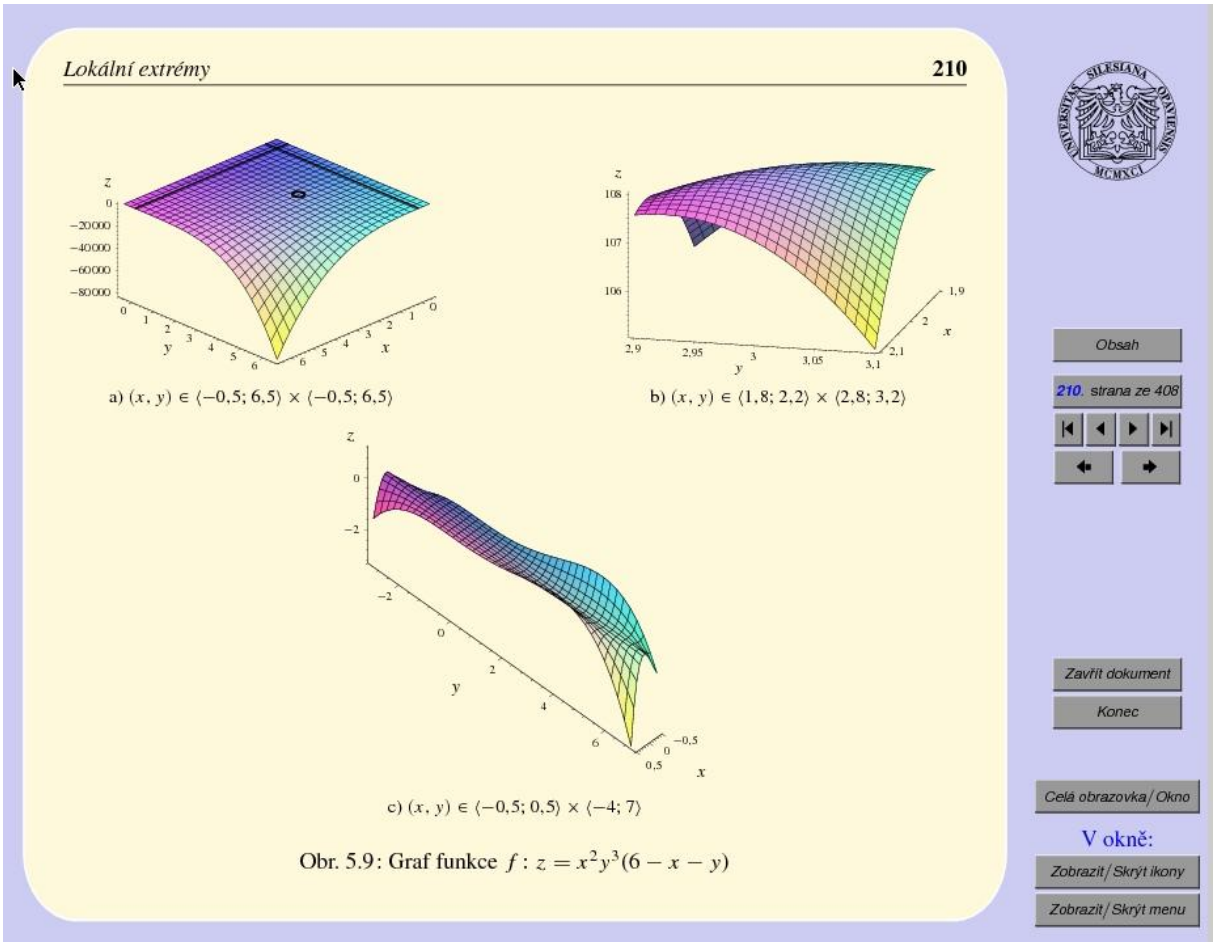

Figure 1. Sample page from the text [3].

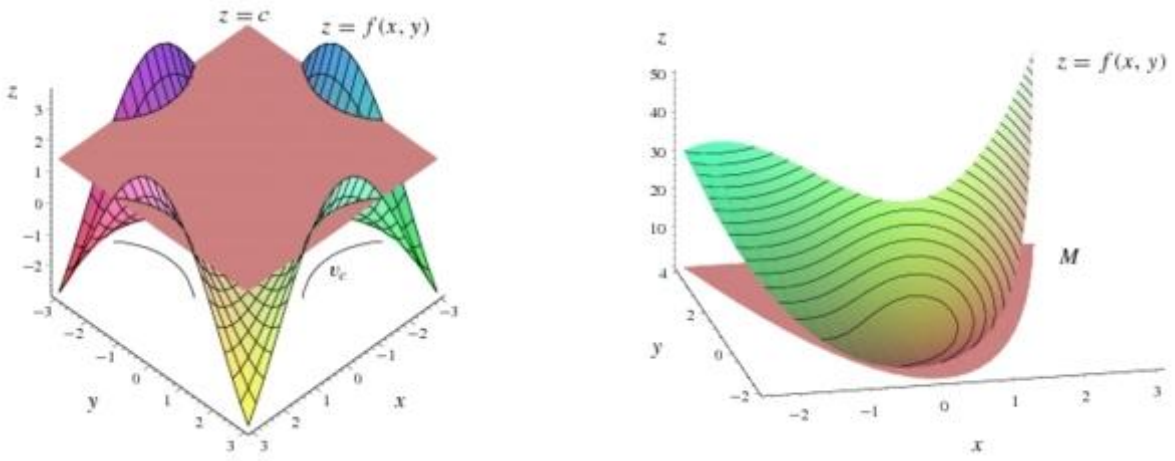

Figure 2. Contour lines of functions of two variables.

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IP TELEPHONY SERVICES OF MODERN COMMUNICATIONS SYSTEMS

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Abstract: *In the first part the paper describes the rapid development in telecommunication field. It points at nowadays world trend of telephony and data networks convergence based on IP and mentions the most considerable advantages of VoIP. In the second part the CIS department VoIP training base is shortly presented. The most attention is paid to Alcatel-Lucent OmniPCX Enterprise communication server. In the last part of the paper the advanced telephony application My Teamwork is described.*

Keywords: VoIP, telephony services, Alcatel-Lucent OmniPCX Enterprise, My Teamwork.

1. INTRODUCTION

There are several periods in the history of telecommunications. One of the most important milestones is the transmigration from analogue to modern telecommunication networks built on digital principles (ISDN - Integrated Services Digital Network) in the beginning of 1990s. The ISDN network has been offered to customers not just high quality voice services, but also synchronous data transmission guaranteeing speed up to 64 kb/s.

Another important telecommunications period has begun by mass expanse of mobile telephones at the turn of the century. Even thought the price of mobile operators calls were several folds more expensive than POST (Plain Old Telephony Service) operators calls, users were willing to pay for mobility and recently offered services such as SMS (Short Message Service), CNID (Calling Number Identification), MMS and video calling.

In modern word the trend in the field of telecommunications is the convergences of telephony and data networks into IP (Internet Protocol) based principles. The transport of voice traffic using IP is generally called VoIP (Voice over Internet Protocol). There are many companies offering complex technological solutions or providing VoIP services. The most considerable advantages of VoIP in comparison with digital POST are:

- Lower equipment cost,
- Integration of voice and data enables new applications,
- Potentially lower bandwidth requirements using by different codec's,
- The widespread availability of IP,

However there are also several disadvantages too, such as:

- Request and support to QoS,
- HW request for network modules supporting VoIP,
- Price for new implementation of HW and SW solution,
- No service during a power outage, or power backup system required, etc.

The advantages and disadvantages are balanced by economical aspects, new applications and required services. This article will consider only the group of advantages. Nevertheless, it is worth to mention that implementation of high-quality VoIP is very difficult issue which comes with a number of questions and brings about various problem areas have to be solved (reliability, required services guarantee, security).

2. CIS Department VOIP Training Base

Implementation and convergency of IP based networks technologies, principles and possibilities is therefore a highly topical issue in the ACR (Army of the Czech Republic). The CIS (Communication and Information Systems) department pays special attention to build up the high quality VoIP training base.

In the first place, the training started with a special VoIP courses based on open source software PBX (Private Branch eXchange) Asterisk in 2004. Asterisk can be run on common PC. For training there is a powerful PC with added communication cards that provide Ethernet even 2 x T1/E1 and 2 x FXS, FXO connections. Although the Asterisk is worldwide very popular and it is used by many companies to provide commercial applications, its implementation still presents a lot of security risks.

The next system obtained to VoIP training base is Cisco CallManager Express. It offers complex solution of VoIP but has some restrictions. CallManager Express is a software running on Cisco router IOS (Internetwork Operating System) and can be managed only on Cisco devices on LAN. Using voice mail requires special expensive Cisco router module. But CallManager Express offers modern telecommunications services, such as phone book on Cisco IP phones via XML (eXtended Markup Language), DND (Do Not Disturb) feature or periodically push messages onto the screen of phones too.

The third and the most modern workplace presents VoIP configuration of Alcatel network devices landed by ATS – TELCOM PRAHA, a.s. company.

Typical connection scheme of training workplace with Asterisk is shown in Figure 1 and workplace with Call Manager Express is shown in Figure 2.

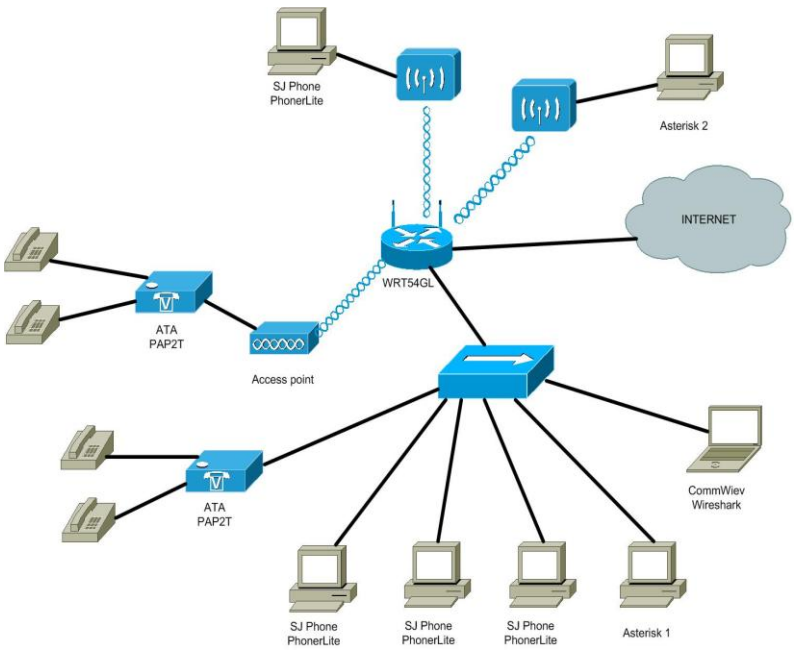

Figure 1. Typical connection schemes of Asterisk.

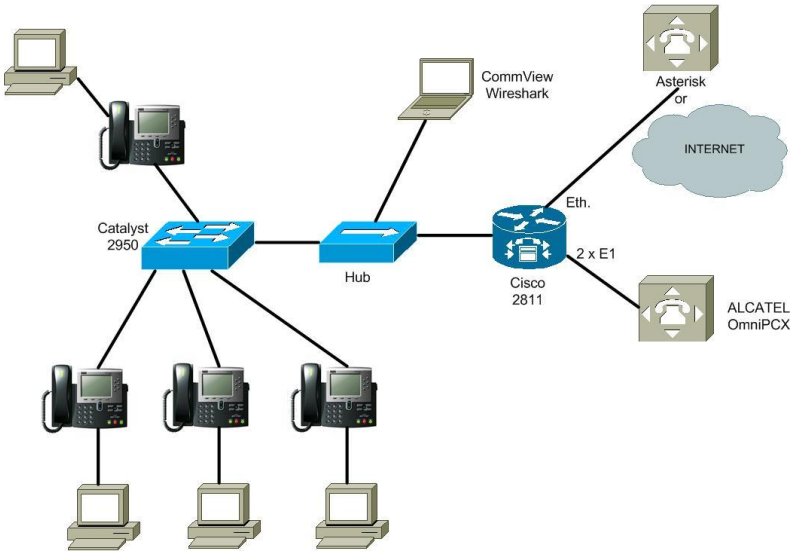

Figure 2. Typical workplace with CallManager Express workplaces.

Because this workplace offers the largest number of modern telephony services we will consider only on it.

3. ALCATEL - LUCENT OMNIPCX ENTERPRISE

The mentioned workplace consists of several Alcatel-Lucent devices. The key device is Alcatel-Lucent OmniPCX Enterprise communication server which provides multimedia call processing not only for Alcatel-Lucent, but also for third party TDM (Time Division Multiplex) or IP phones and clients. The other devices are: L3 Ethernet switch Alcatel-Lucent OmniSwitch 6850 P24X, WLAN (wireless local area network) switch Alcatel-Lucent OmniAccess 4304, two Access points OAW-AP61, four WLAN phones Alcatel-Lucent 310/610 and IP and TDM Alcatel-Lucent phones. The main part of the workplace is common powerful PC running two key SW applications. For network management software is used Alcatel-Lucent OmniVista application and as a server is used Alcatel-Lucent OmniTouch application. The main workplace is shown in Figure 3.

The Alcatel-Lucent OmniPCX Enterprise provides the building blocks for any IP and/or legacy communications solution and open standard practices such as QSIG, H.323, and SIP. It offers broad scalability ranging from 10 to 100,000 users and highly reliable solutions with an unmatched 99,999% uptime. The management of OmniPCX is transparent and easy with friendly GUI. One PC with running management software OmniVista can supervise the whole network with tens of communication servers.

This workplace best advantages build on OmniPCX communication server are: possibilities of complex solution, support of open standards, high reliability and security, mobility and the offer of advanced and additional services. The complexity of communication server is supported by several building blocks. The main component is the Call Server, which is the system control centre with IP only connectivity. One or more (possibly none) Media Gateways are necessary to supporting standard telephone equipment (such as wired digital or analog sets, lines to the standard public or private telephone networks, DECT phone base stations). The scheme of communication server telephony system is shown in Figure 4.

Figure 3. The Alcatel-Lucent OmniPCX Enterprise workplace.

There are none restriction to use only the certain (Alcatel-Lucent) terminals. Many standards and open standards such H.323 and SIP are supported. In addition, Alcatel-Lucent terminals offer some additional services. The high reliability is guaranteeing by duplicating of call servers or by using passive servers in small branches. The duplicated server runs simultaneously with the main server. In case of main server failure the duplicated one become to be a main server. In case of loss of connection to main server passive communication servers provide continuity of telephony services. It also controls the interconnected terminals and can found out an alternative connections trough public network.

The OmniPCX communication server support several security elements. For example: the PCX accesses are protected by strong limited live time password, accesses to PCX web applications are encrypted using the https (secured http) protocol, remote shell can be protected and encrypted using the SSH (secured shell) protocol, remote access to the PCX can be limited to the declared trusted hosts or further IP communications with IPTouch sets (Alcatel-Lucent phones) and the Media Gateways can be encrypted and authenticated, etc.

The WLAN switch Alcatel-Lucent OmniAccess 4304 can utilize the popular WiFi (Wireless Fidelity) technology and offers to users more mobility. The WiFi mobile telephones Alcatel-Lucent 310/610 communicate with call server trough WLAN switch. Only „silly“ access points with integrated today common standards IEEE 802.11 a, b, and g, can be connected to WLAN switch that control the whole wireless network. This solution increases security, because even if somebody obtains WiFi phones or access point, it doesn’t mean serious security risks. The WLAN switch provides many of configuration tasks such as VLAN configuration on access points or it especially provides roaming among the access points which very increases mobility of users.

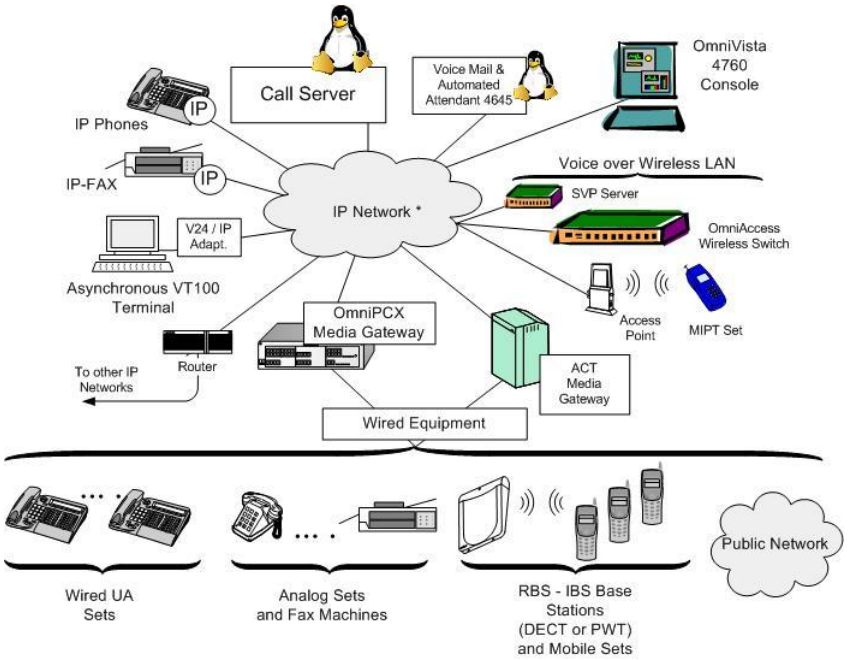

Figure 4. **The Alcatel-Lucent OmniPCX Enterprise CS Telephone System**.

4. MODERN TELEPHONY APPLICATION – MY TEAMWORK

1. The OmniPCX Enterprise communication server is a private telephone switch based on an IP data network infrastructure. It offers number of advanced services (conference calls, do not disturb, call encryption, voice and fax mail, messages sending, local directory, etc.). This part describes the modern telephony application – My Teamwork.

2. My Teamwork is a part of Alcatel-Lucent's Unified Communication consisting of My Phone, My Messaging, My Assistant and My Teamwork. It is a server/client conferencing and multimedia collaboration telephony application compatible with OmniPCX. It can run on any network, from any location. This communication solution combines presence-aware instant messaging with the ability to make phone calls, conference calls, share applications and presentations. The main advantage is that My Teamwork can be operated in a standard Web browser and does not require any installation or special software on user computer. User needs only login name and password for accessing system. It is similar to the popular instant messaging applications such Skype or ICQ with possibility of applications or presentations sharing fully under user control with important security advantages.

3. My Teamwork enables these services:

- Make phone calls and conference calls
- Make video calls and videoconference calls
- Change an instant message into a phone call
- See who is online and who is on the phone
- View logs of past messages and phone calls
- Share your desktop or applications with others
- Make presentations and upload attachments
- Control who can see when you are online and who can send you messages.

5. CONCLUSION

This contribution presents unprecedented Department of Communication and Information Systems training base build in Department of Communication and Information Systems. This base provides possibility for training and testing of newest telecommunication technologies which can be established more or less in Czech military IT networks. Scope of testing possibilities on this workplace may also be used to prevent some problems in the field of current and in the feature possible used technology compatibility, fidelity, dependability, security not to mention testing offered services an user friendly interfaces.

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ARTIFICIAL NEURAL NETWORKS FOR LASER SATELLITE COMMUNICATION SYSTEMS

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Abstract: *Optical space communications are on the verge of being reality. The paper includes briefly analysis, optimization, design and system level development of signal transferring between satellites. In these systems – systems of laser satellites communication are lots of noises. It is focused on the noises' limits of the optical communication system. One of the possibilities of problem resolution is solution due to artificial neural networks as a system for analysis and optimisation input and output parameters of laser satellite communication equation. It involves the introduction into artificial neural networks and description of Hopfield network, which is use for problem solution. There are mentioned the optical energy output on an aperture's spread of optical detector and incoherent detection of optical carrier wave.*

Keywords: satellite systems, laser communication, noises limits, artificial neural network, Hopfield network.

INTRODUCTION

The nowadays research of inter-satellite communication is centred on hybrid ordering laser and microwave systems. The laser inter-satellite communication is predicted on real GEO satellites. The optical space communications are the key building block for wide-area space data networks. A crosslink, or communication between two satellites, may be needed to solve certain requirements of satellite communication architecture. Laser communications offers the users number of unique advantages over radio frequency (RF) systems, including size, weight, power and integration ease on the spacecraft. Integration ease issues include compactness of terminals, elimination of complex frequency planning and authorization, and RF interference issues [1].

1 LASER INTER-SATELLITE COMMUNICATION SYSTEMS

Advances in laser communication system architectures and optical components technology make such high capacity links feasible.

The laser communication equation (LCE) is a basic resort of LICS's (Laser Inter-satellite Communication System) analysis. This equation expresses the dependences of different parameters, such as source power and gains and losses parameters during signal transfer. These parameters provide relevant data for technological implementation design. Based on the background and receiver noise and the type of signal modulation which is to be detected, a required signal is generated. The ratio of received signal to required signal is the system link margin. Identifying these gains and losses requires intimate knowledge of the system design, including both the internal constraints and design choices and knowledge of the external factors, including range, data rate, and required signal criteria.

1.1 The laser communication equation

This equation is used for analysis and optimization.
The equation starting with the transmit source power, the designer identifies all sources of link degradation (losses) and improvements (gains) and determines the received signal level. The laser communication equation (LCE) is very analogous to the link equation for any RF communication link. The link equation can be written as

$$P_{t(dB)} = P_{r(dB)} - \left(G_{t(dB)} + \sigma_{ur(dB)} + L_{wf(dB)} + L_{t(dB)} + L_{R(dB)} + G_{r(dB)} + L_{r(dB)}\right) \quad (1)$$

where: P_t…the transmitting signal power (dB), P_r…the receiving signal power (dB), G_t…the effective transmitting antenna gain (dB), G_r…the receiving antenna gain (dB), L_t…the efficiency loss associated with the transmitter (dB), L_r…the efficiency loss associated with the receiver (dB), L_R…the free space range loss (dB), σ_{ur}…the transmitter pointing loss (dB), L_{wf}…the transmitting Strehl loss (dB).

There are determined signal sources, improvements (gains) and link degradation (losses) in this communication equation. The definitions of all parameters are not in this paper, but each entry into the link equation is given and verified in [3].

2 LASER NOISE

Coherent optical communication systems are in particular very sensitive to the noise of transmitter and local laser. In optical communication links employing an LED, transmitter noise is normally negligible in comparison to the other sources of noise in the system such as shot noise of photodiodes and thermal noise of resistors and electrical amplifiers. However, laser intensity noise can seriously degrade the quality of transmission in high bit rate links and laser phase-locked loop (PLL). Unlike coherent detection, conventional optical communication systems with intensity modulation of light and direct detection (IM/DD) are absolutely intensive to laser phase noise. This is a significant advantage of using direct detection systems instead of coherent detection systems.

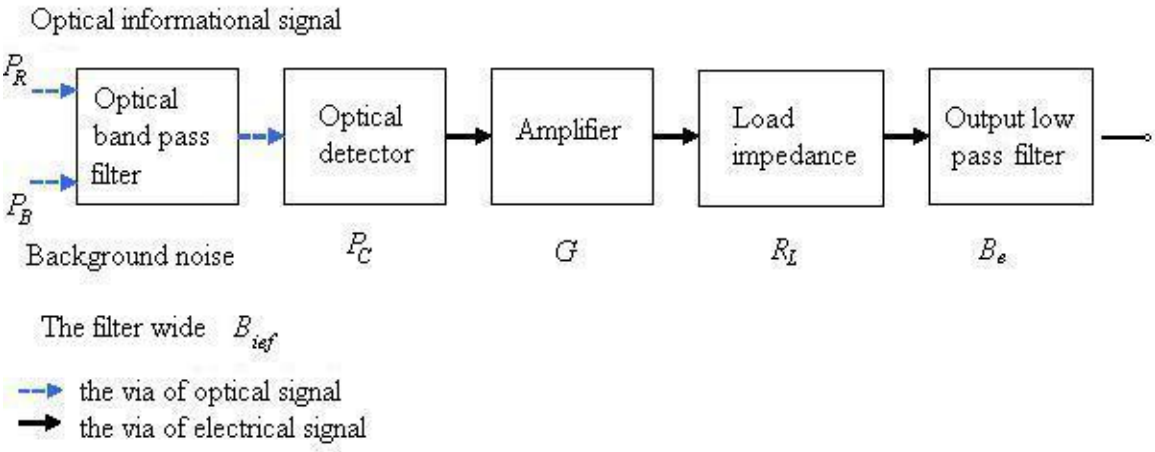

Figure 1: The schematic diagram of optical communication receiver – direct detection

The scope factor depends on noises' limits. They are given by different factors. In an optical communication system, the function of the receiver is to convert a received optical signal into an electrical signal, which can serve as an input for other devices or communication systems.
The optical receiver basically consists of a receiving optics followed by a demodulator/detector. The latter may be based on incoherent or coherent techniques depending upon the type of modulation scheme used [4].

3 ARTIFICIAL NEURAL NETWORKS

An artificial neural network is a system based on the operation of biological neural networks, in other words, it is an emulation of biological neural system. Although computing these days is truly advanced, there are certain tasks that a program made for a common microprocessor is unable to perform; even so a software implementation of a neural network can be made with their advantages and disadvantages.

The Hopfield network demonstrates how the mathematical simplification of a neuron can allow the analysis of the behaviour of large scale neural networks. By characterizing mathematically the effect of changes to the activation of individual units on a property of the entire neural architecture called energy, Hopfield provided the important link between local interactions and global behaviour.

Advantages:

- A neural network can perform tasks that a linear program can not.
- When an element of the neural network fails, it can continue without any problem by their parallel nature.
- A neural network learns and does not need to be reprogrammed.
- It can be implemented in any application.
- It can be implemented without any problem.

Disadvantages:

- The neural network needs training to operate.
- The architecture of a neural network is different from the architecture of microprocessors therefore needs to be emulated.
- Requires high processing time for large neural networks.

Another aspect of the artificial neural networks is that there are different architectures, which consequently requires different types of algorithms, but despite to be an apparently complex system, a neural network is relatively simple.

3.1 Hopfield network

The importance of the different Hopfield networks in practical application is limited due to theoretical limitations of the network structure but, in certain situations, they may form interesting models. This type of ANN is very often used for communication systems. That is the reason, why I chose it for problem solution too. The Neural Networks package supports two types of Hopfield networks, a continuous-time version and a discrete-time version. Both network types have a matrix of weights W defined as

$$W = \frac{1}{n}\sum_{i=1}^{D} \xi_i^T \xi_i \tag{2}$$

where: D….. is the number of class patterns (ξ_1, ξ_2,…ξ_D) vectors consisting of +/-1 elements, to be stored in the network, and n is the number of components, the dimension, of the class pattern vectors.

For a discrete-time Hopfield network, the energy of a certain vector *x* is given by

$$E(x) = -xW_X^T \tag{3}$$

The continuous Hopfield network is described by the following differential equation

$$\frac{dx(t)}{dt} = -x(t) + W_\sigma\left[x(t)\right] \tag{4}$$

where: *x(t)*…is the state vector of the network, *W*…represents the parametric weights, σ…is a nonlinearity acting on the states *x(t)*.

This equation is solved using an Euler simulation.

For a continuous-time Hopfield network, defined by the parameters can define the energy of a particular state vector *x* as

$$E(x) = -\frac{1}{2} x W_X^T + \sum_{i=1}^{m} \int_0^{x_i} \sigma^{-1}(t) dt \quad (5)$$

As for the discrete-time network, it can be shown that given an initial state vector *x(0)*, the state vector *x(t)*converges to a local energy minimum. The minimum constitutes the possible convergence points of the Hopfield network and ideally these minima are identical to the class patterns (ξ_1, ξ_2,…ξ_D). However, there is no guarantee that the minima will coincide with this set of class patterns.

CONCLUSION

Mathematical-physical basic description aforesaid system's aspects are in research work and are starting point for computer implementation programme several-parametric correlations [3].
The noises which are the basic problem for signal transmission are calculating and optimizing using MATLAB programme.
Another possibility is to implement all inputs parameters into artificial neural networks (ANN). ANN is the very good application for analysis and optimization of communication systems with lots of inputs parameters and different conditions which work upon the system.

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POSSIBILITIES OF DISTANCE LEARNING IN APPLICATION PSYCHOLOGY MODULES IN PREPARATION OF MILITARY PROFESSIONALS

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Abstract: *This paper discusses some issues relevant to possibilities an effectiveness education of application psychology modules by distance learning in preparation of military professionals at the Universityo of Defence in Brno.*

Keywords: Education, applied psychology, cognitive management, Blended Learning.

INTRODUCTION

The education of military professionals at University of Defense in Brno takes form of daily and combined education programs. Next to the form of combined education, there is also a distance form of education with supervised self-study supported by multimedia. The characteristic sign of distance education program is the autonomy of learning [1]. Despite the fact that the distance education program offers variety of advantages, the experience tells us that many students prefer face-to-face contact with the lecturer [2]. The aim of this paper is not to discuss the advantages or disadvantages of distance education programs but to explore the possibilities of using this form of education, especially when teaching subjects that demand coordinated processing of experience in direct contact. For example, if the result of studying should be acquirement of socially-psychological skills (for team-cooperation, social communication etc.)

In the first part, we would like to introduce the modules of applied psychology that are taught at University of Defense in Brno. In the second part, we will focus on the possibilities of teaching these modules in a distance form of education, especially on the concept of Blended Learning that creates the environment for the combination of distance form (e-learning) with normal classes.

1. MODULES OF APPLIED PSYCHOLOGY FOR THE PREPARATION OF MILITARY PROFESIONALS AT UNIVERSITY OF DEFENSE IN BRNO

One of the significant scientific disciplines that can be recognized both in most military activities and in military management is psychology. At University of Defense, psychology has its place as an applied science, especially in the form of various models that allow for cultivation and development of specific competences, skills and their foundations that relate both to professional and personal development of individuals [3].

Whole educational process is perceived as a process that systematically supports attaining and developing competences of upcoming professionals and managers that takes place on various levels during their studies and career. In the process of cognition, we operate on various, qualitatively different, levels – knowledge, skills and thinking. Whereas the first

level is mostly focused on the efficiency of learning, in other words, a student learns how to learn so he can in the end possess certain knowledge, the second level concentrates at usefulness – at conscious and reflected development of internal resources and skills. The third level takes into account mental versatility in different situational contexts and refocuses the attention from an individual to other people and systems he belongs to. By their thinking and acting, people create something we call force, and battle force in military context, potential or skills. The potential (of armed forces) can only be created, realized and taken in action in the way where human, through thinking and relations, creates and fulfills vision, goals and tasks.

From our standpoint, in regards to the aforementioned information, we can talk about three important topics of Cognitive management [4], that relate to foundations of most competences and skills in the area of the development of professionals and managers.

- **Mind and thinking module** – relates to the activities that comprise thinking, cognition and decision-making
- **Language and sharing module** – is focused on the activities oriented at the relations of an individual, system and the environment and the possibilities of sharing, communicating and realizing the functions, intentions and goals (organizing, leading, managing)
- **Transformation and change module –** contains two levels. The first one is the management of change of an individual, in other words, self-development as a reflected realization of the ability to learn and to learn how to learn in the process of being. Management of change contains support and cultivation of competences relating to the issue of self-development and managing pressure. The second level of the management of change is the ability of an individual to process the change as a self-aware compound of the higher, human system, hence influencing the processes.

The aim of the modules of applied psychology is to contribute to creating the conditions for conscious usage of psychological knowledge and skills in the individual development of resources and competences that are useful for the prospective professional or managerial work.

From the standpoint of systems, processes and procedures of educating military professionals and managers, we differentiate two basic trends [4]. The first attains the abilities through linear, standardized program handing over the data, information and experience in chosen knowledge, industry or professional model and context (economics, logistics, personalistic, law). The second trend is the cultivation of abilities and competences through creating knowledge and skills by people and human systems in the process of achieving goals. The linear approach creates a body of knowledge and a cognitive model which are necessary for the useful presence of an individual in the environment. The project trend is characteristic for the development of quality of an individual in his profession, field and system environment.

Taking into account these two approaches, the content focus of the modules of applied psychology, including goals we want to achieve, we can start to consider the possibilities of teaching the module of applied psychology in the distance education program.

2. THE POSSIBLITIES OF TEACHING MODULES OF APPLIED PSCHOLOGY IN DISTANCE LEARNING PROGRAMS

As mentioned above, applied psychology that emphasizes pragmatic and experiential aspects belongs to the category of subjects that demand a mutual interaction between students and the lecturer. Thanks to the group environment and ongoing processes, students do not only develop their body of knowledge but they also identify states and processes related to themselves, the others and the group through self-experiential activities. The individual is therefore able to reorganize his internal way and model of thinking and understand his response on the experience. The emphasis is put on the way how the individual thinks, processes the experience, interprets and understands what is happening around him and creates cognition and knowledge. That assumes independence, responsibility and the competence of an individual in the learning process.

Considering the goal of the modules of applied psychology to contribute to the creation of conditions for conscious usage of psychological knowledge and skills in the individual development of sources and competences that are useful for professional and managerial practise, it is evident that if we taught those modules by a distance form of education, we won't probably be able to meet this goal. However, as teachers, we don't object to this form of education because we do think that with an appropriate combination of supervised self-study and classic forms of teaching (such as seminars and lectures) it is possible to create a useful model of distance preparation of military professionals even in psychology. We share an opinion that combined forms of education are more convenient and efficient because of the wider possibilities they offer [5].

In this context, the Blended learning concept seems to be rather useful. It is a combination of various ways transmission of information between students and lecturers. The goal is to create the environment where the individual can study in the most effective way. Therefore, personal contact and classic teaching concepts are combined with e-learning methods [6]. This concept is close to our ideas about the possibilities of studying modules of applied psychology in the distance form of education.

The next part of the paper is based on the Blended learning concept [5, 6]. Based on the focus of education, we can identify three dimensions in this model. In the following part, we provide their brief descriptions and offer for those ideas and concepts for discussion.

Blended Learning in context of teaching modules of applied psychology

- **The education focused on the development of skills**

The model combines the individual education at one's own pace with intentional interventions and support from the lecturer. It employs the interaction between participants of the learning process through personal communication, e-mail and self-study supported by web technologies that allow for distributing study materials to the students.

From the standpoint of teaching the modules of applied psychology, we see here space for individual processing of theoretical pieces of knowledge and, above all, the work with academic papers by a method of reflection. By reflection we understand an act of realizing and dealing with what we feel, experience and observe.

One of the possible outcomes is, for example, thinking about usefulness and utility of the given topic for one's own practice. With this theoretical and personal preparedness that is the output of the distance part, we perceive as necessary to carry on in the environment that students and lecturers create together. Individually studied issues,

including reflections of the given topics, gain a different level and added value in the group meetings where processes like sharing, communication, group thinking etc. allow for the development and cultivation of the individual cognition.

- **Education focused on the development of attitudes and approaches**

This model works with chosen events and media and with their help influences the behavior of the student. It combines traditional lectures in classes with e-learning. The examples of this kind of education are courses of managerial competences, public speech courses etc. [6].

Modules of applied psychology "ask" for teaching in the form of courses, seminars or trainings. The background of the concept is "social learning" that runs as a group process. In this case we talk about active social learning that has following typical signs: intentional improvement of social activities through long-term supervised learning, changes in behavior because of the influence of one or more individuals, formation of attitudes, conscious and active participation on the analysis of one's one activity, improvement of social competences and efficiency of social behavior etc. [7].

One of the useful forms is the work with a complex aggregate in a topic-defined environment. By the aggregate we mean a complex story, book, short novel, movie adaptation etc. Working with story proves to be efficient, especially in the forms of education that demand self-activity. We can mention few aspects: students work with the whole shape a can choose different approaches in the limits of given context. Furthermore, the common shape allows more efficient work in the group. Last but not least, it allows not just reflection but also allows testing body of knowledge attained during studies in the given field.

In context of this, we would like to mention the possibility of using movies in the process of education. In The Czech Republic, this idea was elaborated by Lubomír Kostroň [2]. The form of a story is far more complex than a definition or a scheme. For example, it contains an emotional experience and, from the standpoint of cognition, it is memorized in different way because it works with different aspects than memory or logic.

- **Education focused on the development of competences**

Third model combines several methods and is focused on acquiring knowledge and skills from experienced experts. This process is also sometimes called 'sharing of experience' [6].

From the standpoint of applied psychology, it involves, for example, case studies or work on own projects. The specific alternative is offered by transdisciplinary seminars that create for both teachers and students from various fields an environment for mutual sharing of experience. The added value of these activities is a bigger versatility in a given topic that is underlined by insights and opinions of various experts from various scientific fields.

For example, the question of leadership can be perceived from the standpoint of psychology, sociology, pedagogy, military management, tactics etc. The main outcome is processing the individual experience to a "cognition", critical and creative thinking and responsibility of the student. From here is developed the respect for individual possibilities and level of development.

The goal of the process of learning is not the adaptation of an individual to a model of field, subject, system, society or the outer world but a constant conscious reconstruction of one's own cognitive model and cognition.

CONCLUSION

The notable aspect of the education of military professionals is the fact that the field's specialization demands both cultivation of professional qualities and qualities needed for management – such as leadership, management and development of people and human systems. In this context we think it is useful to pay attention to subjects that support the development of soft kills which are essential for managerial work. Despite the fact that these subjects are not, from the standpoint of focus, content and goals, the typical subjects that should be taught in a distance form of learning, there are models that can be utilized even in these subjects.

The approaches we focus on in the modules of applied psychology concentrate on transformation of the essence and quality of consciousness, mind and thinking processes. What really takes place in the mind of an individual is matter of the process of transmission (form, method, relation and environment – these can be influenced), way of processing (algorithms, models, scenarios) and understanding and comprehension (these cannot be directly, linearly and mechanically influenced)

The experience shows that some practical skills are acquired and developed only through relations and processing the experience by one's own mind. The practice of social relationships cannot be taught by the methods of the first trend of education that is mainly about the management of knowledge. They can be, nonetheless, cultivated in the environment of cognitive management and in those forms of education that are closer to the project trend of education.

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E-LEARNING AND SAFETY

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Abstract: *E-learning, represented by traditional LMS, hides security risks which have not yet been identified. The author outlines the practical problems that LMS hides and suggests possible solutions.*

Keywords: e-learning, safety, LMS, security, risk, score, content.

1. TYPES OF SECURITY RISKS IN E-LEARNING

E-learning is one of the most advanced and promoted forms of education that continues to expand. The width of e-learning systems is relatively large; they encompass many different aspects including their use (education and training, commercial organizations and public sector), support of unwritten standards (SCORM, AICC, or without support), and method of dissemination (via web page - LMS, CD, DVD, EXE). E-learning can also be viewed as a diverse range of solutions for teaching processes (classic presentation, animation, game systems, test systems, traditional chat communications, video communications, virtual classes, etc.). In addition, LMS differ according to their distributional business model (e.g. free delivery). Although the width of e-learning is vast and has gained popularity in recent years, it is still extremely difficult to find any relevant information regarding its safety.

When we focus on creating quality content for students, we tend to forget the corresponding security risks.

1.1. Types of Possible Security Risks

In the area of e-learning there can be several security problems:

- Security of the e-learning platform itself - safety of the LMS.
- Security in terms of content - content refers to the quality of education (teaching, practicing, and testing).
- Security from the perspective of individual content elements - the audio, image, or video may be a security risk.

1.2. Risks as a Result of Deficiency

The market contains three aspects of deficiency:

- Deficiency of freely distributed courses Deficiency of ‘standard’ in-class teaching - this is only relevant because some people still argue that e-learning is not an accepted, full-value form of study.
- Deficiency of pre-established criteria to determine the educational level of individual courses - there is no generally accepted system for establishing the level of courses, or processing and evaluating the input.

These "gaps" can be attributed to the fact that interpolations are given to students and as a result, they accept or download the course without knowing they need to install some sort of spy program (malware) as well. Unfortunately, it is not possible to discern whether such courses intentionally or unintentionally contain malicious coding.

2. SAFETY OF THE LMS

Security of the LMS is an unexplored area; however, it is a non-negligible safety concern especially in regards to the information stored. This security concern is evident in the following areas:

- The quality and strength of the login and password information. For example, if the login name is publicly known then the password decreases in safety. This is considered one of the general safety aspects and is very important because such information can be easily exploited.
- Collection of personal information (date of birth, personal number, e-mail, telephone number, etc.). This safety concern is a whole other matter because this information is generally collected and used by the company. For example, the company may use this information to send e-mail invitations, or use the date of birth and personal identification numbers to uniquely identify students.
- Collection of student information (history of study, result of tests, certificates, etc). This is sensitive information that may be used for the benefit of, or against the student. This information can be accessed when the security of the LMS platform is not perfect. For example, the problem may be an insufficiently secure database server that keeps information in an open area and does not require user access passwords to enter the database.

These security threats can be minimized if the supplier of the LMS clearly states how secure their system is in regards to these specific issues. For example, Moodle, the most popular freely distributed system is easily accessible therefore anyone can retrieve sensitive information. Not only is Moodle an insecure platform but so are very robust, commercial platforms like Eden. This security issue however, is very dependent on whether the program is installed correctly. In practice, I have seen two implementations where I as the guest had access to everything.

3. SECURITY IN TERMS OF ACTUAL CONTENT - THE COURSE

This is where the biggest real risk lies. The principle of preparing courses (based on the content alone) relies on SCORM recommendations, which in turn communicate with the LMS platform (version 1.3, sometimes referred to as SCORM 2004).

I will distinguish between the two aspects of the LMS safety. The first is the credibility of the LMS. For example, if a system is riddled with malware but looks like a trusted source the user has no defence; the user will allow everything the system asks (installation of ActiveX objects and all other applications) which eliminates “the branch of security”. The second aspect of the LMS safety is the security holes that lie outside the system; some technology, in conjunction with improper use allow for security attacks from other systems.

In terms of content, the fields that carry the most risk include:

- Principle of reusability of content (e.g. SCO objects).
- Applicability of JavaScript language for its own content management.
- Active X objects (as objects associated with the SCO).
- Java objects and other executable files.

In general, the universality of SCO objects is paradoxical because the original idea, which was not fully tight ended (it includes safety features strikingly reminiscent of early versions of Windows operating systems and device drivers) is very dangerous in its own principle. More specifically, there is absolutely no security mechanisms applied.

3.1. Reusability of SCO

This problem may not be as important as others because the very principle of reusing the objects of SCO is not practiced, therefore, the safety in this area is only theoretical. However, the principle of reusing a code which defines nothing in the area of security is very dangerous and indefinable behaviour.

3.2. JavaScript

JavaScript can work for both the LMS (e.g. default requirement for JavaScript) and other applications; however, the technology is "cross" dangerous as a result. For example, it is possible to use JavaScript to do almost anything on the clients' side, which in turn communicates with the LMS (e.g. running a keylogger that sends data to the LMS). Likewise, through malicious software it is possible to modify a local JavaScript code that may be exploited directly from the course while users are studying unsuspectingly. The absolute prohibition of the use of JavaScript in the application is not a solution. Rather, the solution is to avoid known and described errors to minimize the risk arising from the use of JavaScript.

3.3. Active X

This area is just one of the many vertices described in the previous chapter. The point is that using a Java script (which may compromise the entire systems control) can run the Active X component which has no restrictions on JavaScript. Doing so, in terms of safety, is a very insidious method because while users are studying it will offer to install Active X components. Therefore, the users knowingly install something that they do not bother to assess in terms of safety because it comes from a 'trusted' source. (Please note that this danger is only valid on Microsoft platforms).

3.4. Java and Other EXE

In essence, the description of Java may sound very similar to the description of Active X. They are both even capable of multiplatform infiltration of a student's computer.

4. WAYS TO SOLVE SAFETY ISSUES

Do you really believe that the LMS of today's SCORM standards are safe? I would like to remind you of the widespread controversy this topic sparked because I am deeply convinced that in the near future there will be courses available that will contain undesirable codes, or at the very least, collect users' information.
I would like to be mistaken.

There are already solutions on the market which circumvent these shortcomings and do not directly support the recommendations of SCORM.

CONCLUSION

In this paper, it was not possible to describe the safety aspects in full detail. Instead, the goal was to enumerate those that are already clear and cause controversy over "Pandora's box". I look forward to hearing your comments.

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GEOMETRIC MAPP-MODELLING BY FRACTALS

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Abstract: *Fractals is a new branch of mathematics and art. Perhaps this is the reason why most people recognize fractals only as pretty pictures useful as backgrounds on the computer screen or original postcard patterns. But what are they really?*
Most physical systems of nature and many human artifacts are not regular geometric shapes of the standard geometry derived from Euclid. Fractal geometry offers almost unlimited waysof describing, measuring and predicting these natural phenomena. But is it possible to define the whole world using mathematical equations?
Digital surface representation from a set of three-dimensional samples is an important issue of computer graphics that has applications in different areas of study such as engineering, geology, geography, meteorology, medicine, etc. The digital model allows important information to be stored and analyzed without the necessity of working directly with the real surface. In addition, we can integrate products from digital terrain model (DTM) and other data in a geospatial information system (GIS) environment.
One of the most popular stochastic models to represent curves and surfaces are based on fractal concept. A fractal is a geometrical or physical structure having an irregular or fragmented shape at all scales of measurement. In addition, a fractal is based on self-similarity concept indicating that each part of its structure is similar to the whole.

Keywords: terrain models, midpoint displacement, squig curve.

INTRODUCTION

Fractals have been recognised as a powerful description of many natural objects for several years1. Their definition is generally based on concepts of dimension which reflect the fragmentation or irregularity feature of these structures. In this work we investigate the definition of fractals by extending geometric descriptions to multiple resolutions. Based on this approach we propose a fractal definition as a composition of exponential functions embedded in a multidimensional domain. By considering transformations between different resolutions we provide a definition of fractals capable of modelling continuous deformations.

The aim of modelling these deformations is to extend fractal descriptions to animated forms. If objects are represented by sets then a geometric mapping can be characterized by a function *f* which assigns $y \in Y$ for each $x \in X$ in such a way that the geometrical properties of the sets are left intact

$$f : X \to Y \qquad (1)$$

Each geometry is defined by a particular group of mappings which are called a group of motions[3]. Isometries, for example, are a group of motions which preserve distance between points and they characterise Euclidean geometry.
Affine geometry is defined when transformations of scale are included. Other geometries such as inversive, differential and topology are defined by more complex mappings. Fractal

geometry is characterized by a group of motions applied to different resolutions within the same object. That is, equation (1) is represented by

$$f : X_i \rightarrow Y_i \qquad (2)$$

where the subindex *i* and *j* represent two resolutions of an object X. According to this definition it is possible to apply the mappings of different geometries to create a fractal.

In the literature the creation of fractals has been restricted to the use of the mappings of Euclidean and affine geometry[4]. In this work we propose to extend the mappings to include homeomorphism. These mappings characterise topology which can be defined as the geometry of continuous deformation.

COMPOSITION OF FRACTALS

The recursive mappings in fractals are characterised by a functional equation which describes a set of transformations applied to an original set. Particular characterizations of this function are the formulation of Iterative Function Systems (IFS)[5] where fractals are created by the recursive use of matrix transformations and grammars applied to descriptions of lines[6]. Dubuc[7] considers an analytic form of a functional equation which defines irregular curves and whose formulation corresponds to a parametric complex-valued function. Here, we extend this definition to a multidimensional parametric space.

This extension allows curves with a self-similar property to be created. We consider the composition of a fractal *F* as a linear additive combination of functions which describe different resolutions

$$F = \sum_{i=1}^{n\rightarrow\infty} f_i \qquad (3)$$

According to equation (2) each function in this equation has a recursive definition. That is

$$f : f_i \rightarrow f_{i+1} \qquad (4)$$

Therefore, an object is described by a composite map of the form $f_{i+1} = f \circ f_i$. The function *f* can be characterized by the motions of any geometry. If *f* is a homeomorphism (i.e. a continuous one-to-one mapping of the plane onto itself) then the resolutions of an object are related by general mappings.
In order to develop equation (3) by a homeomorphic mapping it is necessary to specify a level of detail *fi* using a general function. There exist many potential ways of describing this function, we use a parameterised decomposition based on a series of sinusoids at different frequencies. That is,

$$f_i = \sum_k \left(a_{ik}\cos(k\theta_i) + b_{ik}(k\theta_i)\right) \qquad (5)$$

where the coefficients a_{ik} and b_{ik} correspond to two orthonormal vectors

$$a_{ik} = a_{x_n} + ja_{y_n}, \quad b_{ik} = b_{x_n} + jb_{y_n} \qquad (6)$$

This equation defines a mapping from an *i*-dimensional space to the complex plane, and it can be proven that it corresponds to the generalisation of the mappings described in affine geometry to functions represented by different frequencies.

EXAMPLES

The combination of equations (3) and (5) defines a mathematical representation which allows several irregular curves to be created. We have created several fractals by defining the domain of the function as a discrete set of points. As an example, consider the structure defined by only one term in the summation of equation (5) with $a_{i1} = b_{i1}$, then

$$F = \sum_{i=1}^{n} a_i e^{j(\theta_i + \rho_i)} \qquad (7)$$

Figure 1 shows the result of evaluating this function with a domain θ_i specified by $[0.2\pi / 3.4\pi / 3]$ and a recursive definition of the values of a_i and ρ_i given by $a_{i+1} = {}^{3a_i}\!/_{2}$ and $\rho_{i+1} = \rho_i + {}^{\pi}\!/_{2}$.

Figure 1: Example of a fractal obtained by a change in phase

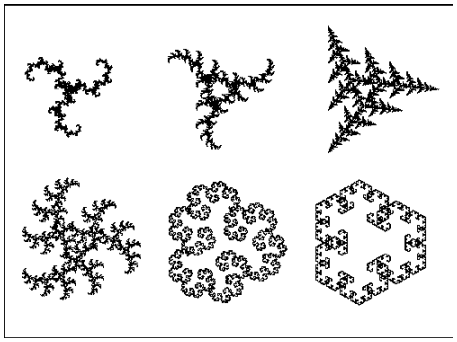

Figure 2: Sequence of a fractal animation

A dynamic fractal can be created by parameterising equation (5) in time. This parameterization corresponds to a function $m(t)$ which describes the deformation of a complete structure in therms of transformations in each resolution. These transformations define a change in a resolution *fi* until it occupies the space defined by another function *gi*. That is

$$m_i(t) : f_i \rightarrow g_i \qquad (8)$$

These kind of functions can be formalized mathematically through the mappings defined in topology and they can be used to model continuous deformations of fractals.
Figure 2 shows a sequence of a fractal deformation produced by changing the definition of the phase in each resolution as a function in time. It can be seen from the figure that simple changes can produce a complex dynamic behaviour where one cannot discover the rules of articulation and where geometric patterns emerge forming a fragmented shape.

CONCLUSION

In this work we have considered the extension of the patterns defined in fractal geometry to dynamic descriptions.
In the same way in which irregular curves have been applied to the study and modelling of complex forms such as plants, trees, molecular chains, clouds, shells, ice formation or ocean waves 1, 5, 8, the extension presented here permits the analysis and synthesis of models for the continuous distortion of complex forms. The extension is developed using a functional representation based on mappings which define levels of detail through geometric

transformations. These transformations are parameterised in time to obtain dynamic structures.

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SIMULATION WITH FRACTALS IN URBAN GEOGRAPHY

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***Abstract**: Many people are fascinated by the beautiful images termed fractals. Recently, fractal theory has become popular in urban geography. Actually, its formalisation is compatible with many characteristics of the urban systems : self-similarity in clustering and fragmentation of spatial patterns at different scales, hierarchical organisation, sinuosity of borders, and non linear dynamics. Analysis and measurement of urban morphologies led to the conception of urban models which simulate urban growth and are able to reproduce the observed properties of the urban spatial patterns. In that field of application, fractals have two different kinds of contributions. They can be used to control the results of simulations : they help to say if the results are realistic or not. But fractals can also be used as basic principles to generate urban forms. First, we recall how fractal properties can be related to important features of urban morphology just as easily as to the evolution of urban systems. Second, we briefly review the main trends in the application of fractals to urban issues : the description of urban morphologies (built-up areas, distribution of activities, networks, borders…), the simulation of urban growth and settlement systems analysis. A specific application to the question of urban limits will be presented in detail. Issues of relevance and validation will be discussed, especially regarding the combination of different types of spatial structures.*

Keywords: urban geography, urban morphologies, fractal nature, modeling of natural phenomena.

INTRODUCTION

Fractal geometry was developed and has become popular through the work of the mathematician B. Mandelbrot (1977). It deals with mathematical objects which exhibit properties of self-similarity (that is, which present the same type of structure at different scales) and which take intermediary dimensions when compared to Euclidean geometrical objects (for instance, while a straight line has a dimension 1, fractal geometry considers lines which are able to fill a surface such as the Peano curve and whose dimensions take values between 1 and 2).

Such mathematical objects are useful for describing spatial forms which are not regular in the sense of Euclidean geometry but which are characterised by alternate patterns of continuity and fragmentation, or some varying degrees of concentration, and include similar structures at different scales of analysis. Geographers have taken a specific interest in this new concept. One famous example is the question of measuring the length of coastal lines (one of the cases first mentioned by Mandelbrot) and the problem of their generalisation in cartography. But most applications refer to the analysis of spatial distributions which are generated by asymmetrical interaction processes between a centre and its periphery, and which reproduce the same way of alternating free and occupied places at different geographical scales.

In this paper, we focus more precisely on the utility of fractal geometry for urban geography especially when taking a global level of analysis (system of cities or a city considered as a global object, but without developing the analysis of networks within cities). After recalling why it is compatible with some of the major principles of urban theory, we briefly review

different ways of applying fractal measures and simulation methods to urban problems. Unresolved problems will be discussed as well as the question of the usefulness of fractals for social sciences, especially geography.

1. CONCEPTS IN URBAN GEOGRAPHY AND FRACTAL THEORY

By escaping rigid rules of Euclidean Geometry, fractal objects allow the development of useful tools for the description of observed spatial patterns. In the case of urban systems, many properties which have been formalised as major concepts of geographical theory can be related to the framework of fractal geometry. Indeed, the main properties of fractal objects are the same as the properties of urban patterns.

1.1. Heterogeneity of spatial distributions

The traditional approach of the spatial distribution of population and activities in geographical space relies on the concept of density (Haggett, 2001). This concept is borrowed from physics and refers to a specific concentration level which is typical of a homogeneous milieu. The measure of the density is particularly well suited for analysing and comparing, for instance, the performance of regional agriculture in given conditions of soil, topography and techniques. When applied to rural population it can be interpreted as a yield (it is the only sociological index which has as a denominator a measure of surface and not of population).

Although widely used, the concept of density is not so well adapted to the description of urban milieu. On one hand, as urban population survival no longer relies on the local resources of their site but on more distant advantages of their situation (for instance, linked to comparative advantages in trading networks), the conceptual meaning of density referring to a direct relationship between the urban population and the occupied surface is not so relevant. On the other hand, from a measurement perspective, towns and cities introduce major discontinuities in statistical landscapes of spatial population distributions, since urban average densities are always several times higher than the average surrounding rural densities. Inside towns and cities, there are also major contrasts between urban density levels, linked to the higher rents attached to central or more accessible locations, which give rise to more or less regular heterogeneous patterns of density, generally decreasing from the centre to the periphery and following the land prices gradient.

Alternative measures for analysing the spatial repartition of a phenomenon are auto-correlation functions and concentration indices. The first method calculates the probability similar elements being located either close to each other (spatial autocorrelation measures (Odland, 1988, Cliff and Ord, 1973)) or far away (variograms (Lajoie, Mathian, 1991)). Such measures are very useful for studying contagion phenomena characterised by a high probability of close areas having the same characteristics. They are also useful to describe repulsion processes inducing a high probability that if a given area has a given characteristic, this characteristic will be missing for the closest areas.

A second alternative is to study concentration or dispersion phenomena (e.g. of a type of retail or industrial activities) by using the classical means of spatial analysis, whether on points or on areas. The spatial analysis indexes measure the deviation from a situation of equi-distribution. They suppose a linear relationship (proportionality) between population and surface. But, such a relationship is not present in most cases : the most populated units are very often smaller (in size) than the less populated ones. Thus, concentration indices give different results according to the geographical scale considered for the calculation. Considering the same scale, they even give different results according to the number of spatial units considered (Bretagnolle, 1996).

Thus, density measures and spatial analysis indexes all have the major inconvenient to refer to a homogeneous spatial repartition of elements.
Let us now consider the physical morphology of cities. Urban landscapes have become heterogeneous and fragmented especially since they escaped the enclosure of medieval walls and suburbanisation began to shape their spatial form. Clusters of buildings alternate with empty spaces. Local concentrations may take highly variable levels and forms. When looking at land use maps at any scale, the spatial distribution of urban population or activities appears as intrinsically non-homogeneous : smaller and medium-sized clusters appear in the vicinity of much larger clusters (figure 1).
Finally, the fact is that theoretical thinking in architecture and planning mainly refers to objects stemming from Euclidean geometry (as the circle or the square) whereas the emerging urban forms with their irregularities and fragmentation are more often better described by fractal geometry. This results from the polygenic character of most cities, which never reflect a unique and homogeneous concept in their construction. Even the most geometric master plan ends up with unfinished irregular parts or has to become inserted in a different spatial pattern of areas, which are built over the following periods.
Fractal structures share the same property of fundamental heterogeneity. Like a city, or like a set of towns and cities, the distribution of their mass in space is never uniform, neither dense nor diluted. Nevertheless, this fragmented distribution is not purely random, since fractal objects are structured following a central organisation principle, self-similarity throughout the scales, which is a property especially useful for studies in urban geography.

1.2. Spatial gradients : fractal and non fractal scaling exponents

Self-similarity is a property very often linked with scaling effects, producing regular spatial gradients or hierarchies. A well-known example is the gradient describing the intensity of land use which characterises the internal structure of cities. This gradient was first mathematically described by Clark (1951), who formulated an exponential curve for describing the regular decrease in population densities or in land prices from the city centre to the periphery. Density $\rho(r)$ at a distance r from the centre, which has maximal density $\rho(0)$, can be expressed by the following equation :

$$\rho(r) = \rho(0)e^{-br} \qquad \text{with } b>0$$

Such a spatial distribution of local densities can also be approximated by a hyperbolic law (*i.e.* an inverse power law):

$$\rho(r) = \rho(0)e^{-a}$$

In principle, the estimated value for a depends upon the size and number of subregions. For instance, in the case of the urban area of Paris, subdivided into arrondissements and communes, the estimated value of a was 2.69 in 1982 and 2.57 in 1990 with the power law. In the case of Lyon, using the exponential model, the b parameter reduces from 0.28 in 1968 to 0.17 in 1990.
In both cases, the absolute value of the parameters a or b measures the rate according to which the density is decreasing over the distance, it is known as an urban density gradient. Both models refer to a non linear but regular distribution of the mass (of population, but it also applies to built-up areas, to rents…) in urban space. The densities are decreasing more quickly than proportionally to the surface when considering more distant outer rings from the city centre. The rapidity of this decrease is however regular and is measured by parameters (b in the exponential model, a in the Pareto model) which have constant value for all the urban structures.
The independence of the parameters a and b from the distance to the city centre is one major characteristic which exists in fractal structures too. It corresponds to the mathematical iteration process which is generating them. It is usually summarised by a measure which is

called the fractal dimension (see below). Actually Batty and Kim (1992) have demonstrated that there is a strict equivalence between the parameter a of the Pareto model and the fractal dimension D, which are linked through the simple relation $D + a = 2$. D and a are designed as scaling exponents.
The fractal dimension D of an urban pattern may be obtained by counting the number of built-up elements (or resident population) at several scales and then, by fitting a fractal law. Such a law can be written as following :

$$N(\varepsilon_i) = c + \varepsilon_i^D$$

where c is a constant, ε_i, the analysis level (i.e. the considered distance between the elements) and N, the number of counted elements.
The Pareto model expresses the fact that the largest elements of a statistical distribution are much less numerous than the smallest ones and the parameter a is a measure of the inequality of the distribution of the elements with respect to their number and their size. The Pareto model applied to urban densities is close to a fractal law because it considers a heterogeneous spatial distribution of the elements, just like a fractal law does. But the fractal dimension of a pattern is an indicator of the heterogeneousness of a spatial repartition, at a multitude of scales whereas the Pareto model is non-scalar (or uniscalar).
Hence, some precision is required : even if the density function can be derived from a spatial organisation of a hierarchical nature, the reverse would not be the case. In other words, if a hierarchy is observed, then it is possible to determine a gradient which describes (measures) the change between one level and an other... But the existence of a gradient does not necessarily imply a hierarchical spatial organisation. Indeed, a gradient isa purely descriptive approach including no reference model, and no explanation. Basically, a gradient is the derivative of the incremental change of something.
However, in the case of the Pareto model applied to the urban densities, the formalisation implicitly refers to a radioconcentric model of the city. The difference with a fractal distribution of elements is the explicit geometrical nature of such a model, which is intrinsically hierarchical.
At another scale of analysis, inverse power laws are also very frequently used for modelling the hierarchical organisation of urban systems. Known as Zipf's rank size rule, this model describes the distribution of the number of towns and cities according to their population size as a Pareto function. According to Zipf's notation, the population P_i of a town or a city is inversely related to its rank R_i in the system of cities by the following power law :

$$P_i = \frac{K}{R_i^a}$$

Zipf's law is obviously like the Pareto model a hyperbolic law, and the same analogy with a fractal distribution can be derived in that case. One of the first papers about fractals in geography (Arlinghaus, 1985) suggested that the geometry of central places is a subset of fractal geometry and that an iterative fractal process could generate all possible systems of central places. N. François (François et alii, 1995) has demonstrated it for Christaller's models and applied measurements of fractal dimension to the French system of towns and cities.

2. SOME APPLLICATIONS OF FRACTALS TO URBAN QUESTIONS

Applications of fractal geometry in the urban field are now too numerous to be completely reviewed here. We have selected a few which seem representative of the main research currents.

2.1. Description of urban morphologies

The most frequent use of fractal dimension in urban geography has involved measuring the fractal dimensions of urban patterns, aiming at finding new descriptions of the variety of urban morphologies. The morphology of urban patterns is analysed following principles from fractal geometry.

Such analysis relies mainly on the study of the built-up surface of cities and shape and length of their border. Three main sets of results can be obtained :

- The verification of the hierarchical nature of the spatial structure and the characterisation of this hierarchy ;
- The identification of thresholds in the spatial organisation of the city ;
- The determination of the number of different types of spatial organisation (for instance, connected and weakly hierarchical built-up clusters when considering an analysis window of length from 0 to 200 meters, then non connected and more hierarchical built-up clusters for an analysis window greater than 200 meters). Such results could be related to the multifractality of an urban structure.

The identification of these potential uses of fractal geometry for the analysis of the urban patterns raises two types of questions :

- *Which properties of urban patterns are revealed by the different measures of fractal dimensions ?*

E.g. if the border of a city is characterised by a very high fractal dimension, it means that this border is full of tentacles. Thus, the very extension of such a border allows the access to free spaces (mostly green spaces and roads) for almost all the buildings.

- *What reflects these properties in terms of individual behaviours ?*

For instance, the very high number of tentacles of an urban border could mean that everyone has tried to settle as near as possible from a green area and then, that they try to maintain this situation.

Answering these two questions could allow the identification of types of city or urban patterns with well identified properties.

Actually, fractal dimension measures are a good instrument for a global comparison of the morphology of cities : they are more homogeneous in the case of American or Australian cities (fractal dimensions near to 2), more variable for European cities or more generally for very polygenic cities characterised by their high density gradients from the town centre to the periphery (fractal dimensions between 1 and 2, but nearest to 1) (*Frankhauser, 1994;Batty and Longley, 1994*). However the number of comparable measures is not sufficient to obtain a clear classification of the cities of the different parts of the world. Moreover, the results obtained by fractal analysis are highly dependent on the generalisation methods of the maps representing the built-up surfaces that are used for the measurement of fractal dimension.

In addition to static analysis of urban forms, the comparison of the fractal measures over time may throw light on the urban growth process. Studying the evolution of the fractal dimensions of a city in the course of time shows how the urban pattern is progressively self-organising, following a centre to periphery gradient. The structuring of the peripheral areas often occurs a long time after the emergence of the first buildings in the suburbs. A set of fractal analyses of urban patterns across time have shown that urbanised space is increasingly strongly organised around a central cluster. Moreover the urbanisation is accompanied by a self-structuring process which appears in the growing regularity of the curves resulting from the fractal analysis, despite the fragmented morphology of the urban patterns (Frankhauser, 1998).

Now, even if fractals are mainly used in urban geography for identifying different forms of cities and of urban growths, some research also tackles the question of the patchwork of intra-urban patterns (Batty & Xie, 1996; Frankhauser, 1998; Frankhauser & Pumain, 2002). In that

field of research, the analysis recently undertaken by M.L de Keersmaecker, P. Frankhauser et I. Thomas (2003) and (2004) are particularly interesting. On the basis of statistical analysis of an exploratory nature, they tried to determine if the fractal dimension is a useful index for distinguishing either urban wards (de Keersmaecker et al., 2003) or types of peri-urban built-up patterns (de Keersmaecker et al., 2004). Indeed, they showed firstly that different fractal dimensions measure complementary aspects of the structure of the urban and peri-urban built-up pattern, secondly that interesting statistical associations can be found between fractal dimensions and the structure of the housing market, the rent, the distance to the city centre, the income of the households as well as some planning rules.

2.2. Simulation of urban spatial dynamics

Analysis and measurement of urban morphologies led to the conception of urban models which simulate urban growth and are able to reproduce the observed properties of the urban spatial patterns. In that field of application, fractals have two different kinds of contributions. They can be used to control the results of simulations : they help to say if the results are realistic or not (*White et alii, 2001; Engelen et alii, 2002*). This is the case for the dynamic model of land use developed by R. White and G. Engelen (*1994*) for Cincinnati. But fractals can also be used as basic principles to generate urban forms.

Indeed, several authors have suggested urban growth models based on fractal rules (*Batty, Longley, 1986; Batty et al., 1989; Markse, Halvin, Stanley, 1995*). Cellular automata are frequently used as simulation tool for modelling urban growth or land use changes, whereas available physical growth models (Eden, DLA : Diffusion Limited Aggregation) could be profitably substituted by more detailed and realistic models of spatial evolution dealing with social processes. As an example, we briefly describe a model developed by E. Bailly (*Bailly, 1999)*. To start with, we have a raster image of an urban pattern made up of two types of pixels : black pixels which represent built-up spaces and white pixels representing non built spaces. An iterative fractal growth model (the DLA model) is applied to the image. At each iteration step, new built-up pixels appear under the constraint that their location is compatible with the fractal nature of the simulated pattern. Other non fractal constraints have been integrated into the model, accelerating, slowing down or preventing the apparition of the built-up areas (rivers, slopes declivity, exposure…). When applied to the town of Marseilles (South of France) in 1930, the pattern simulated by the model presented a global form very similar to the one of Marseilles in 1990's. But locally, the simulated and the real patterns could be very different.

Following the same direction, it would be particularly interesting to provide several models of fractal growth allowing the simulation of urban patterns with well differentiated characteristics. Thus, it could be possible to simulate different conceivable evolutions of an original urban pattern, each of the simulations corresponding to a particular vision of the urbanisation process (e.g. urban intensification or sprawl, increasing or decreasing hierarchy…).

Very recently, J. Cavailhès et al. (2004) also presented the application of a residential location model (standard in urban economics) on a spatial support provided by fractal geometry : on the one hand, a Sierpinski carpet is used to render a nested hierarchy of the rural and urban places within a metropolitan area. On the other hand, households maximise a utility function which portrays the households' taste for variety in urban and rural amenities. Such a modelling uses the fractal approach to replace the Euclidean spatial representation of the city (i.e. the "Thünian city") by a fractal one, which is closer to the actual observed reality. A particularly interesting idea developed in the paper is that the "Thünian city" appears as a limit case for the "fractal city".

CONCLUSION

Fractal analysis as applied to the Basle agglomeration throws a promising light on the evolution of the urban structure of the city. It shows that the general form of the agglomeration was already shaped in 1957, the consecutive evolution being merely a space filling process around the existing built-up cores. Considering tables 1 and 2, it appears that fractal dimensions of the border and of the built-up area are similar in 1957 and 1994, while results are more different in the case of 1882. The relationship between surface and border changed over time. The results obtained should now be interpreted thoroughly in order to identify the substantive meaning of the identified thresholds as well as the substantive meaning of the intersection of the curves which appeared.

From a general point of view, urban sprawl mainly involves the homogenisation of the built-up texture and an increasing sinuosity of the border, which also becomes less contrasted in design. But it seems useful here to sum up the morphological properties of urban patterns which can be identified through the analysis presented and which manifest themselves in the existence of urban sprawl :

- great number of built-up clusters at the initial step of dilation : the space is highly covered with housing; this coverage is locally rather homogeneous; the urban pattern is rather weakly compact; built-up clusters are rather close to one another;
- at the end of dilations, only a relatively small number of built-up clusters remains;
- at the end of dilations, only a small number of lacunas internal to the clusters remains;
- in the course of dilations, emergence of a great number of lacunas when emerge big clusters;
- the initial total border of the urban area is particularly long;
- the curve representing the evolution of the length of the border through dilations is characterised by a steep negative gradient.

Now, the objective of further research is to better understand the time evolution of the relation between the length of the border, the number of clusters and the number of lacunas. Such an objective could be attained mainly through systematic comparisons with other urban areas.

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THE USE OF CUSTOMIZED ASSESSMENT GRIDS

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Abstract: *Customized assessment grids are educational materials that each teacher uses on daily bases to evaluate both the students and own results in increasing the level of student knowledge. To obtain proficiency each teacher should know a bit about quality standards and also to use updated materials. In the same measure each software producer should fight that his educational products become more and more competitive by implementing the latest standards in education.*

Can we speak about eLearning 2.0 ?

There is no doubt that quality is the most decisive factor determining the future of eLearning. By definition: "the quality in elearning brings together the field of education, technology and economy in comprehensive concepts in order to contribute to the societal development , to innovate formal, non-formal and informal learning opportunities, and empower the learners as citizens to take part in the building of a shared knowledge and learning space"[8]. In the same measure a clarification should be made between quality of methods and instruments and quality of educational opportunities, access and learning. In this perspective "quality standards should improve flexibility, reusability, transparency, and compatibility and is widely accepted in the community"[9].. A short history of evolution to web 2.0 can be seen here[10]:

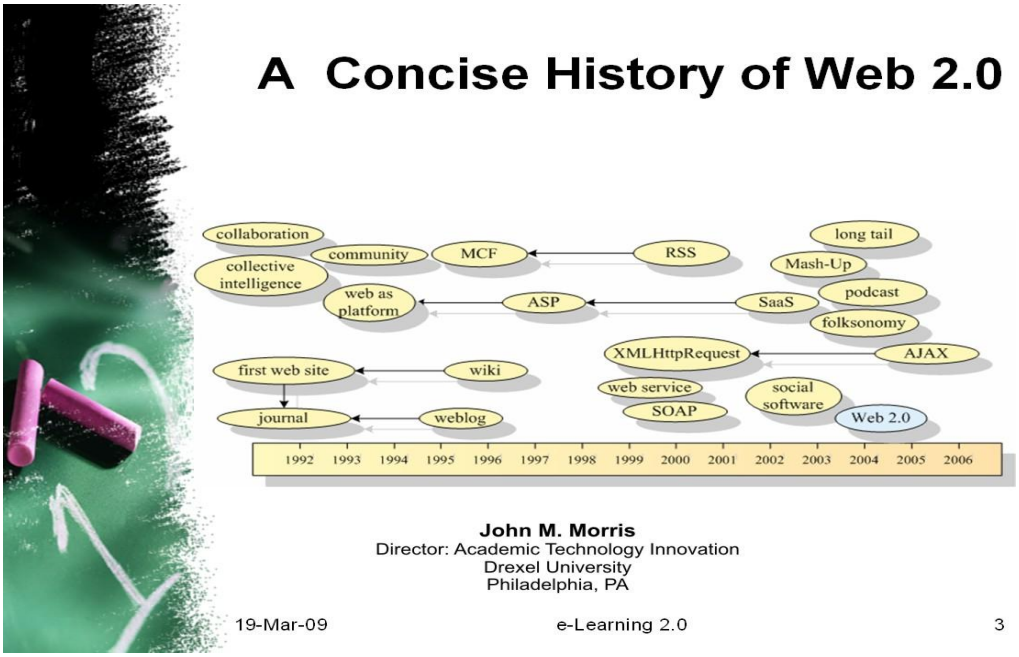

Figure 1 – Concise History of Web 2.0

[8] www.springerlink.com/index/q2h520q041202v44.pdf
[9] www.springerlink.com/index/q2h520q041202v44.pdf
[10] http://www.drexel.edu/irt/eLearningConf2007/present/e-Learning2.0-DU-Conf.ppt

The need of customized assessment grids in eLearning 2.0

A few days ago one of the RSS feeds signals me a new reality in eLearning.
Moodlerooms, a Moodle partner, is launching a new enhancement to the open source LMS in collaboration with search giant Google to provide access to the application suite using a single sign-on. Google Apps Education Edition is the widely deployed hosted application suite that includes communications tools like as Gmail, Google Calendar, and Google Talk; collaboration apps, such as Google Docs, Google Sites, and Google Labs (for software code review); and various administration features and APIs for integration with existing systems[11]. This was to me and others an expected development. It was well known that some educational platforms enable communication with your own calendar, mail, and other tools, but all that programs are installed on student computers. The collaborative work is not at easy because students use different software. It easy enough to mail a task to a group of students but it is not easy job to create a common document without Web 2.0 tools. The move made on educational market by Google certifies that eLearning is now mature enough to move to eLearning 2.0. It is a matter of months until all LMS (Learning Management Systems) will prove that are able to integrate with industry standard SAML 2.0 and OAuth protocols for secure single sign on and information transfer. All will implement tools that allow integration of the students without fear of different operating systems or incompatible software. And that means an increase quality for LMS.

Some professors tends to loose their control over the sources of learning accepting as done sources that are not academically sure in their Wikipedia. This implies a seismic shift in the role of the teacher to that of facilitator and that learners' responsibility for their own learning becomes more than a slogan. eLearning in this case lose much more of the "e" because ICT is now integrated into education as, for example, paper is today. Professors developed some new ways to deal with these circumstances adding in their courses a number of mentoring schemes.

Mentoring is not a part of traditional eLearning LMS in problems that regards the course content. From this reason a new standards of eLearning should be issued to regain quality standards.

If eLearning 2.0 is the using Web 2.0 tools in teaching appear some question regarding the classical standardization. Classical LMS have all the tools integrated inside. It often implies a great deal of effort on the part of the teacher to set up blogs, wikis, and so on as well as setting up the networks that their students will use to communicate with others. When learners take on much more of the responsibility for setting up their own blogs, wikis, and podcasts and for creating and nurturing their own networks some professors say that will be eLearning 3.0[12]. Although we cannot speak about this part as impossible some tendencies of loosing information credibility appear in eLearning 2.0.

The assessment is part of didactical processes and eLearning role from this perspective starts to become more and more similar with use of the electricity on traditional learning. Everybody use now computer assisted assessment practices, In this perspective is important to have a clear perception of the outcomes of didactical process and . to understand which of the evaluation tools are bringing the most value.

11 http://campustechnology.com/articles/2009/02/20/google-collaborates-on-moodle-integration.aspx
12 http://www.checkpoint-elearning.com/article/4753.html

Case study – Customized Assessment grid

A customized assessment grid it usually starts with a simple self-evaluation grid or a simple perception regarding course expectation. .

From didactical point of view it can look like this
Focusing - Professors know the levels at which students are currently working. Professors have some understanding of student's strengths and areas for development. The progress of individuals and groups of students is recorded as numeric data.
Developing Learning objective is analyzed against assessment focuses and specific areas for development are identified. This assessment informs a shared understanding of strengths and areas for development across the university. Professors set curricular targets for students which tell them what they need to do in order to improve their learning. Feedback on written work reflects this. Target setting procedures aim to move students learning on so that it matches university expectations for attainment. Differences between the attainments of specific groups of students are monitored. Professors know which groups are underperforming.
Establishing – Professors provide students with targets which address areas for development identified following classroom observations and assessments, data analysis, face to face discussions and work scrutiny. Professors ensure that students know the steps that they need to take in order to achieve their targets; they receive feedback on their progress against these steps. Professors know which students have been identified as being at risk of underachieving. These students receive targeted support which is referenced in planning. The progress of underachieving students is accelerated so that their attainment is in line with university expectations. All the persons who work with students know the student's targets and understand their role in supporting the students to achieve them. Opportunities to reinforce curricular targets through whole class, independent and guided work, are highlighted in planning across the curriculum.
Enhancing There is an effective, coherent and manageable whole-university system for agreeing and revising targets against student's progress. Students are able to articulate their successes against their targets. They agree future targets with their professor and show, through the level of challenge that they set for themselves, that they expect to make good progress in their learning.

Or……

A more simple approach (more "correct" from a student point of view) can look like Figure 2:

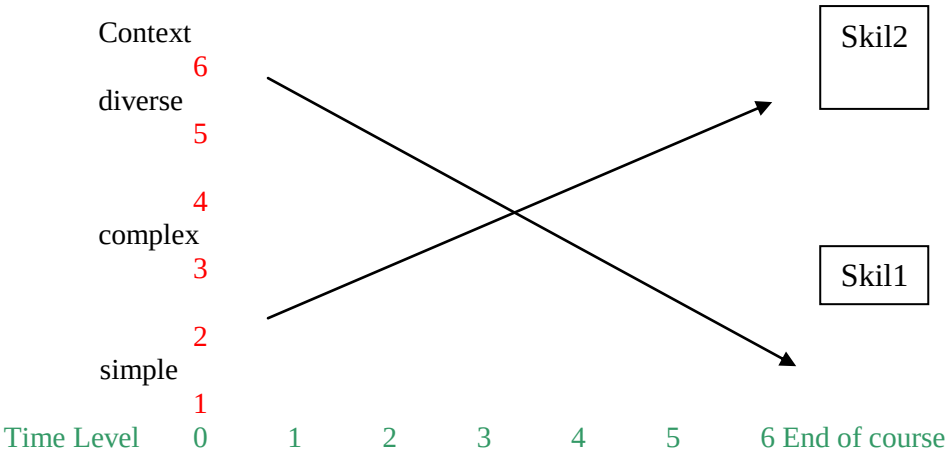

Figure 2 Desired course expectations

This drawing is developed by a student on a design course asked to explain his expectations from a course. He wants to master 2 skills and use differently at the end of the course[13].

[13] See also O'Donovan, B., Price, M. and Rust, C. (2001) 'The student experience of the introduction of a common criteria assessment grid across an academic department', *Innovations in Education and Teaching International*, vol. 38, no. 1, pp. 74-85

Implementation of assessment grids

In eLearning the user modeling is the process of constructing (often computer-based) users models, while the user model means all the information collected about a user that logs to a web site, in order to take into account her needs, wishes, and interests. Every LMS has its techniques to modeling his users so as to construct the user model or profile. The process of user modeling covers user model as an output, as well as background knowledge, and the user behavior.
Construction of an effective user model and tracking of its continuous changes are a real challenge in contemporary LMS. The quality and expressive power of the user model is crucial in respect to the implementation of intelligent support for different adaptive education strategies and their switching during the personalization, of the:

- the learning content, based on learner's preferences, educational background and experience, learning content tailored to individual learning style of the user;
- the representation manner and the form of the learning content (for example, learning content in the form of the adaptive learning sequences of learning objects).
- a combination of the previous two types.

Personalization in current Learning Management Systems[14] tends to be concerned with remembering which courses the user is allowed to view and how they like their pages to be presented. Observing the educational process as a whole, learners are very rarely allowed to get access to learning objects which are conditioned on a wide range of personal data including achievement, date/time and class code. In the future a more increased role of communication new standards will allow more flexibility.
The following approaches (based on user model) can be used to apply the learning personalization:

- Personalization, controlled by the learner – It requires direct input of the learner's needs and preferences by filling question forms or by choosing options and alternatives.
- Personalization, based upon an existing user profile and meta-descriptions of the information content - In this case, the learners' preferences are stored in their profile.
- Personalization via searching for a correlation between the learners - Correlation is through the values of the attributes, describing the learner's profile. If there is a strong correlation, there is a possibility that the content for a given profile is suitable for applying to its close (adjacent) profiles.

User modeling is a complex and sophisticated one. Application of the semantic web approach to representing student model based on multiple student data with respect to the most important and well-developed learner model standards will help and decrease the difficulty of the process. Ontology is a key Semantic Web technology for marking up electronic resources. Ontologies typically consist of definitions of concepts relevant for the domain, their relations, and axioms about these concepts and relationships.
The assessment grid in this case has a role in customizing the content offered to the student LMS.

Customized learning

Customized learning, presenting just the right material to the learner on demand, can be described using data representations from learning technology standards (learner profiles, competency definitions, sequencing rules, learning objects). William Blackmon and Daniel Rehak[15] offer a web

14 http://mdl.cc.bas.bg/dessi/Desislava%20Paneva_files/Approaches%20and%20solutions%20for%20personalization%20in%20eLearning%20systems_article.pdf

15 www.dlib.org/dlib/march05/kraan/03kraan.html

services-based methodology for customization by profile, specifically one of eliminating learning objective from a course because either:
a. Learner's current role does not require the learning objective taught by the professor, or
b. Learner's profile indicates the learner has already achieved the objective taught by a professor.
The learning content and data used in customization are represented in a set of standards-based data models. These are used in a content authoring and delivery process that customizes the activities delivered to the learner based on the learner's role and competencies. To determine which processes will be used for the following lesson assessment grids are now again in role.

Content and learning activity customization uses six sets of data elements (with data representations taken from current learning technology standards):

- Learning Objects -- the collection of content and learning resources maintained in a content repository.
- Content Structure -- the organization of learning objects in a tree or hierarchical structure.
- Roles -- definitions of the job roles of a learner.
- Competency Definitions -- definitions of the skills and knowledge acquired by a learner.
- Learner Information Package -- the collection of stored profile information about a learner.
- Sequencing -- rules used to select content and sequence the learner through a content structure.

The major steps for use customized assessment grids in preparation and delivering a course are:

- Create Course and Content Description -- describe the course (content structure) and behaviour rules used to express the progression of the learner through the content:
- Associate role and competency definitions with each learning object by mapping a sequencing objective id (used to label the objective) to a competency definition id or to a role id.
- Specify the conditional rules used to customize the course by eliminating learning objects from the activity sequence.

• **Establish Learner Profiles** -- specify the role of the learner (which in turn may yield a set of competencies required to perform the role), and contain data on the learner's record relative to each of the specified competencies.

Implementation

The customization process has been implemented through a set of web services. Rather than building large, closed systems, the focus is on flexible architectures that provide interoperability of components and learning content, and that rely on open standards for information exchange and component integration. The overall web services architecture for learning is divided into layered services. The layers from top to bottom in this services stack are:

- **User Agents** -- provide interfaces between users (both end user applications and program agents) and the learning services. Agents provide the major elements of learning technology systems: authoring of content, management of learning, and actual delivery of instruction to learners.
- **Learning Services** -- collection of (many small, simple) data models and independent behaviours. Service components are characterized as providing a single function that implements a particular behaviour. Each service is identifiable, discoverable, (de)referenceable, and interoperable. They include built-in security and rights management, and assume an unreliable underlying network. Services are grouped into logical collections, where upper-level services rely on the support from the lower-level services:
- **Tool Layer** - Tools provide high-level, integrated server applications. Accessed via known, published interfaces, they provide the public interface to the learning tools (tutors, simulators, assessment engines, collaboration tools, registration tools, etc.). User agents and end user applications are built using collections of tool services.
- Common Applications Layer - These are services that provide the commonly used learning functions and application support behaviours used by tools and agents (sequencing, managing learner profiles, learner tracking, content management, competency management, etc.).
- **Basic Services Layer** - Basic services provide core features and functionality that are not necessarily specific to learning, but which may need to be adapted for learning (storage management, workflow, rights management, authentication, query/data interfaces, etc.).

All services are built on and use a common infrastructure model. The infrastructure layer relies on basic Internet technologies (e.g., HTTP, TCP/IP) to connect service components over the network. The services themselves are implemented using web services bindings. Messaging is done with SOAP; service descriptions are catalogued with UDDI, and described in WSDL - all are XML representations [6]. Overall service coordination is expressed in a workflow or choreography language. These standard technologies permit the upper-level services to be implemented in a platform-neutral manner, and provide interoperability across different implementations of the actual learning services.

Conclusion

In elearning all approaches merged into one, because the courses were thought initially as one system and at each of its component parts, they interrelate and interact. Even in eLearning 2.0 the situation is similar. Assessment grids have the role to identify the week point of the course in the same measure with students learning process. Also, the continued emphasis on explicit articulation of assessment criteria and standards is not sufficient to develop a shared understanding of 'useful knowledge' between staff and students. In traditional learning socialization processes are necessary for tacit knowledge transfer to occur. The traditional methods of knowledge transfer in higher education placed reliance on complex socialization processes based on practice, imitation, feedback and discussion, often on a one-to-one or small group basis. In eLearning socialization is on forum and chat , but professional communication is held on assessment grids. For most institutions, reliance on these resource-intensive methods is difficult, if not impossible, in the context of today's rapid expansion of student numbers and cuts in the unit of resource. It does appear, however, that through a relatively simple intervention incorporating a combination of explicit articulation and grid assessment processes and a considerable amount may be achieved in developing shared understanding and, consequently, in improving student performance— and that this improvement may last over time and be transferable, albeit possibly only in relatively similar contexts.

VIRTUAL LEARNING ENVIRONMENTS

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***Abstract**: There are currently thousands of schools and colleges operating on the Internet and it is now possible to get a degree without ever having to leave the comfort of your own home. Virtual learning environments are hugely diverse in size, capabilities and services offered, and can cater for individuals ranging in attainment levels, ages and special needs. We wished to examine the current uses of these new virtual environments and how they utilize technology to create a more interactive learning curriculum. To do this we examined the current debate surrounding the longevity and relevance of the traditional classroom in a digital society. More flexible, comprehensive and dynamic communication is now possible through the available technologies of videoconferencing, live broadcasting, and faster connection speeds. There has been a significant rise in interest towards implementation of Internet based virtual learning in the last number of years, as educational institutions and individuals realize the benefits of these virtual environments.*

Keywords: virtual learning environments, technology, interactive, classroom, wireless, haptic.

INTRODUCTION

With the vast amounts of money being provided by governments to train educators and supply students with new technology, it does not take a leap of faith to consider a future where virtual learning environments will have the potential to dominate or perhaps replace the traditional classroom, as we know it. There are currently thousands of schools and colleges operating on the Internet and it is now possible to get a degree without ever having to leave the comfort of your own home. Virtual learning environments are hugely diverse in size, capabilities and services offered, and can cater for individuals ranging in attainment levels, ages and special needs. With our own personal experiences of virtual learning environments being little more than a text only Web page, we wished to examine the current uses of these new virtual environments and how they utilize technology to create a more interactive learning curriculum. To do this we examined the current debate surrounding the longevity and relevance of the traditional classroom in a digital society.

After locating examples of virtual learning environments we considered how technology has been able to emulate the role of traditional classroom equipment and teaching techniques and whether they can be successfully transferred. Upon examination of these virtual environments we raised questions about the extent to which student's needs were being met and how students adapted to these new en reactive virtual environments has now become an integral part of our learning environment. More flexible, comprehensive and dynamic communication is now possible through the available technologies of videoconferencing, live broadcasting, and faster connection speeds. There has been a significant rise in interest towards

implementation of Internet based virtual learning in the last number of years, as educational institutions and individuals realize the benefits of these virtual environments.

1. VIRTUAL CLASSROOMS

The Jones International University, the first accredited "cyber-university" to operate completely online, was thought to envision the future of the "mega-university" and set the trend for education institutions online. [5] Current educational virtual environments are large and extensive and can be difficult to define as they are constantly changing and evolving. They often range in the level of interactivity they offer and the variety of services they provide. If we consider virtual schools, we can possibly make a division into three possible broad categories: independent, collaborate and broadcast. [7]:

- Independent models can often be referred to as "asynchronous" because they do not rely upon direct communication between teachers and students, as they do not avail of chat or videoconferencing facilities. Students access and interact with materials at their convenience and so the learning structure is considered unscheduled.
- Synchronous models usually involve more communication and collaboration through videoconferencing and live chats so there are more opportunities for socializing. As online meetings are usually scheduled there is limited flexibility.
- Broadcast models allow students to access lectures or broadcasts on the Internet and so interaction is often limited.

These different models give an example of the wide range of learning flexibility offered by these virtual environments that serve the individual needs and are regardless of age, gender, religion, nationality or disability. It is therefore not surprising that we have witnessed such a move towards interactive learning in such virtual environments. This has consequently given rise to debate over the future of the traditional classroom in a digital economy. Some critics believe that the traditional classroom will become outdated as the demand for flexibility and distance learning increases, while others believe in its longevity as a communicative learning medium. Such debate is fuelled by surveys, such as the study at the California State University at Northridge, which claimed that students leaning in a virtual classroom tested 20 per cent, better across the board than their fellow students in a traditional classroom. [19]

Jerald Schutte at Northridge randomly selected half of his students to be taught through traditional in-class lectures and written assignments while the rest of the class learned through text posted online, email and real time chat with classmates and electronic assignments. Both groups were given identical tests under the same conditions and there were no significant differences between the age, gender and computer experience of the groups involved. What is astonishing about the results was how quickly the students adapted to the virtual classroom and formed peer groups online as compensation for not being able to converse in class. Students in the virtual class spent 50 per cent more time working with each other then their counterparts in the traditional classroom.

1.1 Virtual Versus Traditional Classroom

These results were quite confounding at the time as little experimental evidence had been generated to demonstrate the effects on student performance in virtual versus traditional class formats. The results contradict popular hypotheses that face-to-face teacher-student interaction in a more valuable experience and produces better results. Schutte observed that the traditional classroom could be sometimes an inhibiting environment for students, and its

structure can be pressurizing and intimating. Whereas the virtual environment encourages freedom of expression and students are more open to communicate and express opinion and would often thrive in these environments.
While these results are impressive and virtual environments have the obvious benefit of being more accessible than traditional classrooms, and are often a more flexible and convenient approach to education, they do however have several unfortunate consequences. One thing that Schutte pointed out in his report was the fact that 'the virtual students seemed more frustrated', not from only the technology but from the inability to, ask the teacher, questions in a face-to-face environment. This lack of human face-to-face interaction is what concerns a lot of those critics against virtual learning environments, as they fear students will not develop a deep understanding of their own emotions and this could have a long-term effect on their relationships as future adults in society. It is thought that children will miss out on the important friendships that are formed in school and this will lead to poor social skills in adulthood. Also differences in learning styles and varying aptitude levels will mean that some will learn less effectively in virtual environments and would require more individual personal contact with a teacher.
As many traditional educational institutions are coming under pressure to join the virtual realm, Glenn Russell [7] highlights the important point that "virtual schools may be promoted due the self interest of the economist, bureaucrat, or on-line entrepreneur, rather than on the evidence of educational research or merit". With the thousands of schools and universities now operating online, it is becoming increasingly difficult to distinguish and judge their academic virtue and the quality of education may become compromised under commercial pressure. But while it is unlikely that the virtual classroom will replace the traditional classroom as an educational medium completely, there is no doubt that interactive learning in virtual environments will become more common as the technology advances.

2. TRANSFERRING THE TRADITIONAL CLASSROOM TO THE VIRTUAL ENVIRONMENT

In a physical classroom there is a standard set of equipment and tools, this usually includes audio-visual equipment such as textbooks, a chalkboard, video player, and tape recorder. Virtual environments need equivalent equipment and tools in the form of network-based software application to allow a group of instructors and students to carry out the learning process. The sophistication of such software structures vary widely, from simple electronic mail systems to systems that have been specially enhanced to support classroom-like experiences, such as virtual auditoriums. Some of them are well established on the Internet and new ones are still emerging.

2.1. The Textbook

For century's textbooks have been the most important teaching and learning tool at all kinds of schools. They provide the teaching plans for the teacher, help the teacher and students to orientate in the curriculum content, provide background materials and direct the student's understanding and learning. In spite of that there are certain restrictions of the traditional textbook; above all the physical format of the textbook does not easily allow student and teachers to depart from the prescribed path, or to link to new concepts and ideas from other disciplines [4]. Virtual textbooks are a new tool. Siegel and Sousa state that:
"the goal of virtual text books is to move learners beyond content mastery to information-seeking and problem solving skills that include … evaluating and synthesizing information

from diverse sources; understanding and applying the difference between fact and opinions; grasping multiple and diverse perspectives; and drawing insights from these perspectives within the context of one's own knowledge base and experiences." [8]
The Web seems to be more suitable for this than the traditional textbook in many ways. The information can be delivered in both linear and non-linear format; it can be presented via multimedia with text, pictures, video, sound and animation. Vast amount of information can be searched, reorganized and downloaded from decentralized worldwide digital libraries. Also the quick-delivery feedback ability of the Web can make learning more effective [4]. But there may be some drawbacks in using electronic textbooks. Above all they sometimes do not provide all of the details that users need or conversely insufficient emphasis on good human-centered design of the interface and huge amount of information results in information overload and frustration of the users.

2.2. The Chalkboard

Most teachers make use of a chalkboard for further clarification of a point. The instructor of an electronic course might make use of the shared whiteboard to answer questions from students. Such tools allow "images to be displayed, manipulated, annotated, and shared between two people or among a whole group" [20]. It is offered by a tool like NCSA College [17], which combine communications software tools with "NCSA scientific visualization software", allowing researchers to conduct virtual collaborations. In these sessions students can share data visualization and create documents collaboratively-producing and editing text in real time.

2.3. The Sound System and Face-To-Face Interaction

An important part of the physical class environment is the personal interaction as questions are asked by the students. Allowing all students to "hear" the questions and answers helps everyone to learn and encourages additional questions. [20] List servers can be used to redistribute e-mail messages, Usenet newsgroups, computer conferencing and collaborative work spaces may serve for sharing this kind of interaction. A newsgroups example can be found at Charter of uk.education.misc. [11] These are rather simple methods and provide asynchronous interaction. More dynamic question and answer interaction can be created using text-based chat sessions, text-based virtual learning environments or net-based virtual auditorium or lecture room systems. [9] The simplest method is text-based chat, which can run on almost any hardware, providing text only chat. Text-based virtual learning environments also do not have high demands on user hardware and speed and offer their users the opportunity to create their own text-based rooms and learning environments. The net-based virtual auditorium or lecture room systems are more sophisticated, they provide voice communications and more features of traditional classroom such as slides, application sharing and students' feedback. They require higher end user hardware equipment (Pentium class) and special software tools and plug-ins. The example of such an environment is Open University of the UK's Knowledge Media Institute's Stadium [15] or Place Ware's Auditorium system. [18] When using computers to substitute for face-to-face interaction, why to go beyond e-mail and newsgroups? According to Ehrmann and Collins [2] there are two major reasons: interaction among students is a powerful catalyst for improving learning outcomes and second, collaborative skill is" itself and important yet often vestigial outcome of higher education".

2.4. Video Player

Mpeg movies and audio clips can be used as effective additions to textual information. Movies and cartoons can illustrate to explain a procedure; audio clips might be helpful to describe a particularly difficult point. It can also make rather dry or long material more attractive, just as video can be used in traditional classrooms to keep the students' attention.

2.5. Video Teleconferencing

The attractive presentation of the teaching material is not the only reason for using video in virtual learning. In traditional learning environment much information is transferred through the body language of the teacher. Hand motions and details such as facial expressions enhance the students' understanding. Also teachers may miss the direct contact with their students. One teacher who had been involved in a telephone-based virtual classroom explained the problem: "I like to be able to read their expressions. When you're explaining something to them and they say "Yes, I understand but you can see from their faces that they don't, you can go through it again. The body language that guides your teaching is missing." [7] Although still more virtual classrooms are including videoconferencing, the frame rate and quality is often poor with generally small image size and slow refresh rates. The most common systems are Microsoft NetMeeting [16], CuSeeMe [13], and QuickTime [10]. After the quality improves, "the use of video teleconferencing could enhance electronic courses not only by transferring these forms of communication but also by providing visual and audio cues which help the instructor and students to form an informal rapport." [20] A potential solution to this problem will be discussed in the Future Developments section of this essay.
Creation of software systems for supporting virtual education is still problematic. The same functionality must be available for all popular user platforms (the absolute minimum is the Macintosh and Microsoft Windows systems). Bandwidth limitations also must be considered as to limit participation to those users with the best Internet access and hardware equipment is unacceptable. Another problem is lack of standards because "just as html has provided a standard which allows participation by users with diverse implementations of both low-end and high-end browsers, audio-visual tools … require similar standardization." [20] The specific issue is the design of the virtual classroom and above all the integration of the components into a single interface that is easy for students to learn and use.

3. FUTURE DEVELOPMENTS IN VIRTUAL LEARNING ENVIRONMENTS

Through research we have tried to identify future trends which may have a beneficial impact on Web based learning. These are haptic interfaces, new networks and PDAs/wireless connections.

3.1. Haptic Interfaces

Haptic interfaces are not widely used in current Web based learning environments but are found in some commercial games. They are defined by Bussell [1]:
"Haptic technology has come to include tactile feedback – for example, smooth and rough textures; and force feedback – kinesthetic sensation, movement, resistance, and muscle tension."

So what contribution could this technology make to virtual learning environments? Many learning resources employ the sense of touch to involve learners – for example children's books with textures illustrations or embossed letters or the wide use of sand, modeling materials in classrooms. "We rely on our sense of touch as we interact with the world …but this physical connection is missing from our interaction with computers" [1]
Haptic technology is already proving to be successful in offline training situations – for example the training of surgeons. A virtual learning environment which engages a range of senses would immerse learners and surely enhance learning. This technology had been used to describe concepts in physics. Reiner [6] used a haptic interface to simulate forces and reported a high level of success within the group of learners. This however was a specific project with a small number of students who had access to the specific hardware required.
This technology can however make learning situations more accessible to students with special needs – especially those with a visual impairment. Bussell [1] describes studies carried out using the Wingman force Feedback Mouse. This study allowed blind physics students to test electrical charges on an object using the concepts of attract/repel. Other studies have allowed visually impaired students to explore tables of data, represented as bar and line graphs.
Although Bussell [1] describes a range of products which provide haptic feedback it is unlikely that these would be available to a wide range of learners. Some – such as the I-feel Mouse – are almost the same price as a standard mouse but limited in capabilities. Other products such as Phantom Interface Hardware are very expensive but allow greater sensation, replicating substances such as ice, honey etc. The need for specialist hardware seems to be one of the major obstacles to be faced when incorporating haptic technology in a virtual learning environment. Another obstacle is the programming demands placed on Web developers. Immersion's Touchsense Web Toolkit for JavaScript allows programming which can be incorporated into Flash movies, a fast growing format for the Web.
In summary haptic technology can benefit the visually impaired and also be used to successfully teach concepts in physics or math's. It allows for a more interactive learning experience which could be potentially implemented across a wide range of subjects. The main obstacles are requirement of specific hardware and demands placed on programmers.

3.2. New Networks

Learning does not happen in isolation and in good practice students are guided through direct, face-to-face contact with teachers, as detailed previously in this essay. This is an issue in current virtual learning environments. The quality of images produced by web cams and Internet connection speeds has an effect on the quality of interactions between teacher and student. The Internet2 and Geant may address these problems.
Internet2, led by 180 U.S universities working in partnership with the government, is developing an advanced network applications and technologies, which will change the way we interact with the Internet in the future and will have profound implications for the future of education. Universities in research laboratories are developing the new Internet, already operational, and users are receiving connections up to 100 times faster than regular modems used in the home. Both projects have been developed to provide faster and more powerful means of communication. It has been reported [12] that Internet2 is providing connections up to 1000 times faster than in domestic situations, allowing not only faster access to information but opening up new possibilities for communication.
These projects have been set up by academic and research facilities (Internet2 is American, Geant European). "This is what Geant provides: a pan-European network at such high speeds

it completely dwarfs the Internet as we know it today. The speeds available on Geant or Internet2 would impress the most up-to-date technology companies." [12]
This new network could offer new opportunities to virtual learning environments. For example, current academic experiments allow astronomy students and researchers to precisely maneuver telescopes from controls at their own desk. "Tele-immersion is the technology that will allow people in different parts of the world to feel as if they are sharing the same physical space… connecting real places in real time through the development of "tele-cubicles". [12] With projects such as Geant virtual learning environments would be able to employ tele-immersion to enable real-time tutorials and meetings between teacher-pupils. This would also use the aforementioned haptic technology so that objects could be handled even though they were thousands of miles away.
This network has also been able to include curriculum areas that have been, until now, less suited to a virtual learning environment. Dodson [12] describes experiments involving the transmission of High Definition Television over Internet2. The University of Washington in Seattle, which has been sending High Definition Television over Internet 2, reports that the images are as good as "the best photographic plates". This will push the boundaries of video conferencing allowing the transport of TV-quality pictures, which will improve real-time conferencing between student and teacher. Experiments have already been carried out in a violin master class at the University of Oklahoma, where pupils and teacher, separated by several hundred miles. The high quality of connection allowed a violin teacher and pupil to play in harmony despite being geographically separated. This quality of connection will be able to reduce limitations placed on students who would be able to study with any tutor regardless of where they lived. So as technology improves and advances so we will witness the fast acceleration of interactive learning in virtual environments.
The implication this places on virtual learning environments is immense. It requires so much more organization and imagination than simply placing text on the Web, perhaps the simplest form of virtual learning environment.

3.3. PDA/Wireless Technology

When accessing a virtual learning environment there may still be a need for students to work together: "Web-based learning environments should capitalize on social, communicative, and collaborative dimensions, allowing mediated discourse…they should be portable as far as possible so that they can be used in the proper context" [3] Future developments in virtual learning environments may embrace wireless and portable devices. The benefit of portable devices would mean that students would be able to collaborate and share solutions, thus fully acting out the learner's roles of apprentice and peer-tutor as described by Hung [3]. Students could also fully utilize a PDA by taking it with them for reference – for example a student on a biology field trip could use their device to identify an unfamiliar organism. Wireless local area networks, as described by Flickerman [14] could be used to provide access to these virtual learning environments while allowing the learner to choose their own personal learning location.
The future of virtual learning environments has many possibilities. If issues of cost and programming were resolved we could access curriculum using a range of senses. New networks can allow students new opportunities way beyond those offered by the Web in its current state but careful planning and innovation will be required to ensure that the potential for the scope of delivery is reached. The importance of mobility should also be considered so that learning can take place in the most appropriate context.

4. CONCLUSIONS

Virtual learning environments can provide relevant and rewarding experiences. Although currently underused in some curriculum areas, particularly the arts, new technologies will provide more effective means of delivery. Many emerging technologies and networks can be used to enrich and provide greater interactivity within the virtual learning environment. Advances in technology ensure that almost all traditional classroom equipment can be emulated in the virtual learning environment.

In terms of academic results, virtual learning environments can represent a more successful learning environment and have proven to be motivating contexts for learning. In these virtual environments the learning experience can be flexible, more accessible and inclusive. Not only are these environments often a more economically viable option, but they also allow specialist tuition and knowledge to transcend geographical boundaries.

The future of virtual learning environments has many innovative and exciting possibilities. New networks can allow students more opportunities way beyond those offered by the Web in its current state but careful planning and innovation will be required to ensure that the potential for the scope of delivery is reached. The importance of mobility should also be considered so that learning can take place in the most appropriate context. If issues of cost and programming were resolved students would be given access to the range of additional hardware and software required.

One of the main disadvantages of the virtual learning environment is the lack of face-to-face personal interaction and the student social contact, which traditional educational contexts provide. It is because of these factors, and the lack of evidence of how they will impact on student personal and social development, those virtual learning environments may not entirely replace traditional classrooms and teacher pupil contact.

In summation, only when learning environments, and those involved within them, are fully responsive to the needs of students will optimal levels of progress take place. For most students this will involve a judicious blend of both traditional and virtual learning environments.

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EDUCATIONAL PROJECT BASED ON E-LEARNING TECHNOLOGY

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Abstract: *We can notice that in the entire world the educational content is converting into a digital form, making such products available to anyone, anywhere and anytime. The present paper describes mainly the educational approach used for projects in an e-Learning environment.*

Keywords: eLearning project, education, network, natural disasters, human behavior.

INTRODUCTION

Since the number of natural disasters and climate changes is continuously growing, different international organizations, but especially the European ones, focus a lot on educating people in dealing with many crisis situations generated by the wide range of threats on individual and society in disaster situations.

According with this statement, the Advanced Distributed Learning (ADL) Department from National Defence University, has started a project in the framework of the national research programme having in the heart of it security citizen's education against the non-war threats, like as natural disasters and other types of disasters.

ADL Department is an important institution on the e-learning field in Romania, and it is strongly connected to the research national programme. ADL Department tries to focus both on educational and research activities with the same interest and efforts. By the research activity we try to increase the quality of education by newest e-learning instruments, intuitive and interested content, performance of learning management system and proficiency of didactical tutoring.

I. DIMENSIONS OF THE PROJECT

The main goal of the project is creating a pilot system for an educational network which uses eLearning technologies and knowledge portal meant to build security awareness for the citizen and community. The final product will be a functional model of an eLearning educational network which will spread information about the threats in relation to citizens and community's security, as well as interactive multimedia scenarios to mould human behavior in crisis situation.

The project is part of an interdisciplinary field, combining research activities from technical and scientific knowledge proper for IT and education to offer educational services within security and crisis management.

Thus, according to the hereby representation (figure 1), there is a knowledge portal at the core of the projects, that includes: Learning Management Platform; content interactive tools WIKI and blog type; e-content type standard digital content development tools; semantically structured data base for knowledge, lessons, classes in security; interactive knowledge spreading tools for security and crisis management; collaborative virtual-space to

ensure secure informational exchange among researchers in education and security. In the same time by means of international partnerships, this portal will be connected to the European research network within security allowing thus real time information exchange, offering a wider view for the researchers in the world, especially in Europe.

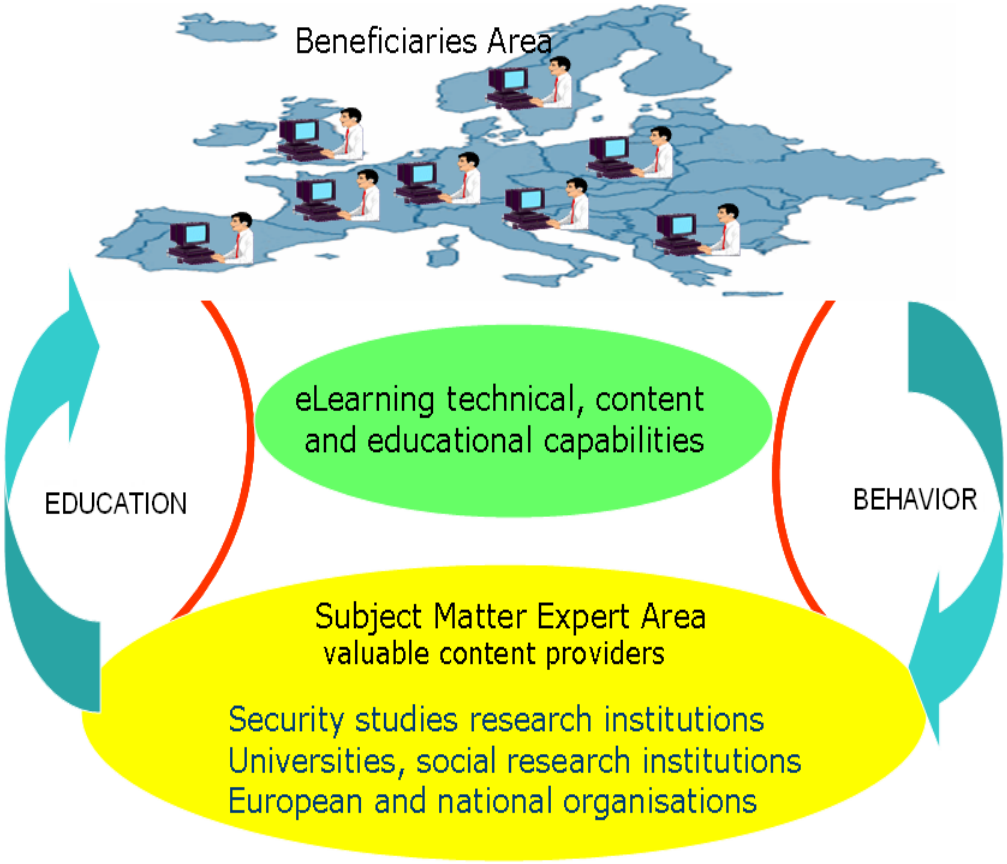

Figure 1 – The overall concept of the project

The whole educational content will be based on gathering data from researchers and studies in different institutions and organizations, called Subject Matter Expert (SME), and they will be transformed by specific tools on different complexity levels in educational data system for citizens and formal/ informal educational networks. Meanwhile, low complexity e-content tools will be developed, to be used directly by the SME while producing scientific content applicable in education. Thus we will shorten the time for evaluating researchers' results within security for educational purposes or developed dissemination.

Identifying knowledge needs in individual's or community's security will be accomplished by sociological studies (questionnaires, tests, interviews) unfolded openly within the projects or taken from institutions as such. In the 3rd year of the projects pilot classes and tests will start for the disseminated content, developed with target groups from at least three national geographical areas, three age categories, both by spreading self-development content and by tutorial on-line procedure. The results of the project stages will be made known by means of scientific international conferences in all three areas of interest: security, computers, education, and we intend to get scientific recognition through prizes, patents or others.

The project mainly aims at intersectorial cooperation among civilian and military experts, who develop their activity in complementary fields, security, communications and IT, education, in order to develop institutional partnership among universities and academies-research institutes and the economic field, to create scientific and technological clusters to

serve the citizen and society. We also intend to develop new scientific ways on the already mentioned topic in order to relate the research in this project to the European and world research topics. In this sense, we have partners as Romanian Space Agency, Romanian Meteorological Administration, Civil Protection, Siveco Romania, and Centre for Security and Defence Studies.

By using the results of these projects and implementing them in other fields as well, we can create knowledge management systems to produce improved economical value, and represent elements in a knowledge based society.

The project is built around the specific goal requested by the European topic FP 7, in the "Security and society" area. Through this project we intend to develop a knowledge portal which sums up all the tools to create and spread security standard digital content to give citizens access to unclassified information on security and insecurity phenomena to address the individual and society. Also, by means of this portal, digital courses will be produced, to focus on the knowledge in this field, security awareness tailoring, civic attitude and training human behavior for crisis situations, during and post conflict cases. At the same time we have in attention content and knowledge within the field of protection and reconstruction in case of disaster in order to give citizens, and economic agents access to unclassified information on assistance in case of disaster and good practice as response to disaster situations which endanger the individual and society.

For example, at Stakeholders' meeting on Disaster Prevention in April 2008, the Commission Communication on reinforcing the Union's disaster response capacity announces that the EU should embark on an integrated approach to disasters. This means that the full disaster cycle – from prevention to recovery – should be taken into consideration for any type of disaster, be it natural and man-made. In order to strengthen the EU's capacity in dealing with disasters, all steps of the disaster management cycle need to be strengthened and link at national, European and international levels.

The education process must be supported by information campaigns relying on scientifically based educational content, explainable and relevant to building security awareness, identifying risks and threats, avoiding panic and sending instructions on the way people react in such circumstances. The educational content focuses on risks and threats coming from other sources, such as: natural disasters (fires, floods, earthquakes, etc), terrorism and its aspects, deception, and so on.

The results of the research will be turned into standardized digital content and they will be stored in topic database being easily taken for debate or implemented in specialized course structures. Thus, the project has two ways to be exploited and further development:

1. As knowledge and courses portal for security meant to educate citizens and build a security culture/ awareness.
2. Virtual platform to cooperate and disseminate knowledge among research institutions within security and crisis management.
3. As knowledge, scenarios and courses portal in the field of intervention, protection and the reconstruction of affected areas, meant to educate citizens and create good practice as response to crisis situations.
4. Virtual platform to cooperate and disseminate knowledge, scenarios and role play games within institutions involved in the field of intervention, protection and reconstruction of affected areas, conservation of protected ones and crisis management.

In the ICT field we have recently noticed a clear orientation to integrated systems and services, most of them having citizens as a main target group. One of the main directions that had remarkable results lately is the e-learning system and services, knowledge management, semantic web, educational portal, etc. These applications look mainly at knowledge spreading tools, both in a formal and an informal way, to raise competence and knowledge for different

socio-professional categories. Another important aspect is represented by the growing interest in developing tools for a standardized e-content, thus being encouraged the specialized software productions, called authoriting content tools that would allow digital content production without strong IT knowledge. Practically, the specialist will be able to use software intuitively, to transform the classical content into a digital one by means of simple operations. This project intends to produce this kind of tools adjusted to security and crisis management, but which can be used in other fields with mainly descriptive content.

II. SPECIFIC OBJECTIVES

Through this project our intention is to achieve the following objectives:

1. Research regarding the trends for technological development and public educational wider range, especially in individual's security in order to perform proper activities and to identify compatibility or integration solutions.
2. Sociological studies and research to determine the public knowledge level of the security/ insecurity concepts as well as the need for civic education in the field.
3. Research and experiments to develop software easily accessible digital content, available for the topic research teams within security, to ease the research transfer into education.
4. Raising the knowledge level over risks and threats for individual's and community's security by designing topic digital content and spreading it through the eLearning educational network.
5. Discovering effective collaborative solutions with researchers by using interdisciplinary scientific tools between different fields: IT- security- education.
6. The transfer of the sectorial research results in education by moulding the topic content and by adding psycho-pedagogical tools to develop efficient educational process.
7. Activities to attract the youth to research fields and to develop working skills for specialists' teamwork in different fields.
8. Integrating the pilot center in the International Security Network studies by means of which an international research cooperation in intended, as well as an exchange of proper activities and solutions for the education in this field.
9. The maximum and proper use of the eLearning solutions to create a virtual education environment for the security awareness.
10. A raise in the excellence and scientific visibility of the consortium through spreading the scientific results via conferences, national and international technical-scientific manifestations (poster making, scientific papers, web design, CD-s with presentations)
11. Developing technical documentations and application guides for the solutions tested and promoted in other fields in order to expand the results of this research to other topic areas of wide interest (energy, proper feeding, environment, etc.).

III. CONCLUSION

Once the project finished, the model can be expanded to other fields, thus setting the premises to creating collaborative virtual media in different domains and contributing to a better dissemination of information and to the development of knowledge in those fields. This will be a first step to a knowledge-based society.

THE UTILIZATION OF THE SINGULAR VALUES OF IMAGE MATRIX FOR SIMULATION OF CAMOUFLAGE EFFICIENCY OF THE SOLDIERS AND MILITARY MACHINERY

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Abstract: *The image matrix represents digitized and encoded information about an image. A saving of complete information about this image requires a large computer memory for an image processing. The singular values of image matrix represent characteristic information about the image, but they require smaller memory than image matrix. The singular values are sensitive to the changes of image. Performed analysis of obtained results indicates possible utilization of SVD for a detection of changes in the image and so we can evaluate the effects of camouflage.*

Keywords: image matrix, singular values, Singular Values Decomposition (SVD), detection of changes, effects of camouflage.

INTRODUCTION

The image matrix represents digitized and encoded information about an image scene. This is scanned by a suitable scanner (e.g. a camera). The singular values contain the characteristic information about the image matrix.

The singular values are one of output of Singular Value Decomposition – SVD. An input of this method is the image matrix and the outputs of this method are a vector of singular values and two contiguous matrices of row (column) oriented orthonormal eigenvectors [3, 4, 5].

The introduced method and their singular values were used for image processing in coding, separation, recognition of binary images and coding and recognition of multilevel images [1, 5, 6, 7]. The algorithms of singular values decomposition are exacting on computing capacity, however if back transformation of output matrices and the vector of singular values into an initial image isn't required, calculating is possible to speed up by calculating of vector of singular values only.

The singular values have high sensitiveness on little changes in a scanned scene, therefore SVD is testing than tool on an evaluation of camouflage efficiency of the soldiers and military machinery. The singular values are compared for various camouflage methods and the most effective form of camouflage is chosen on the basis of this comparison.

1. SINGULAR VALUES DECOMPOSITION OF IMAGE MATRIX

The matrix is given

$$F = [f(i,j)] \tag{1}$$

for i, j = 1,2,…,n.

Then the decomposition of the image matrix F on singular values is given by [2, 3, 4, 5]

$$F = U S V^T \tag{2}$$

where:
U = [u(i,j)] is the matrix of orthonormal row-oriented eigenvectors $F.F^T$.;
V = [v(i,j)] is the matrix of orthonormal row-oriented eigenvectors $F^T.F$.
U a V satisfy $U^TU=I$ and $V^TV= I$, where I is an unit matrix;
S = [s(i,j)] is a diagonal matrix of singular values.

If the matrix U is expressed using column vectors $U = [u_1, u_2, u_3, ..., u_N]$ and the matrix V is expressed than $V = [v_1, v_2, v_3, ... , v_N]$, where u_i and v_i are column-oriented vectors and the matrix S is expressed by submatrices

$$S = \begin{bmatrix} s_1 & 0 & ... & 0 \\ 0 & 0 & ... & 0 \\ ... & ... & ... & ... \\ 0 & 0 & ... & 0 \end{bmatrix} + ... + \begin{bmatrix} 0 & 0 & ... & 0 \\ 0 & 0 & ... & 0 \\ ... & ... & ... & ... \\ 0 & 0 & ... & s_N \end{bmatrix} \tag{3}$$

then the decomposition (2) will be in the form [4, 5]

$$F = \sum_{i=1}^{N} u_i s_i v_i^T \tag{4}$$

The elements s_i are eigenvalues of the characteristic equation

$$\det(\lambda I - F^T.F) = 0 \tag{5}$$

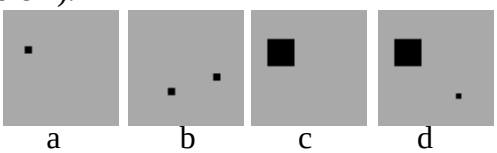
For the singular values $s_{i,j}$ holds

$$s_{i,j} = \sqrt{\lambda_i} = s_i \tag{6}$$

The singular values of the image matrix with an object on homogeneous background account the invariance toward the translation, dilatation (after standardization by maximal singular value) and rotation (within specific angles) too [5, 7].

2. PROPERTIES OF SINGULAR VALUES FOR VARIOUS TYPES OF IMAGE MATRICES

A fundamental property of singular values for evaluation of camouflage efficiency is a fact that a limited change in the image scene evokes the changes of singular values [8] (Figure 1, Table 1 and Table 2).



a b c d

Figure 1. The change in the image.

Singular value	a	b	c	d
s_1	11732,56	11688,80	11231,56	11204,59
s_2	0	0	0	2222,84
s_3	692,56	648,80	2215,56	0
s_4	0	736,00	0	517,75
s_5	0	0	0	0

Table 1. Singular values of simple images.

Property	a	b	dif a %	c	dif a %	d	dif a %
Average brightness of colours	183,28	182,56	0,393	173,90	5,12	173,49	5,34
Average of singular values	194,14	204,28	5,22	210,11	8,23	217,89	12,23

Table 2. Comparison of change of images and change of singular values.

where *dif a %* is difference (in %) compared to figure a.

An average brightness of colours in table is calculated by (7)

$$\overline{f} = \frac{\sum_{i=0}^{N-1} n_i * f_i}{\mathrm{n}} \tag{7}$$

where:

$\overline{f}$ is an average brightness of colours;
n_i is a frequency of appearance of i-colour;
f_i is a value of brightness of i-colour;
n is a count all of pixels of image;
N is a count of colour tone.

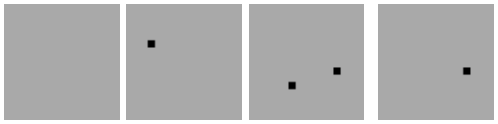
An average of singular values is calculated by (8)

$$\overline{s} = \frac{\sum_{i=1}^{N} s_i}{N} \tag{8}$$

where:

$\overline{s}$ is an average of singular values;
s_i is i-singular value;
N is a count of singular values.

A single-coloured background (with nonzero brightness) has one nonzero singular value. A count of nonzero singular values increases with an increase single-coloured objects on the background (Figure 2 and Table 3). A position of single-coloured object on the single-coloured background does not effect for size of singular values (Figure 2 b, d) [5, 6, 8].



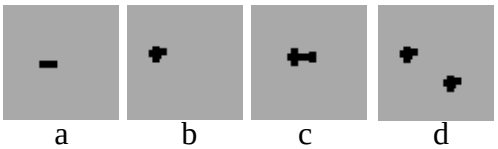
a b c d

Figure 2. The images with various number and position of objects on the background.

Singular value	a	b	c	d
s_1	0	11732,56	11688,80	11732,56
s_2	11776	0	0	0
s_3	0	692,56	648,80	692,56
s_4	0	0	736,00	0
s_5	0	0	0	0

Table 3. Singular values of the images with various number and position of objects on the background.

The number of nonzero singular values of composite objects (objects with composite pattern) on the single-coloured background is higher than the number of singular values of simple objects (objects as rectangle) [8] (Figure 3 a Table 4).



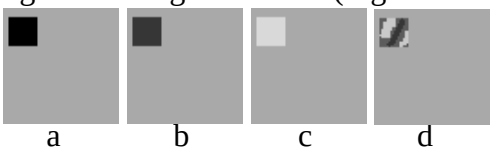
a b c d

Figure 3. The images with composite objects.

Singular value	a	b	c	d
s_1	11671,74	11614,50	11533,33	11448,83
s_2	0	1156,61	1357,71	983,53
s_3	1044,25	481,59	0	474,47
s_4	0	0	656,33	0
s_5	0	284,11	363,40	248,08
s_6	0	167,80	0	167,75
s_{13}	0	0	0	1323,95
s_{14}	0	0	0	487,17
s_{15}	0	0	0	284,13
s_{16}	0	0	0	0,02
s_{17}	0	0	0	167,83
s_{18}	0	0	0	0

Table 4. Singular values of images with composite objects.

Change of colour has effect on size of the singular values. Varicoloured filling of pattern has effect on change of all singular values (Figure 4 a Table 5).



a b c d

Figure 4. The images with changed colour.

Singular value	a	b	c	d
s_1	11161,55	12053,99	11804,20	11608,49
s_2	0	0	0	1224,76
s_3	2329,55	762,01	83,80	977,75
s_4	0	0	0	779,70
s_5	0	0	0	573,59

Table 5. Singular values of images with varicoloured objects.

The aforementioned properties of singular values, primarily a sensitivity to limited changes in image by a change of colour or by a presence of new object in the image scene is used for a detection of changes in territory or for an examination of camouflage efficiency. A cyclic scanning of the image scene with a calculation of singular vales and their comparison with singular values from previous cycle are needed for a detection of changes in monitored territory (Figure 5).

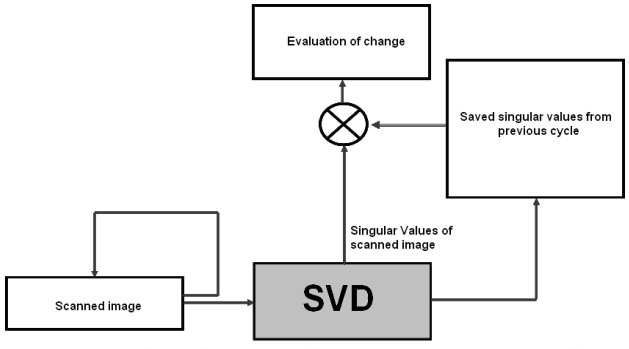


Figure 5. The changes detection in scanned territory.

A constant image of background is needed for an examination of camouflage efficiency (Figure 6). Their singular values are compared with singular values of image with a camouflage object on the background.

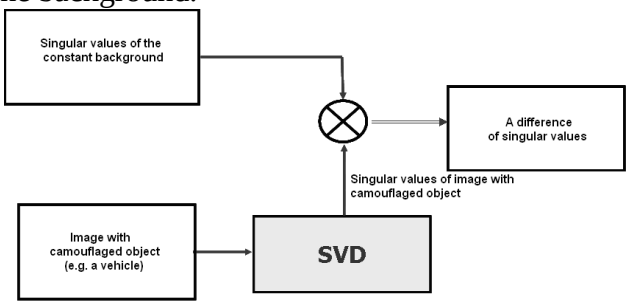


Figure 6. The comparison of singular values of background and of object on background.

Figure 7 brings thermo-image of a background (a) and thermo-image of object on a background (b) and Table 6 contains from the first to the tenth singular value. Table 7 contains a comparison of change of average brightness of colours and average of singular values and the Euclidean distance of both vectors of singular values.

a b

Figure 7. Thermo-image of a background and thermo-image of an object on a background.

Singular value	a	b
s_1	34933,33	35400,34
s_2	2740,51	2857,13
s_3	2146,22	2082,41
s_4	1378,39	1547,10
s_5	1153,17	1205,03
s_6	970,27	1114,30
s_7	879,88	880,36
s_8	702,76	762,95
s_9	690,04	653,34
s_{10}	544,96	547,16

Table 6. Singular values of a background and singular values of an object on a background.

Property	a	b	dif a %
Average brightness of colours	133,96	135,60	1,22
Average of singular values	217,89	221,99	1,88
d_{Eukl}	- - -	542,65	- - -

Table 7. A change of an average brightness of colours and a change of an average of singular values.

where *dif a %* is difference (in %) compared to figure a,
d_{Eukl} is the Euclidean distance of vectors of singular values.

An average brightness of colours in table is calculated by (7), an average of singular values is calculated by (8) and the Euclidean distance is calculated by (9).

$$d_{Eukl} = \sqrt{\sum_{i=1}^{N} (v_{2i} - v_{1i})^2} \tag{9}$$

Herein presented singular values confirm that a change of a little part of image scene causes change of singular values again.

3. EXPERIMENTS FOR AN EXAMINATION OF CAMOUFLAGE EFFICIENCY

Groups of thermo-image with various distances from an observer to a scanned object were created for an examination of camouflage efficiency (Figure 8, Figure 9). The image of background (a), the image with one person on the background with low level of camouflage (b) in the IR, the image with one person on the background with upper level of camouflage (c) in the IR, the image with both persons on the background (d) and the image of the background (e - for verification) were created in the one group. Ten singular values for mentioned images and the Euclidean distance of vectors *b* ÷ *e* from vector *a* are in the Table 8, Table 9. The images have 256 x 256 pixels and are saved that 24-bit .bmp.

Figure 8. Thermo-images – distance 25 m.

a b c d e

Figure 9. Thermo-images – distance 68 m.

Singular value	a	b	c	d	e
s_1	17747,68	18476,78	17955,98	19514,21	17402,68
s_2	2818,33	5841,75	4308,90	6788,05	2790,99
s_3	2194,19	2277,53	2160,59	2739,06	2121,17
s_4	806,17	1770,81	1235,33	1834,60	806,10
s_5	741,19	1297,10	969,21	1403,06	755,41
s_6	596,39	1175,29	762,68	1153,21	609,65
s_7	611,08	743,07	709,04	989,88	590,50
s_8	426,48	652,81	582,09	782,18	422,86
s_9	354,69	589,53	525,30	622,63	353,66
s_{10}	285,32	505,23	496,04	565,22	294,83
d_{Eukl}	**0**	**3394,71**	**1649,69**	**4668,38**	**355,65**

Table 8. Singular values of thermo-images - distance 25m.

Singular value	a	b	c	d	e
s_1	25398,52	25225,61	25250,73	25241,54	24992,33
s_2	4514,22	4541,89	4531,79	4524,94	4575,29
s_3	2338,63	2399,09	2287,28	2564,65	2302,47
s_4	1645,58	2164,61	1817,19	2214,20	1666,61
s_5	1248,10	1400,90	1270,85	1394,63	1267,39
s_6	982,63	1078,57	974,50	1114,63	949,72
s_7	763,65	964,74	984,22	959,49	772,74
s_8	711,37	726,15	678,33	740,84	695,51
s_9	642,42	666,49	664,50	680,53	636,42
s_{10}	594,52	641,49	622,32	631,08	599,26
d_{Eukl}	**0**	**623,92**	**328,54**	**714,63**	**416,00**

Table 9. Singular values of thermo-images - distance 68m.

The Euclidean distance of vectors of singulars values are minimal for both images of background. These distances are nonzero, because it is impossible to obtain the equal conditions for both shots. Both backgrounds histograms prove this fact (Figure 10). A detection of a scanner settings error is possible by this.

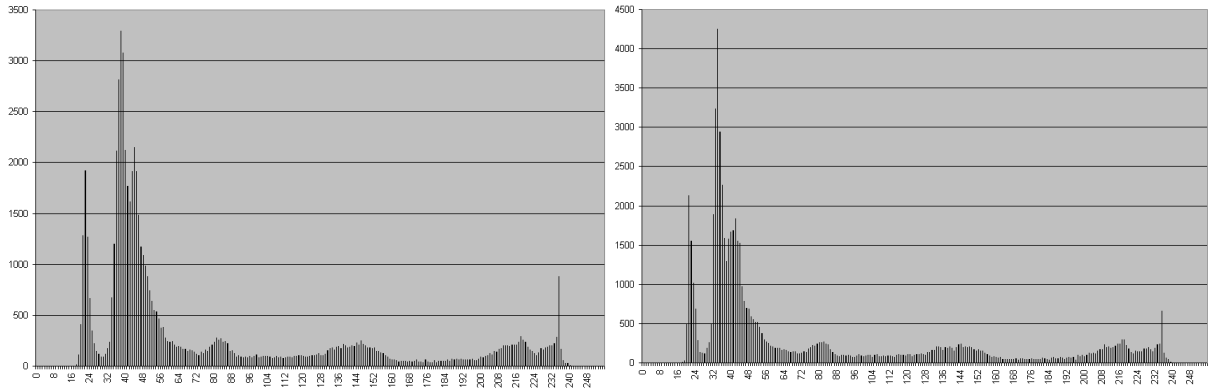


Figure 10. The histograms of the backgrounds (various conditions of scanning).

The Euclidean distance of vectors of singular values with persons on the background are corresponding for a state and a level of camouflage.

CONCLUSION

This paper gives the basic information about SVD and about properties of singular values. These properties are illustrated by means of various model situations. Performed analysis of obtained results indicates possible utilization of SVD in military applications. We can use the singular values for a detection of changes in the image and so we can evaluate an effects of camouflage or we can recognize security violation.

The singular values are changed for limited change of image scene. A change of colour of object has effect on size of singular values.

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THE POSSIBILITIES OF UTILIZATION OF DATABASE SYSTEMS IN SIMULATION COMPUTATIONS

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Abstract: *This paper deals with possibilities of utilization of modern database systems in the area of computations within various problems, such as simulations. The authors of this article come out from possible approaches for realization of the application logic in database applications.*

Keywords: database systems, database applications, application logic, stored procedures, external functions, extended stored procedures.

INTRODUCTION

A typical database application can be divided into three main parts [1, 5]:

- Presentation rules – provide interactions between users and database applications, represent a presentation of results of selected tasks to users and provide an interface to application control;
- Data rules – represent direct operations with data in the database, e.g. select, insert, update or delete operations;
- Business rules – represent application logic in the database application (data processing in the application – performing necessary computations with data obtained from the database).

All parts mentioned above are integral components of database applications.

The application logic represents computations associated with data stored in the database which fall outside the date rules and that are not possible to execute using only the resources of the database server or their utilization in this way is very complicated [3].

The client–server architecture supposes three basic approaches to the realization of application logic [3, 4, 5]:

- Application logic is realized by means of a client PC through the use of functions programmed in a suitable programming language in a common part (with presentation logic) of the application;
- Application logic is realized using resources of an autonomous application server in a suitable programming language;
- Application logic is realized by means of a database server through the use of stored procedures and user-defined functions.

1. REALIZATION OF APPLICATION LOGIC BY MEANS OF DATABASE SERVER

A realization of application logic by means of a database server (Figure 1) is possible through the use of stored procedures and user-defined functions (programmed in a specific programming language for a particular database server - SPL, T-SQL, etc.). Nowadays there is a possibility to utilize user-defined functions created in external programming languages (C, Java, etc.), which are compiled into a library located and registered on the database server. This makes it possible to use them similarly to the other build-in functions (aggregation, mathematical, etc.) of a given database system.

Advantages of this approach are [3]:

- Lower volume of data transferred between a database server and a client PC for realization of application logic.
- Higher level of data protection. Data protection is realized by means of a database server;
- Increase of capabilities of SQL commands through the use of these external functions – it results from the capabilities of these functions.

The way of realization of these external functions is not essential for the user. It is sufficient for the user to know only the structure of input parameters and the types of output values. However, these advantages depend on the type of application. If the demands on the application logic are minimal then this approach is not necessary.

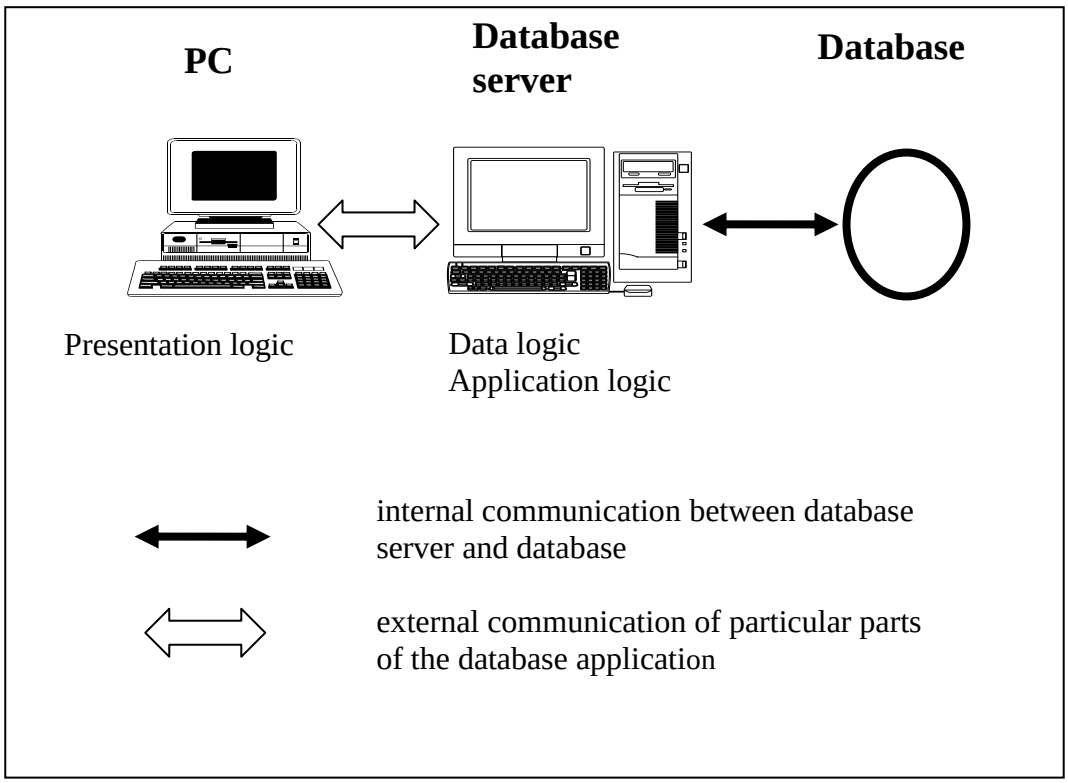

Figure 1. Realization of application logic by means of database server.

1.1. Realization of application logic through stored procedures

Stored procedures are compiled sequences of permitted commands stored in the database [2, 5]. Those sequences of commands are executed when the stored procedure is started.

Advantages of applications based on stored procedures are:

- Stored procedures are components of the database and can be available for each active database application. Stored procedures can be exploited by several database applications and for this reason the time for application development can be shorter.
- Stored procedures alleviate data processing, decrease the load of database server and also decrease the time of response.
- Stored procedures hide the commands that represent application logic to the user.
- User's permissions can be set on stored procedures in order to make it possible to restrict their usage.
- Users can have access to data stored in the database via stored procedures and so it is possible to define data processing in stored procedures.

A certain disadvantage here is lower possibility of realization of complex algorithms through the use of stored procedures due to some limitations of specific programming languages for particular database servers.

1.2. Realization of application logic through user defined external functions

Nowadays there is a possibility to utilize the means of modern database technologies, which make further processing of data directly on the database server possible even within the two-tier client-server architecture. They utilize user-defined functions (created in an external programming language – C, Java, etc.), which are compiled into a library located and registered on the database server for a particular database.

The importance of user defined external functions (UDFs) resides in [4]:

- UDFs are accessible only via the database server and components of an application which lie outside the database server do not have direct access to them;
- Security of UDFs is realized by means of the database server;
- UDFs are created in high level programming languages and so it is possible to utilize all set of commands of these languages;
- UDFs are implemented on the database server; so the results of their computations must be sent through network to a client PC;
- UDFs can use standard SQL commands.

2. HANDLING THE PROBLEMS BY MEANS OF DATABASE SERVERS

Storing data in a database has a few advantages. The data stored in the database are secured by means of the database server (permissions for users). This is very flexible: The database system makes it possible to change the data structure according to the requirements.

It is not possible to describe the availability of computations by means of database servers (i. e. stored procedures, extended stored procedures) for particular problems in a general way. This strongly depends on the database application itself. It is necessary to

consider the process of computation for each specific problem. One proposed way for computations using data stored in a database is in Figure 2.

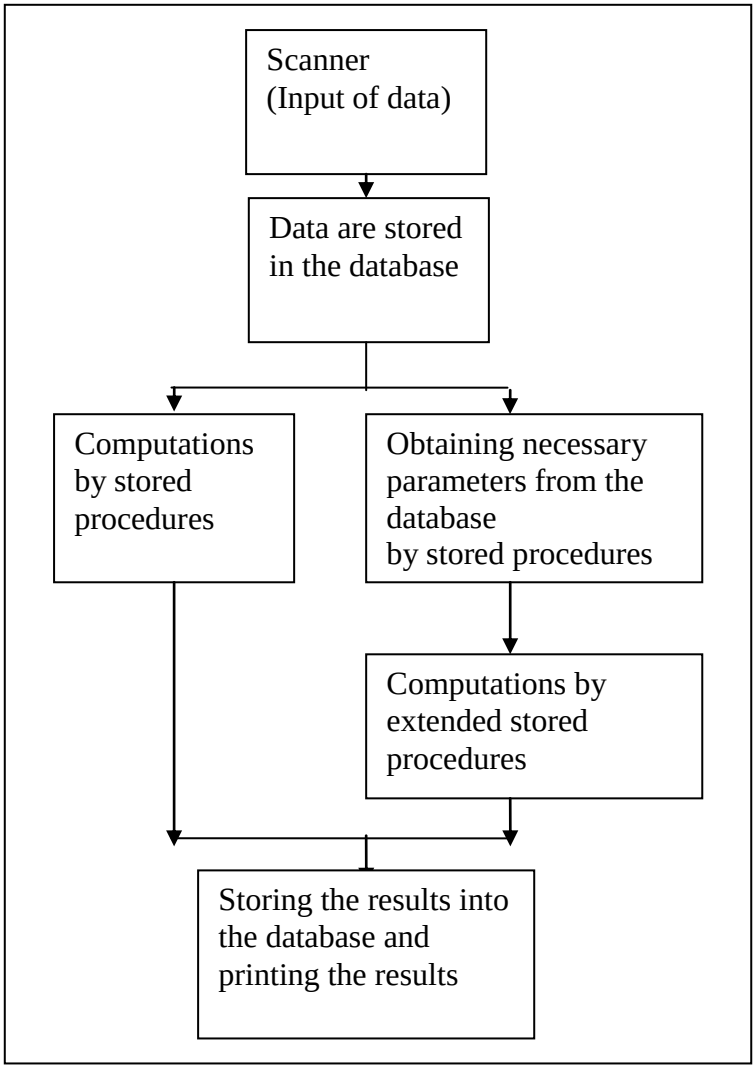

Figure 2. Computation by means of database server.

The decision about the process of computation (using stored procedures only versus using a combination of stored procedures and extended stored procedures) depends on the complexity of a particular problem. On the one hand, extended stored procedures are not easy to create, but, on the other hand, high level programming languages offer a large set of commands and library functions.

A benefit of both approaches (stored procedures as well as extended stored procedures) is that the computations are performed on the same computer system as the necessary data is located and only the results of computations are sent to the users.

An example of parts of a stored procedure and an extended stored procedure which takes input parameters from this stored procedure is in Figure 3.

```
'extended stored procedure'
{
definition of memory variable
count of parameters
allocation of memory for values of first paremeters
obtain value of first parameter via pointer pTyp1
processig of parameter value
}


CREATE PROCEDURE proc AS
declare parameter variable
setting value of parameter or obtain this value from database
execute 'extended stored procedure' 'parameter variable'
saving of returned data from extended stored procedure into database
```

Figure 3. Computation by combination of stored and extended stored procedure.

CONCLUSION

Considering the ever increasing demands on the processing of data stored in databases and the security demands on data protection it seems to be reasonable if the data are sent to the network for further processing as little as possible. It is not necessary to make all the data stored in a database accessible to the users. Sometimes it is sufficient to make accessible to them only the results of computations, without the input data of these computations.

For this reason it is useful if only the results of data processing can be retrieved from the database. This goal can be achieved by using user-defined functions on the database server instead of a program on the application server or on the client's PC.

A benefit of this approach is that the computations are performed on the same computer system as the necessary data is located and only the results of computations are sent to the user. At the same time it is possible to utilize a broader set of commands of the high-level programming language than it is in the case of stored procedures of the database system.

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ON PRINCIPLES OF THE DESIGN AND ASSESSMENT OF DISTANCE COURSES

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Abstract: *This article describes key considerations in designing distance learning courses. The author focuses in particular on such aspects of distance courses as course description, the structure of a distance course, guidelines for the comprehensive assessment of course distribution versions, and other issues. Some of the issues are illustrated with screenshots of the interface of distance courses, included to facilitate the understanding of the material discussed. The issues discussed in the article are both theoretical and practical in nature. The author, throughout her scholarly career, has implemented and tested them, especially during the development, and co-ordination of the development, of several dozen distant courses in pedagogy, computer science, mathematics, etc., taught on the e-learning platform managed by the Faculty of Ethnology and Sciences of Education at the University of Silesia (http://moodle.weinoe.us.edu.pl). The solutions were also put to the test in pre- and in-service teacher training programmes in distance education, offered to both active and prospective teachers from southern Silesia.*

Keywords: distance course, principles of designing distance courses, structure of distance courses, assessment criteria of distance courses.

INTRODUCTION

A distance course is defined as a set of educational and teaching resources and as well as educational services developed to enable individual and group learning using online distance education technologies. There are a number of theoretical and practical aspects as well as issues related to teaching methodology and computer science that need to be taken into account in the design of distance learning courses. Some of the them have already been discussed in numerous scholarly publications [Polat, 2004, Hojnacki, 2004, Smyrnova-Trybulska, 2007, 2008, Morze, 2008, etc.]. This article discusses some of the principles of the design of distance courses, particularly those related to the structure of distance courses and criteria for the evaluation of e-learning courses.

1. STRUCTURE OF AN INTERNET-BASED DISTANCE COURSE

1.1 Primary components of a distance course

1. General information about the course: (target group, goals, tasks, course content, structure, requirements for admission into student groups, registration forms, information about documents, assignments required to obtain credit for the course, expected outcomes and competencies upon completion of the course . This information should be available to all visitors to peruse. Although courses themselves are not accessible to outsiders, visitors should be able to view demo versions or to participate in 1 or 2 lessons free of charge.

2. *Package of surveys* (designed to collect information on potential students), containing questions on various aspects, if information provided in registration forms is insufficient.

3. *Placement survey package* (measurement of the entry-level knowledge in a given course subject area). Based on the performance in the placement tests, participants are divided into workgroups. Thus courses are delivered at different levels. At this stage, i.e. when student groups are formed, students can get acquainted with one another and with the instructor, and

account can be taken of students' shared interests, knowledge levels and computer literacy, individual study habits, personal qualities.

4. *Core reference materials* relating to a given course subject area (*Lessons, Glossaries, Encyclopaedias, text files, presentations, other materials*)

5. *Course library* - additional reference materials - *Lessons, Reference Books, Dictionaries, Glossaries, Internet resources, text files, presentations, other materials*)

6. *Course proper,* divided into autonomic modules of various length – Units.

7. *Block of tasks* designed to help the student assimilate material, check the understanding, reflect on material being learned.

8. *Block of creative tasks* designed to help the student apply the knowledge independently, to develop practical skills and ways to solve problems, including non-standard tasks, to complete both individual and group projects

9. *Performance monitoring block* – in individual form - checking students' work (self-check, peer review, in workgroups)

10. *Examination materials (tests)* – designed to test participants' competencies according to levels A, B, and C where such levels have been provided for.

11. *Monitoring and analysis of students' opinion about the course.*

1.2 Detailed structure of an Internet-based distance course.

An Internet-based distance course should have a hierarchical structure composed of a number of standard modules and features (Figure 1, 2, 3):

I. Module: Introduction to distance learning course (Figure 1):

1. ***Course description:*** goals, objectives, registration procedures, course structure, skills and knowledge (both in terms of IT and course subject matter) required prior to taking the course and upon its completion, information on documents, assignments required to obtain credit for the course (*text or html documents).*

2. ***Reading list:*** core reading, additional reading, Internet resources (a listing of recommended core and additional sources with which participants need to familiarize themselves during the course – *a text, PDF or html document*)

3. ***Glossary of terms*** *containing basic concepts and key terms related to the course topics* (types of dictionary: *Encyclopaedias, ordinary Glossaries, FAQ's, etc.).*

4. ***Forum***, a course feature facilitating discussion on a given course (*News Forum, Discussion Forum*)

5. ***Participant registration survey*** *designed to collect information on the profile of potential students, contains questions relating to various issues* (*Survey, Questionnaire*)

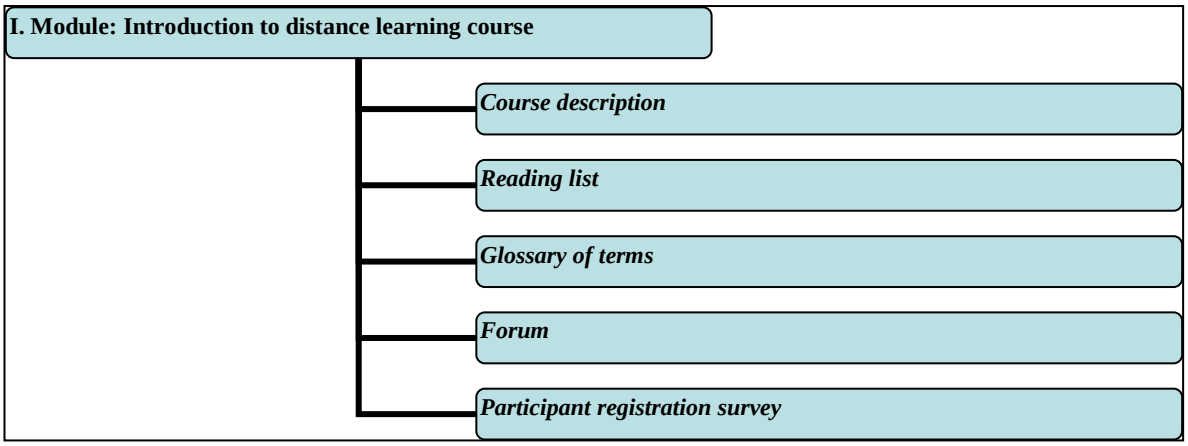

Figure 1. The structure of distance learning courses (Module: Introduction to the course).

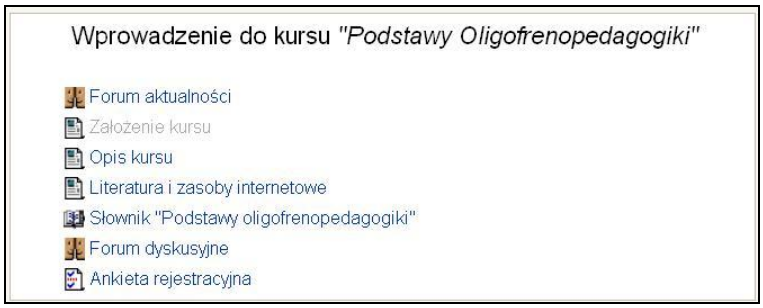

Figure 2. The structure of distance learning courses (The example of Module: Introduction to the course). [7]

II. Thematic Modules N (1<N<10):

1. ***Pre-test (a diagnostic test)*** (*a package of quizzes (tests) designed to gauge participant knowledge of the course material*)
2. ***Core didactic materials*** for a given course subject area (*Lessons (didactic materials and self-testing quiz*), *Glossaries, Encyclopaedias, reference links to Internet resources, files included in folders (text files, PDF, audio files, video files, multimedia presentations, other)*
3. ***Package of tasks*** designed to help participants assimilate material, to help the instructor check student understanding of the material, to consolidate and apply the knowledge (in a MOODLE-based course, educators can effectively utilize such features as *Assignments (various types: Advanced uploading of files, Online text, Upload a single file, Offline activity), Journals (*workbooks), *Workshops, Forum, AudioRecorder, WIKI, other features)*
4. ***Checking and testing knowledge*** (1) self-testing quiz (can be incorporated into a lesson), 2) comprehension questions (progress tests), 3) Test quiz (examination test) (*Quiz, Hot Potatoes Quiz)*
5. ***Creative tasks block*** designed to help the student to work independently to assimilate knowledge, skills and to develop ways to solve specific problems, to complete individual projects; practical tasks (individual and group ones) (*Assignments (various types: Advanced uploading of files, Online text, Upload a single file, Offline activity), Journals, Workshops, Forums, AudioRecorder, WIKI*, etc.*)*
6. ***Interactive communication feature,*** *enabling students to communicate with one another and with instructors synchronously (Chat, instant messaging software (Skype, NetMeeting, Gadu-Gadu, Yahoo Messenger, ICQ, etc.), and asynchronously (Forum, E-mail, Internal Messaging System, etc.)*
7. ***Additional reference material for a given subject area*** (*Lessons, Glossaries, Encyclopaedias, reference links to Internet resources, files stored in folders (text files, PDF, audio files, video files, multimedia presentations, other material)*
8. ***Checking students' knowledge*** (Test quiz) *(Quiz, Hot Potatoes Quiz)*

III. Conclusion module (Conclusion of the course)

1. ***Examination designed to test*** the knowledge and skills taught during the entire course (*Quiz*)
2. ***Final evaluation survey*** - monitoring and analysis of student feedback on the course (*Survey, Questionnaire*)
3. ***Self-reflective survey*** – analysis of student feedback on distance learning - (*Survey, Questionnaire*)

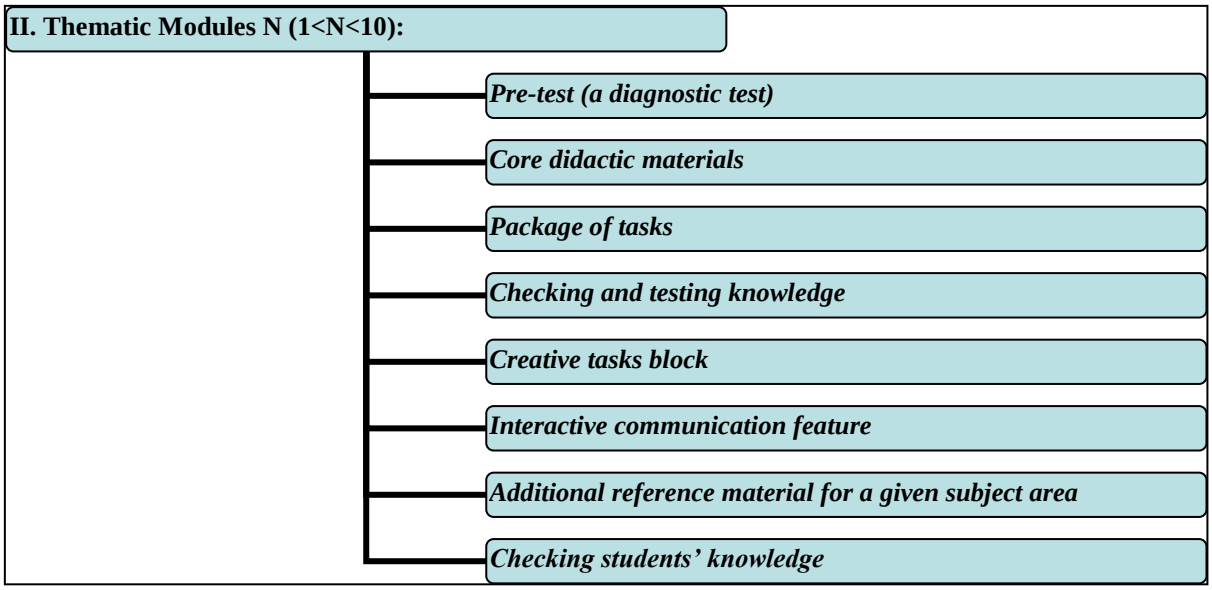

Figure 3. The structure of distance learning courses (Structure of a specimen thematic module).

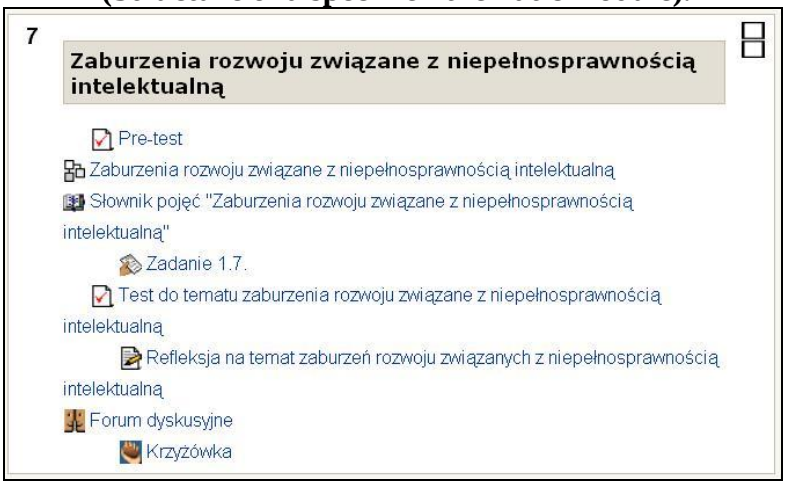

Figure 4. The structure of distance learning courses (The example of Structure of a specimen thematic module). [7]

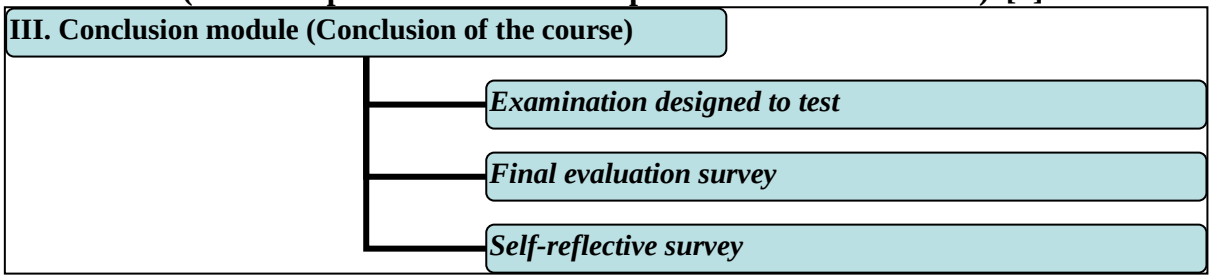

Figure 5. The structure of distance learning courses (Structure of course conclusion module).

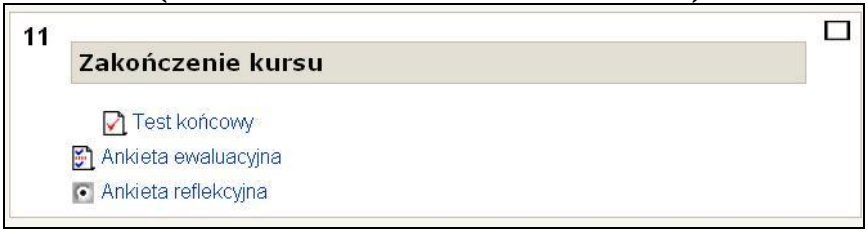

Figure 6. The structure of distance learning courses (The example of Structure of course conclusion module). [7]

2. ASSESSMENT CRITERIA FOR DISTANCE COURSES

In order to comprehensively evaluate the usefulness of a distance course offered over the Internet, one needs to use a set of specific standards by which the course can be judged. The measures below are recommended to be considered when developing and evaluating distance courses [Hojnacki, 2004, Smyrnova-Trybulska 2007]:

1. ***Course subject and structure*** (*Adequacy of the selection, and sufficient specification of the course subject according the objectives of the project*). Subjects taught in web-based distance courses should make it possible both to utilize the functions of individual system modules (e.g. MOODLE) and to develop competencies to operate modules using active teaching methods. The structure of a course and its description should be complete; the course should have a modular hierarchical structure and contain all necessary components (goals, description, theoretical materials, quizzes, creative tasks, journals, glossaries, Wiki, reference to Internet resources, etc.), which allow for the online implementation of all major stages of the educational process.
2. ***Course elements in the MOODLE*** *system* (*broad scope; approx. 35 modules in all, of which 18 are the key ones*). Ideally, a course should comprise all MOODLE modules that can be demonstrated to effectively contribute to the success of the course. The application of appropriate features of the MOODLE system should support all of the components of an education system (designing an education process, actual process, monitoring, assessment, communicating students' performance results, evaluation, communication, administration, etc.)
3. ***Description of each course feature and resource item.*** A course should be accompanied by a detailed and clear description (e.g. in the introduction) of all features and resources utilised in the course so that participants could learn in advance about the course contents and become aware of the goal of subsequent learning stages.
4. ***Course contents*** *(use of diverse teaching resources, tools, and ideas).* A course should include proprietary educational materials as well as other resources that are properly edited, are adequate to meet the goals and objectives of the course, and are provided with detailed references to reliable sources, including Internet resources.
5. ***Course format*** (*pleasant interface, variety, easy navigation*) A course should be visually attractive, should have an appealing design, thanks to the instructional materials presented. At the same time, the hierarchical interface, adequately developed and accessible descriptions, etc., should make for simplicity, ease of viewing and navigation.
6. ***Multimedia and poly-sensory character*** (*Variety of materials and media utilized*). A course should include multimedia modules (e.g. multimedia presentations) and other media – static and dynamic graphic objects, audio and video files, online educational games, animation, etc. What attracts most praise is components developed by course authors themselves.
7. ***Teaching styles and methods*** (*constructionist elements*). A course should be primarily based on stimulating teaching methods (preferably, we should first use such MOODLE features such as lessons, Quiz, Hot Potatoes Quizzes, Assignments, Journal, Forum, Wiki, study, Questionnaire, Survey, Chat-room, etc.). Features (resources) that have one-way links to the user (that offer theoretical information without any return links, e.g. text files) earn the lowest score.
8. ***Interactivity*** (*communication, group work and group learning, collaboration, mutual help, self-assessment and peer assessment*). Courses should be rated according to how they enable students using the platform to communicate and interact with one another (and with their instructors) as well as to collaborate with, assist and assess one another, using the whole array of means and tools available on the platform and outside (Forum, chat-

room, WIKI, Dialogue, Workshops, Dictionary, the Internal Messaging System, Skype, NetMeeting, Yahoo Messenger, etc.).

9. ***Compliance with the law and ethical standards*** (*Pursuing work and learning activities in accordance with copyright laws and ethical standards*.) Course material made available should be the original work of authors or instructors. Quotations should be adequately referenced and acknowledged. External resources (e.g. photographs, films, animations, etc.) may only be used if permission has been obtained from the authors, originators or publishing houses.
10. ***Instructional materials for course instructors and materials for students.*** A course should include teaching materials, developed by specialists in teaching methods, for use by course instructors, describing the course rationale and procedures for online teaching (hidden from students); also, there should be materials for students, containing brief and essential information about the course rationale and rules for participation.

CONCLUSION

The issues discussed in the article are both theoretical and practical in nature. The author, throughout her scholarly career, has implemented and tested them, especially during the development, and co-ordination of the development, of several dozen distant courses in pedagogy, computer science, mathematics, etc., taught on the e-learning platform managed by the Faculty of Ethnology and Sciences of Education at the University of Silesia (http://moodle.weinoe.us.edu.pl). The solutions were also put to the test in pre- and *in-service teacher* training programmes in distance education, offered to both active and prospective teachers from southern Silesia.

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TAILORING ENGLISH LANGUAGE LEARNING OBJECTS TO STUDENTS' NEEDS

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Abstract: *The paper tracks some changes in e-learning material development in English language teaching at the University of Defence (UoD) in Brno that have responded to continuously growing needs of military personnel over the past four years. It depicts the English language teachers' effort to provide UoD students and staff with access to an effective e-learning support, evaluates its outcomes and contemplates the tendencies in recent and future English language e-learning material development at the UoD.*

Keywords: e-learning, English language, ICT, learning object, military English.

INTRODUCTION

Since the introduction of multimedia, language learning has witnessed dramatic changes. The ability of multimedia to combine different content forms, such as text, audio, video, still images, animation and various kinds of interactivity contributes to the complexity of the language acquisition process. Foreign language computer-mediated programs, the Internet and the World Wide Web provide unprecedented opportunities for the development of individual strategies of learners. In addition, advanced authoring tools enable the lecturers to create their own learning objects which allow the users to interact with their contents, and thus to be actively involved in the teaching-learning process.

Being aware of the merits of multimedia usage in English language teaching (ELT), the teachers at the Language Training Centre of the UoD are searching for effective e-learning methods that would respond to the Czech military professionals' growing demands. The main objectives of ELT are to develop students' general English language skills in compliance with NATO STANAG 6001 requirements, and to enlarge their professional vocabulary. The following chapters track all important changes on the path towards providing the UoD students and staff with access to an effective learning support.

1. LOOKING BACK

The project on the utilization of ICT in ELT was carried out in 2005 and 2006 with active participation of about ten English language teachers. Its aim was to test the possibilities of the only available virtual learning environment – the UoD Learning Portal, and the authoring tool ToolBook II Instructor for creating and distributing English language learning objects. The project stages were based on the ADDIE (Analysis, Design, Development, Implementation and Evaluation) model [4]. As a result, dozens of theme-based interactive learning objects [3] were developed and saved on the UoD Learning Portal in six sections: Grammar, Vocabulary and Speaking, Listening, Reading, Writing and Military English. All of them contain distance learning elements, such as free progression within a learning object, multimedia, internet links

and feedback. The language level of the exercises varies from pre-intermediate to advanced levels of proficiency.

In 2006 the learning objects were evaluated in a questionnaire survey by 166 UoD students and met with a very positive acclaim. One of the questions examined the students' opinion on the circumstances in which the e-learning exercises should be used. The students' responses are shown in Figure 1.

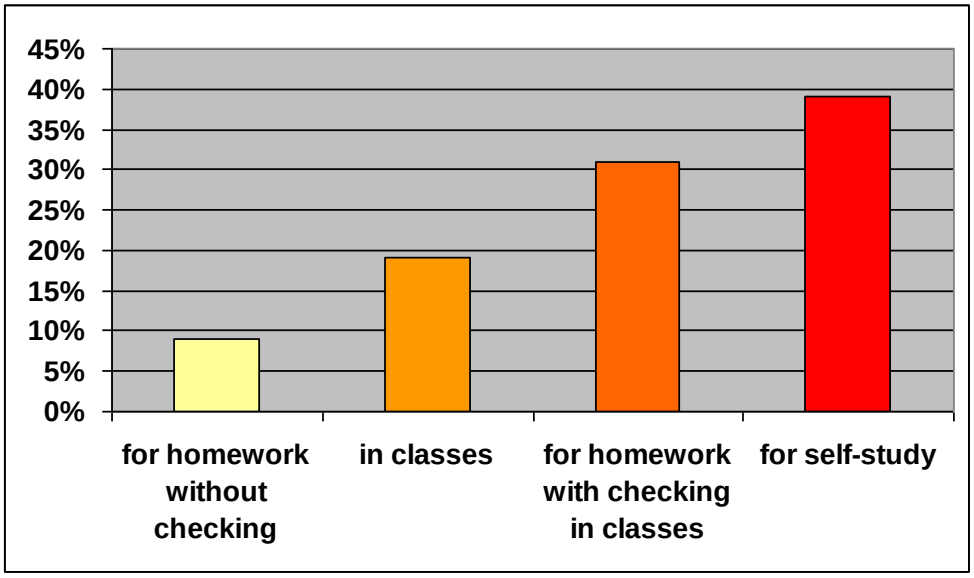

Figure 1. Students' responses to the question:
In which situations should the e-learning support be used?

As it follows from Figure 1, most of the students are convinced that the English language e-learning support should be used for homework and their self-study practice. However, 20% of the respondents would like to use it in classes. These views also correspond with the teachers' opinions.

Thus at the end of the year 2006 the teachers participating in the project were able to create helpful learning objects using the virtual learning platform available at the UoD. The evaluation questionnaire confirmed that students accepted the learning support as a suitable tool for English language skills development.

2. MAKING THE BEST OF IT

Since the beginning of the e-learning project some teachers have been implementing the learning objects into language training. The following sub-chapters depict some crucial changes in the English language learning support development which reacted to students' actual needs.

2.1 Responding to students' language needs

Since 2005 the demands on the level of students' English language skills have been growing. Four years ago, both the entrance and leaving requirements were lower. At that time, most of the learning objects were designed to develop English language skills at pre-intermediate to intermediate levels. Two years ago, the situation changed. The entrance examinations were set

to intermediate level and leaving requirements to upper-intermediate level. The teachers flexibly reacted to the change and started creating new learning objects aimed at developing language skills at upper-intermediate or advanced levels. Most of the learning objects are based on authentic materials and contain sets of interactive tasks designed by the teachers.

2.2 Responding to curriculum innovations

In response to the growing demands on the UoD undergraduates' English language skills level, it was necessary to innovate the curriculum for ELT. When the teachers were exploring and gathering teaching material which would cover the topics incorporated into the newly designed curriculum, they selected several topics that were to be developed in electronic version. As a result, several new learning objects have been created, such as 'Red Cross', 'United Nations', objects reflecting contemporary social issues and objects based on military context. Thus the new learning objects created on demand filled in the thematic gaps in the teaching content required by the new curriculum.

2.3 Focus on military and professional English

As far as the content of the learning objects is concerned, there is a tendency to create tasks based on military or professional context rather than on general English context. This change is entirely natural and justifiable on the grounds of the increased availability of general English task-based exercises on the World Wide Web. Over the past two years some teachers have been developing mini-courses, such as 'Interactive Military Exercises', 'ACR Foreign Missions' and 'Red Hat in Brno'. Such learning objects are too capacious to be accommodated on the UoD Learning Portal, so they are distributed on CD ROMs. In this way, they can be also used by students at other military installations.

2.4 Students' contribution

The benefit of employing multimedia in the teaching-learning process lies in the options to suit the individual strategies of active learners. Active learning approach requires learners to be diligently working on problems. Fundamental to this concept is allowing the learners to assume control of their learning. One of the ways is to encourage them to interact with the learning content, for example, by enabling them to create teaching materials. It is obvious that engaging learners in material development requires effective organization which must be based on a clear pedagogical rationale; it is essential to carefully consider methodological and instructional aspects.

In 2006 and 2007, the author has conducted two projects engaging twelve University of Defence (UoD) students, majoring in technical subjects, in creating electronic English language learning objects [1]. The intention was to expose the students to a problem-solving task with the use of multimedia, and, at the same time, to enlarge the existing English language electronic learning support. In groups of three, the students were asked to select an authentic text according to their own interest, adapt it and create interactive task-based exercises focusing on English language reading skills and vocabulary development. ADDIE (Analysis, Design, Development, Implementation and Evaluation) model [4] was used as a methodological procedure. The process of creation was conducted entirely in English, which enabled the students to practise all language skills actively and purposefully.

All students involved showed positive attitude to the project. They especially enjoyed working with the texts which were chosen according to their own interest. Among the topics

they dealt with were Aviation, Military training in the USA, Third Servile War, Luftwaffe, Combat engineering, Laser, El Nino, and the Assassination of Reinhard Heydrich. They considered the activities facilitated by the project as "useful, interesting, attractive, innovative and thought-provoking". According to the students, due to the selection of suitable texts from the Internet and creation of interactive learning tasks they enlarged their vocabulary considerably. Most students also appreciated the chance to develop group collaborative skills.

3. LOOKING FORWARD

Based on the analysis of the past and current students' needs, we can anticipate that in the near future, we have to take into consideration the following tendencies.

- There is a demand for learning objects aimed at developing English language skills at higher level of proficiency (for the examination in compliance with NATO STANAG 6001, Standardized Level of Proficiency 3 3 3 3).
- The context of tasks becomes even more tailored to the students needs: there is a tendency from general context towards military or professional context.
- As the learning objects created in software ToolBook II Instructor are becoming more and more technologically advanced due to the use of multimedia applications, the UoD Learning Portal is not able to accommodate them. Some teachers prefer other ways of e-learning materials distribution, e. g. in the form of mini-courses on CD-ROMs. This allows other military installations to share the learning objects.
- Students have been participating in e-learning material development. By choosing the context according to students' interest, the content of the learning support reflects students' real needs and areas of interest.
- There is still a great chance to explore the possibilities of interconnecting other previous or recent projects, such as the e-learning project and videoconferencing [2], and to take advantage of their optimal utilization.

CONCLUSION

The list of the abovementioned tendencies following the termination of the English Language Learning Support Project presents evidence that the outcomes of the project are being constantly improved and new learning objects are being continuously developed. By covering gaps in a required teaching content, learning objects can flexibly respond to any curriculum innovation not only in foreign language teaching.

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INTERACTIVE MILITARY ENGLISH EXERCISES

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Abstract: *This contribution deals with the state of English e-learning on the premises of the University of Defence and it also presents some examples of the English e-learning support materials that have been created by the author of the paper and her colleagues for the use of the students and employees of the University of Defence. Because of the fact that some of the interactive materials were placed on CD-ROM (for example the CD-ROM Interactive Military English Exercises), they can be used by all the members of the Czech Armed Forces who feel like refreshing the basic military English or improving their general English as well. Some of the mentioned materials are available only on the Learning Portal of the University of Defence (https:/portal.unob.cz) and that is why they cannot be used without access to Learning Portal. These interactive materials are suitable for the use in different English level courses as well as for self study thanks to the feedback given to all the exercises. The paper describes the main advantages of these interactive materials. According to the results of the questionnaire given to the students who used the materials, the materials mentioned above are considered to be user friendly and that is why students like them. They consider them very useful and also appropriate for the preparation for STANAG 6001 exam. Undoubtedly, one of the biggest advantages is that every user can regulate his own pace, choose only the exercises he prefers and skip the exercises he does not like.*

Keywords: E-learning, interactive.

INTRODUCTION

Talking about the state of English e-learning on the premises of the University of Defence, it is necessary to mention the fact that there is not a unified Learning Management System. It is possible to use LMS Barborka as well as LMS MOODLE. Because of this fact, only elements of e-learning are used as language teaching support. Most of e-learning materials that were created by the author of the paper and her colleagues for the use of the students and employees of the University of Defence are placed on the Learning Portal of the University of Defence. Most of these e-learning materials were created in software TOOLBOOK II Instructor and it means they are interactive. These interactive exercises are supposed to support English language acquisition. They were designed to enable the learners to study the language in an amusing way. This generation of students was raised in computer environment thus it is logical and natural that they prefer innovative and much more engaging methods of learning. They really appreciate “learning by playing”.

1. DEFINITIONS OF THE TERMS E-LEARNING AND INTERACTIVE

The terms e-learning and interactive are used frequently in this paper so it seems to be a good idea to introduce at least some definitions of these terms.

For example, Derek Stockley defines e-learning as "*The delivery of a learning, training or education program by electronic means. E-learning involves the use of a computer or electronic device (e.g. a mobile phone) in some way to provide training, educational or learning material.* (Derek Stockley 2003) [1]

Next definition of e-learning says that it is "*Education via the Internet, network, or standalone computer. E-learning is essentially the network-enabled transfer of skills and knowledge. E-learning refers to using electronic applications and processes to learn. E-learning applications and processes include Web-based learning, computer-based learning, virtual classrooms and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, and CD-ROM".* [2]

On the premises of the University of Defence, the content is delivered in most cases via the intranet (Learning Portal) and sometimes via CD-ROMs.

The term interactive, according to Merriam – Webster dictionary, means "1. mutually or reciprocally active; 2. involving the actions or input of a user"... [3]

Next definition of the word interactive reads as follows: "1. Acting or capable of acting on each other; 2. Computer Science. Of or relating to a program that responds to user activity". It gives also an explanation, for example, ... "If you are required to select True or False, then you are supplying input to the computer. This would be classified as interactive"... [4]

2. CD-ROM INTERACTIVE MILITARY ENGLISH EXERCISES

Before creating the English interactive materials, needs analysis was carried out. It is apparent that it is necessary to understand certain users' needs first and after that meet and even exceed these needs. The reason why the authors decided to place some of the English interactive materials on a CD-ROM (for example the CD-ROM Interactive Military English Exercises) was that on such a medium they can be used by all the members of the Czech Armed Forces who feel like refreshing the basic military English or improving their general English as well not only by the students and employees of the University of Defence. In the following part, some information about the CD-ROM Interactive Military English Exercises [5] will be provided because the author of this paper is also a co-author of the CD-ROM mentioned above.

The CD-ROM Interactive Military English Exercises is intended for in-class usage (in a language lab) as well as for private study (self study). At start-up, the user is presented with two categories – Military in the Czech Republic by Hana Businova and Military in General by Jana Stodolova.

To start the particular category the user pushes its button. There is a button-based menu of chapters for each of the categories. In the category Military in the Czech Republic there are the following chapters: ACR – Basic Facts; Organization of the ACR; Mission of the ACR; Operational Structure; NATO Multinational CBRN Defence Battalion; Joint Forces; Deployments; Women in the Military. In the category Military in General there are the following ones: Armour; CIMIC; Combat Engineers; Field Artillery; Field Hospital; Military Chaplains; Military Medical Service; Military Police; PSYOPS; Reconnaissance Troops; Signal Corps; WMD.

There is a variety of exercises, for example, matching, multiple choice, gap fill Drag & Drop, word building, T/F statements, answer the questions, etc. - All these activities are provided with feedback.

In the category Military in General all the chapters follow a similar pattern. There are similar types of exercises. The chapters are consistent in format. Each chapter starts with a scrolling text where key words are in bold. Next there is a matching exercise for practising the key words and gap fill Drag & Drop where the key words are practised again to enable the users to fix the vocabulary. Then there are some exercises focused on word building or synonyms and antonyms. Then some T/F statements follow and each chapter ends with an answer the questions exercise. On the last page of each chapter there is a button *go back to the list of files* and when you click on it, you get to the page with the menu of the chapters. When you want to finish working on the CD-ROM, you click the *EXIT THE PROGRAM* button. The CD-ROM is easy to work with. The structure of the CD-ROM is logical and instructions are clear enough to follow. Buttons *Back* (click to go to the last page you were working on) and *Text* (click to see the text) facilitate working with the CD-ROM. For the feedback there is the button *Your score* on every page and also the buttons *Correct Answers* (close with *Hide Correct Answers*) and *Sample Answers* with some of the exercises. The button *Reset* (or *Reset Page*) is used when you want to reset the certain page. Button *Note* gives you additional information on the page where it is advisable.

The CD-ROM Interactive Military English Exercises is considered to be user friendly by the students and they like working with it.

3. OTHER ENGLISH INTERACTIVE MATERIALS

As mentioned above, there are a lot of e-learning English materials on the Learning Portal. Besides the Study Guide there are the following sections: Vocabulary and Speaking; Listening; Reading; Writing; Military; Webquests, and News Lessons. Most of them are interactive. The author of this paper created a lot of files in the section Reading and Military. In the section Reading she contributed into the sub-sections Crime (for example she came up with the files Terrorism, Trafficking in Human Beings, and Trafficking in Human Organs) and Social Issues (she came up with the files Sexual Harassment; Obesity; Violence in Sport; Culture; Euthanasia; Racism and Xenophobia; Abortion; Addictions, and Bribery and Corruption). Except for the materials placed on the CD-ROM Interactive Military English Exercises, in the section Military there are also materials devoted to the ACR Foreign Operations and Cultural Awareness. The author of this paper created the files War in Afghanistan; War in Iraq; Kosovo Conflict and KFOR, and Intercultural Competence, all of them focused on reading comprehension and vocabulary. All the mentioned e-learning materials can be used for STANAG SLP 3 exam preparation.

CONCLUSION

According to the questionnaire given to students who used these materials, they found them to be a good and interesting learning tool. Respondents considered all the topics useful, interesting and the materials user friendly. They found them easy to work with. Especially, they liked clear instructions and the feedback on each page and also the fact that every user

can regulate his own pace, choose only the exercises he prefers and skip the exercises he does not like.
They appreciated the interactive form very much because they love “learning by playing”. Being asked, all of them would recommend these interactive materials to their colleagues even for preparation for STANAG 6001 SLP 3 exam.

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E-LEARNING AS A TOOL TO ENHANCE THE QUALITY AND EFFECTIVENESS OF TRADITIONAL TEACHING METHODS IN PRACTICE

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Abstract: *This article shows authors' experience in designing and realization of the interactive e-learning courses allocated on educational portal for students "eLearn central" (http://ec.elf.stuba.sk). These courses have been successfully implemented in the distance and blended learning since 2004. "eLearn central" includes more than 30 unique interactive animations used in courses accessible on this educational portal. Portal "eLearn central" is the outcome of continuous reciprocal interaction and cooperation between teachers and students of "eLearn central team".*

Keywords: e-learning, educational portal "*eLearn central*", interactive flash animations, SCORM, LMS Moodle.

INTRODUCTION

Nowadays the demands on us are so complex, multifarious and rapidly changing that the only way in which we should be able to keep this pace is to commit to a process of an individual, communal, and global learning throughout the lifespan of all of us. The effort of the society to be successful enhances stress to the quality of education.

University education meets with other serious different problem: Students come from secondary schools to the university with different levels of knowledge. These differences are mostly evident in technical courses, which include practical electric measurements. In these cases the situation for teachers is not very pleasant: there are three main groups of students [1]. One part of the students has very good study results in general but no practical experiences, no skills with applied measurements, and this technical subject is for them the source of frustration (about 25%). Second part of the students who manage with practical experimental work in a laboratory without problems (about 50%) and third part of the students who have skills and also their own practical experiences – these are mostly the students from High school with technology oriented education (electrical engineering) or radio amateurs. Practical laboratory exercises seem very easy for these students and they usually underestimate the careful preparation for examination (about 25%). Teachers have to solve three basic questions:

- How can we help the students to reduce the knowledge differences?
- How can we motivate the students?
- How can we increase the special courses education efficiency?

In 2001 we already tried to solve these questions and we have started to use the interactive web pages. But our solution has not match the continually growing demands anymore – educational texts, interactive animations, tests, dictionary, friendly service for teachers and

also for students. We have converted to creation of comprehensive educational materials using learning management system Moodle – in 2004 we have created educational portal "*eLearn central"*. This e-Learning project is placed on the server of the Department of Microelectronics of Faculty of Electrical Engineering and Information Technology, Slovak University of Technology in Bratislava and it is accessible through the link http://ec.elf.stuba.sk.

It is interesting that the basic study materials placed on this portal are original (interactive flash animations, education modules) and also they are created in very close and creative cooperation of students and teachers from "*eLearn central team*". The courses created for individual and team projects are also notable. These make use of Moodle system´s great potential for creative work.

The scope of this paper is to present the experiences with designing and developing the courses located on portal "*eLearn Central*" and also using and implementing them in blended study of bachelor and master programs at our faculty.

1. EDUCATIONAL PORTAL "*eLearn central"*

More than 100 courses are still being developed in these groups and more than 1600 users are registered. 12 groups of courses were designed and located on the portal, for example: "Electronics", „Management", "Team projects", "Individual projects", "Kaleidoscope of Information", "Course creating".

1.1 "*eLearn central"*: Courses

Four basic types of courses are developed on this portal: The standard self contained e-Learning course, One-shot courses – fast courses and Project courses - the courses „Team Projects" and "Individual projects".

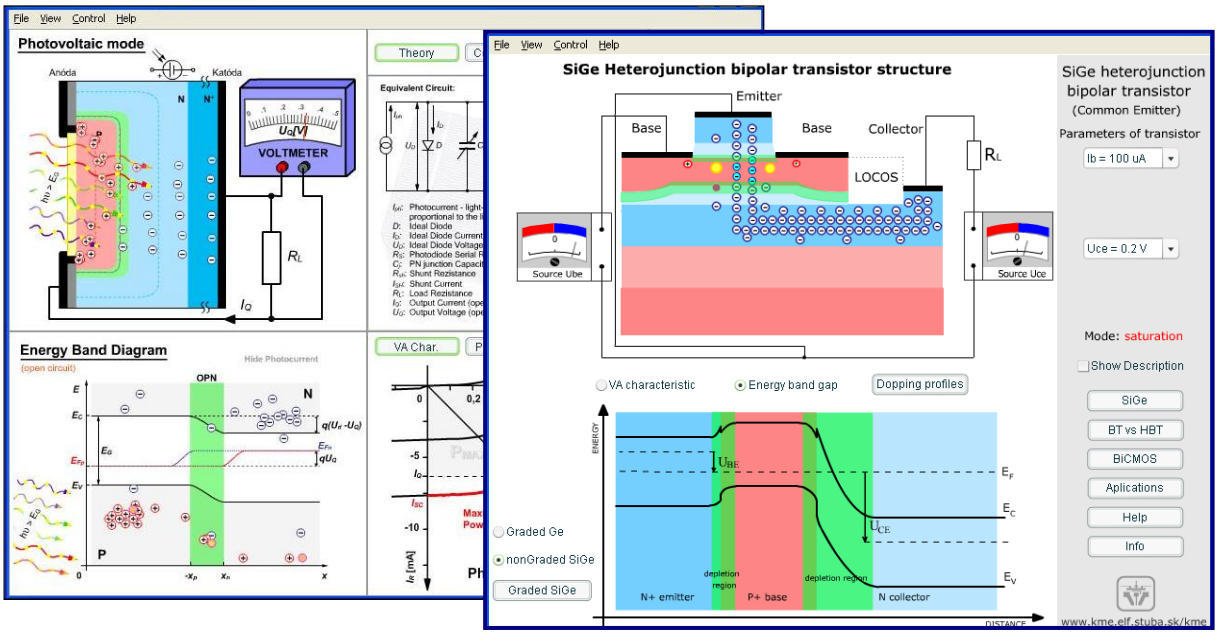

Figure 1: Screenshots: Photodiode; SiGe Heterojunction bipolar transistor structure

1.1.1 The libraries of e-Learning source

The libraries of e-learning source are storage places of created e-learning material divided to modules. Each module represents one defined topic. These modules are exploited by all types of courses allocated on the portal "*eLearn central*".

For example the library of interactive animations "*Interactive flash animations*" [2]**,** is allocated on portal "*eLearn central*". This library includes more than 30 interactive animations initially developed for a course „Electronics devices and circuits": animations of passive devices, passive filters, diodes and their usage in electronic circuits, LCD, LED, OLED, photodiode, e-paper, as well as BT, HBT, JFET and IGBT transistors, amplifiers, real and ideal MOS structures, examples of planar technology produced diodes, bipolar junction transistor and CMOS gate, optical storage media, digital circuits and gates (Figure 1). These original animations are uniqueness of our portal. Our ambition was to help the students to understand the inner processes in semiconductors and electronic circuits through interactive animations. Static pictures and characteristics do not support students' imagination of such inner processes very much. The animations have been designed in such a way that they would show details of a given object and so they would contribute to obtaining of knowledge much easier and faster. The animations have been created by using Adobe flash tool or by using softwares Adobe Flash and SPICE (Simulation Program with Integrated Circuits Emphasis). Some of animations work as a format converter of SPICE output files into graphic Internet browser show format [3]. We created the output files for variety of input parameters by simulating in programme SPICE and so we are able to provide a high degree of interactivity of animations. All interactive animations are free available for everyone interested.

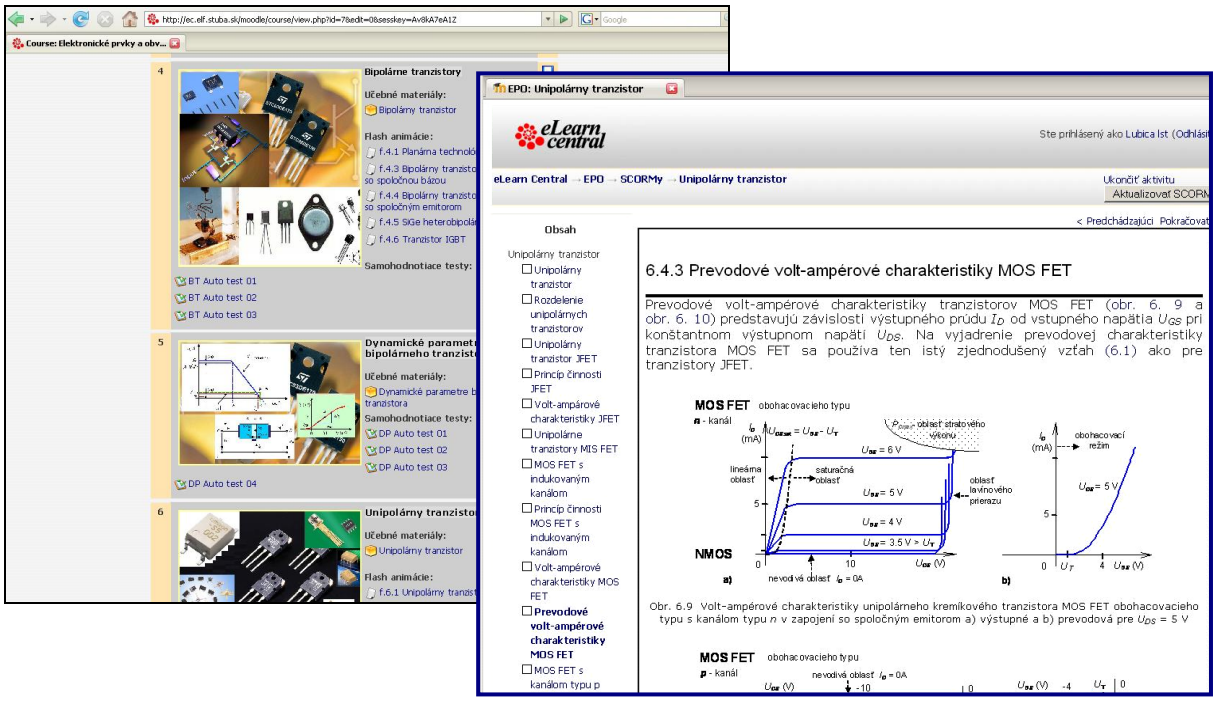

Figure 2: The course "Electronic devices and circuits" – main page; SCORM

1.1.2 The standard self contained e-learning course

The standard self contained e-learning course includes lessons converted into SCORM packages (Shareable Content Object Reference Model), interactive animations, quizess,

glossary, and number of hypertext references. This type of course is very useful for self-study students in distance study. Creating the standard self contained e-learning course is very difficult and time consuming. For example the course „Electronics devices and circuits" [4], developed by our "*eLearn central* team", includes 10 lessons, 32 interactive animations, glossary with more than 300 terms and number of hypertext references (Figure 2). A single lesson gives the basic principle definitions and terms connected with electronic devices and circuits to students in the second year of their Bachelor study at the Faculty of Electrical Engineering and Information Technology. The lessons have been advanced with one or two types of interactive self testing modules.

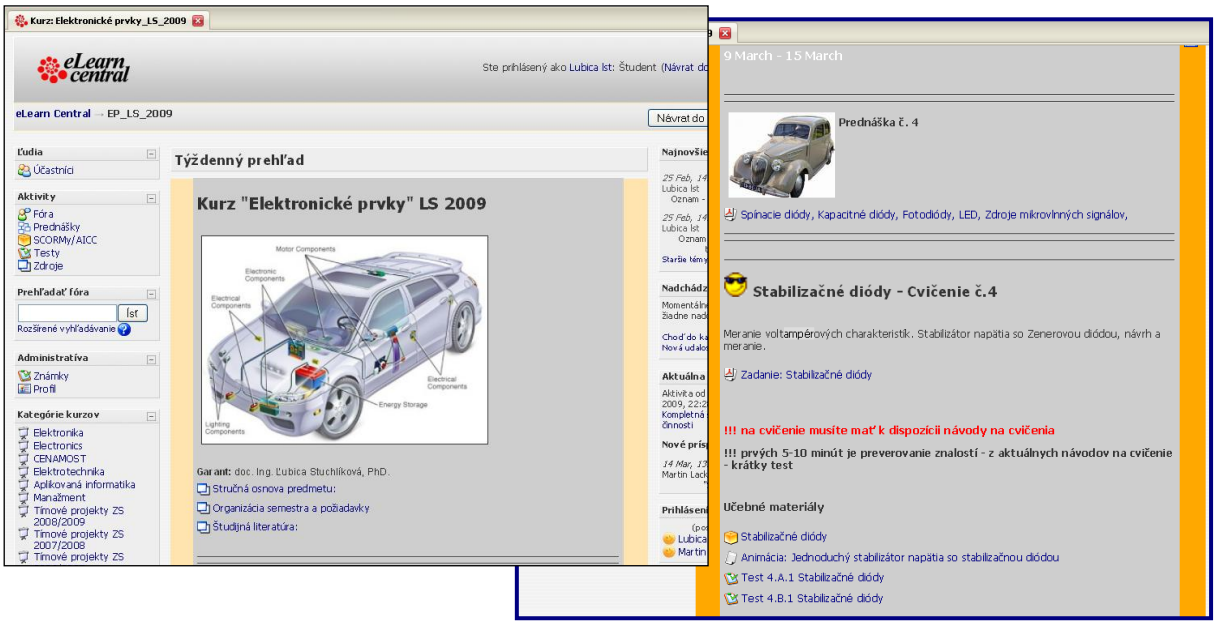

Figure 3: The course "Electronic devices 2009"

1.1.3 One-shot courses – fast course

One-shot courses – fast courses usually serve as a support for practical laboratory exercises. We regard these one-shot courses as fast courses, because we can usually create this type of course in CMS Moodle in a very short time, students and teachers notably use these courses for communication, adding and exchanging information, file transfer and for getting information as quick as possible and it is very easy to do changes. These courses can be used only for one occasion or can be updated regularly. This kind of e-learning course is a very useful tool for teachers and students at both the standard and the blended form of education in all cases. For example the course „Electronics devices 2009" [5], includes lectures, lessons, interactive animations, a guide for practical laboratory exercises, self-tests, news forum, discussion forums, (Figure 3). Our students attend the course "Electronic devices" in their second year of a bachelor study in study program Automobile Electronics.

1.1.4 Project courses

The project courses - „Team Projects" and "Individual projects" are a workspace for students in team projects and individual projects. These model of study takes advantage of the whole potential of course management system MOODLE: a basic communication, a creative work by means of discussions, forums, adding the resources, storing the educational materials, etc. An example is "Team projects 2008/2009" [6]. Students and teachers have the same roles –

editing teachers. Moodle is a very useful tool to provide detailed team project valuation – the work is focused not just on the 'final product' (as in a report, essay and/or presentation) but also on the single creative process and all factors leading to achieve it. This might better tell us about how effective the team was organized, track and convert the process into a recognizable 'output'.

1.2 "*eLearn central*": Courses implementation in the distance and blended learning

Operation of the "*eLearn central*" portal started on December 16, 2004. The profile of our web page visitors corresponds mostly to the second year students of our faculty, who have no problems with access to Internet and have some experience with web learning and this kind of education suits them. The number of our site visitors dramatically rises before tests. The users also have the right to give an anonymous feedback to an individual interactive animations and courses. The feedback was very positive and it helped us to improve our work.

We have been using the courses allocated on educational portal "eLearn central" in the distance form of education for four years. Distance students feedback was unambiguous positive.

We have been using the discussion forum "News Forum" in CMS Moodle as a tool to increase the motivation to study since February 2008. Our students have actively joined these News forums. They have prepared the news related to electronic devices and semiconductor materials from internet sources and gave it for free use to their colleagues. This study material features with high level of interestingness and topicality.

Project courses are used by Master study students. The results and contributions achieved within the Team projects proved that Moodle system is a proper tool for goal analysis, communication and solution search, specifically for team projects.

1.3 "*eLearn central*": Authors

The educational "*eLearn central*" portal and e-learning materials on this portal are a result of teachers and students collaboration from the "*eLearn central* team". We achieved very attractive and original quality results by reciprocal interactions and cooperation between teachers and students based on equal rights. Our new students used the Flash software and created complicated animations in a very short period of time. They used the created animation templates, multimedia schoolbook [7, 8] and a library of our symbols. These templates and symbols were created by their predecessors. It is also a confirmation of how useful standardization of shapes, colours, templates is in a support e-learning materials design. We have been communicating together on a regular basis, either in face-to-face meetings... Complicated physical problems were solved by involving other teachers of our Department of microelectronic who specialize in a resolved problem [9, 10].

CONCLUSION

An alternative source of information - the educational portal "*eLearn central*" (http://ec.elf.stuba.sk) was created. We formed "*eLearn central* team" composed of teachers and students for eLearning courses and study materials creating on this portal since 2004. Very positive student feedback inspires us in future. We would like "eLearn central" become

a midpoint between students and technology. Lessons, animations, assets, quizzes, glossaries and other resources can be accessed by a few mouse clicks. Students do not need to browse the paper books - they simply search. Students do not need to be stressed before tests - they simply try passing then before the tests. They do not need to have another book explaining the technical terms - they simply click on a term to see its explanation…

e-Learning is a very useful tool to enhance the quality and effectiveness of traditional teaching methods according to our experiences with using of courses on portal "eLearn central".

ACKNOWLEDGEMENT

We would like to express our sincere thanks and acknowledgement of the efforts made by all members of our "*eLearn central* team" who contributed to the successful implementation and operation of the courses on the portal "*eLearn central*". This work was done in Center of Excelence CENAMOST (Slovak Research and Development Agency Contract No. VVCE-0049-07) with support of project KEGA 3/4009/06, APVV-20- 055405 and grant VEGA 0742/08.

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EXAMINING ENGLISH LANGUAGE TEACHERS' USE OF E-LEARNING AT THE UNIVERSITY OF DEFENCE

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Abstract: *The paper presents a case study based on a survey examining University of Defence (UoD) English language teachers' use of e-learning and their attitudes to its application in the process of teaching. The survey employed a questionnaire and semi-structured interviews to find out the differences between the teachers' genuine intentions and their real use of e-learning, depending mostly on real technical conditions and curriculum requirements. In addition, the concern here was to learn whether the teachers' approaches to e-learning in teaching English are diverse or show some common features. Using statistical analysis, the paper examines teachers' responses and evaluates the outcomes of the research project. It concludes with remarks and suggestions with a view to facilitate further implementation of e-learning in English language teaching at the UoD.*

Keywords: English language teaching, e-learning, ICT use, questionnaire, statistical analysis, survey, University of Defence.

INTRODUCTION

Rapid advances in the development of ICT (Information and Communication Technologies) bring about new opportunities in all walks of life and teaching foreign languages is far from an exception. New technologies, namely the Internet and computer mediated communication enable the language teachers and students to access and retrieve authentic material with ease, and thus to enrich classroom activities with up-to-date information. In this way, the authentic materials compensate the artificiality of classroom-based learning. Additionally, the increased multimodality of material on the Internet, e.g. the use of words, still and moving pictures, sounds, as well as their increased interactivity, such as the possibilities of using hyperlinks, submitting written text and transferring spoken words allow learners to practise all four language skills. There is no doubt that a reasonable use of ICT enhances the quality and effectiveness of language teaching and learning [3].

Most English language teachers at the UoD welcome the challenge of the ICT supported learning and teaching, especially of e-learning (computer assisted learning). They can offer many convincing arguments in favour of integrating e-learning in classes as well as of using it for reaching beyond the classroom. However, several arguments can be put forward that ask for a more cautious approach when using technology in teaching. What still remains rare are case studies on real use of e-learning and on teachers' attitudes to it. Thus this article describes a case study the aim of which was to obtain and evaluate teachers' opinions on e-learning in foreign language teaching.

1. THE OBJECTIVE OF THE CASE STUDY ON USING E-LEARNING IN FOREIGN LANGUAGE TEACHING

The case study expands on the results of the specific research project carried out by the English language teachers at the Faculty of Military Technology, UoD, in the years 2005 and 2006. The project dealt with the possibilities of ICT use with the aim of developing UoD students' English language skills, grammar and vocabulary. As a result, electronic English language learning support has been designed. It includes topic-based sets of interactive exercises that are accessible through the UoD Learning Portal.

The project naturally initiated English language teachers' interest in e-learning. Several teachers took up courses on distance education and e-learning, which equipped them with knowledge and skills enabling them to create learning objects based on methodologically sound principles. Consequently, the experience of incorporating these learning objects in language teaching has been shaping teachers' opinions on e-learning.

Therefore the objective of this case study is to examine to what extent e-learning is used in the process of implementing a newly proposed syllabus aimed at preparing the students of the Faculty of Military Technology for the examination described in NATO STANAG 6001 document, Standardized Level of Proficiency 2222 and 3333 [5]. In addition to that, the study enquires into teachers' views on the suitability and effectiveness of using e-learning in foreign language teaching.

2. RESEARCH METHODS

A questionnaire and a semi-structured interview have been used as the two basic research methods in this case study. Each of them has been utilised in one of the two successive phases of research.

In the first phase the questionnaire was applied. It was based on the form of the questionnaire used in the previous research studies accomplished by Černochová et al. [1] and Zounek and Sebera [4]. This type of questionnaire was adapted to suit the needs of this case study (doc. M. Černochová authorized us to use and modify her questionnaire). The designed questionnaire consists of 25 Lickert scale entries. The respondents' task was to specify their level of agreement or disagreement with a statement. Five ordered response levels from 5 to 1 were used, namely: agree, partly agree, neither agree nor disagree, partly disagree and disagree. If the respondent was not able to answer, he could use the variant "N". This provision prevented the respondent to be forced to an answer which would not be adequate for him or her.

The questionnaire consists of two parts. The first part (items 1 – 15) analyzes teachers' general ideas (conceptions), attitudes and opinions concerning ICT usage in the sphere of language education. In fact, this theory can only be applied to the technical aspect of implementing ICT in language instruction. Statements are collocated in groups of three. Each of the groups is based on the characteristics of individual innovation adopters' categories according to the theory of diffusion [2]. The categories are: innovator, early adopter, early majority, late majority and laggards. The innovator is a real enthusiast, while the early adopter can be described as a visionary. The early majority represents teachers – pragmatists, and conservatives are called late majority. Those who are totally sceptical to ICT are laggards.

The main purpose of this first part of the questionnaire is to find out to what extent the teachers identify themselves with the statements in the separate categories.

The statements in the second part of the questionnaire (items 16 – 25) are also Lickert scale entries. Contrary to the first part, here the respondents were given the possibility to explain their individual answers freely in their own words. The statements in this part of the questionnaire focus on considering the real situation in the sphere of ICT usage at the very workplace of the teachers and at getting information about ICT real usage in their own tuition.

During the second phase of the research the method of a semi-structured interview was used. Individuals for this interview were chosen based on the data from the first part of the research. The main purpose of these interviews was to obtain more detailed qualitative data on the examined problem. The individual areas focused on during the interview derived both from the questionnaire and the respective theory. The effort during the interview was to get detailed information about the selected teachers' attitudes and opinions concerning e-learning, its real usage in the tuition of these teachers and their experience with e-learning. Individual interviews were recorded and subsequently transcribed verbatim because of the need of their content analysis.

3. STATISTICAL ANALYSIS AND INTERPRETATION

Using the quantitative data from the questionnaire, a basic statistical analysis was carried out. The results for individual questionnaire items are shown in the following graph using mode as a suitable statistical characteristic. For items 12, 21 and 25 there are two values provided because two different modes were obtained for these items. The values of median were also calculated, but for the purpose of brevity of this paper, the appropriate diagram is not provided and only referred to further on in this text.

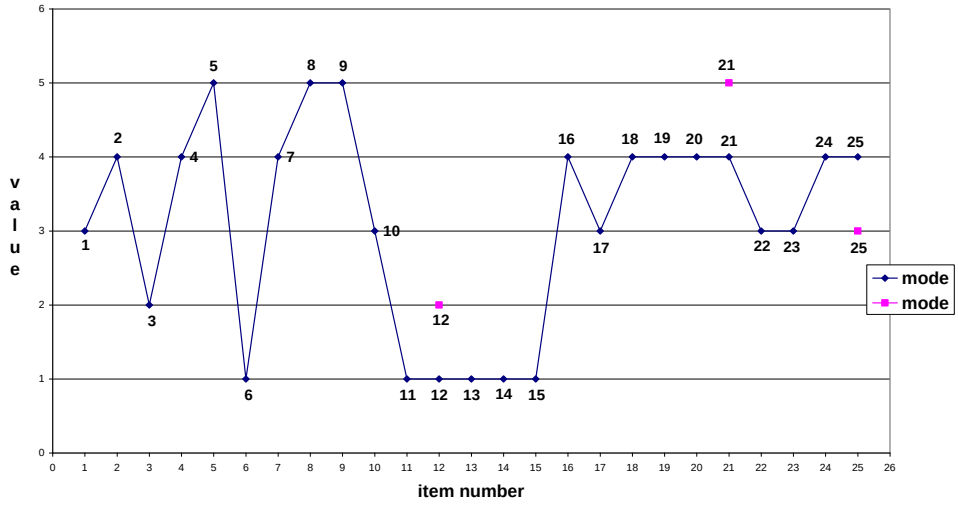

Figure 1: Modes of teachers' answers to individual items

It is apparent from Figure 1 that in the first part of the questionnaire (items 1 – 15), which refers to teacher's general ideas, attitudes and opinions regarding ICT use in language instruction, the values of teachers' most frequent answers spread widely within the extreme range of 5 (agree) to 1 (disagree), while in the second part of the questionnaire (items 16 – 25), which focussed on the actual state of using ICT in teacher's language instruction, the

answers narrowed down to the central range between 3 (neither agree nor disagree) and 4 (partly agree). These results suggest that the statements in the first part of the questionnaire cover a wide range of the opinion continuum and that the teachers are rather consistent in their attitudes having strong and settled opinions about the potential use of ICT in language instruction. It is also visible from the graph that the idea of collocating the statements in groups of three (see adopters' categories) does not seem optimal because these groups do not prove to be homogeneous. Consequently, it probably would not be reasonable to categorise the teachers according to this criterion. The results for the second part of the questionnaire suggest that the teachers view the actual situation of ICT implementation at their workplace in a rather similar way and there were mostly no extreme answers in this area.

The values of mode for individual items along with the values of median allow us to identify those statements with which the teachers agreed most or least. In the first part of the questionnaire the teachers identified themselves most with the following statements in items 5, 8 and 9.

5. When trying out new ICT applications, I share my experience with the others.
8. I carefully consider which ICT applications I will use.
9. I prefer gradual, not revolutionary development in the use of ICT applications.

It is possible to deduce from these statements that using ICT is a social phenomenon for the teachers since they consider support and experience of their colleagues as an important factor. Moreover, the teachers also seem to assume a rather careful approach to using modern technologies.

On the other hand, in the first part of the questionnaire the statements the teachers disagreed with most (the values of mode and median were the lowest) were in items 6, 13 and 15. The statements were the following ones:

6. At my workplace I am considered to be an authority in the field of ICT.
13. I will use ICT applications only when forced to do so.
15. I will be among the last ones who will decide to use ICT.

The high amount of disagreement with item 6 is rather surprising and deviating from the tendency visible in Figure 1. This fact is probably caused by an improper use of the word "authority" in the statement, which thus sounds quite exaggerated and consequently discouraged the modest teachers from agreeing with this statement. Answers to the other two statements imply that the teachers are not strong objectors to ICT use in language instruction.

In the second part of the questionnaire the values of mode and median are the highest for items 16, 19, 20 and 21, which contain the following statements:

16. I can see an essential difference between ICT-supported language instruction and instruction without ICT.
19. In my own language instruction I use ICT the way I imagine it.
20. I have very positive experience with using ICT in my own language instruction.
21. I have made my students sufficiently familiar with the possibilities of using ICT for language instruction purposes.

Answers to these statements suggest that the teachers are aware of the potential modern technologies can offer to them, as well as of their limitations. The teachers also make use of ICT but not to their full satisfaction, they have rather positive experience with ICT, but it is not overwhelming and they have more or less informed their students how to use ICT for language learning.

The teachers showed the least agreement with the statements in items 17, 22 and 23. Namely they turned out to be rather neutral to the following statements:

17. *I am very satisfied with the way of ICT implementation into education at the UoD and with activities of the people participating in this process.*
22. *I can see many obstacles which prevent me from using ICT in language instruction properly.*
23. *I am willing to do my best for better use of ICT in my language instruction.*

It might be deduced from the teachers' answers to these statements that they either do not know much about the process of ICT implementation at the UoD or they prefer not to express themselves explicitly to that matter. It also seems that the teachers are either not fully aware of the potential barriers to their ICT use or that it is difficult for them to assess whether the amount of problematic areas is excessive or not. Finally, the teachers seem to be neutral about their willingness to get more involved in the field of ICT use because that might probably have either binding connotations for them or they feel already limited in their time and other resources.

In order to obtain more detailed qualitative data about the examined area, a semi-structured interview was used. For practical reasons it was necessary to reduce the number of respondents by choosing suitable candidates for the interview. To achieve this, a cluster analysis was applied to the questionnaire data to disclose any possible opinion patterns among the teachers. The cluster analysis was carried out by means of the STATISTICA 8.0 software and the graphical results in the form of a dendrogram are shown in Figure 2.

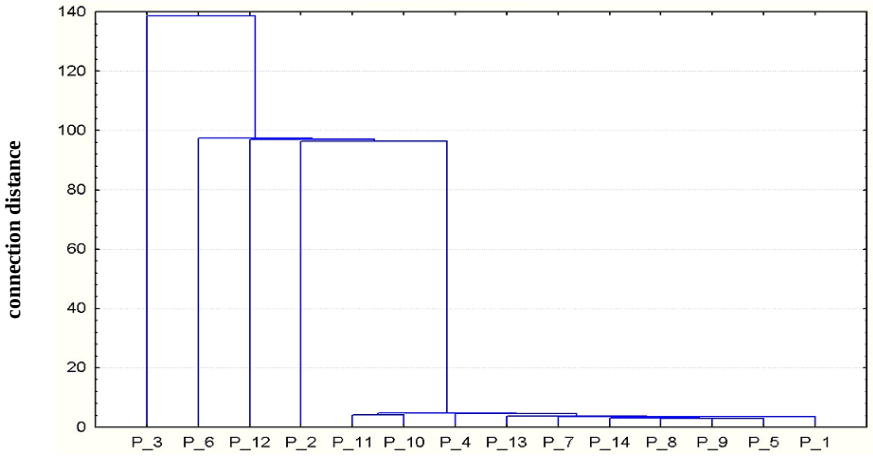

Figure 2: Clusters of teachers based on their answers

It is apparent from Figure 2 that there are five clusters, four having only one object-person and one having all the others. On the basis of these results, five teachers were chosen for the interview as representatives of different opinions.

4. GENERAL CONCLUSIONS AND RECOMMENDATIONS

The analysis of quantitative data from the questionnaire shows that the examined language teachers accept innovations in the field of e-learning willingly, although with a certain amount of deliberation. The reason for their cautiousness might be the fact that they are not experts in the e-learning field and, consequently, acquiring adequate knowledge and skills concerning e-learning is quite time-consuming for them. At the same time, they are aware of the advantages that e-learning might bring about in foreign language teaching and that is why most of the respondents are trying to implement it into their instruction.

The semi-structured interviews with five teachers indicated that the main obstacle to e-learning development at their workplace is insufficient technical support and deficient equipment in classrooms, even though the situation in this area is gradually improving. Consequently, it can be concluded that technical support and equipment is the most important factor influencing the examined language teachers when they implement their ideas about using e-learning into practice.

To improve the situation concerning e-learning at the examined workplace, the following general recommendations are suggested:

- to provide functioning and reliable technical equipment in computer and language classrooms which will be professionally looked after and maintained;
- to organize training in using modern technologies and to motivate teachers to participate in it;
- to provide a competent expert who would advise and support teachers in the field of e-learning;
- to motivate teachers to use modern technologies and to support their co-operation and sharing experience at their workplace as well as within other educational institutions.

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WHY MINI WEBQUESTS

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Abstract: *The paper deals with the implementation of an e-learning method called Mini WebQuest in English lessons at the University of Defence, the Language Training Centre (hereinafter LTC) in a bachelor study course during the years 2007-2009. The aim of this activity was to make students organise their ideas, plan their work using their inspiration and then execute their ideas in a multimedia environment. This method incorporated students in the active creation of study materials which have been designed on the basis of the bachelor degree programme. Mini WebQuests are inquiry-based activities that involve the interaction of students with web-based resources. Focus on pre-selected websites encourages students to analyse, synthesise and evaluate information to complete group tasks efficiently.*

Keywords: NATO STANAG 6001 SLP 3, Structure of Mini WebQuests, students' active involvement, curriculum, teaching process, skills, application in teaching technical subjects.

INTRODUCTION

Over the past decades, the concept of student autonomy and authenticity of study materials has become significant issues in foreign language teaching. "No school, or even university, can provide its pupils with all the knowledge and the skills they will need in their adult lives. Adult life, in its personal as well as its conventional aspects, is far too diverse and too subject to change for any educational curriculum to attempt to provide a detailed preparation. It is more important for a young person to have an understanding of himself/herself, an awareness of the environment and its workings, and to have learned how to think and how to learn." [2]

This statement completely applies to students at the University of Defence in Brno and corresponds with its requirements for the exit English language level. The students are required to reach a relatively high level of language competence. They have to pass a standardized NATO language exam STANAG 6001 (NATO Standardization Agreement), SLP 3, which approximately corresponds with C1 according to CEFR (Common European Framework of Reference for Languages that is a guideline used to describe achievements of learners of foreign languages across Europe). The aim of this agreement is to provide NATO Forces with a table describing language proficiency levels in language skills: oral proficiency (listening and speaking) and written proficiency (reading and writing).

The author's assumption is that that learner autonomy, as well as specific orientation of English language teaching at the University of Defence in Brno (UoD) that is in accordance with the tasks military professionals might encounter in real professional life, both on the territory of the Czech Republic and abroad at military schools or on various missions, should help the students to be more involved in setting educational goals. At the same time the learner autonomy could be very beneficial for affecting the students' motivation and self-determination.

Hence, incorporating autonomy and authenticity in the process of teaching and studying will help the students acquire knowledge, skills and beliefs that meet their needs for competence, autonomy and relatedness.

The amount of information available on the Internet is enormous and it will even grow in the future. New emerging technologies lay demands on teachers interested in forming autonomous learners and increasing student autonomy in conventional institutions. "With the new assumption, where lifelong learning is the organizing principle for education, the primary mission of institutions therefore must be the development of skills of self-directed inquiry rather than inculcation of subject matter content. The mastery of the skills of autonomous learning should be the product of formal education. This would need different teaching-learning strategies and curricular structure." [1]

1. PRACTICAL APPLICATION

In recent years the philosophy of the language training at the University of Defence is to expose our students to language tasks which they might face in real life. When designing study materials the teachers lay emphasis on authenticity of tasks and texts. In view of the fact that the students who graduate from the bachelor study programme should reach STANAG 6001 SLP 3 in English, we have to respect the topic-based curriculum which has been designed and tailored for students to help them fulfil the exam requirements. Taking into consideration all these aspects it is quite challenging for teachers at the UoD to incorporate in English lessons such activities that increase student self-determination.

This effort has led to some experimentation on promoting autonomy in both teaching and learning processes which was reflected in the creation of e-learning objects created in the first phase by teachers and then in the second phase by a group of students, a project that was conducted by the author's colleague, RNDr. Eva Staňková. These e-learning materials allow the UoD students and the staff to practise English language skills, grammar and military vocabulary on their own, and thus encourage their independent learning on the UoD internal computer net.

Students' active involvement in the creation of interactive language tasks and the results of the project were so inspiring for the author of this paper that she decided to apply her experience with an e-learning method called WebQuest and to set up a project based on the creation of Mini WebQuests.

2. WEBQUEST PROJECTS

The term WebQuest was coined in 1995 by Prof. Bernie Dodge, at San Diego State University. He defines this kind of activity as "an inquiry-oriented activity in which some or all of the information that students interact with comes from resources on the internet." [6]

There are many web sites that offer WebQuests. They come in different styles as they have been created by teachers of different subjects. Most of the Internet sources related to the description of WebQuests refer to six elementary portions that each WebQuest should consist of. The first one is an *introduction* that makes the students aware of the upcoming

problem they will be exposed to. The second portion is a *task.* The task includes a description of what the learner will have learned and completed in the WebQuest. In the *process* section the teacher should give a recommended list of steps that learners may go through to achieve their goal. In the *resources* section the teacher gives the learners both on-line and off-line resources that will help them to research their topic or prepare for their role. "Because pointers to resources are included, the learner is not left to wander through web space completely adrift." [3]

Evaluation section forms an integral part of each WebQuest and serves for evaluating the learner's product or performance. In the final *conclusion* part of the WebQuest the teacher debriefs the learner and reviews what has been learned.

This e-learning activity has already found its application not only in language teaching (http://www.webquest.cz).

There are many reasons why WebQuests have become popular all over the world. "The advantages of WebQuests are numerous: fostering cooperative learning, engaging students in performing real world tasks, using authentic online materials, promoting learner motivation, developing reading skills such as scanning, skimming, paraphrasing, summarising, organising, and analysing as well as problem solving skills." [5]

At the UoD we have had quite long experience with creation and incorporation of WebQuests into courses. The first WebQuests were designed and piloted in the academic year 2000/2001. The feedback was very positive, participants of these courses highly appreciated authenticity of tasks and authenticity of the actual social situation of the classroom language and at the same time they were very surprised at their ability to communicate in EFL (English as a Foreign Language) and solve the tasks. "If language learners are to be efficient communicators in their target language, they must be autonomous to the extent of having sufficient independence, self-reliance and self-confidence to fulfil the variety of social, psychological and discourse roles in which they will be cast." [4]

In the academic year 2005/2006 there was launched a project aimed at implementing multimedia technologies into curricula at university level. The method which was used and analysed was the method of WebQuest and the author of this paper was one of the team members responsible for designing the WebQuests.

Bearing in mind the results of the qualitative and quantitative analysis of the project that was piloted in a doctoral study course at the Faculty of Military Technology and the author's experience with implementing the method of WebQuest in a bachelor study course, it has been proven that the method of WebQuest is applicable in different study programmes and it is the responsibility of teachers either to find the most appropriate way to utilise the existing online activities in the classroom or to create WebQuests tailored to the students' needs.

3. POSITIVE AND NEGATIVE ASPECTS OF WEBQUESTS

At present, the students of the Faculty of Military Technology are computer literate and technically oriented. Our assumptions that this computer-based activity will increase their motivation have proven true. Apart from the explicitness of instructions, variety of roles, scenarios and tasks, students highly appreciated the authenticity of each WebQuest. The fact

that all WebQuests were tailored to our students' needs (military context, choice of the topics based on needs analysis and required language competence) contributed to the acceptance of this method by students. "When students are asked to understand, hypothesise or problem-solve an issue that confronts the real world, they face an authentic task, not something that only carries meaning in a school classroom." [7]

The combination of individual and team work helped the students to become aware of the fact that their individual work has a direct impact of the intelligence of their group's final product. They particularly appreciated the possibility of working at their individual pace (home activities) combined with team work that consequently enhanced students' motivation because it gave the shy students or students with lower proficiency level the possibility to adjust the pace of the learning process to their needs and at the same time to the needs of the particular team.

To get the proper information on the Internet and to be able to evaluate it before acting on it requires special thinking skill levels (organizing, applying, analysing, generating, integrating and evaluating). Based on our experience, unlike students in doctoral study courses, students in bachelor study courses are less experienced in analysing, organising and generating, which had required special teacher' s preparation, and thus preteaching particular theory before the WebQuests were introduced. The same applied to writing and oral tasks.

Using the method of WebQuest forced students to transform information into a cluster that charts the main issues, a comparison, a solution, a hypothesis, etc. By asking students to undertake specific sub-tasks, WebQuests made students experience the kind of thinking process that more expert learners use. "What students need are many examples with lots of information and opinions on the topic through which they will sift until they have constructed an understanding that not only connects to their own individual prior knowledge, but also builds new schema that will be refined when students encounter the topic again in the future." [8]

Higher and more controlled attendance in lessons of the bachelor courses guaranteed better preparedness and motivation of students, and consequently the efficiency of this e-learning activity was much higher.

Even if the instructions in each WebQuest were very clear, user-friendly and explanatory, we decided to avoid any misunderstandings of instruction comprehension. Considering the fact that none of the bachelor students had had any previous experience of using WebQuests, the instructions of the first WebQuest were consulted with students in the first lesson in which this method was introduced. This eventually proved to be very beneficial because it helped to exclude misunderstandings that occurred when the first WebQuest had been introduced in doctoral study course. Explanation of each step of the process by the teacher made the role of a facilitator turn to a coordinator or organizer that after all simplified the whole process of introduction of this new method.

One of the weak points of each WebQuest were evaluation charts. They were designed and developed for assessing students' assignments as well as students' awareness of their performance assessment criteria. But students did not get used to them, they considered them too complicated and that is why they ignored them. Therefore this evaluation rubric failed (and afterwards it was not incorporated in the structure of Mini WebQuests created by students).

Since the teacher's intention is not to interfere in the performance of each WebQuest, their role should be advisory. That is why the students were monitored and given feedback after each WebQuest.

Students highly appreciated the teacher's effort to make evidence of their grammar and vocabulary mistakes. The list of mistakes was presented to students in the following lesson and their task was to identify and correct the mistakes. This helped to increase their sense of self-correction.

There is one more weak point that is worth mentioning. It is the technical problem of WebQuests that users of the Internet cannot prevent from happening. In the course of time some of the web links are cancelled and cannot be found. But any time the teacher can substitute them with other ones that apply to the topic and are available on the Internet.

As the students' task within each WebQuest is to produce an essay, an article, an advertisement or to prepare a power point presentation, it is necessary to provide them with theoretical instruction on each task or to provide them with examples which would demonstrate what they are required to produce. Therefore we used the Nicenet classroom management system that enabled effective communication between the teacher and the students.

Since the students in bachelor study course were not very experienced in debating and they did not master quite sophisticated arguing techniques, they had been familiarized with some basic phrases that were necessary for giving opinions, expressing preferences, collaborating and summing up, arguing for and against, etc. It proved to be very beneficial for the process of debating because it helped the students' oral presentation to sound natural.

4. MINI WEBQUEST PROJECT

As a result of the author's experience and students' creativity and enthusiasm, a set of Mini WebQuests (MWQ) has been created by students during the years 2007-2009.

The expression MWQ indicates that it is a short-term WebQuest, in which the main goal for students is to make sense of new information. Concerning the students' preparation they are less time-consuming than long-term WebQuests and thus more suitable for full-time courses. Mini WebQuests are short web-based activities used to acquaint students with web sites and the information they can work on. These Mini WebQuests prepare students to take on the other, larger WebQuests with greater confidence. Students must explore many different parts of the site to find the answers.

The MWQs that have already been created at the UoD are named *Arab Culture WebQuest, Marihuana WebQuest, Alcohol WebQuest, Addiction WebQuest, Gun Control WebQuest, Weapon Law WebQuest, Czech Army Issues WebQuest, Czech Armed Forces History WebQuest, Modern Conflicts WebQuest, Environment WebQuest, Terrorism WebQuest, First Aid WebQuest, Discrimination WebQuest, College WebQuest, Money WebQuest, Happy Woman Quest*.

Here are some common features of these MWQs:

- The concept of MWQs is based on the original WebQuest model. It means that each MWQ has the following steps:1) an introduction, i.e. explanation of activities and background information, 2) a task that is feasible and interesting, 3) a set of information sources needed to complete the task, 4) some guidelines on how to organize the information, 5) a conclusion that closes the quest.
- The MWQs are based on the bachelor study programme curriculum covering different areas of discussion such as *Ecology and Environment, Guns and Military, Money and Economics, Social Issues and Miscellaneous Issues.*
- The outline format is identical. It is represented by Cascade Style Sheet and Web Graphics that was designed by a student of a bachelor study programme.
- The tasks are grounded in (military) authenticity and the process, while simple in its steps, allows for discovery, inductive learning, deductive learning, group work and collaboration/sharing of ideas, reinforcement of information for better learning – through reading, listening, talking, writing and presenting. Tasks are clearly defined and concise and so they are easy to follow.
- The online sources are credible and enable students to reflect and to decide for themselves what they believe the issues are.
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To provide an illustration, a screenshot of a MWQ is shown in Figure 1. It comes from the MWQ *Arab Culture WebQuest.*

Figure 1. A screenshot of the MWQ Arab Culture WebQuest

CONCLUSION

Since the MWQ project is still in process and some students haven't completed their work, it will last for some time before the final MWQ will appear on the UoD internal computer net. It is supposable that teachers and students of the UoD will have the opportunity to familiarise themselves with the new form of this inquiry-oriented activity in the academic year 2009/2010. These new activities will be hopefully attractive and inspiring not only for students but even for other teachers who will realise that this method can be applied in their teaching process, particularly in teaching technical subjects.

Providing support for student self-determination in school settings is one way of motivating students in the effort to acquire knowledge, skills and beliefs that meet their needs for competence and autonomy.

Learner autonomy is not easy to achieve, and for that reason alone it poses a very great challenge to teachers. Yet it is a challenge we must respond to positively.

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NUMBER THEORY IN MILITARY EDUCATION

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Abstract: *Number theory with modular arithmetic should be permanent part of (military) education. Two topics are recommended: systems of linear congruencies with extended Euclidean algorithm, and divisibility tests in general base B positional number system. Interactive applet is described that generates and applies tests for base = 2..36, and divisor = 2..999.*

Keywords: Extended Euclidean algorithm, modular arithmetic, Euler-Fermat theorem, (system of) linear congruencies, Chinese remainder theorem, divisibility test, applet.

Introduction

Probably, one of the first applications of Number theory was counting soldiers in Chinese army. This is now covered under Chinese remainder theorem for systems of linear congruencies. More modern applications are related to {en, de}{ciphering, cryption} – comp. [It3] – in communication. So, Number theory is a natural subject to be included into preparation of military professionals. Of course, NumTh is applied frequently in maths itself, e.g. in group and field theory, esp. in calculation with permutations – see [6]. All these maths branches need a good deal of numerical practice. For this purpose we prepared highly interactive applets to play with divisibility tests, permutations, and small groups. The users may form their own hypotheses/conjectures and understand more deeply interesting branches of mathematics. Applets contain helping comments and voice (native speaker) telling what is on.

Special attention should be devoted also to specific needs of human education as to presentation of information. The prevailing linearity of textbooks and web sites is annoying, embarrassing, and misleading. The information should be transformed to underline the content and relations between its parts. And this should be also applied to applets.

The reader is supposed to have heard: positional number system, divisibility, common divisor, coprime (= relatively prime) numbers, modular arithmetic, i.e., congruence, compatibility with arithmetic operations (with dangerous exceptions), inverse modulo m, Euler-Fermat theorem, order of an integer with respect to the modulus, primitive root and its existence. All this can be found in [1-5] or, of course, on the Internet (e.g. Wikipedia).

1. Extended Euclidean algorithm

This algorithm is very useful for evaluation of the greatest common divisor of a given pair of positive integers (without knowing their divisor or prime factorization). The mechanism goes

$$dividend = divisor \cdot quotient + remainder \quad \& \quad dividend \leftarrow divisor \leftarrow remainder$$

meaning that the integer division with remainder alternates with promotion of terms. All ends with zero remainder, the preceding nonzero remainder being the looked for gcd(a, b).

The extended version expresses gcd(a, b) as a linear combination of integers a, b:

$$ax + by = \gcd(a, b),$$

which is necessary when solving both linear Diophantine equations and congruencies. Theory of EEA is in [4:86-93; It1-2]. The steps $j = 0(1)n$ of the procedure can be seen in Tab. 1.

j	r_j	r_{j+1}	q_{j+1}	r_{j+2}	s_j	t_j		
0	$a=r_0$	$b=r_1$	q_1	r_2	1	0	1	Searching $\gcd(a; b) = \gcd(r_0; r_1)$.
1	r_1	r_2	q_2	r_3	0	1	$-q_1$	Initial values.
2	r_2	r_3	q_3	r_4	s_2	t_2		
…								
$n-2$	r_{n-2}	r_{n-1}	q_{n-1}	r_n	s_{n-2}	t_{n-2}	1	$\gcd(a; b) = r_n \neq 0$ ⌊last nonzero rest⌉
$n-1$	r_{n-1}	r_n	q_n	0	s_{n-1}	t_{n-1}	$-q_n$	
n					s_n	t_n		$a \cdot s_n + b \cdot t_n = (a, b) = r_n$

Table 1. General schema of extended Euclidean algorithm.

2. Congruence

Congruencies are rather general tools for working with periodicity of integer sequences. We summarize equivalent formulations for a pair $a, b \in \mathbb{Z}$ to be congruent modulo m:

their difference is divisible by modulus;	$m \mid (a - b)$;
a multiple of modulus;	$a - b = k \cdot m,\ k \in \mathbb{Z}$;
they differ (at most) by a multiple of modulus;	$a = b + k \cdot m,\ k \in \mathbb{Z}$;
they have the same residue upon division by modulus;	$a = u \cdot m + r,\ b = v \cdot m + r,\ u, v \in \mathbb{Z}$, $r \in \{0,1,...,m-1\}$.

Congruence generalizes (as equivalence) the equality relation having analogous properties and compatibility with arithmetic operations (addition, subtraction, multiplication):

If $a \equiv_m b$
and $c \equiv_m d$,
then $a \hat{o} c \equiv_m b \hat{o} d$, where $\hat{o} \in \{+, -, \cdot\}$.

Esp. $a^k \equiv_m b^k$, for $k \in \mathbb{N}$. This implies possibility to polynomize congruence.

Modular arithmetic (working with congruencies) simply uses standard arithmetic followed by reduction (adding/subtracting) multiples of the modulus. Division is rather dangerous.

We remind also the Euler (phi/totient) arithmetical function $\varphi: \mathbb{N} \to \mathbb{N}$

$\varphi(1) := 1,\ \varphi(n) := \#\{c \in \mathbb{N};\ n \perp c < n\}$.

(Euler-Fermat)Theorem:

$c^{\varphi(m)} \equiv_m 1$, iff $c \perp m$ (coprime), where $c, m \in \mathbb{N}$, φ is Euler function. ♥

Theorem (solvability of a linear congruence equation $ax \equiv_m b$):
A linear congruence equation $ax \equiv_m b$ is solvable
iff the congruence $b \equiv_d 0$ holds,
where $d = \mathrm{GCD}(a, m)$ is the greatest common divisor.
If one solution is $x_0 < m/d$, then the solutions are $x = x_0 + t \cdot m/d,\ t = 0, 1, \ldots, d - 1$.
If $d = 1$, i.e. the coefficient a and modulus m are coprime, then there is only one solution in the integer interval $\langle 0, 1, \ldots, m - 1 \rangle$. ♥

For invertible coefficients a (iff a, m are coprime) the multiplication by a^{-1} yields $x \equiv_m a^{-1} b$.

3. Chinese Remainder Theorem

Theorem (CRT for system of k linear congruencies): If $m_1, m_2, \ldots, m_k \in \{2, 3, \ldots\}$ are pairwise coprime integers, and $b_1, b_2, \ldots, b_k \in \mathbb{Z}$, then the system of congruencies

$$x \equiv b_i \mod m_i,\ i = 1, \ldots, k$$

has unique integer solution $x \in \langle 0, M-1\rangle$, where $M = m_1 \cdot m_2 \cdot \ldots \cdot m_k$, meaning that if

$$x \equiv z \mod m_i,\ i = 1, \ldots, k, \text{ then}$$
$$x \equiv z \mod M.$$ ♥

The proof in [2:138[1-23]] is based on EF-theorem. We apply the proof in [4:145[1-15]] to solve the system of congruencies with different moduli.

Introducing $M_i = M/m_i,\ i = 1, \ldots, k,$ transforms our system to

$$M_i y_i \equiv 1 \mod m_i,\ i = 1, \ldots, k,$$

and

$$x = b_1M_1y_1 + b_2M_2y_2 + \ldots + b_kM_ky_k$$

gives us the unique solution of the system mod M.

Example. Chinese problem from the 3rd century C.E. leads to system of congruencies

$$x \equiv_3 1, \quad x \equiv_5 2, \quad x \equiv_7 3.$$

➲ We have $M = 3 \cdot 5 \cdot 7 = 105$, $(M_1, M_2, M_3) = M/(m_1, m_2, m_3) = 105/(3, 5, 7) = (35, 21, 15)$. Our system transforms to

$$35y_1 \equiv_3 \lfloor 2y_1 \equiv_3 1 \Rightarrow y_1 \equiv_3 2; \qquad 21y_2 \equiv_5 \lfloor y_2 \equiv_5 1, \qquad 15y_3 \equiv_7 \lfloor y_3 \equiv_7 1.$$

Hence

$$x \equiv_{105} 1 \cdot 35 \cdot 2 + 2 \cdot 21 \cdot 1 + 3 \cdot 15 \cdot 1 = 70 + 42 + 45 \equiv_{105} 157 \equiv_{105} 52,$$

which satisfies the given system of congruencies. ➲

4. Divisibility tests in base *B* systems

Everybody knows some of the very basic divisibility tests for numbers represented in our favourite 10-system deciding divisibility by 2(1)12 (without 7, 13). They are standard parts of introductory arithmetic courses, quite easy to remember and nice to show to the others. And we all wonder whether there are similar tests for other divisors and maybe even in non-decimal positional number systems. Applying analogy to 10-system case demands caution.

Generally, given an integer represented in B-system and a divisor $d \in \mathbb{Z}$ we can modularize by d the powers of B in B-expansion of the integer:

$$\text{mod } d \quad \begin{array}{l} c_uB^u + \ldots + c_{t+1}B^{t+1} + c_tB^t + c_{t-1}B^{t-1} + \ldots + c_2B^2 + c_1B^1 + c_0 \\ \searrow\ c_u[B^u]_d + \ldots + c_{t+1}[B^{t+1}]_d + c_t[B^t]_d + c_{t-1}[B^{t-1}]_d + \ldots + c_2[B^2]_d + c_1[B^1]_d + c_0 \end{array}$$

Description of behaviour of the test sequence $(\alpha_t) := [B^t]_d,\ t = 1, 2, \ldots,$ is enabled by factorization of the divisor d, $d = u \cdot w$, where $w \perp \{B, u\}$. The colliding part u determines pre-period and the coprimer w the length and symmetry of the test sequence period. E.g.

$\varphi(d) = \varphi(u \cdot w) = \lfloor u \perp w \in \mathbb{N} \rceil = \varphi(u) \cdot \varphi(w)$, showing admissible lengths of periods.

The applet applies three calculation machines working in 10-system:

Factorization $d = u \cdot w$, where $w \perp \{B, u\}$
$w := d$, $u := 2$
for *lpp* from -1 by 1 while $u > 1$: do $u := \gcd(B, w)$, $w := w/u$ od:
$u := d/w$
Remark. Final/output value *lpp* (= number of loops) gives the pre-period length.

Powers of base B mod d
(product of the current coeff α and base B is reduced mod d):
$\alpha := 1$, $\alpha := [\alpha \cdot B]_d$ ⌊the new value of variable α on the left, the old on the right⌉
$\alpha_0 = 1$, $\alpha_t := [\alpha_{t-1} \cdot B]_d$, $t = 1, 2, \ldots$, where $[V]_d$ denotes V mod d

Application of divisibility test
(scalar product (sum of products of coeffs $\alpha_k \times$ digits b_k) always mod *d*ivisor):
$[\Sigma_k]_d := [\Sigma_{i=0(1)k}]_d := [[\Sigma_{i=0(1)k-1}]_d + \alpha_k b_k]_d$, $k = 1,2,...$, where $[V]_d$ denotes V mod d
Or more simply
$[\Sigma_k]_d := [[\Sigma_{k-1}]_d + \alpha_k b_k]_d$, $k = 1,2,...$,
Even more simply (for programming):
$\Sigma := b_0$, $\Sigma := [\Sigma + \alpha_k b_k]_d$, $k = 1,2,...$,

5. The Applet "(Your) Divisibility Test"

Using the applet you may develop your own original divisibility tests and check your numbers on divisibility. The applet is demonstrating also the usefulness of elementary number theory including modular arithmetic. Two levels of the applet can be chosen by the extended button: the basic and the extended one.

This applet should help you to acquire a basic knowledge about and ability to deal with divisibility tests, their generation and application. The goal of this applet is to develop a small portion of necessary arithmetic theory as well.

You should try to answer the following tasks.

Given **base *B*** of a positional number system (let's say $B = 10$) and a **divisor *d*** (e.g. $d = 35$), could you develop a corresponding divisibility test and understand its structure and applications to integers of interesting size? Could you give some reasoning for it?

Remember: The **order of** a positive **integer** B **modulo *m*** is defined as
the least positive integer exponent $e \in \{1, 2, \ldots\}$ which sends B to identity,
i.e. $B^e \equiv 1 \bmod d$.

We started with Flash in 2008 – see [7] – but have gone over in 2009 to a new freeware development technology ".NET framework" ("dotnet"), which is natural part of Windows Vista (also for Windows XP). Programming language – compiler C# 2.0 is used. (More programming languages for .NET library exist.) More see in [It4-5].

The applet in action for $B = 21$ and the devil´s case $d = 666$ can be seen in Fig. 1.

The applet from top to bottom

Either at the beginning or later on some functionalities can be chosen. Item file offers to save the derived test to a queue, which can be exported and printed later. The options in setting allow switching on/off hints and voice/sound. It is possible to minimize test table lengths, and save the last applet appearance when quitting for use in the next session. Also, the needed maximum for divisors (at most 999) may be chosen. Help/F1 contains introduction to applet and target with authors. The applet name is surrounded by "?" offering hints commenting parts of the applet, loudspeaker for switching sound, and icons for printing and saving results.

We are going to describe mainly the extended test machine. It contains 4 sections: Choose your base and divisor, Generate your test, Choose your number, and Apply your test. Each part contains rows consisting of input fields and others including intermediate for results, tables with scroll bars and boxes, push buttons and switches, random and up/down steppers, bubbles commenting on parts of the applet, and error messages helping to cure input errors. In general, the flow of information is controlled by buttons to be automatic or delayed (step-wise) with manageable portions. Errors alert may appear in the corresponding field.

The 1st section starts with input of the base and divisor. Both can be given by the random procedure, steppers, and the user intervening into the field or their combination. The range of base B is 2 to 36 (= 10+26), and of divisor d = 2 to 999. There is a joint random button for these two entries. Prime-power factorizations of base and divisor and information about their interrelation are automatically calculated. The divisor is factored as product of collider and coprimer separating the part of divisor colliding with the base from the remaining part. The collider determines the so-called pre-period of the test sequence, and the coprimer the other main part (its length and structure), which can be repeated if necessary for testing the number.

Generating section produces terms of the divisibility test sequence corresponding to the given base and divisor. Structure characteristics of this sequence are given. The result is concentrated into 3row table, which starts with exponent sequence, the sequence of test coefficients in the 2nd row and its denotation below it. Stepper for the base exponent activates the calculation field above, which shows the intermediate results enabling to follow the calculation.

The Choose your number section specifies the size and tested number, which is given both in the decimal and *B*-system. The user can play with size (= length) and number directly intervening into the field, by stepper, by "Rand" or combining these possibilities. In case base greater than 10 the conversion table of letters A to Z to their decimal equivalents is activated.

The last Apply test part calculates the dot product of the test coefficient sequence with digit sequence of the tested number deciding the needed (in)divisibility of the number by divisor. Again, stepper for the index/exponent allows to follow the calculation in the field above.

And at the last, at the bottom of the applet we can see the final result about (in)divisibility:

Your number {is NOT; IS} divisible by *d* .

Conclusion

Number theory including modular arithmetic are important parts of general culture and also of manager and officer education. In the past many of them indulged in number research. Our applet may equip all devotees with their own secret divisibility criteria to baffle the others.

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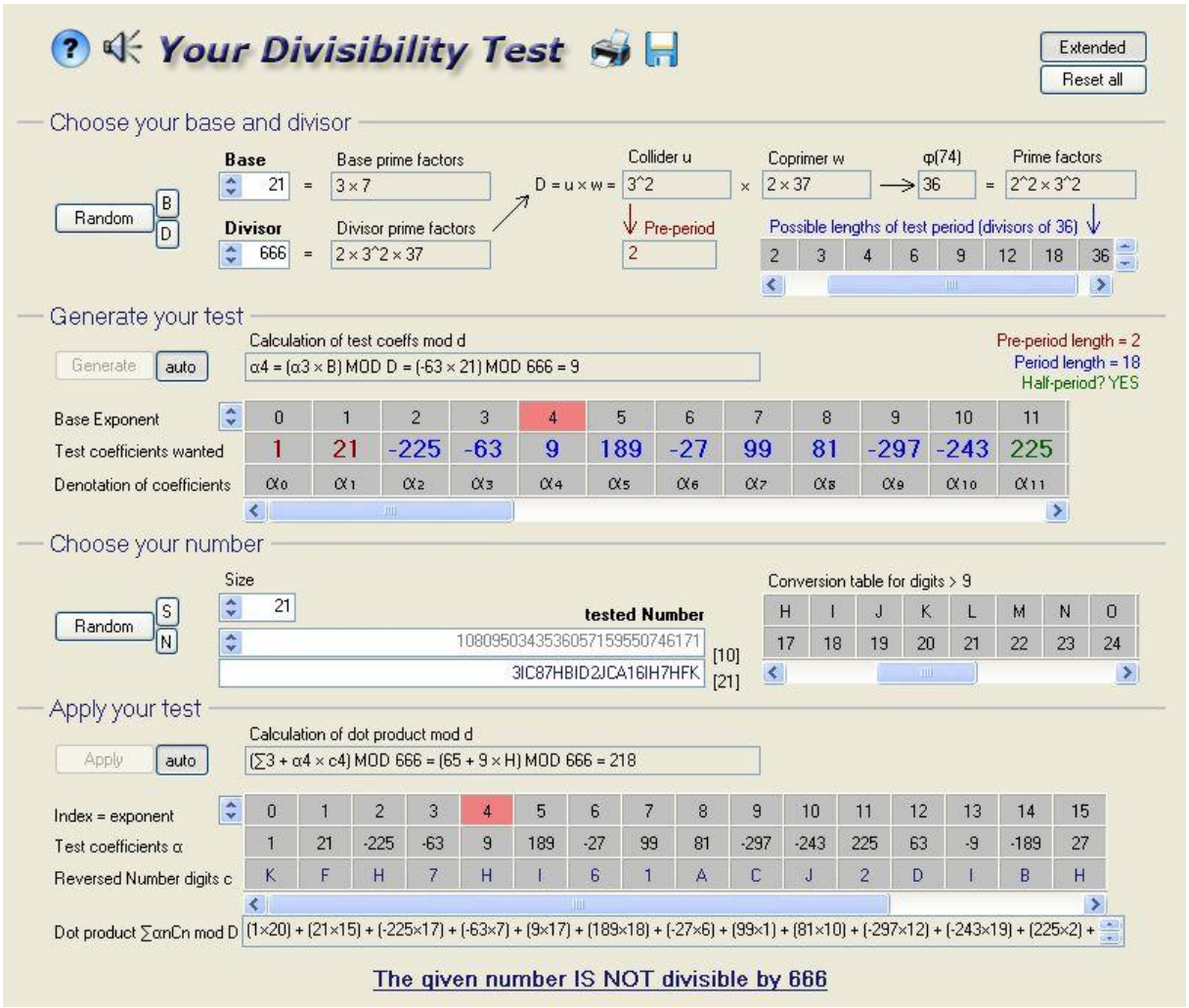

Figure 1. Applet "(Your) Divisibility Test" for $B = 21$, $d = 666$.

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VALUE CHAIN AND PROCESS MODELS: IS THE GAP BETWEEN THEM REAL?

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Abstract: *Business process models represent the flow of operations inside the company. The main issues here are control and data flow, resource handling and co-ordination of cross-operational processes. The main advantage of business process models is the operations sequence and process status representation. The value chain (business value) perspective illustrates the value flows among process participants inside and outside of the company. The main advantage of value chain based models is that they capture cross-concern activities and represent the actual aim of the business – value exchange between the company and the environment. Both perspectives seem difficult to interconnect. This paper describes the value chain approach based on Resource – Event- Agent (REA) approach and discusses possible ways how to connect both perspectives taking the value chain perspective as the starting point.*

Keywords: Value chain modeling; REA ontology; Business process modeling; e3-value; IT architecture.

INTRODUCTION

Typical business application using IT needs at least three different perspectives: IT system perspective, business process perspective and business value perspective. The business process perspective describes business processes, their sequences and resulting information flows. Corresponding business process models represent the operations inside the company. The main issues here are control and data flow, resource handling and co-ordination of cross-operational processes. Main advantage of business process models is the operations sequence and process status representation. The value chain perspective illustrates the value flows among process participants inside and outside of the company. Main advantage of value chain based models is that they capture cross-concern activities and represent the actual aim of the business – value exchange between the company and the environment. Distinctly from business process, value chain based models do not depict sequences in which these exchanges take place. Both perspectives can be modeled using well known approaches, but they seem difficult to interconnect. This paper describes the value chain approach based on Resource – Event- Agent (REA) approach and discusses possible ways how to connect both process and value chain oriented perspectives to achieve consistent two-perspective model. The approach used assumes that value chain perspective should be the starting point of the join. The paper is structured as follows. In section one; basic principles of value chain modeling and the REA framework are shortly presented. REA model of a simple production run is shown in section two and the way how the REA framework can include time perspective and possible transition to process oriented model is shown in section 3. The last section presents a reflective discussion and conclusions.

1. BASIC PRINCIPLES OF VALUE CHAIN AND REA MODELING

Value chain models depict **who** is involved in the value flow (enterprise, customer, person etc.); **what** is the object of value flow (e.g. goods, services, cash) and **types of events** accomplishing the actual value flow. It is determined by nature of value flows that the value transfer is reciprocal. The value chain models neither determine **how** value flows are actually accomplished nor do they use the notion of time. Behavior of the object taking part in the value transfer and the order of value transfer steps is beyond the value model perspective. To determine the order of value transfer steps a process model is to be used. On the other side, a process model does not describe which value objects are taking part in a single value transfer or which processes create objects of value. This is accomplished by value flow modeling. It is obvious, that both perspectives are complementary and useful. The question arises if there is a gap between both modeling options or if there is consistency enough to make it possible to derive a process model from a value model.

There are two leading value flow ontologies. The e^3 ontology stipulates that the **actors** exchange **value objects** by means of **value activities**. The value activity should yield profit for the actor. More about e^3 modeling can be learned in e.g. [3], [4].

Our object of interest is the second ontology – the REA. The REA (Resources, Events and Agents) model originated from the accounting domain. It represents a conceptual framework and ontology for Enterprise Information Architectures now. [1], [2], [5].The decomposition of the REA framework leads to four levels:

- Value system
- Value chain
- Extended business process level
- Task level.

More detailed description of the REA framework was presented in e.g. [6]. General value system of an enterprise can be presented as follows. The enterprise provides goods and services to customers and receives cash in the value of the goods and services delivered. Working capital (cash) coming from the investors or creditors, goods and services purchased from the suppliers and labor provided by employees for cash are needed to accomplish deliveries to customers. On the next level of decomposition the value chain can be modeled. The basic value chain idea is that there exist ***transaction cycles*** mutually connected by value flows. The main transaction cycles of an enterprise are:

- ***Acquisition cycle*** responsible for goods & services acquisition
- ***Manufacturing cycle*** responsible for production of goods
- ***Revenue cycle*** representing the sale process including money collection
- ***Financing cycle*** responsible for cash flows
- ***HR cycle*** realizing the labor acquisition.

In this paper we focus on the *manufacturing cycle* at business process level. The reason for this focus is that *manufacturing cycle* includes production, the processes of which can be easily followed as they are sufficiently structured. In the REA framework objects of value are called ***economic*** r***esource*** (further on *resource* only). Resource is a thing that is scarce, and has utility for economic agents. It is something users of business applications want to plan,

monitor, and control. Examples of *resources* are products, money, raw materials, labor, tools, and services the enterprise uses. The final *resources* (goods) are produced during a ***conversion*** within the *manufacturing cycle*. Other *resources* like materials, tools, and others take part in the *conversion*. Procurement of *resources* is done in the *acquisition cycle*. Also human resources are needed to accomplish the production. They are procured and financed within the *HR cycle*. The actual payments are done by means of *finance cycle*, the money needed are collected in the *revenue cycle*.

The business process level is the core of the REA modeling. We already mentioned one of the three basic notions of the REA framework namely the *resource*. Other REA fundamental entities are:

- ***Economic agent*** (further on *agent* only) as an individual, organizational unit or company controlling its resources and capable of transferring the resource value to another agent. Examples of *agents* are customers, vendors, employees, and enterprises. (Enterprise is an agent. From its point of view the REA model is constructed).
- ***Economic event*** (further on *event* only) representing increment or decrement of economic resources value under company control. *Events* are e.g. production run, product sale, cash disbursement etc.

The principal rule of the REA framework says: "One *agent* gives up a part of its *resources* by means of a ***decrement*** *event* in order to increase other part of its *resources* by means of ***increment*** *event*". In plain words – an enterprise (*agent*) gives up (sells) the *resource* (Goods) to the *agent* (Customer) in order to increase *resource* (Cash). The Goods delivery is a *decrement event* while the Cash collection is the *increment event* seen from the *agent* – Enterprise point of view. This exchange process is presented in Fig.1. Here like in other figures the UML notation is used. As we see, there exist a relation between both events – for one decrement (Goods) there exists one increment (Cash) from the Enterprise's point of view. Similarly, there exists an increment – delivery of Goods and a decrement – Cash disbursement from the Customer's point of view. The relation between both *events* is called ***"exchange duality"*** in the REA ontology.

It can be clearly illustrated that there is no notion of time in the value chain perspective models. More, it cannot be seen who started the exchange. In this model it could be the enterprise or the customer, but it is not shown there. Further, the model does not depict, if the goods delivery happens before or after the cash disbursement. The modeller cannot include any conditions, loops, joins or forks. This can be done in a process model. It really seems that there is a gap between both perspectives.

2. SIMPLE PRODUCTION RUN

A very simple production run can be defined as follows. Based on production schedule, the supervisor sends production order to the worker ordering the product to be produced, start time and expected duration of the operation. At the same time the product information and corresponding Bill of material information is sent to the warehouse clerk ordering necessary tools and material. The warehouse clerk provides tools and material and the worker starts operation. Having finished the product, he returns the tools (the material was completely consumed) to the warehouse clerk and advices the supervisor of the operation completion. The warehouse clerk informs the supervisor that the tools were returned to him. Supervisor

marks the production order as finished. The simplified REA model illustrates the *production run* as follows (see Fig.1.). The Enterprise is an *agent* that controls own *resources* needed for

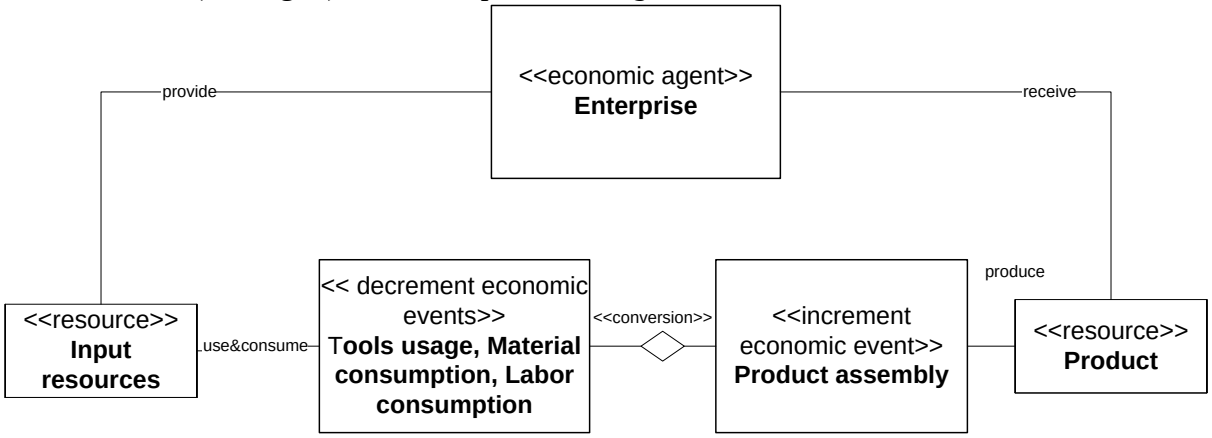


Fig. 1. Simplified REA production model
Source: own.

production, namely Labor, Materials, Tools and Machines. The Supervisor, Warehouse clerk and Worker are internal *agents* empowered by the enterprise to manipulate the input *resources* to produce the final *resource* - the Product. The usage and consumption of the input *resources* takes place during the decrement *event* while the Product is created during the *conversion* and increment *event* - the product assembly. The necessary Labor consumption for these processes is also part of the decrement *event*. Note that the internal *agents* do not have any ownership right over the *resources*. Also the Worker, Warehouse clerk or Supervisor do not have any ownership right over their own Labor because they sold their Labor to the Enterprise by signing the labor contract. On the other side, all of them are able to manipulate the *resources*. But in this case they have what we will call **a possession right**, granted to them by the Enterprise by means of labor contract and the production schedule. Here we are at an important point of conversion from the value oriented approach using the REA framework to the consistent process oriented approach. By definition, the *agent* has a **control** over the *resource*. Now we can see two perspectives of the notion of control. Control in the REA framework includes **both** ownership and possession rights. However the possession right can be treated independently from the ownership right in many cases. Another example of the ownership and possession right independency can be illustrated in case of a car rent. The ownership right stays by the renting company, while the possession right is transferred to the person who hires the car. The control over the car goes to the hirer, but the ownership of the car stays by the renting company. It is beyond the scope of this paper to discuss the importance of the ownership and possession rights for the transition to the process model. Here we simply assert that the REA framework using the notion of resource control simplifies the situation in comparison with the e^3 ontology [3].

More detailed REA entities and relations within the production run are illustrated by Fig.2. The resulting *resource* – Product is produced and assembled from the *resource* Material, by means of the *resource* Tools. Both *resources* were provided by *agent* Warehouse clerk using *resource* Schedule knowledge. The Schedule knowledge contains the Bill of Material data necessary to provide the Material and Tools to *agent* Worker and the production order data. The Schedule knowledge is provided by *agent* Supervisor. Worker starts his work based on Schedule knowledge. The Schedule knowledge was fully used during the production (*conversion* process). *Resources* Material and Labor were consumed while Tools were used and returned to Warehouse clerk. (In order to keep the model not confusing, this relation was omitted in Fig.2). After the production had been finished the resulting *resource* Product was

provided to Supervisor who marked the Schedule as fulfilled finally. The workflow, starting and ending points of the production order are not visible in the REA model. This is a point of discussion in the REA community since a long time. An attempt to solve it was done within the ISO/IEC 15944 standard. This standard deals with e-business using open-EDI. Within this standard a relation of the REA ontological components to the Open EDI business transaction phases was defined. The discussion on the 15944 standard is beyond the scope of this paper.

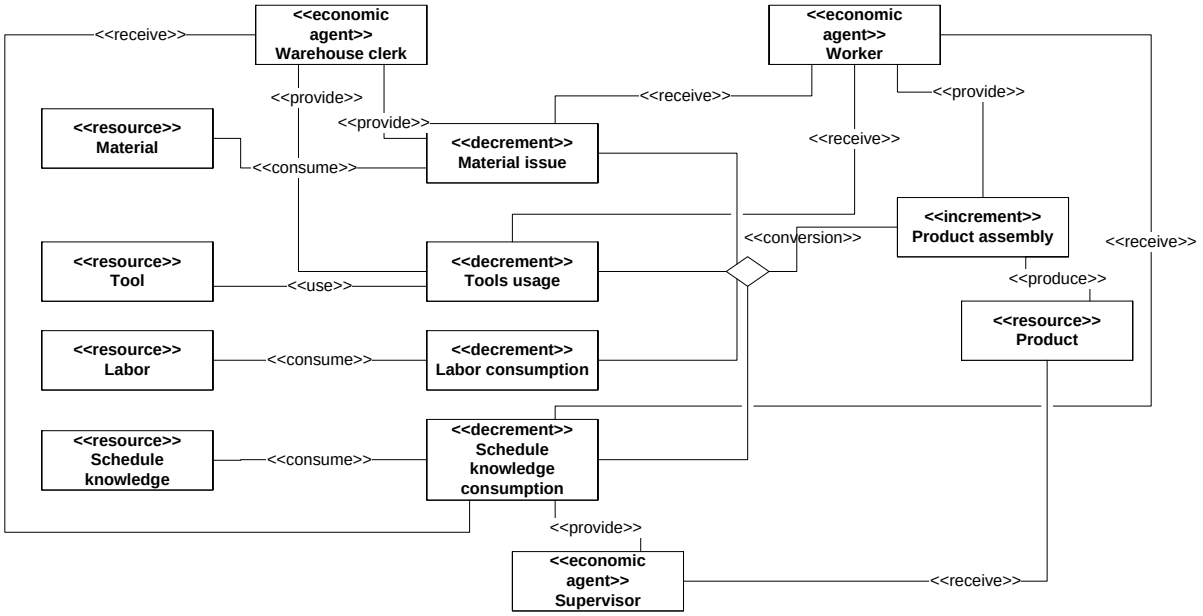


Fig. 2. REA model of the manufacturing cycle - production run
Source: own.

We will mention here only the important notion of *economic event* **state** defined there. There are following states defined for the business transaction: Planning, Identification, Negotiation, Actualization and Post-actualization. However, moving from one state to another in sense of the 15944 standard pertains exclusively to selling – buying transactions, does not define the starting and ending point of the transaction and who is the initiator. Therefore, in our opinion, the gap we are analyzing, narrowed down, but at least for the production planning domain still exists. Moreover, no economic transactions pertaining to production were described in 15944.

3 TRANSITION BETWEEN VALUE ORIENTED AND PROCESS ORIENTED PERSPECTIVES

During the transition to process oriented perspective we can utilize the fact that controlling the *resources* in the REA framework both ownership and possession right can be taken into consideration. This is not the case of the e^3 ontology, where more transition steps are needed. The starting point of the process is the moment when the Supervisor places the production order, the ending point is arrived in the moment when the Supervisor obtains the information from the Worker and the Warehouse clerk. The *resource* schedule knowledge governs the whole process. We will use a column in the UML activity diagram to illustrate the activities of the participants. Like in [3] we will call the columns "swim lanes". Following changes need to be done in order to obtain transition from the REA model to process model:

- each REA *agent* gets own swim lane in the Activity diagram

- each REA event and relationship is transfered to activity, each REA resource is transfered to object in the Activity diagram
- the resource Schedule knowledge must be splitted into relevant parts for agents. This is acomplished by decrement ecnonomic event Schedule knowledge consupmtion. The time scale of this action is not visible in the REA model due to REA principles and properties.
- multiple receive – receive or receive – provide assotiations have to be modeled in the swimlanes in order to get the resource flows sequenced.

Similarly to ISO 15444 the production states can be defined. Following states can be seen (see Fig.3).

- In the Starting state the Supervisor sends Schedule data to Warehouse clerk and Worker.
- In the next state – Enabling the Warehouse clerk sends Tools and Material to the Worker making the production run possible.
- In the state Conversion running the actual production and assembly takes place.
- During Actualization state Worker provides Product to Supervisor and returns Tools to Warehouse clerk, Supervisor receives the warehouse information and product control
- Finally, in the Ending state, based on the information obtained the Supervisor marks order as fulfilled.

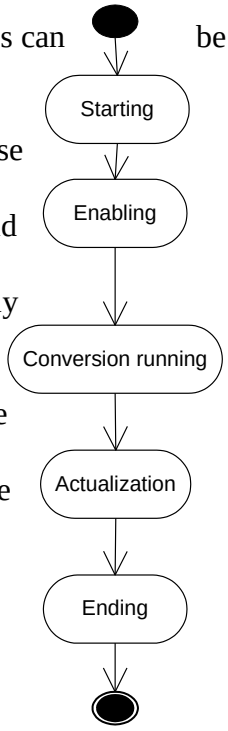


Fig. 3. REA Production process states
Source: own.

The transition to activity diagram illustrates Fig.4. It can be seen that using possesion rights incorporated into the Control notion of the REA framework made it possible to derive a consistent process model based on the REA value flow diagram.

4. REFLECTIVE DISCUSSION AND CONCLUSIONS

The herein above presented transition model and REA conversion state machine could lead to the conclusion that the gap between value chain perspective and process perspective in the enterprise modeling can be bridged. However, this was the first step in the transition modeling. Firstly, no iterations or cycles were modeled. There is a question how to model the multiple repeated production run orders. The production Schedule normally consists of more production runs planned. Secondly, when the product is sold, real ownership, not only possession rights transfer takes place. Thirdly, we used a very simple model assuming that other processes like planning, reservations, co-operations of more Workers or Machines have no connection with the process modeled. This will be the topic of further research.

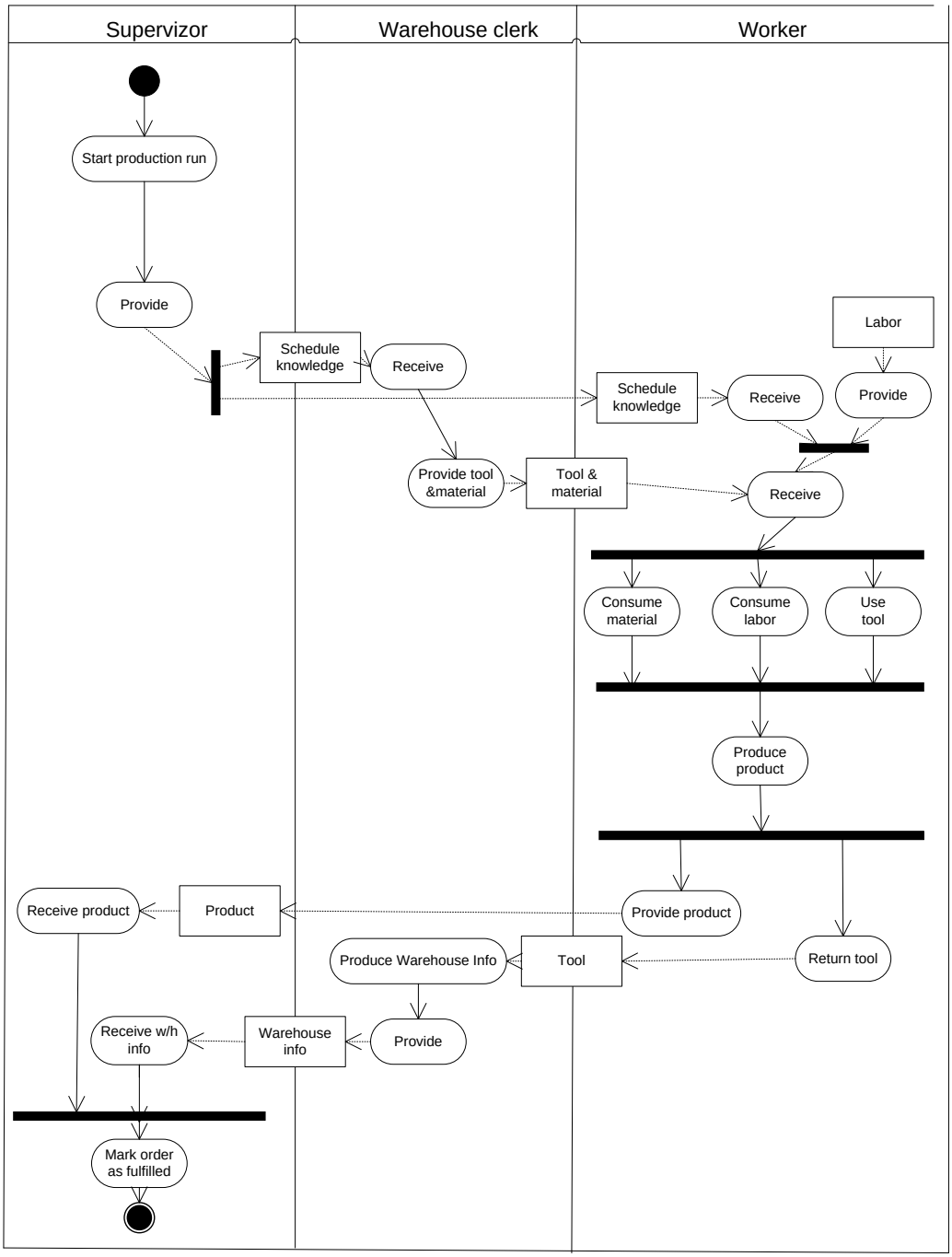
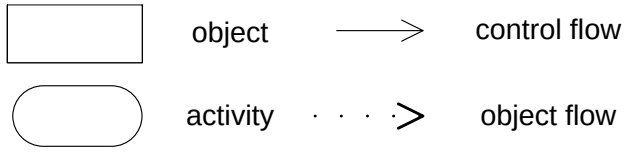


Fig. 4. Transition between REA and process oriented perspectives - single production run
Source: own.

Legend:



Acknowledgement
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E-COM - SPONSOR PREZENTATION

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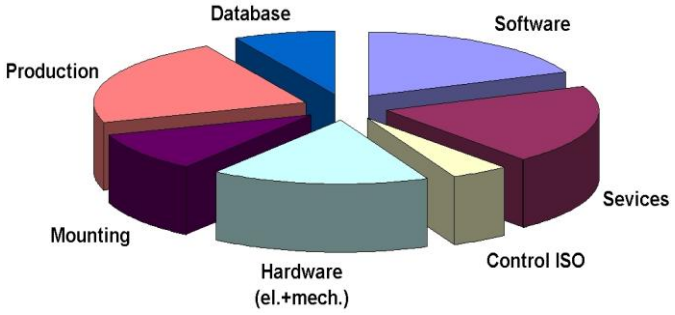
E-COM – supplier of complex solutions for simulation and training systems

General information

E-COM has been specialized for its whole existence since 1992 on development and production of simulators and training systems. From four foundation members E-COM has spread to present 150 employees. Majority represents HW and SW development specialists. Progressive production specialized on prototypes and small series production and skilled mounting department is also important.

E-COM has been certified under **ISO 9001 :2001 a AQAP 2110.**



Complex assortment of HW and SW modules enables to realize wide range of training devices (specially designed for every user), that covers:

- Modern computer training supportive means – **Computer Based Training** (multimedia classrooms, training SW and specialized training lessons)
- Trainers for **sphere of individual training**
  - Driving trainers (small cars and trucks, combat vehicles, tanks)
  - Shooting trainers (small arms shooting trainers, combat vehicles and tanks gunnery trainers, anti-tank and anti-aircraft systems)
  - Trainers for training of combat vehicles and tanks commanders
  - Systems for training of artillery observers and air control teams
  - Aircraft and parachute training devices
- Simulators for **collective and tactical training**
  - Simulators for training of combat vehicles and tanks crews
  - Complex systems for training of artillery operations
  - Tactical simulators for commanders and staff

E-COM delivers complete simulators and also **cooperates with a range of prime simulators producers** and supplies them with HW and SW modules and subsystems for their training devices.

Complex assortment of E-COM HW and SW modules enables creation of new subjects specialized on development and production of simulators on the base of **Technologies transfer**. This process is advantageous especially in distant countries where abates products price and at the same time solves questions of maintenance system and update of delivered devices.

New Simulators E-COM

Tactical simulator for commanders and staff E-TS

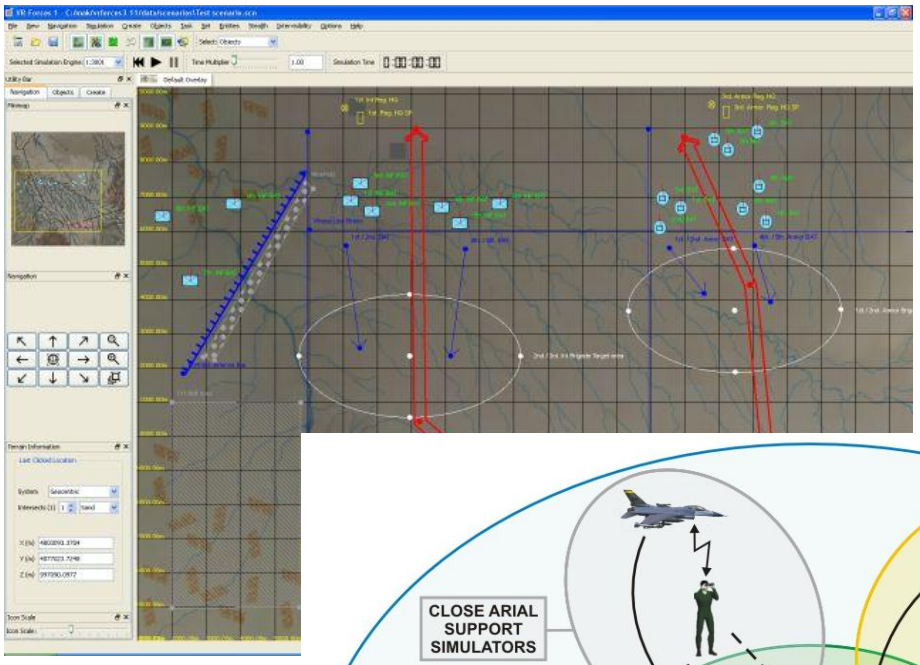
E-TS Simulator is a modular reconfigurable system, which can be used for:

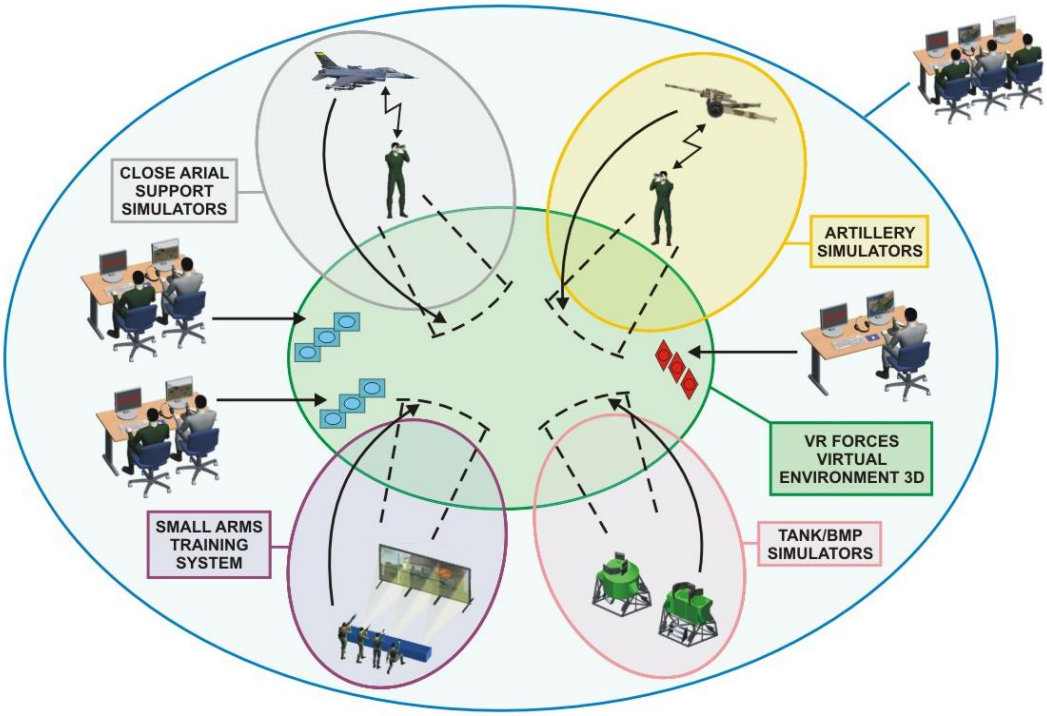
- Modeling, simulation, analysis and solving of specific tactical situations
- Training of commanders and staff up to division level
- Simulation can be controlled by trainee or operators
- Possibility for interconnection to different virtual simulators as for example
    - Tanks and BMPs
    - Artillery
    - Small arms
    - Close aerial support and observers

E-TS simulator functionality is based on

- SW products MAK as VR – Forces, B - Have
- SW products E-COM as Image Generator and Specific simulation modules for VR- Forces and system integration

E-TS DEMO system is presented at IDET – E-COM stand No. 1 in pavilion F.



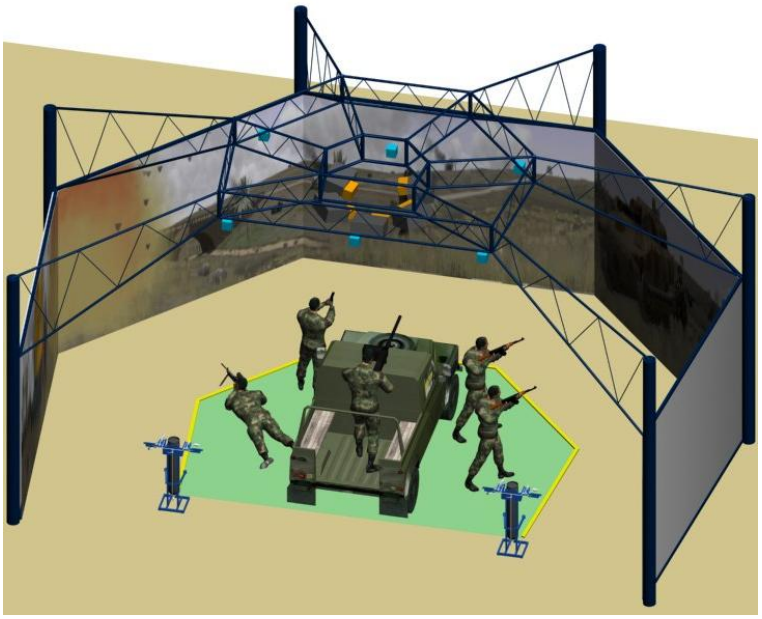


New Simulators E-COM

Small arms Simulator SATS

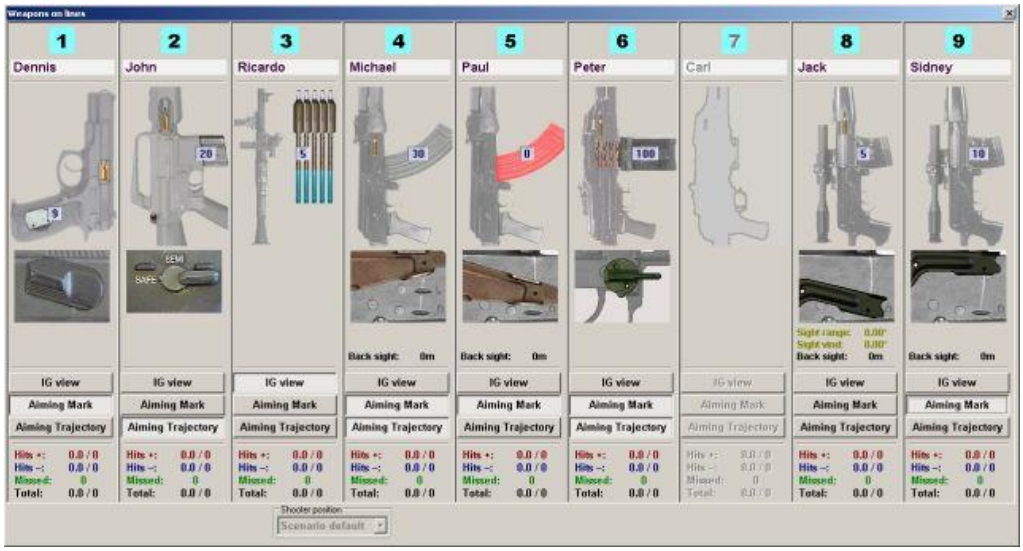
Key parameters

- **SATS can be used:**
  - For effective and safe shooting training, without ammunition consumption
  - For different training goals and levels as for:
    - Marksmanship training
    - Collective tactical training
- **Design is provided:**
  - In correspondence to used training weapons and their operating procedures
  - To enable connect up to 24 training weapons and instrument
- **Training weapons:**
  - Designed as accurate replicas (100% safe)
  - Maximal similarity to real weapon functionality
  - Wire-less connection for data transfers to control computer
  - Effective (pipe-less) recoil system
- **Scene projection system:**
  - Single or multi-channel systems
  - From small screens up to panorama projection system
  - Modern high resolution projectors (COTS)
- **Accurate aiming system:**
  - Use high resolution and high speed camera system
  - IR lasers integrated in weapons (eye safe)
  - System accuracy corresponds to real weapon parameters
- **Virtual environment:**
  - Uses a latest generation high performance 3D visual and sound system
  - Customer specific Terrain databases and Models
  - Animated personal and animals, models
  - Weather effects and time of day / year simulation
  - Battlefield special effects (explosions, fire, smoke, etc.)
  - Special effects (trasers, hit position identification)
- **Scenario system:**
  - Based on pre-programmed scenarios
  - Computer generated scenario flow on base of trainees activity (uses principles of artificial intelligence)
  - Scenario Generation Editor part of delivery
  - Running scenario modification possibility
- **Instructor Operator Station:**
  - Uses a windows based Graphic User Interface (GUI)
  - Incorporates semi-automated training management functions
  - Effective system for mistakes indication and results evaluation
  - After Action Review (AAR)
  - Trainees, results and training task databases

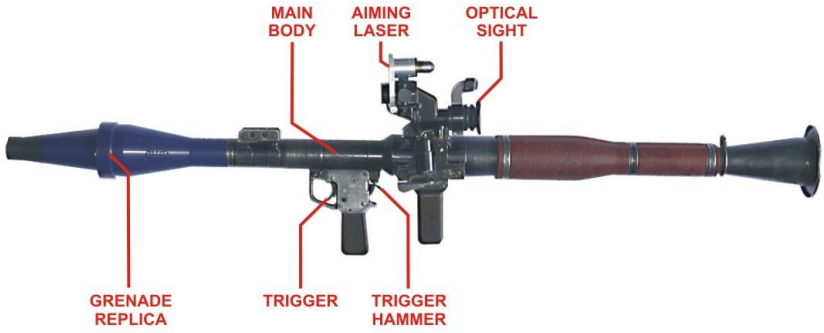


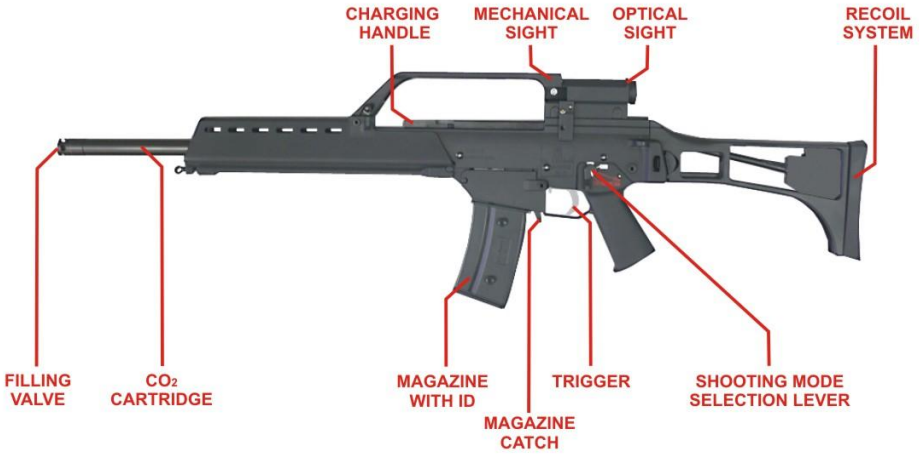
SATS is developed using most modern technologies and long time experiences with shooting simulation.
DOZEN (12) MAIN ADVANTAGES of SATS training system need to be indicated:

1) System **MODULARITY AND EXPANDABILITY**
2) **HIGH RESOLUTION** of Aiming system (special camera 1 280 x 1 024 pixel)
3) **HIGH SHOOTING ACCURACY** based on aiming system high accuracy and accurate ballistic calculation
4) SATS can **EVALUATE THE POSITION** of weapon / trainee in training area
5) Up to **24 DIFFERENT WEAPONS** used in one scenario – each active weapon aiming position is registered continuously
6) Effective **IDENTIFICATION SYSTEM** of trainee, weapons and magazines
7) Very **EFFECTIVE RECOIL SYSTEM** based on new E-COM design principle
8) Light weapons (as pistols and assault rifles) totally **TETHER-LESS**
9) **HIGH RELIABILITY** of training weapons – life time at automatic weapons up to1 Million rounds
10) **MODERN VISUAL SYSTEM** based on Opens source Image generator with many specific functions (as dynamic terrain, destroying of buildings, etc.)
11) Powerful **SW CONTROL SYSTEM**
12) **SCENARIO EDITOR** is part of each delivery



Examples of training weapons





SATS DEMO system is presented at IDET – E-COM stand No. 1 in pavilion F.

New Simulators E-COM

Anti tank missile gunnery trainer MAKS-01

Modular individual trainer for antitank missile systems gunners is a typically low-cost but very effective product.
Key parameters

- Different types, high resolution virtual environment
- Weather effects simulation
- Day / night
- Exact replica of aiming optical system
- Shooting simulation on different targets in different conditions

Simulated weapons:

- MALJUTKA
- KONKURS

MAKS-01 training system is presented at IDET – E-COM stand No. 1 in pavilion F.

New Simulators E-COM

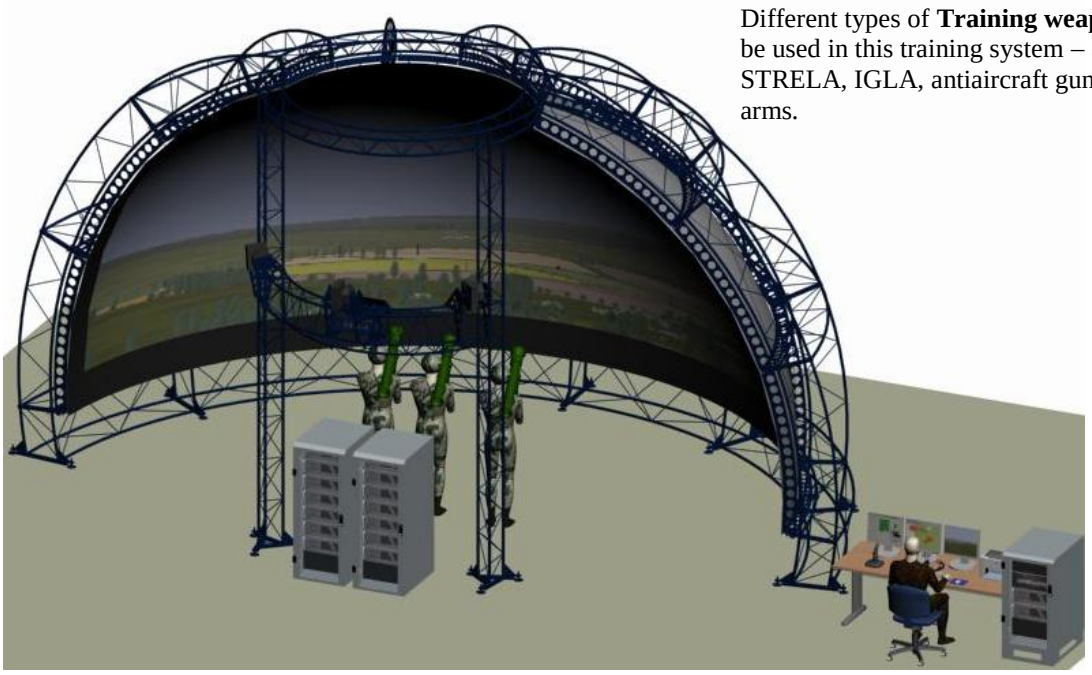
Anti aircraft simulator

Anti-aircraft simulator is the typical example of a very effective training system, developed using universal E-COM technologies

Characteristics: for individual and collective training

Key parameters

- Spherical shooting dome 8 m diameter
- Up to 3 weapons simultaneous training
- unlimited number and types of target



Different types of **Training weapons** can be used in this training system – as STRELA, IGLA, antiaircraft guns, small arms.

Missile operator individual training includes:

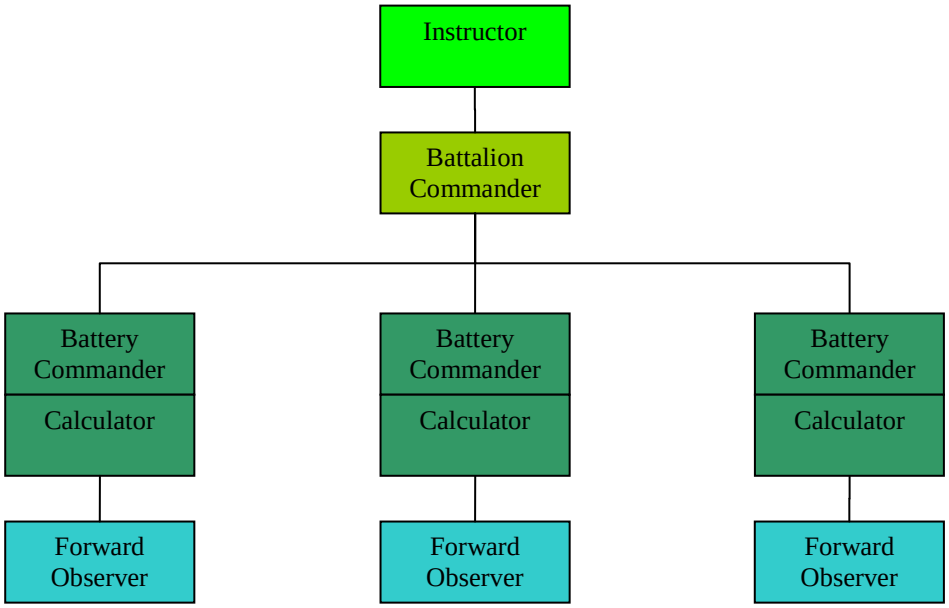
- Correct operation of missile systems
- Target indication, identification, firing list determination, distance, velocity and direction estimating / measuring
- Selection of the correct target
- Aiming and shooting
- Different weather simulation (influences ballistic computation and visual system)
- Missile fire and target destruction (visual and sound system)
- Training of corrections of direct firing

New Simulators E-COM

Artillery complex simulator

E-COM artillery simulator is designed to be used for

- Individual training of all artillery specialists as Forward observers, Commanders, Operators and Battery/Gun teams
- Collective training in full artillery structure as shown on next example



System is modular and reconfigurable.

Artillery simulator enables connection of different **Fire control systems** and different **Observing and calculating instruments.**

System calculate the full ballistic of all types of guns, ammunition and powders, incl. weather influences

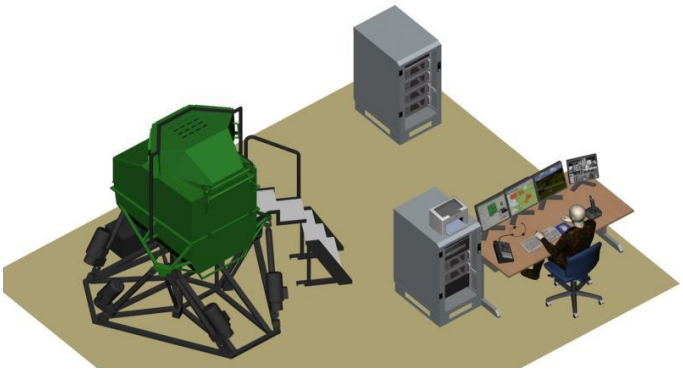
DEMO system of Artillery simulator is presented at IDET – E-COM stand No. 1 in pavilion F.

New Simulators E-COM

PANDUR simulators

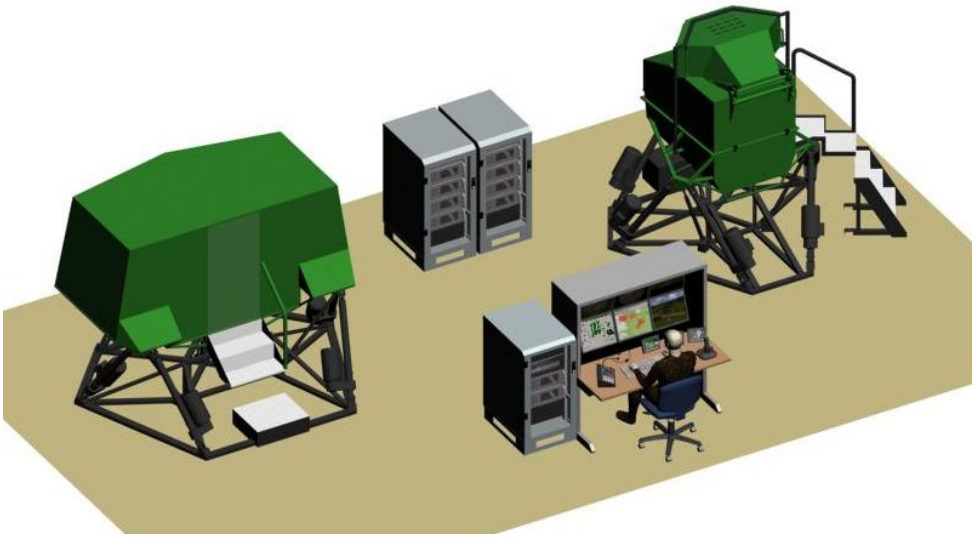
Family of PANDUR simulators include Simulators for individual and collective training

Driving simulator



Weapon simulator

Crew simulator



PANDUR Driving simulator is presented at IDET – E-COM stand No. 1 in pavilion F.

New Simulators E-COM

E-COM Driving simulators

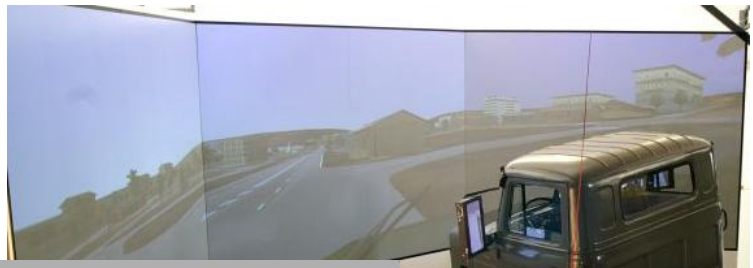
Characteristics: for individual and collective training by interconnection of more simulators

Key parameters

- 1:1 driving cabins
- 3DOF and 6DOF motion system
- Active steering and gear boxes
- Traffic generation

E-COM driving simulator types produced in last period:

- UAZ
- URAL
- TATRA



TATRA driving simulator is presented at IDET – Czech army exposition in pavilion G.

E-COM products

E-COM Image Generator E-IG

Main characteristics:

- COTS hardware
- Multiplatform - Windows and Linux ready and tested
- OpenGL rendering platform
- OpenSource programming platform (OpenSceneGraph)
- CIGI compatible
- Multiple independent views
- Overload Management
- Remote Maintenance
- Unlimited number content synchronized Channels
- Non-Linear Image Mapping
- Seamless connection of adjacent channel edges using edge blending technology

E-IG Image generator Performance

- 60 Hz Update rate
- 45,4 Billion textured pixels / second
- Full-screen antialiasing, up to 8 sub-samples plus supersamples
- Display resolution up to 1 920 x 1 200 pixels / channel
- Anisotropic texture filtering, up to 16 x

Simulated Environmental

- Visibility range configurable up to 50 NM
- Cloud layers, 3D clouds
- Thunderstorm cell, lightning flash
- Fog
- Rain (influenced by wind speed and direction)
- Sand storm

Simulated Lighting

- Landing lights
- Airfield lighting system including VASI, PAPI, strobes
- HOST controlled lights and animations
- Environmental lights
- Realistic Sky-dome (position of Sun, Moon, Stars according to time of day, geographical position, and time of year)
- Dawn and dusk horizon glow

Virtual Terrain Databases

- Standard OpenFlight format
- Native OpenSceneGraph .IVE binary optimized format
- Native OpenSceneGraph .OSG text format
- Continuous multiple Levels of detail on terrain
- Terrain and texture paging supports very large geo-specific databases
- Capability to display large number of ground objects (buildings, houses, towers)