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NEW TEACHING APPROACHES IN ENGINEERING

Proceeding of Lectures of the Summer Course Nitra 2014

T. Kozík, et al

Nitra, September 2014

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Development of Embedded System Courses with Implementation of Innovative Virtual Approaches for Integration of Research, Education and Production in UA, Ge, AM

NEW TEACHING APPROACHES IN ENGINEERING
Proceeding of Lectures of the Summer Course Nitra 2014

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Content

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Introduction

In September 2014 at the Faculty of Education of Constantine the Philosopher University in Nitra there was held an international Summer course for academic staff from the universities and institutions participating at the TEMPUS project Development of Embedded System Courses with implementation of innovative Virtual approaches for integration of research, Education and Production in Ukraine, Georgia and Armenia (DESIRE).

The key topic of the international Summer course was implementation of new teaching methods in technical subject education with focus on distance real experiments.

Within the 5 days of the course the academics from 9 different universities and institutions from Ukraine, Georgia and Armenia had an opportunity to become acquainted with issues of e-learning methods and didactic aspects of their use, as well as with the didactic aspects of the utilization of distance experiments in education. Moreover they acquire practical experiences in the work with the system of distance experiments installed at the Department of Technology and Information Technologies at the Faculty of Education, Constantine the Philosopher University in Nitra.

Beside the above mentioned main topic the course was devoted to issues of interactive forms of education and Bologna process implementation.

The Proceedings contains Power Point versions of all lectures included in the summer course programme. But further it contains also a more detailed information on the goals and tasks of the DESIRE project and four contributions dealing with the topic of the remote experiments, which were presented by the authors from the project partner institutions in occasion of other international events, as e.g. scientific conferences.

We believe that the Proceedings will be a suitable teaching material for all participants of the Summer course and will not engage only their attention but it will engage also the attention of other teachers and professionals interested in progressive teaching methods applied currently in the higher education.

Prof. Ing. Tomáš Kozík, DrSc.
on behalf of the team of authors

Prof. Ing. Kozík Tomáš, DrSc.
Foreword to Participants of the Summer Course at the Beginning Course.

Ladies and gentlemen, dear colleagues, our friends:

I feel honoured to welcome you at the Constantine the Philosopher University in Nitra at the Faculty of Education, the Department of Technology and Information Technologies. The summer course organized in the framework of the Tempus project is not seen and do not understood as a classical educational course. I see and perceive this course also from a societal perspective as an area providing a unique opportunity to exchange experience of teaching practice among university teachers.

The recent development of information and communication technologies has brought the new phenomenon into education - the Internet. Application of information technologies shapes, and has a strong impact on, the existing and educational system. The question is: "What type of education should be the new type of education for present days?" This is a challenge both for educational sciences and teaching practice.

Currently the most discussed issues are the advanced and effective forms and methods of teaching and learning, and the pedagogical staff search for the answer to the fundamental questions: "What to teach, how to teach and when to teach the educational topics?!

The aim of education in the European Union has changed. Until recently, the generation has been prepared for the performance only in one profession during the whole professional life. The present generation should be prepared to succeed on the labour market. It means, to be the employed generation, each person must be individually adaptable. We say that people need to receive the lifelong learning skills. The EU recommends lifelong learning education across the lifespan. It proposes the system of education in which individuals acquire the basic life skills such as: communication ability, skills in mathematics, natural sciences and engineering, informatics skills and also social skills such as team work, entrepreneurship, social feeling and others.

Obviously in this time, teaching and learning each subject cannot be done without the support of information technologies. The application of remote real experiments in education is one example how to use and apply technology into technical education in the information society.

The problems of remote experiments have two parts:

Technical solution of the proposed experiment and its remote control

Educational application of the designed and implemented an experiment

At the lectures during this week, we together will try to discuss these issues and search for the answers whether the use of these forms and methods is justified and efficient.

You all received the summer course programme. We will try to meet your expectations. Requirements and recommendations of the project management concerning the lecturers were to focus on practical demonstrations and training practice, teaching and methodology skills. We will do everything possible to have it filled. At the end of the summer course we dared to include a lecture on an interactive form of education as one of the very effective tools of education, particularly in technical subjects.

Ladies and gentlemen, I honestly admit that, although experienced in organizing conference events, we have just little experience in organizing similar type of courses. It may happen also that the information, knowledge which you will receive from our lectures, will not be new for you. However, the important thing is, that we will openly discuss about everything, namely about our common problems and issues. It is the common interest that unites us: Modern, efficient, open and humanistic education complying with the requirements of the 21st Century.

Our Department cooperates with International Society for Engineering Pedagogy IGIP, and we take participation in the activities of this organization. Although we are not engineering faculty, we cooperate with several engineering institutions and industry.

Ladies and gentlemen,

On behalf of prof. RNDr. Ľubomír Zelenický, CSc., the University rector and prof. PhDr. Eva Szórádová, CSc., the Dean of the Faculty, I am honoured to cordially welcome you to Nitra at the Summer courses, and wish you a fruitful stay. I hope that after completing the course, you will remember the positive experience, and will forget possible shortcomings, which seem inevitable at each course.

I promised Mr. Dirk Van Merode to give you his very hot greetings. He wished to all of us a good start of the course, and I hope he looks forward to meeting us.

In this moment, let me declare the summer course open. Thank you for your attention.

Prof. Ing. Tomáš Kozík, DrSc.

Local project coordinator
Head of Department of Technology
and Information Technologies

Prof. PhDr. Eva Malá, CSc.
The Bologna Process and the EHEA

THE BOLOGNA PROCESS AND THE EHEA

Nitra, Slovakia

15 September 2014

Summer Course Nitra 15-21 September, 2014

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BOLOGNA PROCESS

= a term indicating a reform of higher education (HE) with the aim:

- to create greater **consistency** & **compatibility** within European HE
- to enhance its **international transparency** & **attractiveness** built on the intellectual, cultural, social & technological strengths of Europe

= at institutional, national & European levels supported by bodies of the EU, the Council of Europe, the European Commission, the EUA, national governments, associations of European students

The premises of the Bologna process – in the **Declaration of Paris-la Sorbonne** on *Harmonisation of the Architecture of the European Higher Education System* (1998: FR , DE, IT, UK)

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BOLOGNA DECLARATION (1999, Italy)

signed by 29 States signatories accepting the key documents of BP

Priorities & aims of the EHEA –at conferences of Ministers of Education

2001: Prague
2003: Berlin
2005: Bergen
2007: London
2009: Leuven
2010: Vienna & Budapest
2012: Bucharest
The next meeting of Ministers of Education = in Yerevan.

6 PRINCIPLES of the Bologna Declaration

- Facilitating the readability & comparability of qualifications
- Implementing a system based essentially on two main cycles
- Establishing a system of credits (ECTS)
- Developing arrangements to support the mobility of Sts, Ts, Rs
- Promoting European cooperation in quality assurance
- Promoting the European dimension in HE (in terms of curricular development & inter-institutional cooperation)

PRIORITIES within the Bologna process

- the introduction of study programmes based on **3 main study cycles** (BA, MA, PhD)
- more effective **recognition of degrees** & **periods of study** (ECTS, Diploma Supplement)
- promotion of effective **quality assurance systems** (recognised outside national borders)

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STUDY PROGRAMMES based on three cycles

The length of time adopted for courses generally corresponds to **3 + 2 + 3 years** (BA – MA – PhD)

Studies in medicine, architecture, ... = structured in a single cycle lasting 5/6 years = leads directly to a Master´s level qualification

The **third cycle** leads to scientific maturity through a written work which makes a true contribution to the advancements of science.
The **doctoral dissertation**:
- written under the direction of a supervisor/professor
- publicly defended & approved by the university

The academic degree of **doctorate** is conferred
= enables one to teach in a faculty (it is required for this purpose)

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EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

= <u>a tool enabling students to collect credits for learning achieved via HE</u>

= a learning-centred system aimed at increasing transparency of learning outcomes & learning processes

CREDITS = based on the workload students need to achieve expected learning outcomes.

WORKLOAD =the time students need to complete all learning activities (lectures, seminars, projects, practical work, self-study, exams) required to achieve the expected learning outcomes.

LEARNING OUTCOMES describe what a learner is expected to know, understand & be able to do after successful completion of a process of learning.

= relate to level descriptors in national & European qualifications framework.

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THE USE OF ECTS CREDITS

60 credits= workload of 1 academic year learning & learning outcomes.
The student workload of a full-time study programme in Europe = 36/40 weeks a year (1500 to 1800 hours / academic year), i.e.
1 credit = **25 / 30 hours** of work.
The total workload necessary to obtain a first-cycle degree lasting 3 years is expressed as **180 credits**, a second-cycle = **120 credits**

Students can transfer the transcript of their credits collected at home university to other universities to finish a (similar) course.

Credit transfer & accumulation = the use of ECTS key documents:
Course Catalogue, Student Application Form, Learning Agreement, Transcript of Records, Diploma Supplement

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LEARNING AGREEMENT

= an agreement between :

the student, host institution & sending institution.

All the parties need to sign the Learning Agreement.

It indicates (prior to the study period):

- what courses the student will be studying during the exchange (obligatory, or elective) to match to the courses of home HEI
- how many ECTS are allocated to the chosen study components (usually 30 credits to complete the semester).

Students are usually provided with LA before they go abroad. They make **a choice of courses** that suit them best - to benefit most from the exchange & get them recognised after coming back.

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TRANSCRIPT OF RECORDS

= provided by the host HEI at the end of the student mobility

= a document showing which of the courses from the Learning Agreement the student **attended & successfully completed**

RECOGNITION of awarded credits & received grades as integrated part of students´ curriculum is an **obligation for the home HEI.**

The **grading systems** vary greatly at different HEIs in Europe, i.e. home & host institution may use **different grading scales**, but: the credit transfer must be transparent & done properly.

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THE DIPLOMA SUPPLEMENT

- attached to a HE diploma - for all graduates free of charge
- describes in widely spoken European language (EN):
  the nature, level, context, content & status of studies
  that were pursued & successfully completed
- improves international transparency
- facilitates academic & professional recognition of qualifications
- provides additional information on the national HE system in order to fit the qualification in the relevant educational context

ERASMUS INTENSIVE LANGUAGE COURSE

- specialised course in the **less widely known languages** in participating countries
- the opportunity to study the language of the host HEI in the host country for about 1 month with the aim:
  to be prepared for the Erasmus mobility period.

BUDDY SYSTEM

- incoming Erasmus student gets a "buddy" from the host HEI.

Buddy student helps Erasmus student:

- ❑ familiarize with organisation & system of study at the HEI
- ❑ integrate among other students, ...

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THE EUROPEAN NETWORK FOR QUALITY ASSURANCE IN HIGHER EDUCATION (ENQA)

& the Ministers of the Bologna Process signatory states
& the EUA (European University Association), & EURASHE
(European Association of Institutions in Higher Education),
& ESIB (National Union of Students in Europe) developed (2005):

EUROPEAN STANDARDS FOR QUALITY ASSURANCE
= applicable to all HEIs & QA agencies in Europe , irrespective of
their structure, function & size, & the national system

QUALITY ASSURANCE in HE is by no means only a European concern.
All over the world = an increasing interest in quality & standards,
reflecting the rapid growth of higher education

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INTERNAL QUALITY ASSURANCE WITHIN HEIs **(1)**

HEIs should have:

- a **policy &** associated **procedures for the assurance of the quality & standards** of their programmes. They should develop & implement a strategy for the continuous enhancement of quality, & a formal status & publicly available; & include a role for Sts & other stakeholders.
- formal mechanisms for the **approval, periodic review & monitoring of their programmes & awards**
- **assessment of students** – using published criteria, regulations & procedures which are applied consistently
- **quality assurance of teaching staff**, i.e. staff involved with the teaching of students are qualified & competent to do so. They should be available to undertake external reviews.

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INTERNAL QUALITY ASSURANCE WITHIN HEIs **(2)**

HEIs should ensure:

- that the **resources** available for the **support of student learning** are adequate & appropriate for each programme
- that they collect, analyse & use relevant **information systems** for the effective management of study programmes & other activities
- **public information.** HEIs should regularly publish up-to-date & objective info (quantitative & qualitative) about the programmes they offer.

UKF:

Inner mechanisms of quality monitoring in education = realized via:

- controls of managing staff (dept heads, vice-deans , vice-rectors)

- students questionnaires on the quality of educational process of individual UKF teachers

EXTERNAL QUALITY ASSURANCE OF HE **(1)**

- should take into account the effectiveness of the **internal quality assurance procedures**
- **the aims & objectives of external QA processes** should be determined before the processes themselves are developed & be published with a description of the procedures to be used
- any formal **decisions** made as a result of an external QA activity should be based on **explicit published criteria**
- **Processes fit for purpose.** External QA processes - designed specifically to ensure their fitness to achieve the set aims.
- **Reports** should be published & written in a clear style. Any decisions/recommendations = easy for a reader to find.

EXTERNAL QUALITY ASSURANCE OF HE (2)

- QA processes containing recommendations or requiring a subsequent action plan, should have a predetermined **follow-up procedure** which is implemented consistently.
- **Periodic reviews.**
  External QA of HEIs & programmes = undertaken on a cyclical basis.
- **System-wide analyses.**
  QA agencies - produce summary reports describing & analysing general findings of their reviews, evaluations, assessment, etc.

EXTERNAL QA AGENCIES:

group of experts, recognised by public authorities, with clear goals, adequate (human & financial) resources, autonomous responsibility for their operations, not influenced by third parties, publish reports

ACCREDITATION OF STUDY PROGRAMMES

= elementary external means of quality management & monitoring

- ❑ process of accreditation by a committee of the Ministry of Education
- ❑ after a period usually lasting 5 years – subject to re-examination

KEY QUALITY CRITERIA:

personnel, thematic, material, technical

- academic & scientific activity = guarantors: professors, docents (associate professors), teachers & their scientific publications, academic officers, main events = congresses, conferences, symposia
- teaching activity, students, curricula, exams, e-learning
- didactic means & structures, libraries, economic situation
- major issues for the future

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ERASMUS - ACADEMIC MOBILITY

The ERASMUS programme (European Region Action Scheme for the Mobility of University Students) – established in 1987

- forms an important part of the EU **LLP** (Lifelong Learning Programme)
- enables **students** to study & work in the EU from 3 - 9 months (annually, around 200 000 students)
- complements **academic knowledge** gained with opportunities for **personal development**
- helps students acquire **skills** needed for the job market
- means discovering & exploring **new cultures**, meeting **new people**, learning **new languages** & **travelling**
- offers mobility possibilities for **teachers & university staff**

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ERASMUS UNIVERSITY CHARTER

The HEIs awarded by an **EUC:**

- to cooperate within Erasmus programme
- to negotiate bilateral agreements with foreign partner HEIs
- to apply for the financial support for the realisation of students, teachers & researchers mobilities
- to take part in other activities provided by Erasmus programme

MOBILITY of students for the purposes of studying:

- ❑ to enable students to benefit educationally, linguistically & culturally from the experience of learning in other European countries
- ❑ to contribute to the development of well-qualified, open-minded & internationally experienced young people as future professionals
- ❑ to facilitate credit transfer & recognition of study periods abroad

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EXTENDED UNIVERSITY CHARTER

= co-operation between **universities & enterprises**

STUDENT PLACEMENT in enterprises, training centres, research centres & other organisations

The priorities supported by this action:

- design of strategies for enhancing employability of graduates
- promotion of placement of students & academic staff in industry & vice-versa & analysing the benefits of experiential learning
- development of recognition & quality assurance between universities & enterprises in view of lifelong learning strategies

Teaching Assignments for Teaching Staff in HEIs abroad

Staff Training for Teaching & Other Staff in HEI/Enterprise

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ERASMUS MUNDUS

- offers **joint degrees**, so called "European" masters & PhD programmes in a wide scope of fields
- provides:
  - full degree mobility
  - an opportunity to spend part of the studies abroad
- is **not limited** to Europe
- enables an exchange between EU & non-European HEIs (supported by scholarships)

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EUROPEAN QUALIFICATIONS FRAMEWORK

- the core = 8 reference levels describing what a learner: knows, understands & is able to do = **"learning outcomes"**

Levels of **national qualifications** - placed at 1 of the central reference levels ranging from **basic** (Level 1) to **advanced** (L 8)

This structure:

- ❑ enables easier comparison between national qualifications
- ❑ means that students do not have to repeat their learning if – abroad

Descriptors defining levels in the EQF, e.g.

Level: Level 1

Knowledge: basic general knowledge

Skills: basic skills required to carry out simple tasks

Competence: work/study under direct supervision in a structured context

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INTERNATIONAL STANDARD CLASSIFICATION OF EDUCATION

=an instrument for compiling statistics on education internationally

The current version, **ISCED 97** distinguishes 7 levels of education:

ISCED 0 – pre-primary education

ISCED 1 – primary education

ISCED 2 – lower secondary education

ISCED 3 – upper secondary education

ISCED 4 – post-secondary non-tertiary education

ISCED 5 – tertiary education (first stage) = programmes with:

- an academic orientation (type A) theoretically based
- an occupational orientation (type B) – for the employment market

ISCED 6 – tertiary education (second stage)

relates to studies leading to advanced research qualification: PhD.

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MAP OF THE SLOVAK REPUBLIC

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SLOVAKIA

- since 1 January 1993 (former Czecho-Slovakia); 5.4 million inhabitants
- Bratislava = capital city, in southwestern Slovakia, 80 km from Nitra
- on both banks of the river Danube & on the left bank of the Morava R
- political, cultural & economic centre *(bordering Austria & Hungary...)*

NITRA

- the oldest town (828), the seat of Great Moravian Empire (9 ct.)
- in 863 Constantine (Cyril) & Methodius (= Thessalonian brothers): missionaires laid foundation of Slavic literacy, education & culture
- 81 000 inhabitants, Nitra Castle, churches, the river Nitra, Zobor Hill,
- UKF & SUA, 25 secondary schools, Inst. of Slovak Academy of Sciences
- AX area for international exhibitions, theatres, museums, galleries, libraries, sports (hockey, football, basketball, tennis, athletics), ...

UKF IN NITRA

1959 - Pedagogic Institute
1964 - Faculty of Education
1992 - University of Education (three faculties)
1996 - Constantine the Philosopher University

5 FACULTIES:

- Faculty of Education
- Faculty of Arts
- Faculty of Natural Sciences
- Faculty of Central European Studies
- Faculty of Social Sciences and Health Care

UKF STRUCTURE

- Rector, Vice-Rectors, Rector´s Advisory Board, Academic Senate, Scientific Board, Board of Trustees, Deans, Departments, Institutes
- University library (250 000 books & periodicals), ICT centre, 2 stud. dormitories, sport clubs, musical ensembles, student theatre

STUDY:

- 12 000 full-time & part-time students
- Bologna process: 3-cycle system, ECTS, Diploma Supplement, Erasmus plus: mobility of students, teachers, researchers
- AIS (Academic Information System): exams, theses, timetables
- KIS (Library Information System), System registering project data
- CGA (University grant agency) & GAM (Grant Agency for Young Res.)

Psychological Consultancy Centre, Advisors for SEN & disabled students.

INTERNATIONAL COOPERATION

EHEA & ERA (Eur. Research Area) = 2 pillars of knowledge-based society

Promoting the attractiveness of the EHEA:

- UKF **membership**: EUA, Copernicus, Magna Charta Universitatum, Danube Rectors´ Conference, Welcomeurope
- UKF **international cooperation**: British Council, Goethe Institute, DAAD, French Institute, Fulbright Commission
- UKF international **projects & programmes**: TEMPUS, CEEPUS, NIL, Visegrad Funds, LLP: Erasmus Mundus, Grundtvig, Lingua, Leonardo da Vinci, Comenius; bilateral government agreements (Austria/SK), National Stipend Program, European Social Fund
- more than 150 European **Erasmus agreements** & agreements on **bilateral cooperation** with HEIs **outside the EU.**

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I hear and I forget,
I see and I remember,
I do and I understand.
Chinese Proverb
2
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Outcome

- to disseminate and to exchange the mutual knowledge/experiences about e-learning methods;
- to know the opinions/attitudes in the area of application e-learning methods in the education;
- to create model of the implementation the suitable e-learning methods in the particular phases of lesson on the example of selected real remote experiment;
- to present and discuss about the acquired results.

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Outline

- Concepts of education;
- Traditional education (phases, shortcomings);
- E-learning;
- Methods in E-learning.

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Education

the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and generally of preparing oneself or others intellectually for mature life

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Education

According to professor Petlak: Education is a process in which a student acquires knowledge and activities, creating knowledge and skills, develop physical and mental abilities and interests.

You learn something every day if you pay attention.

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Main concepts of education

- Concept: *compliance of process and form of teaching*
- Various concepts of education

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Main concepts of education

- Traditional education (face to face learning)
- Distance education (distance learning) -> e-distance learning
- Open learning
- Flexible learning
- Blended learning
- E-learning

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Traditional education (F2F)

- the teacher is dominant – mostly talks more than a student;
- the communication is guarantee by teacher and student (face to face);
- this form of education represent the useful aid of transmission the basic data and theory;
- it is suitable for specific type of students;
- it is insufficient to meet the needs of current society and in labour market.

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Distance education

- the learning is much more flexible than traditional education, students should learn anywhere with the support of computer and Internet connection;
- the teachers who prepare this education can use different types of available technologies;
- this learning is provided by interactivity, individuality and group work with students;
- e-distance learning – teaching materials are in electronic form and electronic form of communication is dominant.

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Open learning

- the learner chooses the time, learning material and rate of study;
- as a free and democratic;
- it is especially for those who for various reasons cannot attend traditional education (the disabled, employment);
- the educational institution adapts for requirements of student not in the other way as it is by traditional education.

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Flexible learning

- the student is dominant not the teacher;
- the information and communication technologies are integrated to the process of education;
- one of the component of education is to solve the problem tasks.

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Blended learning

- mostly it is a combination of distance learning and face to face learning;
- a variety of teaching methods which should be useful in this way of education and this learning should be flexible and unrestricted;
- the main purpose of this learning is to combine the benefits of face to face and online learning.

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E-learning

- the learning through the new (mostly) ICT;
- e-learning is a computer based educational tool or system that enables you to learn anywhere and at any time;
- Nowadays is e-learning mostly delivered through the internet, although in the past it was delivered using a blend of computer-based methods like CD-ROM.

Main phases of lesson

- Different phases of lesson;
- Particular partial goals of lesson;
- Motivational;
- Exposition;
- Fixation;
- Diagnostically.

Motivational phase

- it is a preparation of students to the active learning;
- at this phase of lesson is very important that teacher motivate students;
- the results of learning to a large dependent on whether a student approaches to learning activities with interest, or forced;
- the correct motivation is half success guarantee.

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Exposition phase

- for this phase is very important to find suitable learning methods;
- the main task of this phase is that the student should acquire the correct idea of the topic and acquire knowledge of the topic.
- is important to use didactical technique, appropriate learning aids, supports the activity of students and their creative approach.

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Fixation phase

- to repeat and strengthen the knowledge of students;
- it is appropriate to realize the repetition and strengthening of the knowledge in the new, changed conditions and situations;
- students should apply acquired knowledge in the practical tasks -> „**what I do I understand.**“

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Diagnostically phase

- the teachers try to find out the level of knowledge by students;
- short questions as a feedback to know, if the students correctly understand the information;
- the degree of acquiring knowledge is not only a measure of the activity of students, but also the result of didactic teacher's work.

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Few questions

- Why is important to know these concepts?
- Why is important to use new ICT in the education?
- Why is important to know phases of lesson?
- Why is important to know methods of education?

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Traditional education - shortcomings

- Teacher - active x student - passive;
- Activity of student is restricted;
- Memorize and mechanical repetition of information
- Not individual approach to the student
- Literature – only teacher and textbook.

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Traditional education - shortcomings

- Not develop any cooperation and interaction of students;
- Subjectivity of teacher by assessment;
- Educational standards do not meet the needs of society.

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Summary/Questions

- Modern concepts of education;
- Which concepts do you rememb
- How much phase of lesson do w
- Which phases do you remember

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E-learning

is a computer based educational tool or system that enables you to learn anywhere and at any time.

- Other terms: *online learning, virtual learning, distributed learning, network and web-based learning*

Main forms of e-learning

- Synchronous
- Asynchronous

Synchronous form of e-learning

- synchronous learning refers to the exchange of ideas and information with one or more participants during the same period of time;
- online real-time live teacher instruction and feedback, Skype conversations, and chat rooms or virtual classrooms where everyone is online and working collaboratively at the same time.

Asynchronous form of e-learning

- asynchronous learning is self-paced and allows participants to engage in the exchange of ideas or information without the dependency of other participants' involvement at the same time;
- email, blogs, wikis, and discussion boards, as well as web-supported textbooks, hypertext documents, audio, video courses, and social networking using web 2.0.

Form of e-learning

- the ***asynchronous*** and ***synchronous*** methods rely heavily on self-motivation, self-discipline, and the ability to communicate in writing effectively.
- Do you use any of this form on your lesson?
- How you integrated this form in your lesson?

E-learning systems (ES)

- **computer software that enables the use of multimedia in a simple platform in the net;**
- with the help of ES the following basic learning tools of online learning can be used: text, still graphics and illustrations, sound and music, video and moving graphics, multimedia.

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E-learning systems

- Virtual Learning Environment (VLE),
- Learning Management System (LMS),
- Course Management System (CMS),
- Learning Content Management System (LCMS),
- Learning Support System (LSS).

E-learning systems

Sakai

Bb Blackboard

Joomla!

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E-learning systems - Questions

- Do you use any of this system on your lesson?
- Why yes, why not?
- What are the opinions from your students to these systems?
- Are they satisfied with teaching in this system?

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Methods in education

According to professor Petlak:

„Method is intentional, purposeful and coordinated arrangement of the curriculum, teacher and student activities aimed at achieving the objectives of education and training in accordance with the principles of organization of teaching.“

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Methods in education

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Methods in education

According to particular phase of lesson:

- Motivational methods;
- Exposition methods;
- Fixation methods;
- Diagnostically methods.

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Motivational methods

- Motivational speaking;
- Motivational dialogue;
- Motivational demonstrating;
- Problem as a motivation.

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Motivational speaking

- an emotional and evocative approximation of what will students learn.

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Motivational dialogue

- teacher leads a dialogue with students with focus on activating their knowledge, skills and experiences.
- the dialogue awakens interest to the new curriculum.

Motivational demonstrating

- teacher with the support of demonstration (film, picture, different objects of observation) try to awaken the interest of cognize reality.

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Problem as a motivation

- teacher try to capture the attention of students on the basis of problem and then he explain the curriculum.
- It is necessary to determine the right/correct problem – which is suitable to solve on the lesson.

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Continuous motivational methods

- motivational challenge;
- updating the content of the curriculum;
- praise, encouragement, criticism

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Motivational challenge

- teacher should ask student to do something on the lesson, for example to pay attention, **to help the other students**, to draw something in the exercise book or on the board, etc.

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Updating the content of the curriculum

- teacher try to interconnect the theoretical background of curriculum with the examples in the real life;
- enable to the students to fill in the content of curriculum with creativity;
- try to use interesting examples, brain teaser etc.

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Praise, encouragement, criticism

- there are significant elements of motivation.
- Students answer on questions – if it was good – teacher gives student praise, if it was bad – teacher gives student criticism and give the good answer.

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Motivational methods - Questions

- Which of these methods do you use to motivate the students?
- Why do you use these methods?
- What other methods do you use on your lesson?

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Exposition methods

- Lecture;
- Dialogue;
- Demonstrational method;
- Observation;
- Manipulation with things;
- Individual work with the using of ICT

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Lecture

- this method is mostly used on the high schools and university;
- the one of the shortcomings of this method is that the students are passive;
- teacher should use didactic technique such as videos, audios, pictures, several of diagrams, etc.

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Dialogue

- In the form of questions and answers, students gain the knowledge about the theme of lesson;
- One of the advantages is to stimulate students for the new knowledge;
- one of the requirement is that student have preliminary knowledge about the curriculum.

Demonstrational method

- Teacher use ICT in demonstrating the phenomena of the curriculum;
- In the area of e-learning are mostly used instructional videos, web-based simulations, real-remote experiments, various schemes, diagrams, interactive tables, etc.

Which didactic techniques do you use on your lessons?

Observation

- The task of students is to observe the phenomena in the lesson;
- it is similar to demonstrational method; but it is only recognition of observation phenomena.

Manipulation with things

- laboratory work;
- work as method, game as a method to gain new information;
- It's very useful method, but it is necessary the good preparation from teacher and from students;

Individual work with the using ICT

- suitable ICT in the suitable form should provide or create the interesting environment how to connect as much senses of students.

Exposition methods - Questions

- Which of these methods do you use in the lesson?
- Why do you use these methods?
- What other methods do you use on your lesson?

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Fixation methods

- verbal repeating the new knowledge;
- the method of questions and answers;
- repeating dialogue;
- Individual work with the using of ICT

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Verbal repeating the new knowledge

- it is based on reproduction of the new information

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The method of questions and answers

- Students answer on questions – if it was good – teacher gives student praise, if it was bad – teacher gives student criticism and give the good answer;
- This is mostly used method;
- mostly it has form of game – the students compete between each other

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Repeating dialogue

- teacher in the form of dialogue with students strengthen the knowledge;

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Individual work with ICT

- The main goal of this method is to connect as much senses of students to the theme;
- Students try to change the variables of the experiments.

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Fixation methods - Questions

- Which of these methods do you use in the lesson?
- Why do you use these methods?
- What other methods do you use on your lesson?

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Diagnostically methods

- Verbal exam;
- Writing exam;
- Didactical test.

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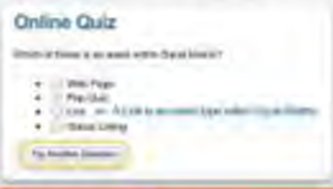
Diagnostically methods using ICT

- Online quiz;
- online courses in LMS Moodle.



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Diagnostically methods - Questions

- Which of these methods do you use in the lesson?
- Why do you use these methods?
- What other methods do you use on your lesson?

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The other methods

- Class discussion conducted by teacher;
- Forums;
- Library research on topics or problems;
- Audio-tutorial lessons;
- Class projects;
- Individual projects;
- Laboratory experiments performed by more than two students working together

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The other methods

- Student construction of diagrams, charts, or graphs;
- Making of posters by students;
- Problem solving or case studies;
- Use of diagrams, tables, graphs, and charts by instructor in Teaching;
- Use of motion pictures, educational films, videotapes;
- Use of recordings;
- Surveys;

The other methods

- Tutorial: students assigned to other students for assistance, peer teaching;
- Web-based simulations;
- Real-remote experiments;

Questions

- What didactical techniques do you use on your lessons?
- Web-based simulations/real remote experiments/Virtual reality systems/Videos/ Audios/Pictures;
- What else do we use on the lessons -> how we should stimulate students to do what we need?
- How do we capture students attention to the curriculum?

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Summary

- As any good teacher knows, all students do not learn in the same way.
- Teachers need to use different teaching methods in order to reach all students effectively;
- A variety of teaching strategies, a knowledge of student levels, and an implementation of which strategies are best for particular students can help teachers to know which teaching methods will be most effective for their class.

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Thank you for your attention

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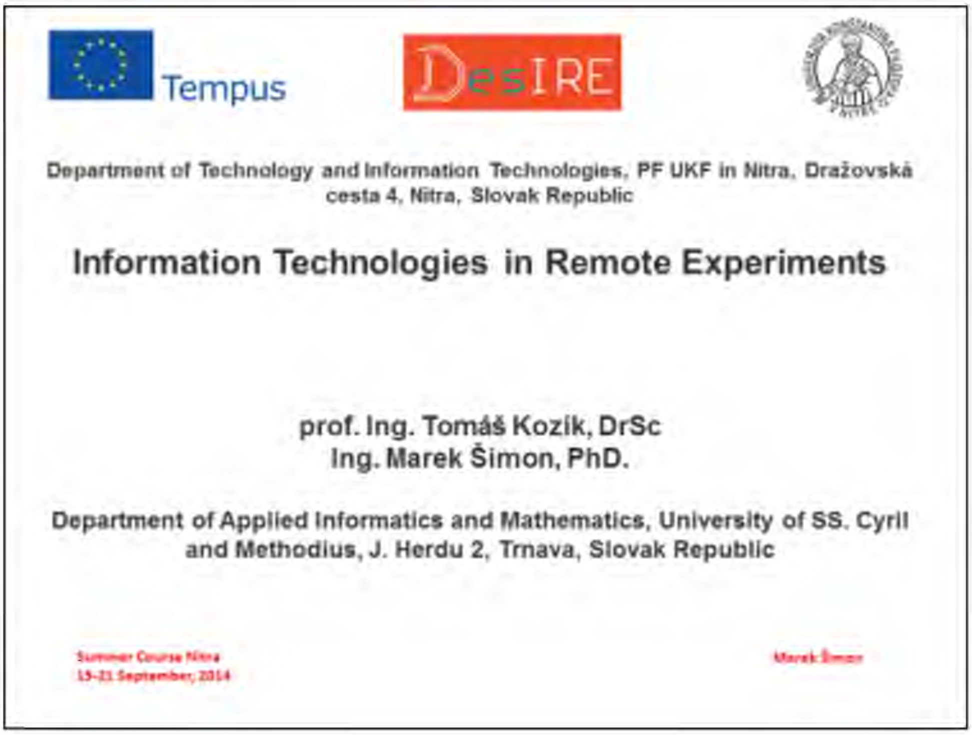
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Department of Technology and Information Technologies, PF UKF in Nitra, Dražovská cesta 4, Nitra, Slovak Republic
Information Technologies in Remote Experiments
prof. Ing. Tomáš Kozík, DrSc
Ing. Marek Šimon, PhD.
Department of Applied Informatics and Mathematics, University of SS. Cyril and Methodius, J. Herdu 2, Trnava, Slovak Republic
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The presentation consist of three parts:
»Introduction to the remote experiments
»ICT and remote experiments
»Remote experiment and teacher
Don't be afraid to ask me.
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»Hands on Experiments

»Simulated Experiments

»**Real** Remote Experiments

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- A remote experiment is a real experiment with real laboratory instruments and equipment that can be controlled by a computer through the Internet.
- One or more remote experiments are accessible in remote laboratory.

Wikipedia

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But how to imagine Remote Experiment ?

Remote experiment in one picture..

The better one..

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Information and Communication technologies behind Remote Experiments

- Internet and computer networks.
- Web browser.
- Web server.
- Web camera
- Internet search services.

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Internet and computer networks

- Network interface
- Transmission medium
- Communication protocols

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Internet and computer networks

- LAN – Local Area Network
- WAN – World/Wide Area Network
- Packet
- ISP – Internet Service Provider
- World Wide Web – web, web2

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Internet and computer networks

- URL
  - five parts
    - protocol (http://)
    - login and password (marek:1234@)
    - name of the server ([illegible])
    - number of port (:88)
    - path to resource (/conference/manuscript.pdf)
  - https://ib.bank.sk/login.php

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Internet and computer networks

- IP address
  - like telephone number
  - IP address = network address + computer address, netmask
    - 193.87.59.115/24
  - public and private IP addresses
  - NAT – Network Address Translating

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Internet and computer networks

- port
  - abstract number for addressing process
  - 0 – 65535
  - well-known (21, 25, 80,..)
  - privileged (<1023)
  - unprivileged (> 1023)

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Internet and computer networks

- domain name
  - who can remember 239.186.247.241, 138.10.87.56, ...
  - www.ukf.sk, experiment1.university.edu, experiment.university.sk,...
  - TLD – Top Level Domain (.sk, .ua, .com, .edu...)

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Internet and computer networks

- common network devices
  - switch
  - router (gateway)
  - firewall (hardware, software)
  - client
  - server

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Internet and computer networks

- few important TCP/IP protocols:
  - Domain Name System - DNS (port 53/udp)
  - HyperText Transfer Protocol - HTTP (port 80/tcp)
  - Internet Control Message Protocol - ICMP

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Internet and computer networks

- HTTPS
  - port 443/tcp
  - secure connection
  - SSL/TLS (TLSv1.2)

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Internet and computer networks

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Web server

- HTTP or HTTPS communication
- listen usually on port 80 or 443
- for RE often listen on nonstandard port (81, 88,..)

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Web camera

- 80 percent of the sensory information the brain receives comes from our eyes
- reality of remote experiment
- visual quality:
  - resolution (pixels)
  - frame rate (fps)

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Internet search services

- to search texts, photos, videos, actually anything..
- Google, Yahoo, Bing
- we are goods for sale
- Worry obout privacy ? Use DuckDuckGo..

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Advanced Search

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Internet search services

- Googling
  - explicit phrase „remote experiment"
  - exclude words remote experiment -solar
  - search on site site:ukf.sk „remote experiment"
  - document type filetype:pdf „remote experiment"


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YAHOO!
Search
ISES - Internet School Experimental System: Remote Laboratory ...
Solar TV Remote — DIY How-to from Make: Projects
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YAHOO! SEARCH
Advanced Web Search
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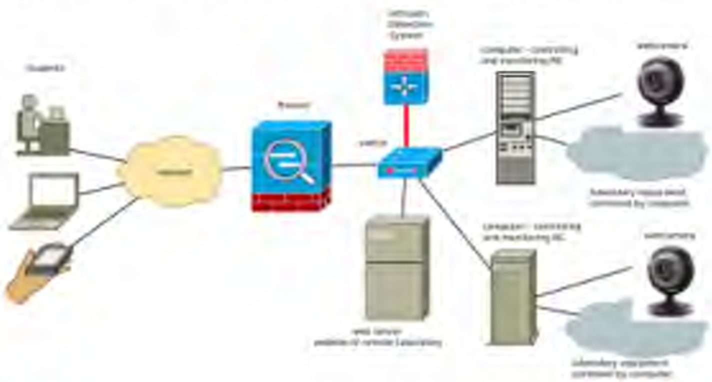
Principles and concepts of remote experiments



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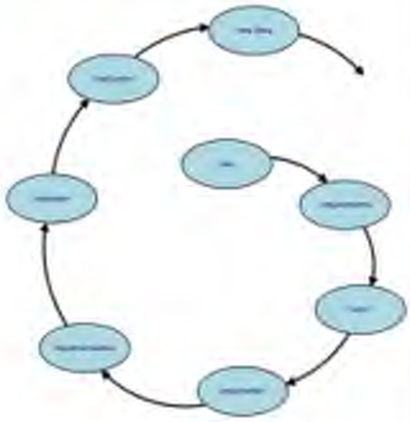
Remote experiments

- different areas, including technology, science and education
- the most numerous are RE in the field of electrical engineering
- operational sustainability of RE
- spiral life-cycle



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There are several kind of RE

- freely available
  - first user win
  - short live on the internet
  - Remotely Controlled Laboratories – RCLs project in Germany
- available after free registration
  - registration take some time...
  - usualy more stable available
  - reservation
  - malicious activities of students
  - NetLab project in Australia

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- available only within educational institution
  - intensive use in education
  - well debugged and available 24/7
  - dedicated only for own students
  - you can try to request access, or join the RE project
  - LabShare project in Australia
- commercial, available for a fee
  - it's a business

Client-server architecture

- specialized client-server applications
  - industrial applications
  - the need to install specialized application on client side, is it permitted ?
  - compatibility, often only for windows platform
  - LabVIEW
  - unique HW and SW solutions, departments that have decided to go their own way

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Client-server architecture

- standard Internet applications
  - common web browser with java or flash
  - sometimes occur problem with compatibility, proper version of java

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Searching of remote experiments

- searching in articles
- searching on the internet
  - remote experiment (laboratory)
  - remotely controlled experiment (laboratory)
  - remotely controlled laboratory -filetype:pdf -filetype:doc (exclude articles)
  - remote experiment oscillation -filetype:pdf
  - remote experiment vibration -filetype:pdf

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Methodology of remote experiments.

- teacher carried out remote experiment within an hour as a demonstration
- student (or group of students) carried out remote experiment in the classroom as a shared experiment under the supervision of a teacher in a computer lab
- student carried out experiment outside of school as a flexible tool for self-learning

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Methodology of remote experiments.

- RE can be used in all phase of the lesson (motivation, exposure, fixation, diagnostic)
- the researchers recommended to combine experiments in hands on and remote laboratories (and simulations)

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Requirements for remote experiments.

- Reality,
  - all aspects of real experiment (including errors!)
- Availability,
  - any time, any where,
  - no special SW,
  - no special costs for using RE

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The presentation of remote experiment.

- simply connect PC to data-projector and open RE
- SW for presentation (MS PowerPoint, LibreOffice Impress)
  - be careful with collors
  - inserting URLs
- LMS

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The presentation of remote experiment.

- LMS and busy word e-learning
- Moodle is our favorite
- Theoretical background in moodle course
- Add an activity or resource and choose URL

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Your questions – my questions..

- What is differences between LAN and WAN?
- Can you explain the relationship between the Internet and the ISP?
- Can you explain the relationship between the client and the server?
- What is a URL?
- What url you enter if you want to search for something on the Internet?

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Your questions – my questions..

- What is remote experiment?
- Can you explain the relationship between the client, server and devices of remote laboratory experiment?
- Why is quality of web-camera so important?
- Try to describe types of remote experiments.
- What key words would you use for searching remote experiments using an Internet search engine?

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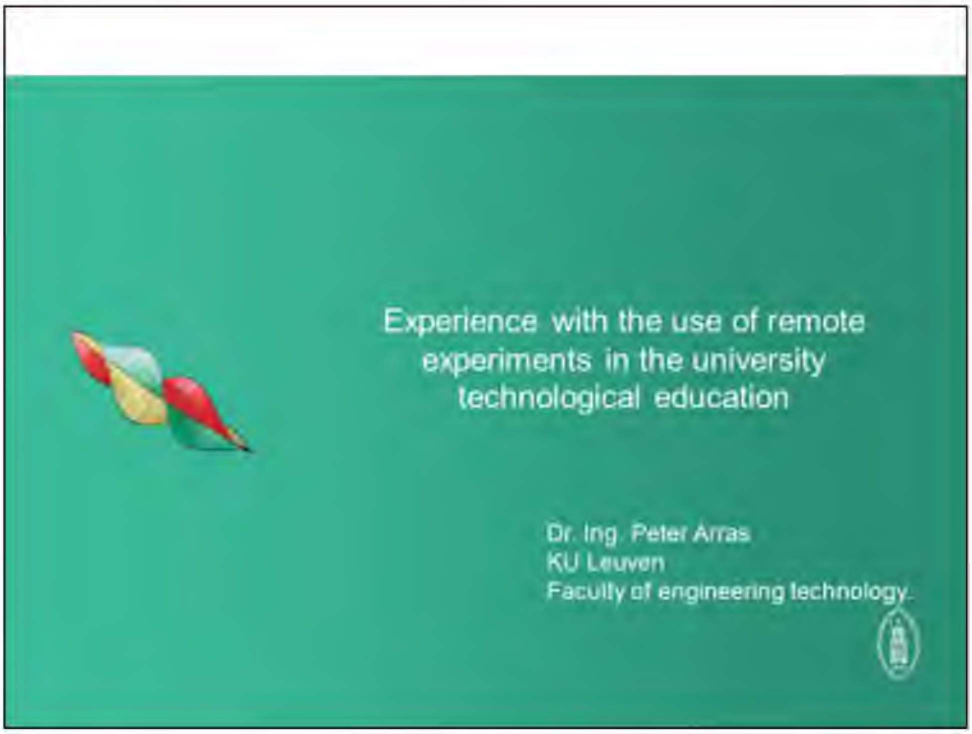
Ing. Peter Arras, PhD.

Experience with the Use of Remote Experiments in the University Technological Education



Introduction:

- Case study on the use of a remote and virtual lab for the courses of material sciences to engineers.
- Engineers are not material experts, but material users.

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Material Sciences

- Material science is a forgotten subject in engineering studies
- All innovation comes from new materials or new use of materials

=> Observation: lack of knowledge on (new) materials by engineers/technicians.

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Paradox
Less interest in technical studies
Technological society
?
Sustainable demands from society
More and newer technologies
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Technological society.
• Everyday life ruled by technology:
◦ Household: kitchen, bathroom…
◦ Transport: cars, planes
◦ Communication: computers, mobile (smart) phones, social networks
◦ Freetime: holidays, sports..
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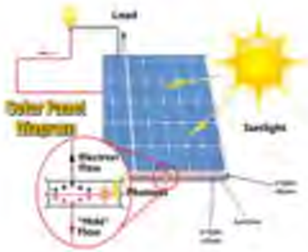
Sustainable demands from society

Observation:

- More population
- More pressure on nature



Demands:

- High standards of living
- More, cleaner energy
- Faster, more efficient transport
- More space for free time activities

Less interest in technical studies.

- Technical studies
  - Negative image of industry (cfr Fukushima)
  - Not sexy: technological nerds
  - Are costly: laboratory equipment is difficult to aqcuire
- Result: technical staff is hard to find for industry

More and newer technologies.

- New materials lead to new possibities and technologies for use in everyday life:
  - e.g. Fleece wear, microwave oven, safe and reliable cars, food safety, drugs and medicine, GPS, electrical bicycles…

- Material sciences/knowledge too often forgotten as a subject in education.

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Observations & Conclusions:

- Observations:
  - Teaching technology is necessary, especially on materials, the motor of many innovations.
  - New technology in (consumer) products: stress on technology teaching to newer directions and more time necessary.
  - Lack of resources (time, people) in education.
- Conclusion:
  - ⇒ Need for new methods to teach material sciences and on new materials
  - ⇒ Need for better use of resources

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Proposed and implemented solution:

- Blended learning:
  - Activating for students
  - Motivating
  - Supporting learners

- Supported with e_learning platform
- Mix of different teaching methods

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Blended learning:

- Combines different methods of teaching and learning.
- Teaching:
  - Classroom teaching (face-to-face)
  - Computer assisted teaching (webinars, icasts, video lessons..)
  - Project work
- Learning:
  - Self study
  - Laboratory work
  - Internships
  - Project work
  - Flipped classrooms
  - ….

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For the new model was necessary:

- Construction of learning environment CALM
  (Computer Aided Learning Module)
- Construction of a remote lab: 2-point bending test
- Construction of a virtual lab: 2-point bending
- Integration on web-server

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CALM (Computer Aided Learning Module)
Op
Materiaalkunde
Virtueel Labo
Goals
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Computer Aided Learning Module:
Opzet van de website
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Goals of laboratory work in learning

Effective laboratory work should:

- [1] Enable students to explicate and understand the questions they are investigating
- [2] Enable students to decide what data is (ir)relevant
- [3] Learn students the limitations of measurements, sampling and data
- [4] Help students to make connections between science concepts and everyday phenomena
- [5] Help students to apply mathematical reasoning and techniques to problems.

17

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Setup of the remote lab:

Laboratory work/practical work

Acquiring knowledge	Practice procedures
• Repeatable • Aimed at specific knowledge	• Lifelike • Similar to real situations

Laboratory work is motivating to the learner.

18

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Different types of labs.

Interactive demo lab
- Real time
- Observation only

Virtual lab
- Real time
- Virtual Experiments
- Simulations only

Remote lab
- Real time
- Real experiments
- Self learning

19

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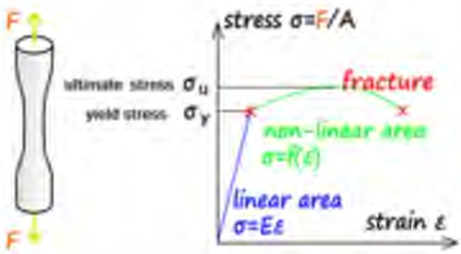
Remote lab

- Same learning outcomes as the physical lab
  - Material properties: Young's Modulus.
  - Difference between shape and material stiffness
- Used to do a real experiment:
  - Choice of parameters
  - Calculations
  - Accuracy
  - Unknown variables



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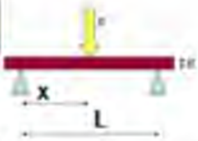
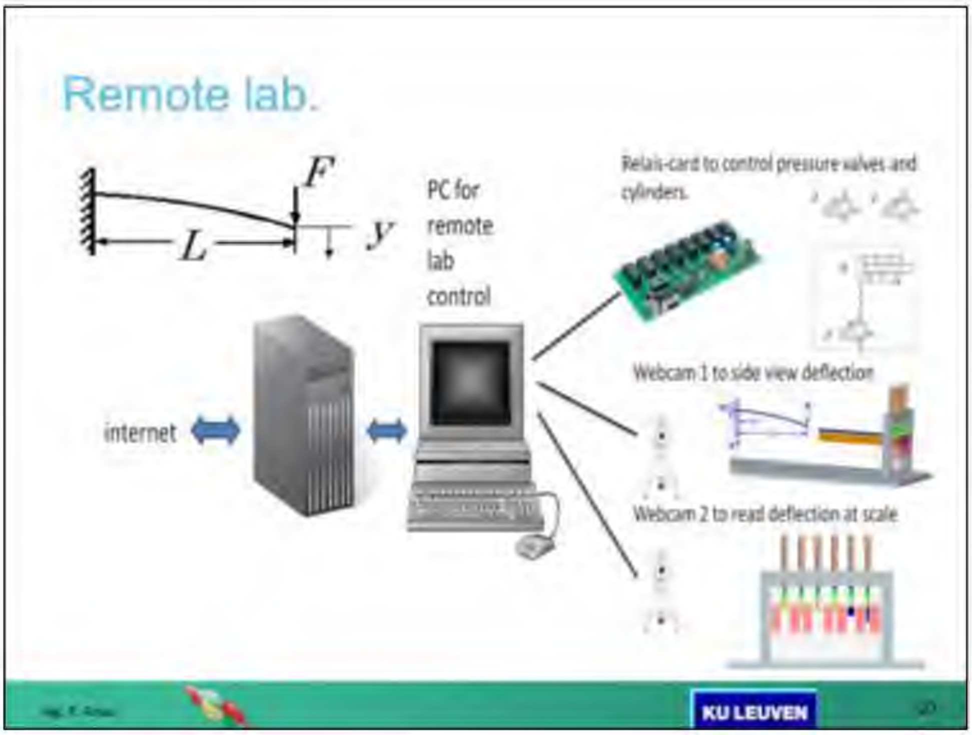
Learning outcomes

- Students can explain material stiffness and illustrate it by commenting on tension-pull diagram's for different materials.
- Students can explain shape stiffness and the relation to the shape itself.
- Students can predict the bending of a beam (with a known shape) under a cantilever load.
- Students can relate material stiffness values to values measured in tension-pull machines and in bending tests.



Real lab (3-point bending test)	Remote lab (2-point bending test)
3-point bending test	2-point bending test
6 different test specimens available, test 1 by 1	9 different test specimens available, test 2 by 2
Force increasable in 5 steps by means of weights	2 different forces available by varying the pressure load
Position of force free	Position of force fixed
Students measure deflection	Students measure deflection
Students measure force	Students calculate force from known specimen
Students measure distance (x) of force to reference point	Distance of force to reference point is given
Students measure dimensions of specimen	Students get all dimensions of specimen
Students calculate possible error	Students calculate possible error


Remote lab.
F
L
y
PC for remote lab control
Relais-card to control pressure valves and cylinders.
Webcam 1 to side view deflection
Webcam 2 to read deflection at scale
internet
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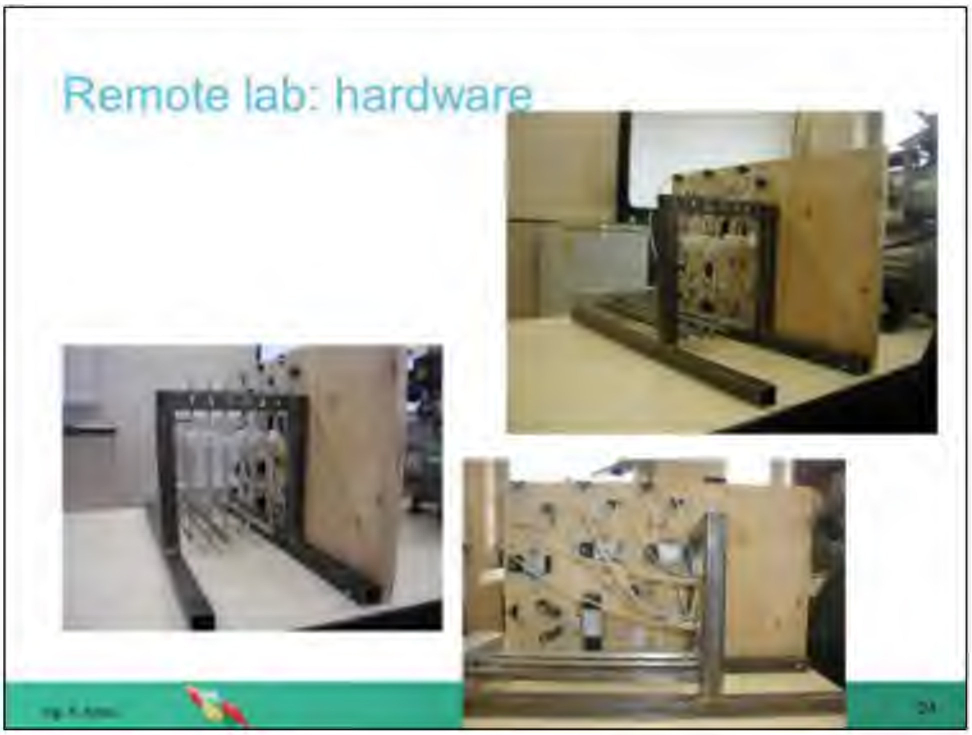
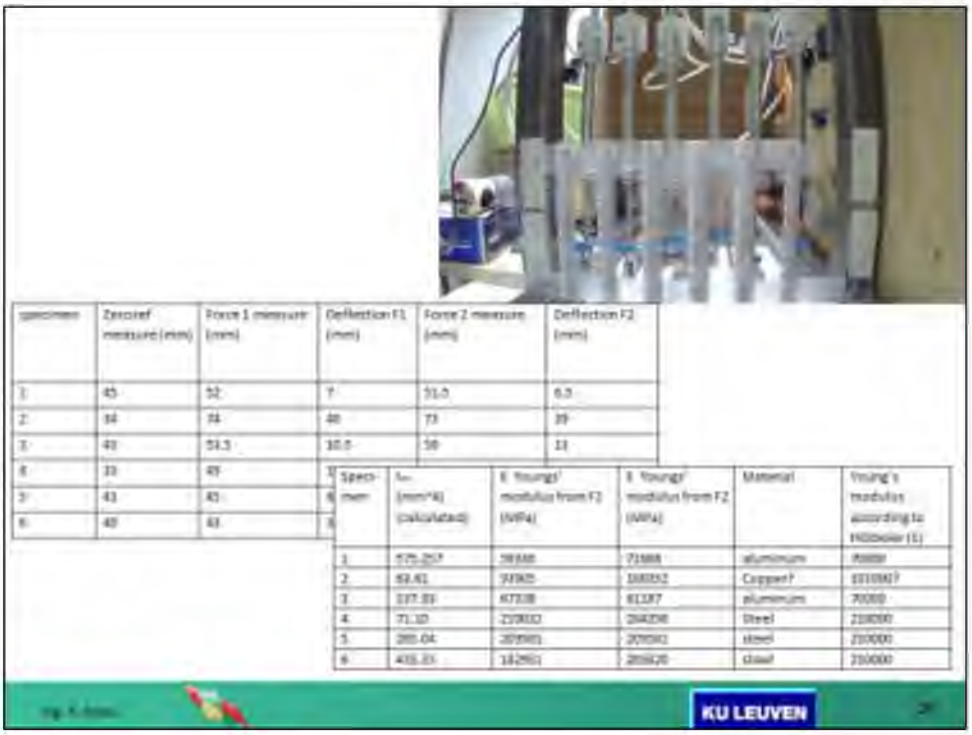

Remote lab: hardware


Remote lab:
KU LEUVEN


specimen
Zeroref measure (mm)
Force 1 measure (mm)
Deflection F1 (mm)
Force 2 measure (mm)
Deflection F2 (mm)
1 45 52 7 51.5 6.5
2 34 74 40 73 39
3 43 53.5 10.5 58
4 33 49
5 43 45
6 40 43
Speci-men
(mm^4) (calculated)
E Youngs' modulus from F1 (MPa)
E Youngs' modulus from F2 (MPa)
Material
Young's modulus according to
aluminium
Copper?
aluminium
Steel
steel
steel
70000
210000
210000
210000
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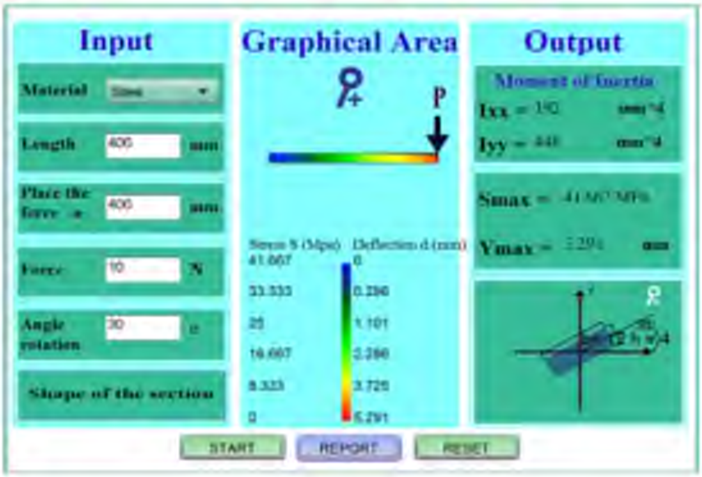
Virtual lab.



Remote lab effectiveness: Experiment

- All students can use the CALM.
- 109 bachelor 2 students in the course "Materiaalkunde"
- 54 using remote lab: 2-point bending test

- 55 using physical lab: 3-point bending test

Experiment:

- Difference in learning/teaching process.
  - All had classroom sessions
  - Lab sessions difference: groups with remote lab, groups with physical labs.
- Same exam on same learning outcomes:

- Statistical analysis: show no difference in knowledge.

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Conclusions:

- The scheme of blended learning is effective in teaching the course:
  - Classroom teaching for the basics of the subject.
  - Classroom training on the use of the CALM-system.
  - Physical laboratories for phenomena with a highly complicated lab infrastructure.
  - Remote labs to test on (less complicated) infrastructure, still experimenting on real experiments.
  - Virtual labs as a supporting tool for quick checking of experimental results.

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Conclusions:

- The use of remote labs and virtual labs showed to be an efficient method to:
  - Be used for knowledge transfer
  - Time and cost efficient.
  - Self study on the phenomenon, supported by the virtual lab and remote lab for difference between material and shape strength.

Points of attention:

- The students need to be trained in using a computer supported learning environment, if not they just short cut to the tasks.
- Careful thinking needs to be done on the pedagogy:
  - What is the aim of the remote lab
  - What learning outcomes you want:
    - Leading to complex/less complex setups
    - Time use on the lab
    - Admission to the lab
    - Evaluation of students

Points of attention:

- Technical side of the labs:
  - Cameras are tough on the infrastructure.
  - Choice of reliable hardware
  - Maintenance free (if possible)
  - Secure the lab for abuse
- First find a reason to build the lab, then only build it: what pedagogical purpose will it serve?

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Thank you for your attention.

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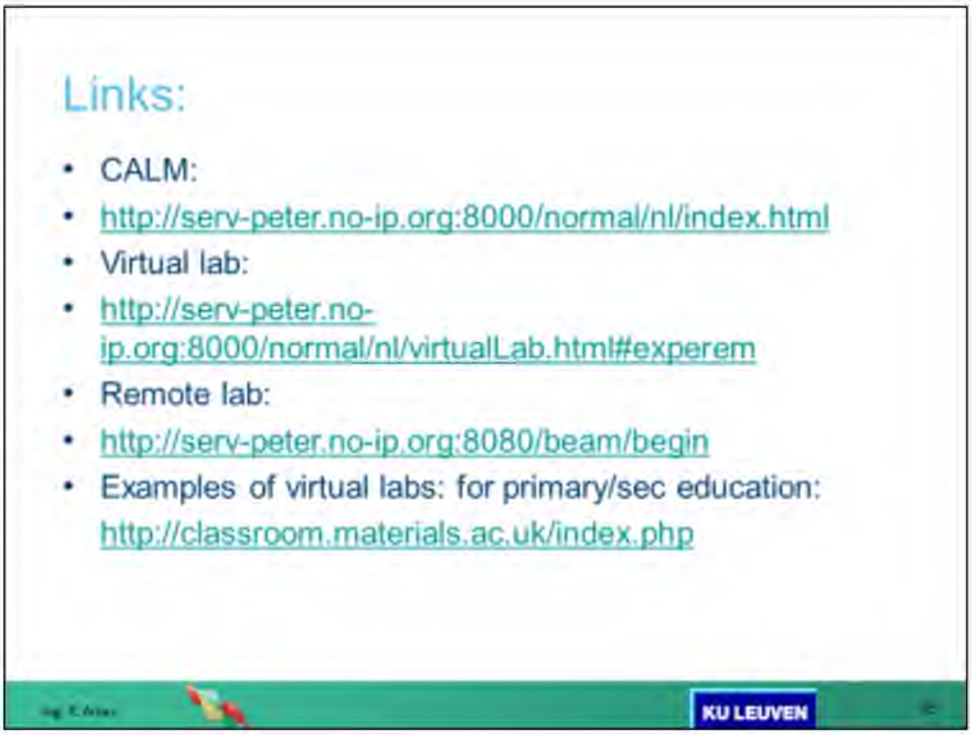
Links:
• CALM:
• http://serv-peter.no-ip.org:8000/normal/nl/index.html
• Virtual lab:
• http://serv-peter.no-ip.org:8000/normal/nl/virtualLab.html#experem
• Remote lab:
• http://serv-peter.no-ip.org:8080/beam/begin
• Examples of virtual labs: for primary/sec education: http://classroom.materials.ac.uk/index.php
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Ing. Dirk Van Merode MSc., Ing. Peter Arras MSc.,
Formula Flowcode

DesIRE

Development of Embedded System Courses with implementation of Innovative Virtual approaches for integration of Research, Education and Production in UA, GE, AM

1 DESIRE

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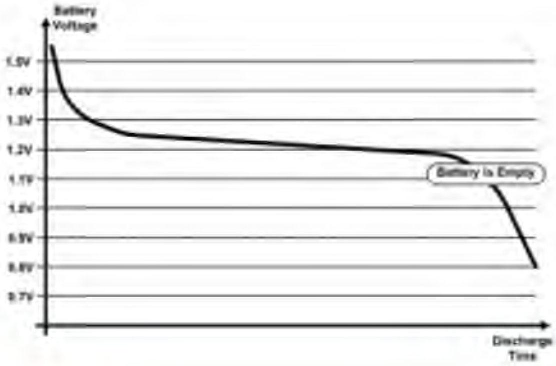
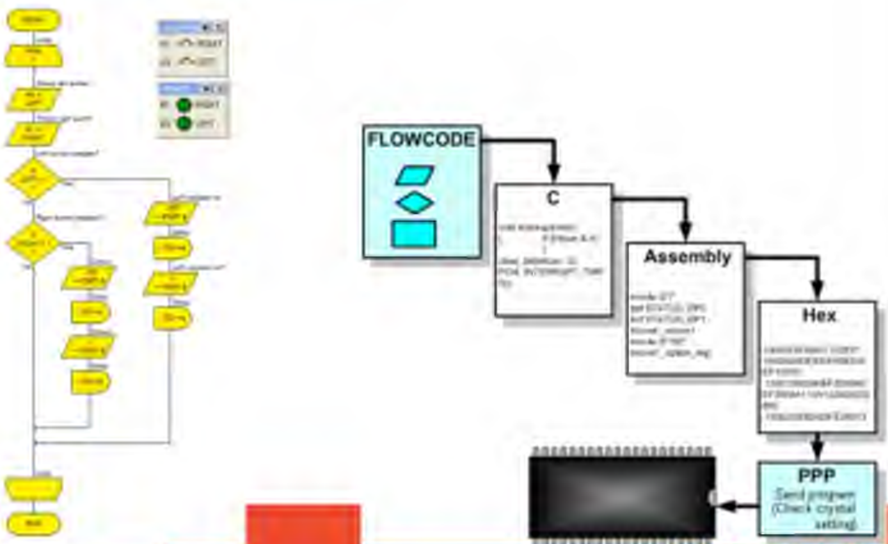
FORMULA FLOWCODE

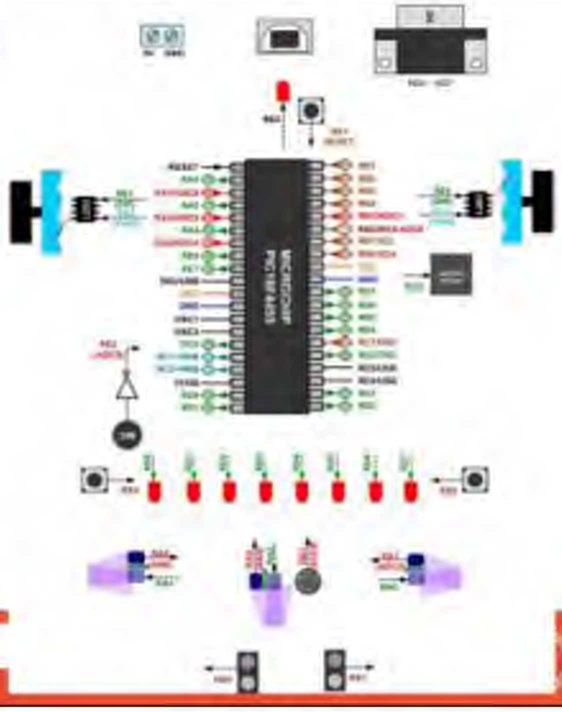
BATTERY

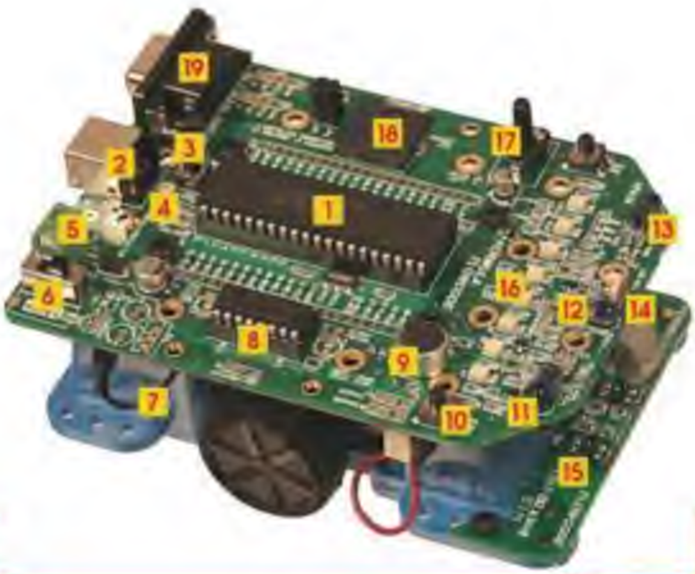


FLOWCODE SOFTWARE



BLOCKS





Tempus DesIRE

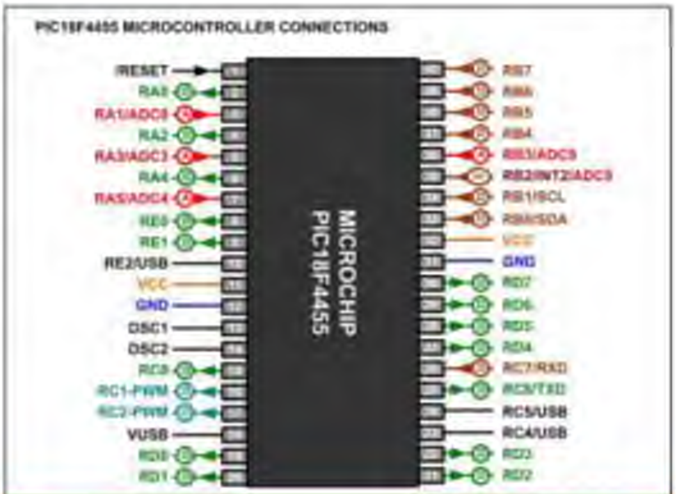
AN INTRODUCTION TO MICROCONTROLLER PROGRAMMING

Free download from
www.matrixmultimedia.com

DesIRE

PIC MICROCONTROLLER

- 40 pins
- 5 gates
- A - D
- Input
- Output
- 6 MIPS



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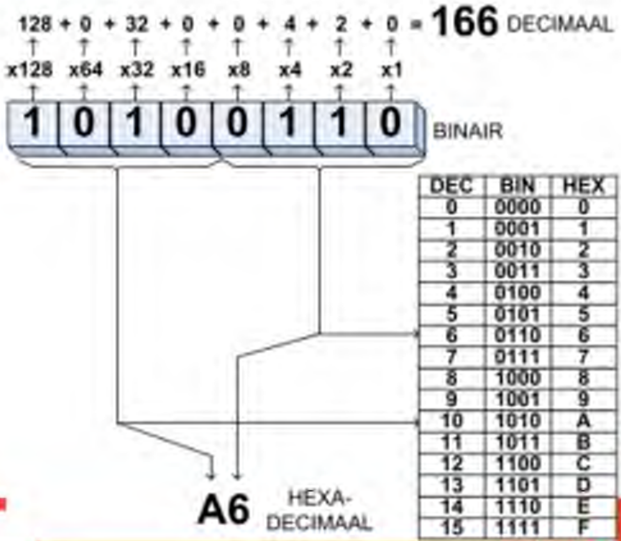
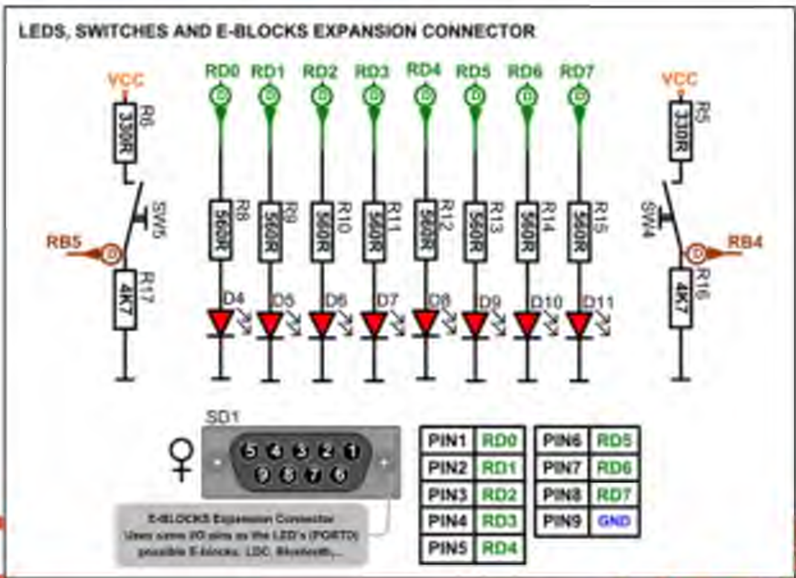
BINARY CODES



DEC	BIN	HEX
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

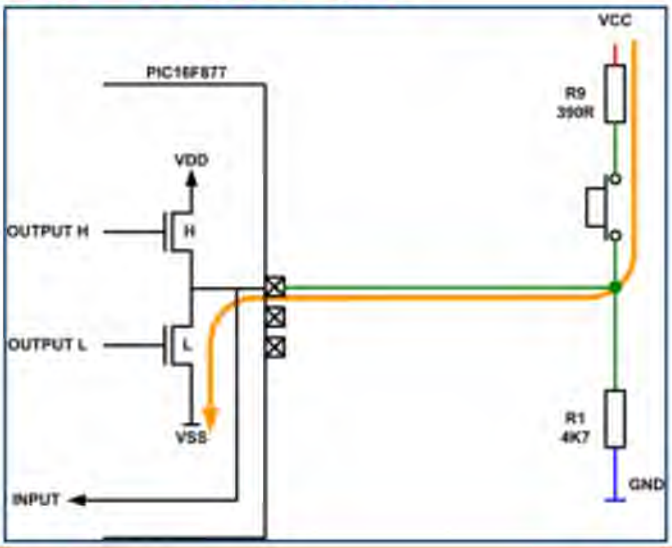
HARDWARE LEDS & SWITCHES



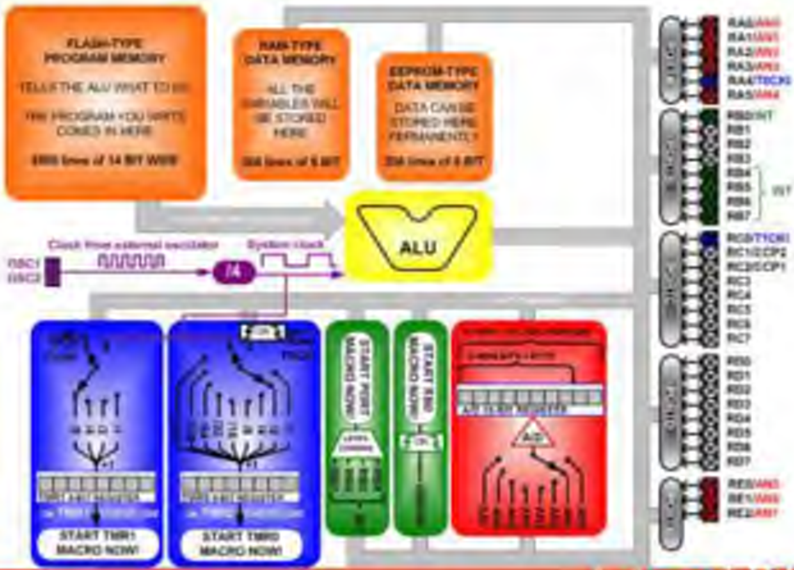
PIN1	RD0
PIN2	RD1
PIN3	RD2
PIN4	RD3
PIN5	RD4

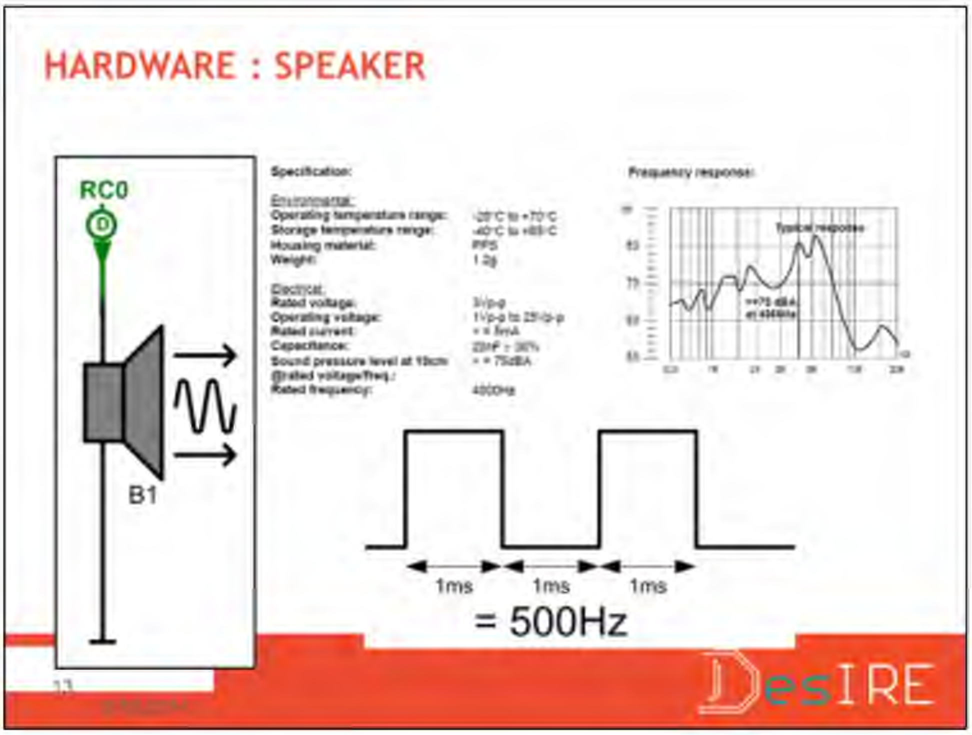
PIN6	RD5
PIN7	RD6
PIN8	RD7
PIN9	GND

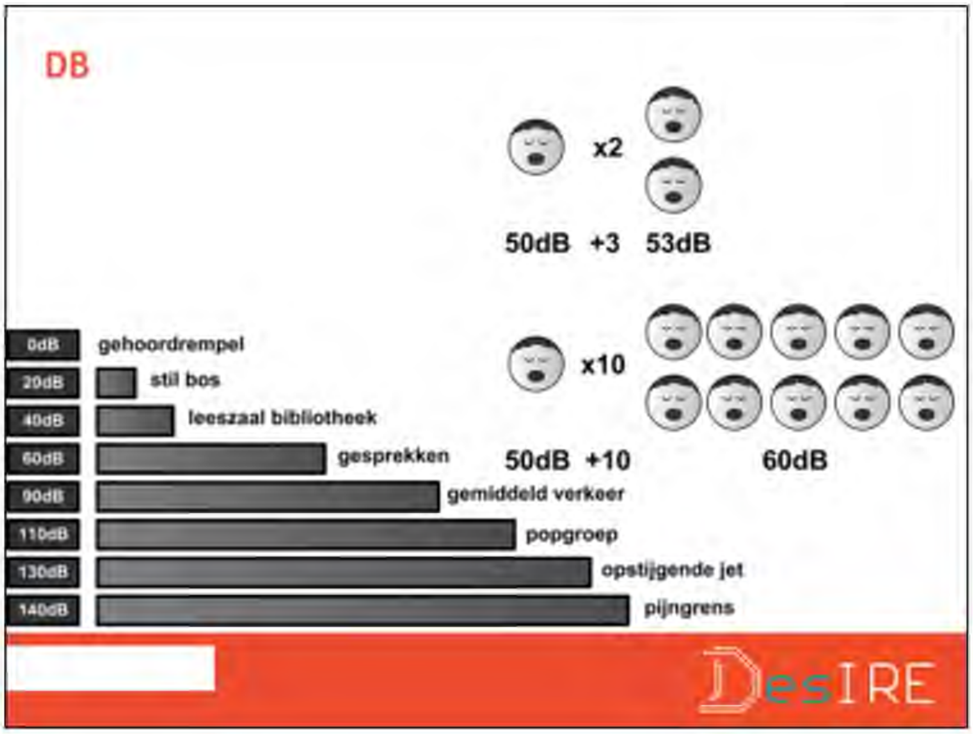
HARDWARE = STUDENT PROOF



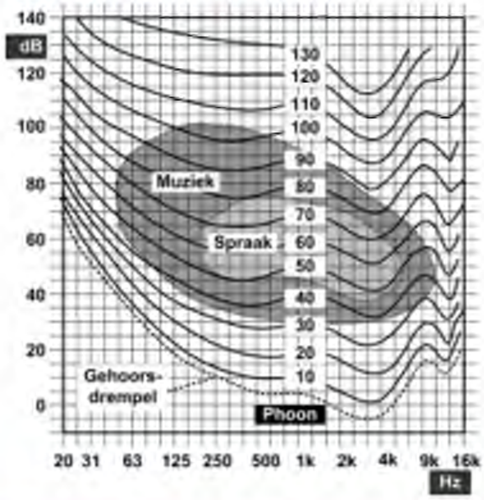
BLOCK DIAGRAM PIC




HARDWARE : SPEAKER
RC0
B1
Specification:
Environmental:
Operating temperature range:
Storage temperature range:
Housing material:
Weight:
PPS
1.2g
Electrical:
Rated voltage:
Operating voltage:
Rated current:
Capacitance:
Sound pressure level at 10cm:
@rated voltage/freq.:
Rated frequency:
4000Hz
Frequency response:
Typical response
1ms
1ms
1ms
= 500Hz
13


DB
x2
50dB +3 53dB
x10
50dB +10 60dB
0dB gehoordrempel
20dB stil bos
40dB leeszaal bibliotheek
60dB gesprekken
90dB gemiddeld verkeer
110dB popgroep
130dB opstijgende jet
140dB pijngrens

SENSITIVITY CURVE



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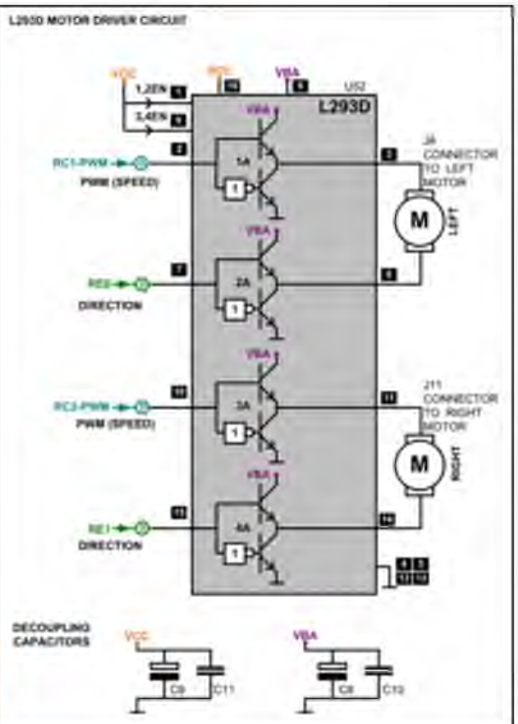
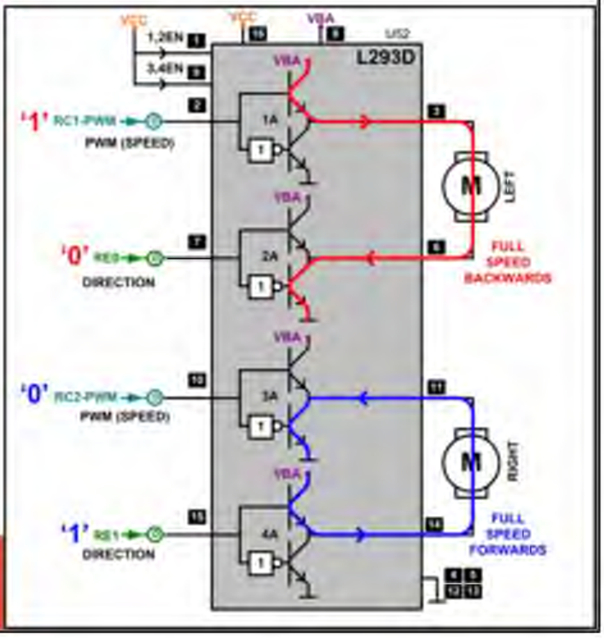
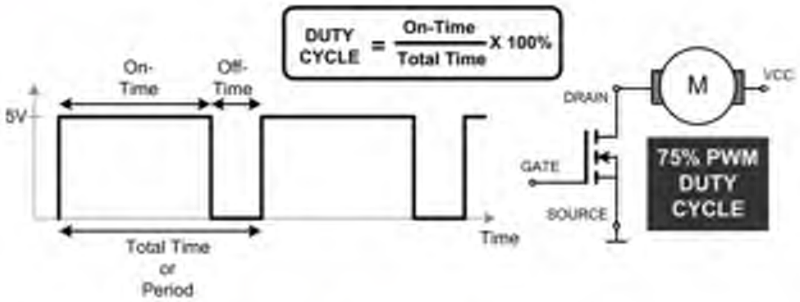
DC MOTOR CONTROL



DC MOTOR CONTROL

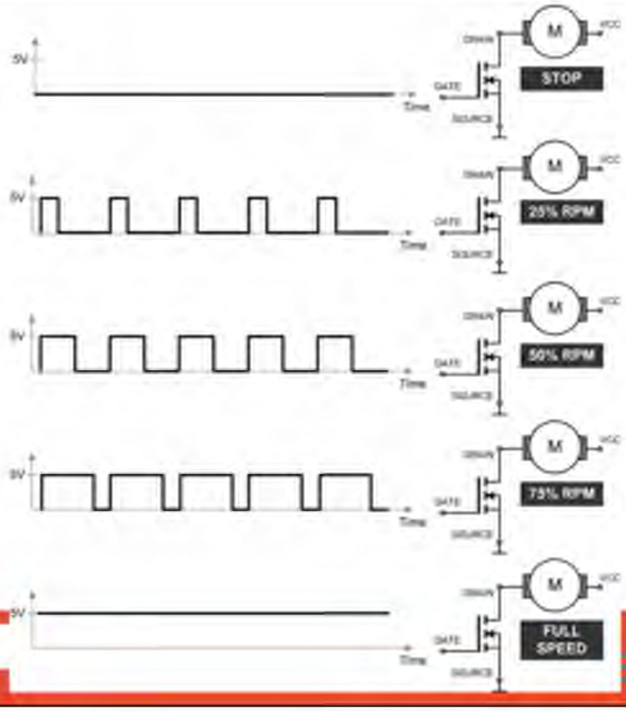


PWM

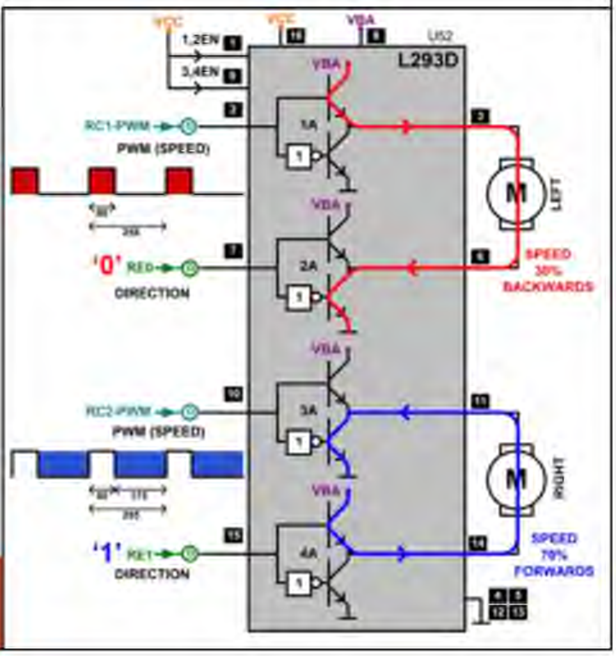


- PWM: Pulse Width Modulation

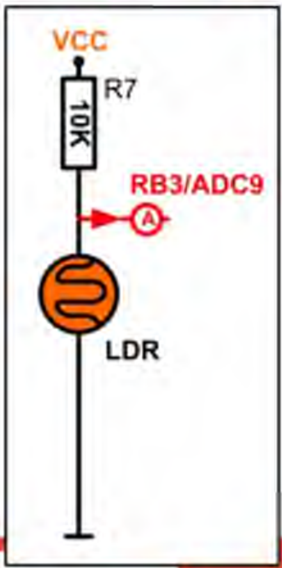
PWM

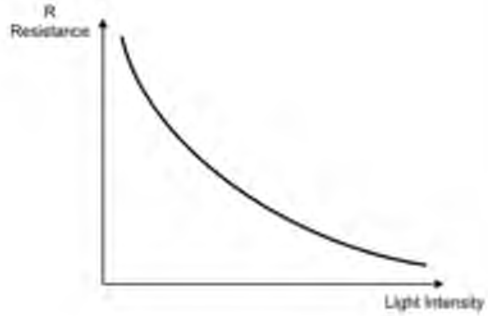


L293D EN PWM



HARDWARE: LDR





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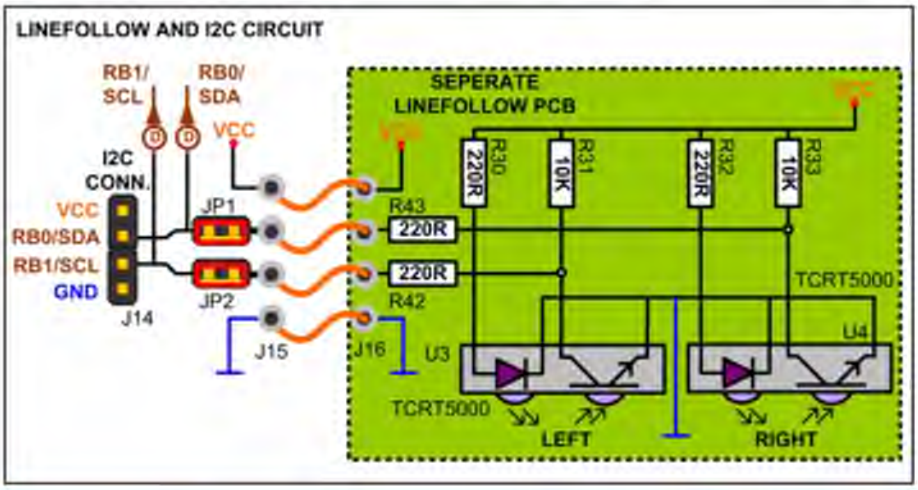
HARDWARE: LINE FOLLOW SENSORS



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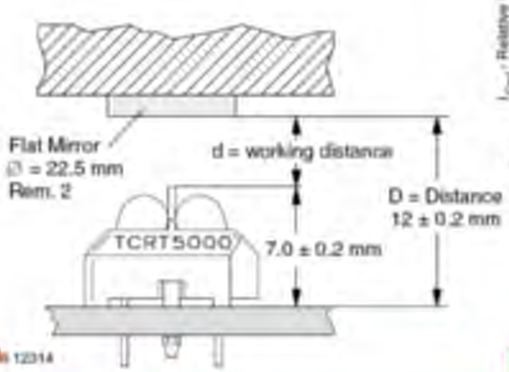
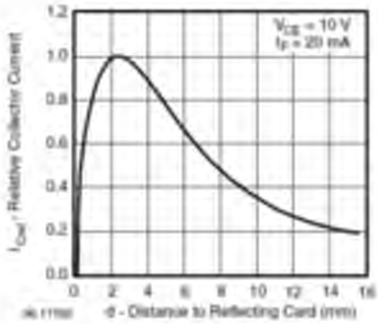
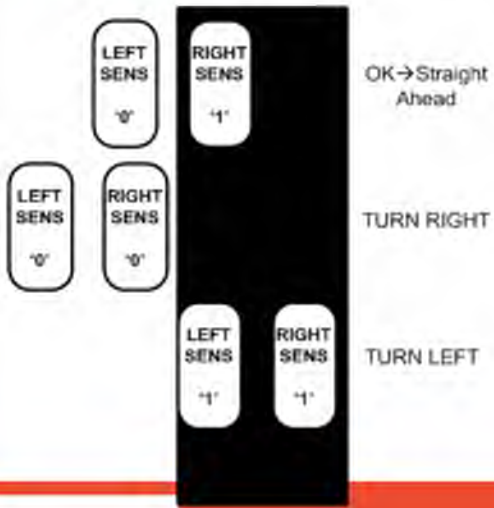
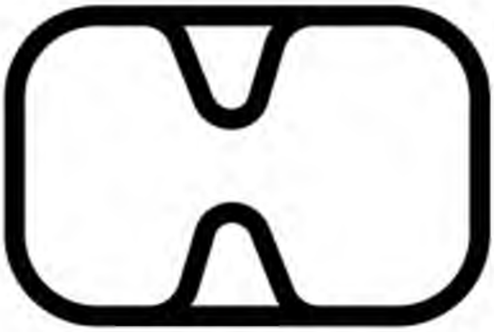
DE LIJNVOLG-SENSOR





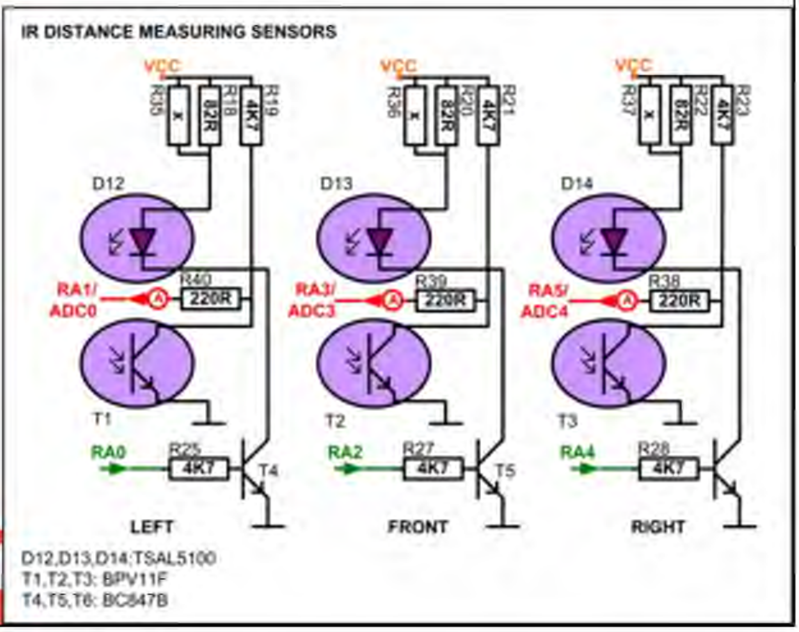
STRATEGY





25

HARDWARE



IR DISTANCE MEASURING SENSORS
VCC
R35
R18
R19
x
82R
4K7
R36
R20
R21
R37
R22
R23
D12
D13
D14
R40
R39
R38
220R
RA1/
ADC0
RA3/
ADC3
RA5/
ADC4
T1
T2
T3
RA0
RA2
RA4
R25
R27
R28
T4
T5
LEFT
FRONT
RIGHT
D12,D13,D14:TSAL5100
T1,T2,T3: BPV11F
T4,T5,T6: BC847B

KARAKTERISTIEKEN

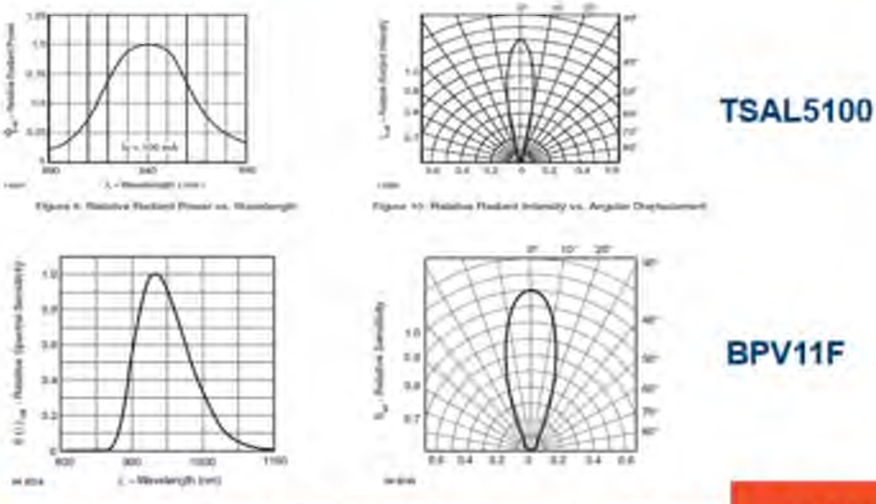
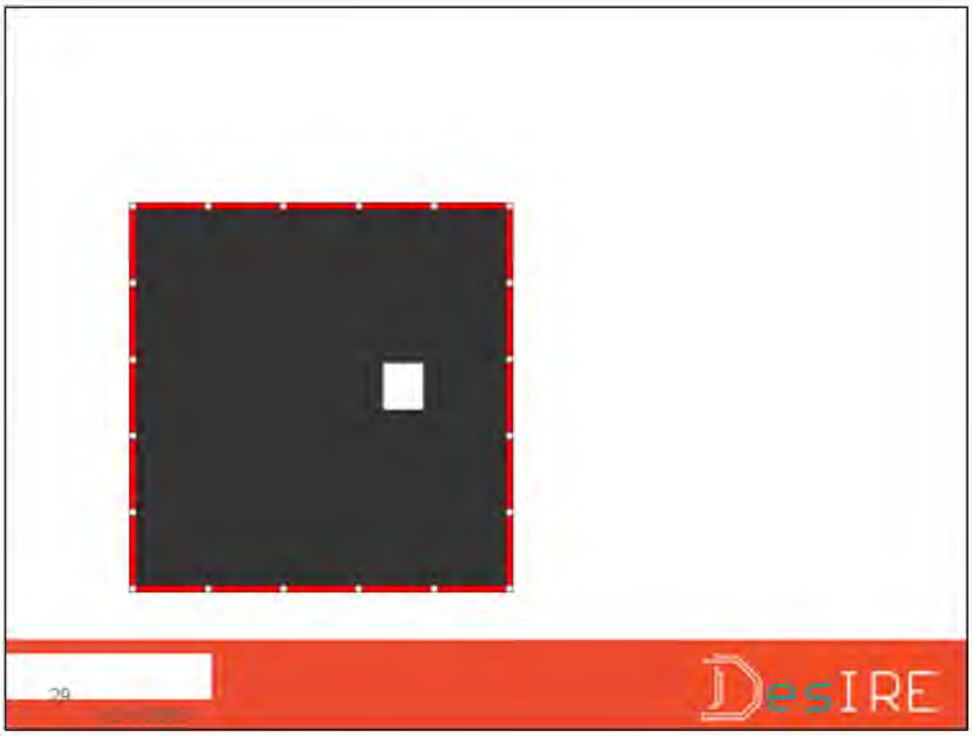


Figure 10. Relative Spectral Sensitivity vs. Wavelength   Figure 11. Relative Radiant Sensitivity vs. Angular Displacement

28


29
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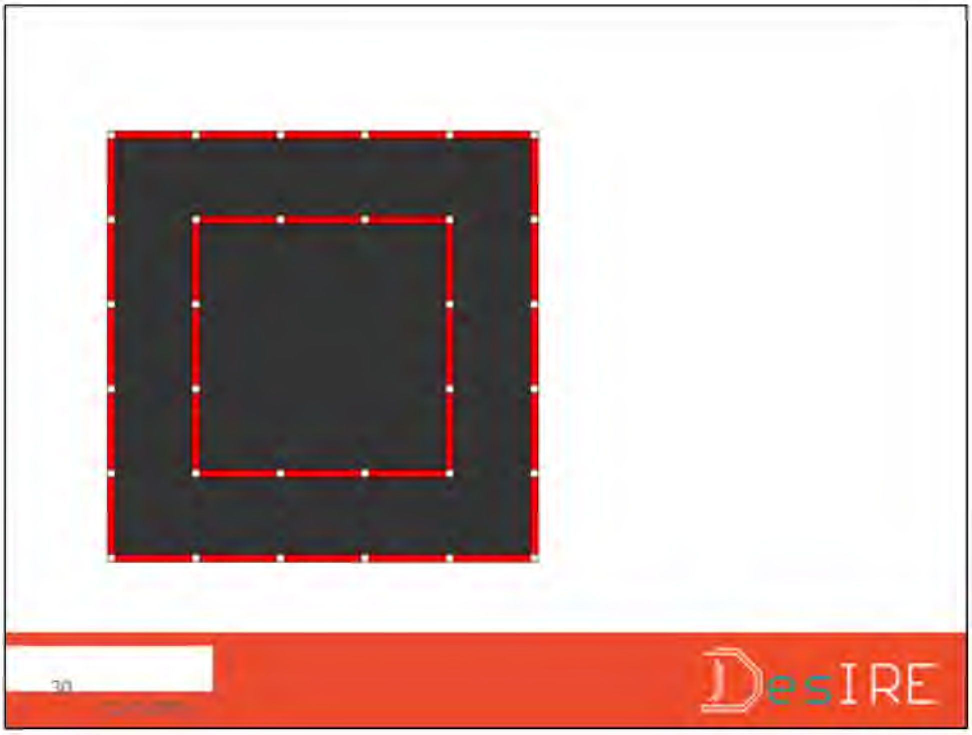
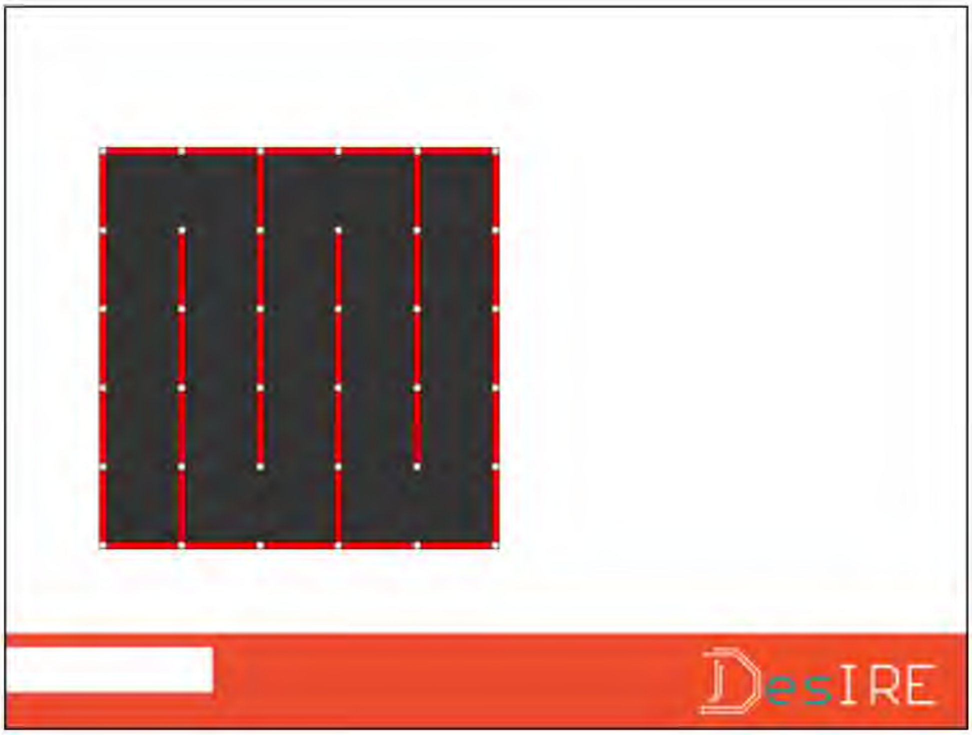
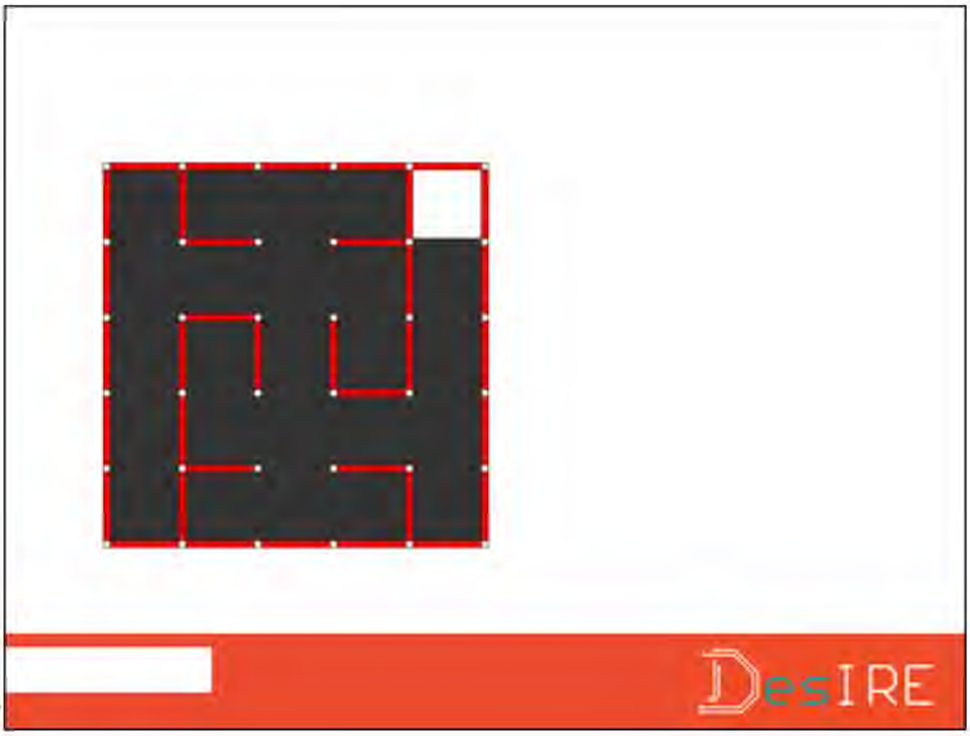
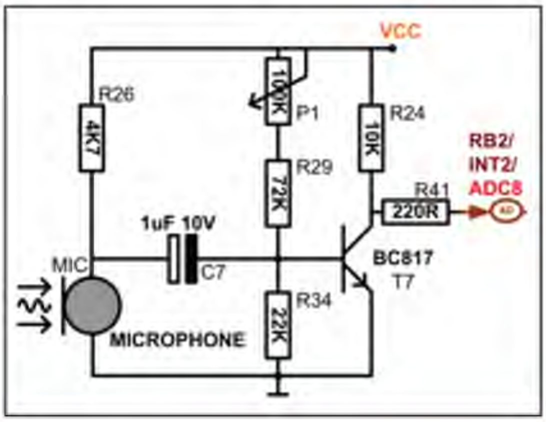

30
DesIRE





7

HARDWARE

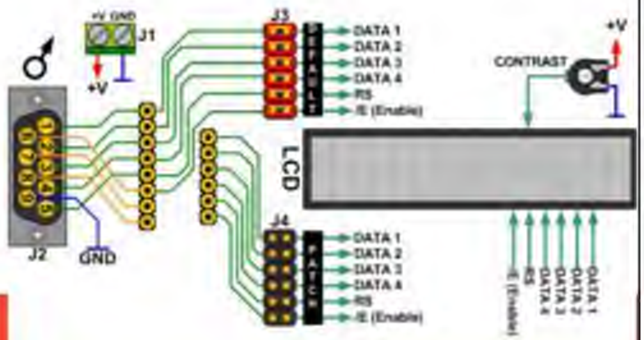


LCD & E-BLOCKS CONNECTOR

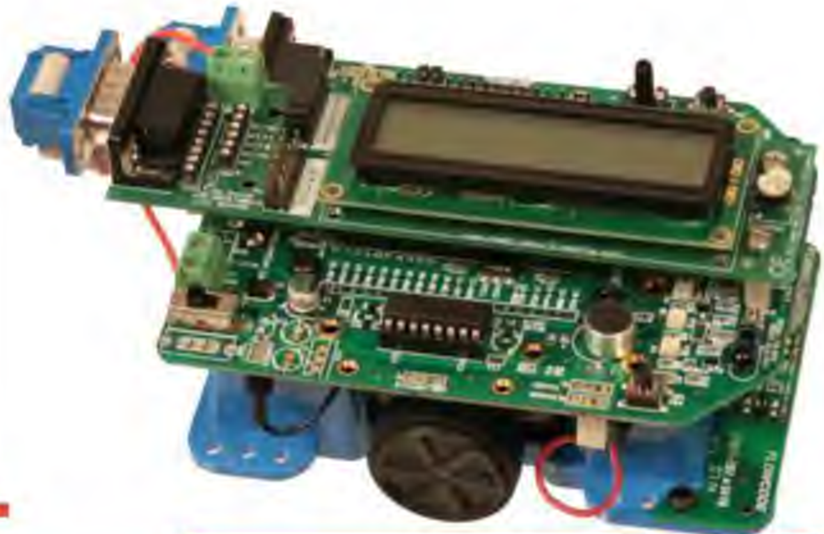
E-BLOCKS CONNECTOR

PIN1	RD0	PIN6	RD5
PIN2	RD1	PIN7	RD6
PIN3	RD2	PIN8	RD7
PIN4	RD3	PIN9	GND
PIN5	RD4		

LCD



CONNECTION LCD



PIMP MY RIDE

CONTACT

Tempus

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Gsm + 32 486 52 81 96
peter.arras@kuleuven.be
Skype pfjlarras
www.iiw.kuleuven.be

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Ing. Dirk Van Merode MSc., Ing. Peter Arras MSc.,
Development of Embedded System Courses with Implementation of Innovative Virtual Approaches for Integration of Research, Education and Production in UA, GE, AM

GENERAL GOALS

- **Specific Project Objective**
  - To create practice-oriented curricula and modules in Embedded Systems
  - To create remote laboratories in Embedded System in UA, GE, AM
  - To form the competences necessary for the Labor Market in Embedded Systems

WORKPACKAGES

- WP1: Analysis of current curricula and competences in Embedded Systems in TC
- WP2: Curricula modification and courses development
- WP3: Implementing a (virtual) learning environment in ESD eng. Establishing remote and ESD labs.
- WP4: Retrain academic teachers on ESD engineering and virtual learning platforms
- WP5: Pilot teaching/operation
- WP6: Quality Assurance and Quality Control
- WP7: Dissemination and Enterprise Collaboration
- WP8: Management of the project

WORKPACKAGES

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- Tempus fugit!

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5
12/01/2015
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WP1

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- Analysis of the current situation in target HEIs
- Questionnaires
- Requirements for stakeholders in embedded systems engineering in TC and EEA (European Economic Area)
- Recommendations on competences needed
- External stakeholders
- Agreement between HEIs for upgrading of the curricula

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WP1

- Key performance indicators
  - number of students, staff and other stakeholders involved,
  - the quality and number of
    - reports and plans from local industry and HEIs
    - the synthesis by the partners

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WP1

- Deliverables
  - 1.1 Analysis of curricula on ECTS for Embedded Systems
  - 1.2 Analysis of competences required at the LM
  - 1.3 Conceptual approach to the curricula construction: Implementation Plan

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WP1

- Status
  - Finalization
    - => Informational bulletin by Galina
    - Publication on the website
  - What about UA problems?

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WP2

- Develop relevant course material on different topics in embedded systems engineering

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WP2

- 1 Module "Hardware for Embedded Systems": 150h (5 ECTS) + 120h (4 ECTS) practical exercises with new equipment:
  - Microcontrollers 30h: IUT;
  - Digital Electronics 30h: IUT;
  - Digital System Design 30h: IUT;
  - Embedded Communication 30h: TMM;
  - Sensors, Actuators and Interfacing 30h: IUT

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WP2

- 2 Module "Software for Embedded Systems": 180h (6 ECTS) + 150h (5 ECTS) practical exercises with new equipment:
  - C for Embedded Systems 30h: TMM;
  - Embedded Software Development 30h: TMM;
  - Embedded Operating Systems 30h: TMM;
  - GUI development 30h: ?;
  - Multicore Programming 30h (MA): TMM;
  - Testing 30h (MA): ?;

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WP2

- 3 Module „CAD/CAM/CAE for Embedded Systems": 80h (3 ECTS) + 80h (3 ECTS) practical exercises with new equipment:
  - ECAD electronic design, ALTIUM, 40 h: TMM;
  - MCAD structural design, Pro Engineer, 40 h: TMM.

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WP2

- Six Courses:
  - Digital Signal Processing: 60h (2 ECTS): TMM
  - Remote Labs and Virtualization: 90h (3 ECTS) + 60h (2 ECTS) practical exercises in the remote labs: IUT

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WP2

- Six Courses:
  - Quality Engineering: 36 h (1, 5 ECTS) + 18 h (1 ECTS) practical exercises: UKF
    - Quality management incl. ISO 9000 family, 18 h (MA);
    - Quality Engineering, 18 h + 18 h practice (MA).
  - New teaching approaches in Engineering: 45h (1,5 ECTS): UKF
  - Soft Skills for engineers: 45h (1,5 ECTS): UKF
  - Management and Marketing for Engineers: 60h (2 ECTS): UKF

WP2

- For the curriculum building:
  - Starting with goals and competences as learning outcomes of the curriculum
  - Entry requirements for each course
  - Learning objectives on module and course level
  - Assessment and evaluation of each course should be described

WP2

Tempus

- Key performance parameters
  - qualitative, quantitative and time based
    - Quality: to which the degree the courses meet up to demanded competences and if attributed ECTS points meet up to expected study, self-study and practical work load
    - Quantitative: the sheer amount of courses which are developed in a timely manner
      - » Order of roll-out: which should be where and when

WP2

Tempus

- Needs
  - Course Material Template
  - PPT Template
  - Template Report on KPI's
  - ESDL
  - REAL

WP2

- Deliverables
  - 2.1 Curricula/modules "Hardware for ESD"
  - 2.2 Curricula/modules "Software for ESD"
  - 2.3 Curricula/modules "CAD/CAM/CAE in ESD"
  - 2.4 Prepare a set of additional modules
  - 2.5 Prepare modules guidebooks in UA/AM/GE/EN

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WP2

- Status
  - Course developers assigned
  - Templates: syllabus & courses
  - Urgent: Syllabi from TMM, IUT, UKF
    - Reasonable deadline? 2 weeks?
  - Courses before yearly meeting in Yerevan (begin February 2015)

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WP3

Tempus

- Implementing a (virtual) learning environment in ESD engineering
  - remote lab and virtualization: REAL
    - plan, coordinate and implement a virtual learning environment
    - efficient and effective implementation
  - every target HEI: a remote lab
  - sustainable
    - expansion & adaption

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WP3

Tempus

- Implementing a (virtual) learning environment in ESD eng
  - embedded systems design labs: ESDL
    - plan, coordinate and implement embedded systems lab infrastructure
    - practice oriented competences
  - every target HEI: lab infrastructure

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WP3

Tempus

- Set up (9 times) for DSP, Embedded SW, Embedded OS, digital systems, µcontrollers, embedded communication, CAD/CAM/CAE: (exemplary, actual implementation may differ)
  - » Pandaboard ES: Single Board Computer with 1.2GHz dual-core ARM Cortex-A9 OMAP4460, 1GB RAM, WiFi, Bluetooth, USB + case;
    - Cables: HDMI to DVI-D, U.FL-RPSMA;
    - BWZ3-RA: antenna 2400MHz;
    - Sandisk SDHC card 16GB;
    - Logitech C615 Full HD-webcam;
  - » Nexys™3 Spartan-6 FPGA Board;
  - » Basic microcontroller board
  - » Zigbee USB Module;

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WP3

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- Altium (11 lic.) + 2 Nanoboards;
- ProEngineer (11 lic.);
- 5 PCs.

Altium

Pro|ENGINEER

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WP3

Tempus

- Implementing a (virtual) learning environment in ESD eng
  - LMS (learning management system) - Wiki
    - open source
    - good practices list

moodle

DESIRE
25
12/01/2015
DesIRE

WP3

Tempus

- Implementing a (virtual) learning environment in ESD engineering
  - As much as possible materials will be bought locally in the TC
  - Master Class travels
  - Monitor self-study efficiency and knowledge gain

DESIRE
26
12/01/2015
DesIRE

Tempus

DesIRE

WP3

Tempus

- Implementing a (virtual) learning environment in ESD engineering
  - As much as possible materials will be bought locally in the TC
  - Master Class travels
  - Monitor self-study efficiency and knowledge gain

27 DESIRE 12/01/2015 DesIRE

WP3

Tempus

- Key performance parameters
  - stability and accessibility of the remote lab
  - active student and teacher usage
  - amount of key competences which can be trained with the e-learning environment
  - self-studying results of students
  - Results on hands-on lab

28 DESIRE 12/01/2015 DesIRE

WP3

- Needs
  - Template Report of Local Implementation
  - LMS (Moodle?)
  - Wiki-based Platform
  - Template Self-study Report
  - ESDL
  - REAL
  - Different labs in different HEIs
  - Template Report on KPI's

WP3

- Deliverables
  - 3.1 Establish LMS platform
  - 3.2 Virtual environment adoption in AM/GE/UA
  - 3.3 Construction of virtual and remote laboratories
  - 3.4 Construction of ESD laboratory

WP3

- Status
  - Altium: 20 licences, on-demand
    - Is this possible everywhere?
    - Demo on live.altium.com
  - 1 Nanoboard as a gift from Altium
  - Hands-on
    - Arduino
    - Raspberry PI
    - Cyclone V GX Starter Kit
    - Platform for DSP, embedded OS & embedded SW still needs to be determined

31 DESIRE 12/01/2015

WP3

- Status
  - Remote labs
    - Server + PCs offers
    - Labs has been chosen but all the same
    - Planning IUT?
  - Planning roadshows + implementations

32 DESIRE 12/01/2015

WP3

Tempus

- Status
  - Flowcode buggy

DESIRE 33 12/01/2015 DesIRE

WP4

Tempus

- Retrain academic teachers on ESD engineering and virtual learning platforms
  - training of the academic staff on the use of the courses and the virtual environment
  - 2 weeks course on ESD at P1
  - 2 weeks course on virtual learning systems and remote labs setup at P2
  - 1 week course on teaching methods at P3
  - Content: getting started course material, demonstration, theory and practical exercises, input from EU private companies

DESIRE 34 12/01/2015 DesIRE

WP4

Tempus

- Key performance parameters
  - ease of access to the new courses
  - measured according to the ease of reproduction of the viewed course material
  - quality of the academic staff present at these courses

35 DESIRE 12/01/2015 DesIRE

WP4

Tempus

- Needs
  - Accommodation
  - Travel
  - Agenda / P1-P3
  - Labs + infrastructure
  - Questionnaires + CV template for candidates
  - Template Report on KPI’s

36 DESIRE 12/01/2015 DesIRE

WP4

- Deliverables
  - 4.1 Retraining in "New teaching approaches in Eng."
  - 4.2 Retraining in "RL for ESD"
  - 4.3 Retraining in "ESD Engineering"

WP4

- Status
  - UKF halfway through
  - Report afterward (please fill in small questionnaire)
  - Reschedule summer courses TMM & IUT?

WP5

Tempus

- Pilot teaching/operation
  - definitive implementation of the new course material
  - dissemination of the course material with master classes in situ to a contact group of stakeholders
  - ambition:
    - 20 students,
    - 6 academic teachers,
    - 2 representatives of local enterprises
    - 2 representatives of public welfare

WP5

Tempus

- Pilot teaching/operation
  - present and demonstrate the new material and teaching infrastructure for creating a good insight in the starting and end competences attained
  - practical demos on expected results
  - train the trainer sessions organized within the target HEIs
  - a pilot group of students and stakeholders starts with complete courses, at least 4 in total.
  - evaluation is organized

WP5

- Key performance parameters
  - attendance of stakeholders
  - relevant questions during demos
  - activity of staff and students on the e-learning platform, virtual and remote labs
  - ease of adoption of the new courses is also important for sustained operation
  - attained grades and competences of the pilot group

41 DESIRE 12/01/2015

WP5

- Needs
  - Stakeholders (who, where, why)
  - Presentation - Demonstration
  - Train the trainer template / material
  - Peer training / assessment
  - Progress assessment pilot group (TC / EU)
  - Evaluation pilot group (TC / EU assessment)
  - Interviews teacher - students
  - E-conference teacher - teacher: Skype / Adobe Connect
  - Template Report on KPI's

42 DESIRE 12/01/2015

WP5

- Deliverables
  - 5.1 Master Classes in "ESD" in TC
  - 5.2 Master Classes in "RL usage for ESD" in TC
  - 5.3 Teaching the teachers and researchers in TC
  - 5.4 Educate the pilote student groups in TC

WP5

- Status
  - Status?
  - Syllabi?

WP6

Tempus

- Quality Assurance and Quality Control
  - high quality of results and smooth project implementation
  - monitoring strategies/methods
  - if quality differs from expected or if outcomes not achieved in time:
    - adjustment mechanisms are foreseen
    - conflict detection and resolving.

45 DESIRE 12/01/2015 DesIRE

WP6

Tempus

- Quality Assurance and Quality Control
  - PMT: appoint quality manager
  - quality manager will supervise:
    - comparison with timetable
    - evaluation of outcomes and their quality
      - questionnaire reports based on feedback reports from target students /academics/ stakeholders groups
      - students, graduates and researchers interviews
      - online evaluation

46 DESIRE 12/01/2015 DesIRE

WP6

Tempus

- Quality Assurance and Quality Control
  - P12 - as research institute - is an external expert
  - Viktor Kabatov, head of International technical center of JSC "Motor-Sich" is invited
  - inter project coaching as a part of external evaluation
  - expert's reports based on semester reports on project results

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47
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WP6

Tempus

- Quality Assurance and Quality Control
  - Milestones:
    - PMT appoint quality manager;
    - feedback, questionnaire, annual reports;
    - online evaluation in function;
    - report inter project coaching;
    - external Expert's reports. (6.1)

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48
12/01/2015
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WP6

Tempus

- Key performance parameters
  - number of quality meetings
  - number of quality reports
  - number of feedback reports
  - number of feedback participants
  - number of external Expert's reports
  - number of reports of inter project coaching
  - assessment of the developed curricula to be accepted by national bodies and by HEIs to be incorporated in the present day curricula

49 DESIRE 12/01/2015 DesIRE

WP6

Tempus

- Needs
  - Quality Plan: goals, expected + timing, evaluation, type of reports
  - Monitoring documents: questionnaires, feedback reports
  - Risk analysis + resolution
  - Planning, timely checking: semester reports
  - Online evaluation
  - Each meeting: evaluation form foreseen => input semester reports
  - Acceptance and implementation curricula
  - Template Report on KPI's

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WP6

Tempus

- Deliverables
  - 6.1 Establish the Quality Assurance Plan
  - 6.2 Inter-Tempus coaching
  - 6.3 Monitoring/Evaluation of processes and products
  - 6.4 Assessment at the regional and national level

51 DESIRE 12/01/2015 DesIRE

WP6

Tempus

- Status
  - There is no formal quality assurance scheme yet
  - It would be advisable to receive a quality report from the external experts each half year

52 DESIRE 12/01/2015 DesIRE

WP7

- Dissemination and Enterprise Collaboration
  - Action in TC is organized by P4-P12
  - reach out to the stakeholders (public, HEIs, industry)

53 DESIRE 12/01/2015

WP7

- Dissemination and Enterprise Collaboration
  - University-Enterprise Contact Group (UECG)
    - university
    - local stakeholders (chambers of commerce, services for unemployed)
    - regional industry.
  - Contact group:
    - information on the project
    - plan seminars on specialized modules open to industry workers and unemployed
    - special dissemination seminars and road shows

54 DESIRE 12/01/2015

WP7

- Dissemination and Enterprise Collaboration
  - local and national press and media to increase visibility
  - academic media (university journals to inform students and teachers at the TC HEI's

WP7

- Dissemination and Enterprise Collaboration
  - project website constructed and maintained to contain
    - project information
    - preliminary and final results
    - contact data
    - agenda's for seminars
    - secured section for developed teaching materials
    - public section: serve as a good practices collection.

WP7

- Key performance parameters

WP7

- Needs
  - Job description UECG
  - Planning + content seminars
  - Press releases
  - Papers in media
  - Project website
  - Posters - Flyers
  - Logo
  - Seminars & roadshows results
  - HEI - stakeholders agreements

WP7

- Deliverables
  - 7.1 Setup university-enterprise contact group (UECG)
  - 7.2 Maintenance dissemination and sustainability
  - 7.3 Dissemination in press and media
  - 7.4 Dissemination through web resources
  - 7.5 Seminars in target HEIs for industry workers
  - 7.6 Dissemination to enterprises

WP7

Tempus

- Status
  - Dissemination events have been organized
    - Needs a formal way to make this tangible
  - Articles written?
  - Website is outsourced
  - UECG?
  - More posters / flyers? 1 year results?
  - External interest (KZ, UG)

WP8

Tempus

- Management of the project
  - Forming the Project Management Team (PMT)
    - one representative from each consortium member
    - strategic decision-making body
    - at least 4 coordinating consortium meetings,
      - » one kick off,
      - » progress 1 & 2
      - » final conference

61 DESIRE 12/01/2015 DesIRE

WP8

Tempus

- Management of the project
  - Forming the Project Management Team (PMT)
    - work plan, milestones, different roles, intermediary results, planning and budgets
    - curative measures
    - sustained cooperation between partners and stakeholders after completion of the project
    - e-conferences: at least every half year
    - other communication e-mail, Skype and Dropbox
    - organizing local and regional meetings
    - reports: sent to the PMT, DMB and QM

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WP8

Tempus

- Management of the project
  - representative in the PMT: lead in the local project team
    - roll-out of the project in the local institution.

WP8

Tempus

- Management of the project
  - daily management: daily management board (DMB)
    - administration and secretarial services
    - controlling of timely work plan follow-up
    - monitoring of project budget
    - monitoring of the work packages status compared to the planned milestones,
    - identify potential problems and delays,
    - establish and implement eventual contingency plans,
    - monthly progress report to QM/PMT

WP8

Tempus

- Key performance parameters
  - establishment of the PMT, LPT and DMB
  - number of meetings of the different bodies
  - adoption of the work plan with dedicated milestones
  - number of progress report delivered on time

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WP8

Tempus

- Needs
  - PMT establishment + job description
  - Planning draft
  - Work plan draft
  - Milestones draft
  - Partner role draft
  - Reports on e-conferences
  - Local meetings reports

66 DESIRE 12/01/2015 DesIRE

WP8

- Needs
  - LPT establishment
  - DMB
  - Monthly report template
  - Contingency plan
  - Reports on lab implementation
  - Final evaluation form
  - Funding usage documents

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WP8

- Deliverables
  - 8.1 Approving plan and establish working bodies
  - 8.2 Monitoring plan and budget
  - 8.3 Coordination/consortium meetings
  - 8.4 Providing final analysis

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WP8

- Status
  - PMT, DMB established
  - Local project plans established
  - 1 kick-off meeting
  - 1 regional meeting
  - 1 consortium meeting (this one)
  - Communication is could be better
  - Plan Follow-up 1

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WP8

- Status
  - Staff costs?
  - Mobility reports
    - Accountancy per person

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CONTACT
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71
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Tempus DesIRE

APPLICATION OF REMOTE EXPERIMENTS IN EDUCATION

Summer Course Nitra
15-21 September, 2014

Mgr. Peter Kuna, PhD.

Tempus DesIRE

CONTENT OF PRESENTATION

- Selected didactic aspects of the use of remote experiments in learning process.
- Selected technical aspects of construction remote experiments.
- Our experience with design, construction and using our own remote experiment.

2

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Mgr. Peter Kuna, PhD.

Tempus DesIRE

SELECTED DIDACTIC ASPECTS OF THE USE OF REMOTE (REAL) EXPERIMENTS IN LEARNING PROCESS.

Mgr. Peter Kuna, PhD.

Tempus DesIRE

When you were a student, did you like the experiments in learning process?

And why ?

Experiments were:

- **something other than the normal lesson**
- **interesting**
- **not just the boring theory**
- **visual and easier to understand the curriculum of study**

... and etc.

Mgr. Peter Kuna, PhD.

Experiments are extremely important part of the educational process !

Because the experiments are "a window" to real life for students.

How many experiments did you prepare for your students in last year?

Reasons, why we did not prepare more experiments for our students.

- expensive equipment,
- lack of time to prepare,
- demotivating salary of teachers,
- dangerous for the health of students, (e.g. chemical experiments)
- ... Etc.

Tempus DesIRE

Statistics of percentage

Approximately 40 % of my own experiments were not successful. (I didn't reach expected results)

What are the reasons?

Tempus DesIRE

REASONS

1. **I am not very successful experimental scientist. ☺**
2. **Measurement error.**
3. **Repeating of experiment with another group of students influences the results of experiment.**
4. **External influences on process of experiment.**
   ... etc

Tempus DesIRE

Experiment is very uncomfortable part of teaching process.

Because we never know, if the experiment is successful. !

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Tempus DesIRE

Let us not forget, that experiment is "a window" to real life for our students.

Let me ask you, how many things in your life are the same than in your dreams?

Honest experiments with all danger for teachers are the best preparation for our students to real life.

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Tempus DesIRE

The use of experiments in education requires teacher which is:

- personality in his field
- prepared to improvise
- depends on preparing his students for real life

This is difficult, but it is not mission impossible.

Tempus DesIRE

The use of remote experiments in education solves a lot of mentioned problems with real experiments.

- We don't need a lot of time to prepare them. (from the user's perspective, of course)
- Remote experiment is cheaper than real experiment.
- Students can use it at home.
- Remote experiment is safe to use by students.
- Remote experiment is safe to use by teachers. (It doesn't create various surprises for the teachers)


Tempus
DesIRE
RE doesn't create various surprises for the teachers
Selected technical aspects of construction RE.
13
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Tempus
DesIRE
Hardware and software of remote experiment must ensure that it will be use only in specified dimensions.
Remote experiments are, unlike the real experiments, very comfortable part of education.
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Tempus DesIRE

Experiment is "a window" to real life for our students.

Hardware and software of remote experiment must ensure that it will be use only in specified dimensions.

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Tempus DesIRE

To be or not to be?

Hamlet

To use the remote experiments in education or not to use.

Peter Kuna

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Tempus
DesIRE
What is material, personal and financial coverage of our schools (in your country) at present?
After reflecting the situation in Slovak republic, my answer is …. (thrilling silence ☺)
17
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Tempus
DesIRE
YES
Let us not forget, that experiment is “a window” to real life for our students.
and remote experiments are not the best solution as a “window” to real life for our students.
(from didactics perspective)
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Tempus DesIRE

OUR EXPERIENCE WITH DESIGN, CONSTRUCTION AND USING OUR OWN REMOTE EXPERIMENT.

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Tempus DesIRE

DESIGNED AND CONSTRUCTED THE REMOTE EXPERIMENT FOR TESTING OF THE BERNOULLI FORMULA

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Mgr. Peter Kuna, PhD.

View of realized remote experiment

A few problems of design and construction of this RE.

1. **Incompatible constructing frame with industrial measuring the flow rate of fluid.**
2. **Constructing frame, could not manage speed of three phases motor.**
3. **Construction frame, which was designed for use was inapplicable to our goals**

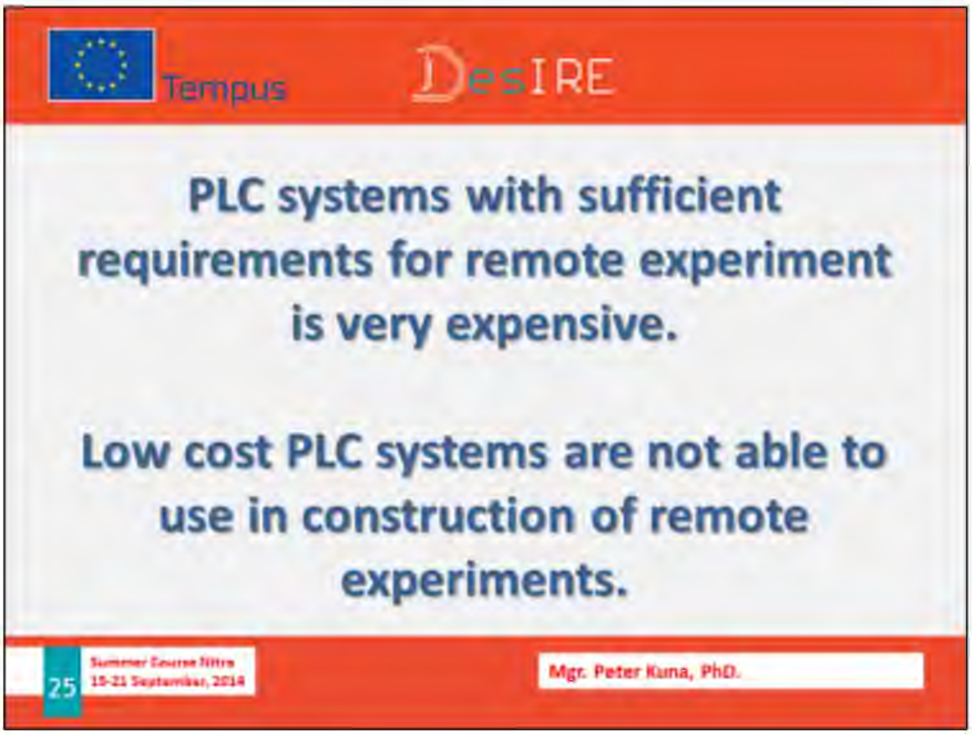
Tempus DesIRE

Remote experiment is remote control industrial automatic system.

We can use a huge number of components developed for industrial automation

Tempus DesIRE

PLC – Programmable Logic Controller


Tempus
DesIRE
PLC systems with sufficient requirements for remote experiment is very expensive.
Low cost PLC systems are not able to use in construction of remote experiments.
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DesIRE
We have found the following solutions:
We prepared to use for RE constructing the low cost PLC system, only by our software upgrade.
(with nothing hardware parts)
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Tempus
DesIRE
Result
So far, the company in question materially supported our research approximately the amount of € 40,000
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Tempus
DesIRE
THIS RESULTS ARE RESULTS OF WORK OF OUR TEAM
BIG THANKS, THAT I AM ABLE TO WORK WITH SUCH EXPERTS AND AMAZING PEOPLE
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Tempus

DesIRE


Tempus
DesIRE
CNC TECHNOLOGY
AS A MOTIVATION ELEMENT
IN PRIMARY SCHOOL
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Tempus
DesIRE
2
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Tempus DesIRE

Tempus DesIRE

COMPUTERS AND INFORMATION TECHNOLOGY ARE VERY SUCCESSFULLY MOTIVATED ELEMENTS FOR PUPILS.

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Tempus DesIRE

We have (in Slovakia) this paradox:

Our children like to use the computers and IT, but don't like to study the technical subjects.

We want use the little CNC machines in primary school for improve the motivation of children for study and for interest to technical subjects.

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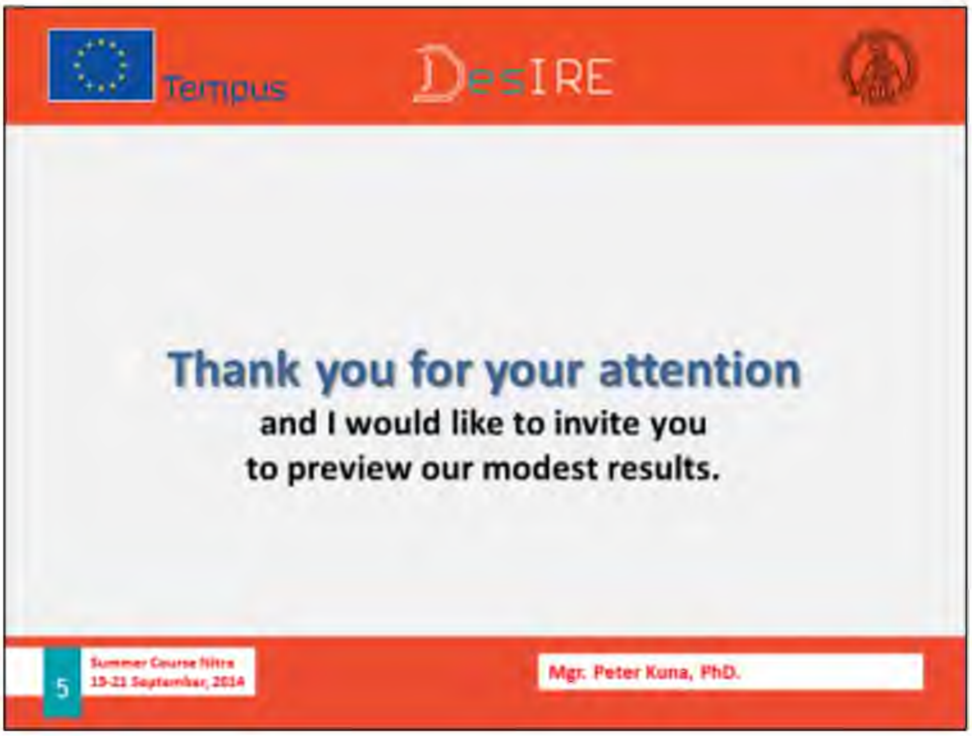
Thank you for your attention
and I would like to invite you
to preview our modest results.
5
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Tempus
DesIRE
?
A
B
C
D
E
F
examples of teaching
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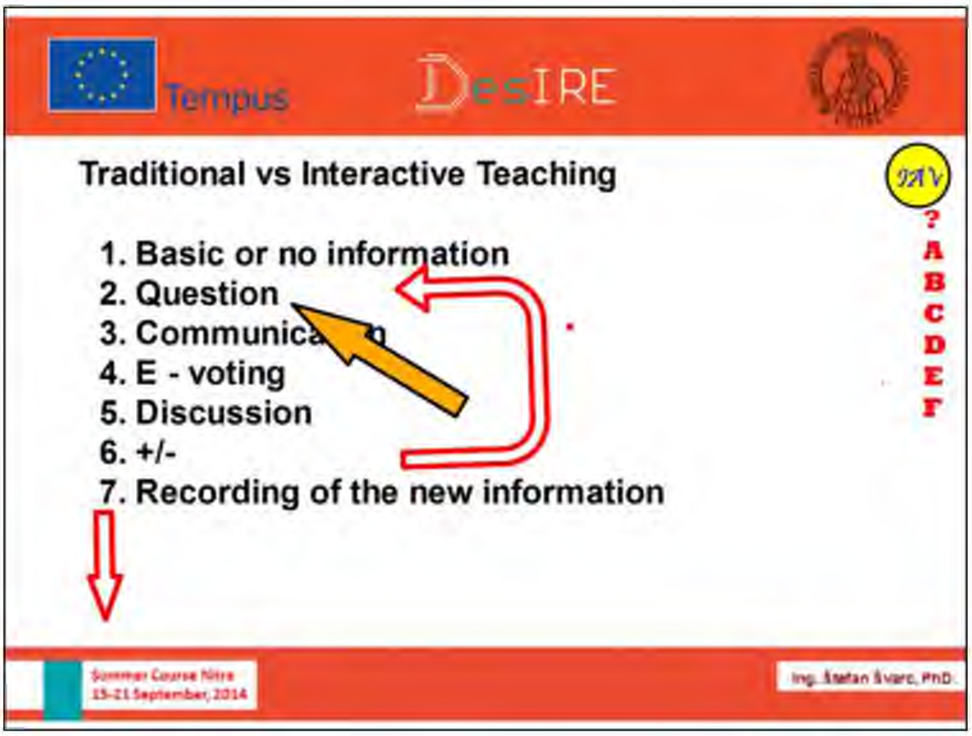
Tempus
DesIRE
Traditional vs Interactive Teaching
?
A
B
C
D
E
F
1. Basic or no information
2. Question
3. Communication
4. E - voting
5. Discussion
6. +/-
7. Recording of the new information
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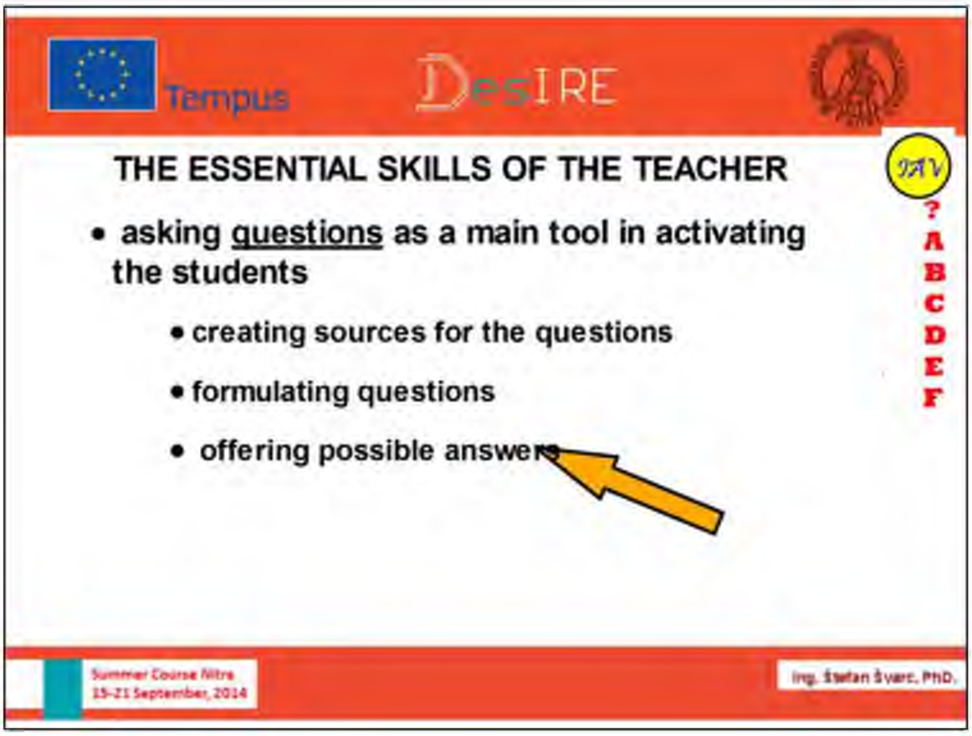
Tempus
DesIRE
THE ESSENTIAL SKILLS OF THE TEACHER
• asking questions as a main tool in activating the students
• creating sources for the questions
• formulating questions
• offering possible answers
? A B C D E F
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DesIRE
FORMULÁCIA ÚLOH -štandardné vyučovanie
Формулировка задач – стандартное обучение
calculate вычисли
judge обсудите
find найдите
choose выберите
compare сравните
connect соедините
separate отделите
group сгруппируйте
sort упорядочьте
sort сортируйте
substitute вложите
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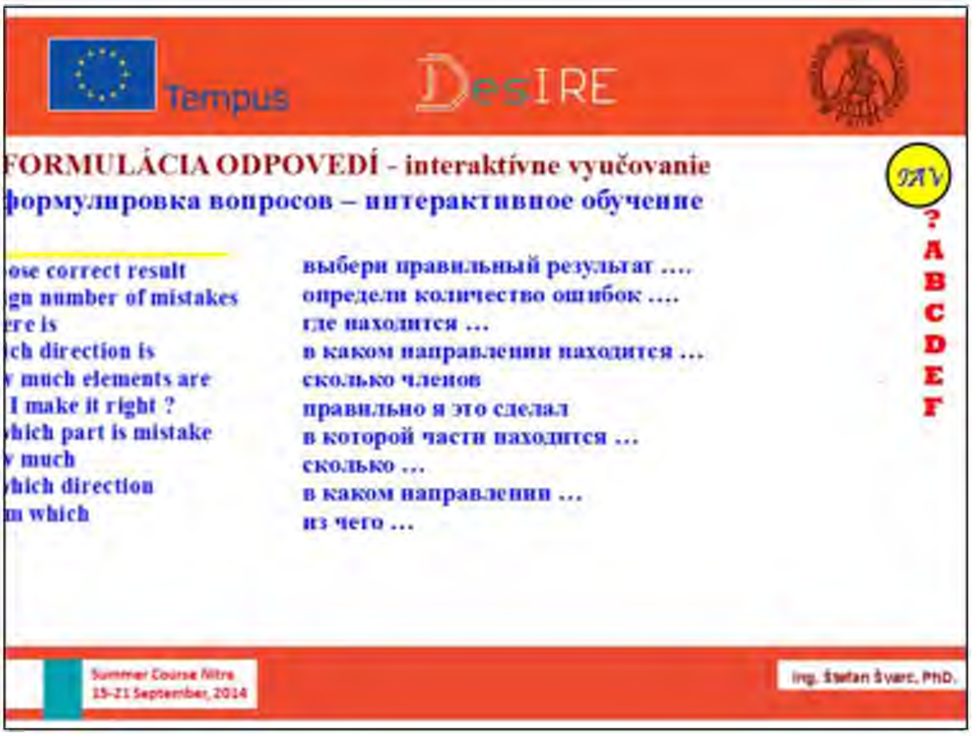
Tempus
DesIRE
FORMULÁCIA ODPOVEDÍ - interaktívne vyučovanie
формулировка вопросов – интерактивное обучение
IAV
?
A
B
C
D
E
F
ose correct result
gn number of mistakes
ere is
ich direction is
much elements are
I make it right ?
hich part is mistake
much
hich direction
m which
выбери правильный результат ….
определи количество ошибок ….
где находится …
в каком направлении находится …
сколько членов
правильно я это сделал
в которой части находится …
сколько …
в каком направлении …
из чего …
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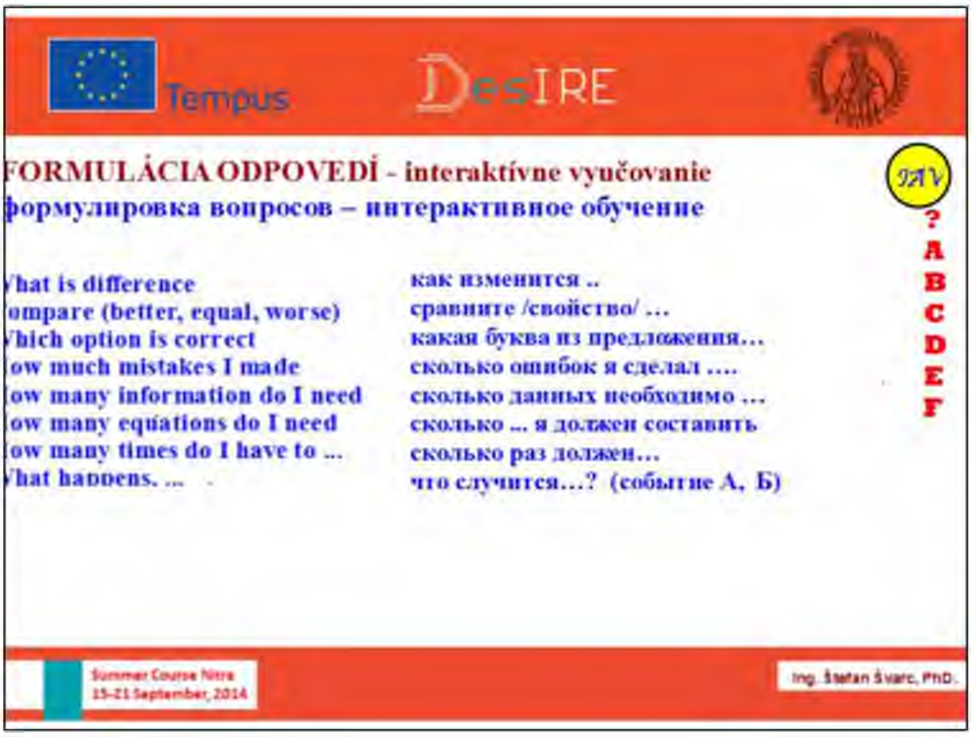
Tempus
DesIRE
FORMULÁCIA ODPOVEDÍ - interaktívne vyučovanie
формулировка вопросов – интерактивное обучение
IAV
?
A
B
C
D
E
F
hat is difference
ompare (better, equal, worse)
hich option is correct
ow much mistakes I made
ow many information do I need
ow many equations do I need
ow many times do I have to ...
hat happens. ...
как изменится ..
сравните /свойство/ …
какая буква из предложения…
сколько ошибок я сделал ….
сколько данных необходимо …
сколько ... я должен составить
сколько раз должен…
что случится…? (событие А, Б)
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2) Máloolejové - zhášanie oblúka je zabezpečené olejom, ktorý sa pohybuje pozdĺžne alebo kolmo na oblúk.

Pohyb oleja je spôsobený zapĺňaním prázdneho priestoru po odparenom oleji.

3) Tlakovzdušné - zhášajú oblúk stlačeným vzduchom, ktorý sa vháňa do priestoru medzi kontakty.

Elektrický oblúk je vháňaný do zhášacej komory, kde sa na opaľovacej mreži roztriešti, ochladí a zhasne.

4) Plynové - na zhášanie oblúka sa používa hexafluorid sírový SF_6, ktorý sa rýchlo viaže s voľnými elektrónmi v oblúku, čím sa značne znižuje elektrická vodivosť prostredia, v ktorom oblúk horí.

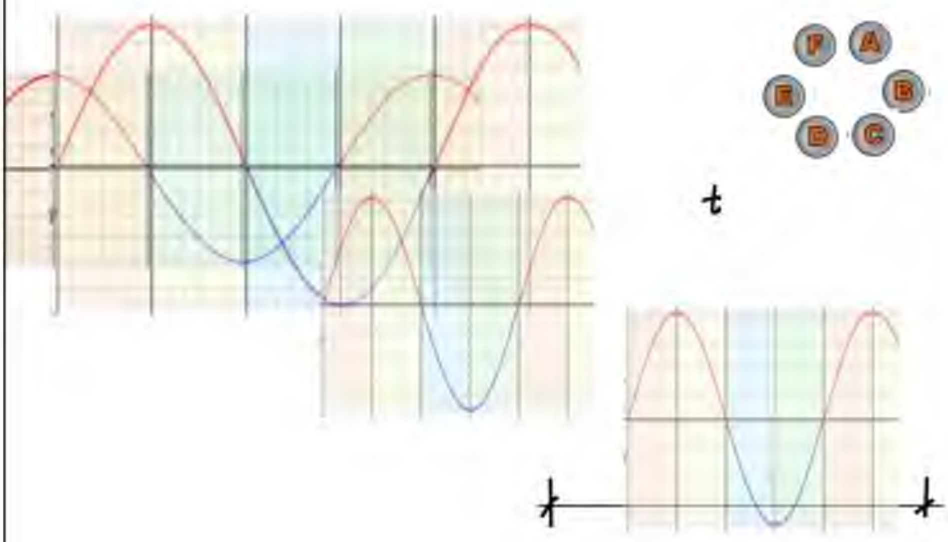
Oblúk sa prerušuje v zavretej komore bez vypúšťania plynu do atmosféry.

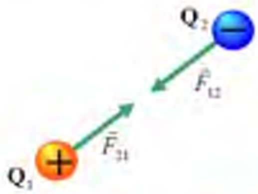
5) Plynotvorné - zhášanie oblúka je zabezpečené plynmi, ktoré sa vyvinú pôsobením oblúka na plynotvorný materiál.

Pri vypnutí vypínača vznikne veľké množstvo plynov, ktoré pri unikaní z priestoru zhášacej komory odnímajú teplo oblúku.

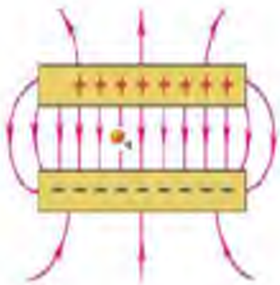
Pri prechode prúdu nulou oblúk zhasne.

Táto publikácia bola podporená



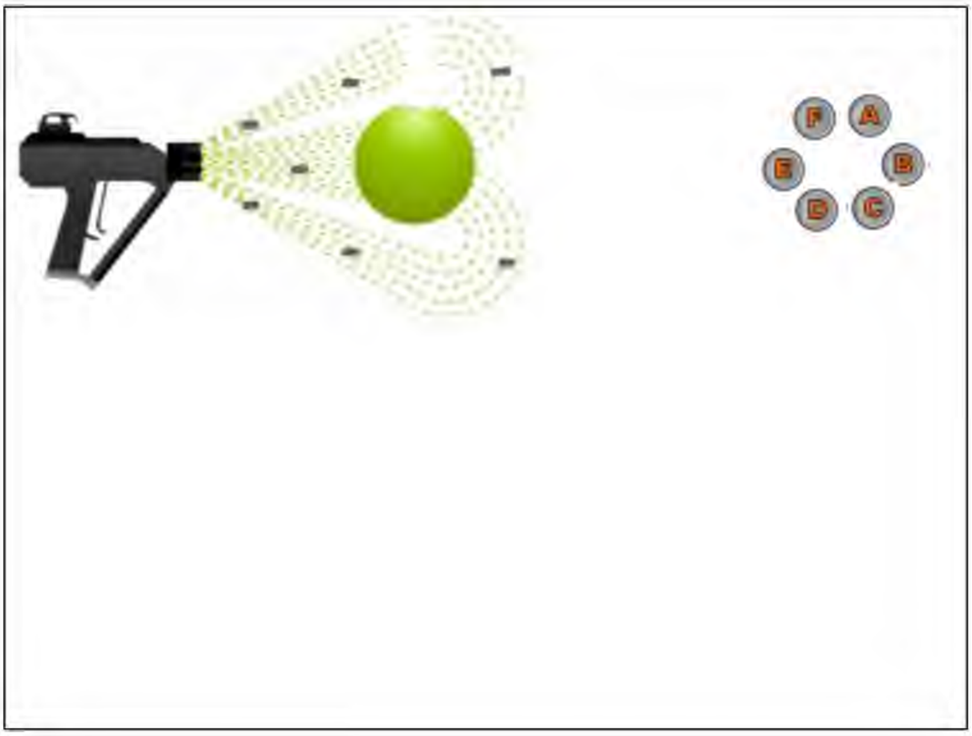


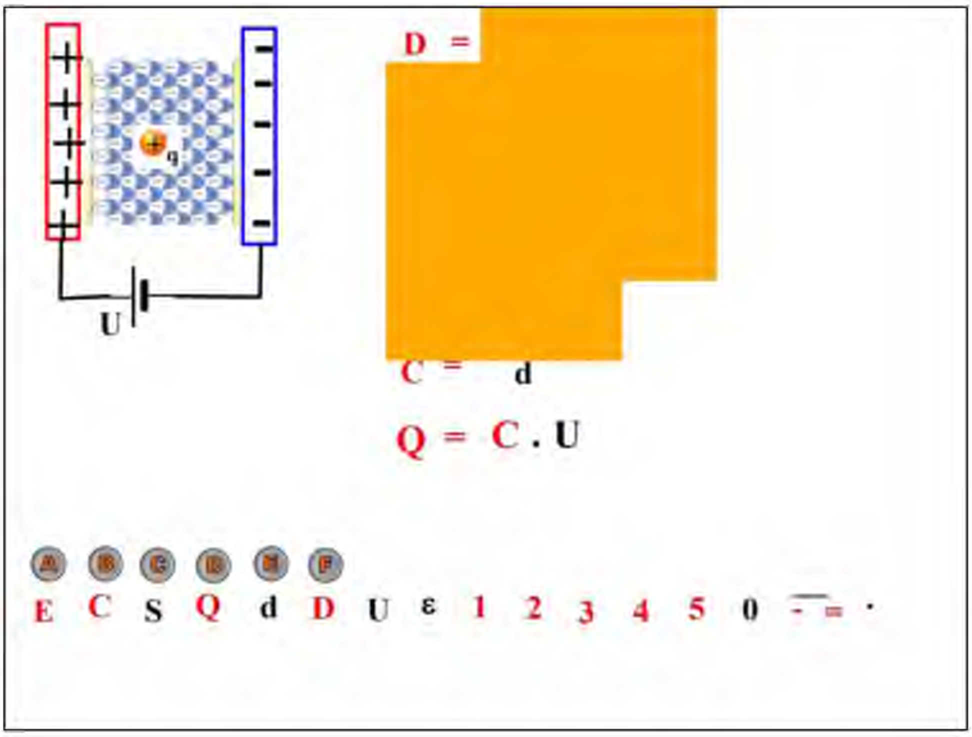
$F = Q_1.Q_2.r$

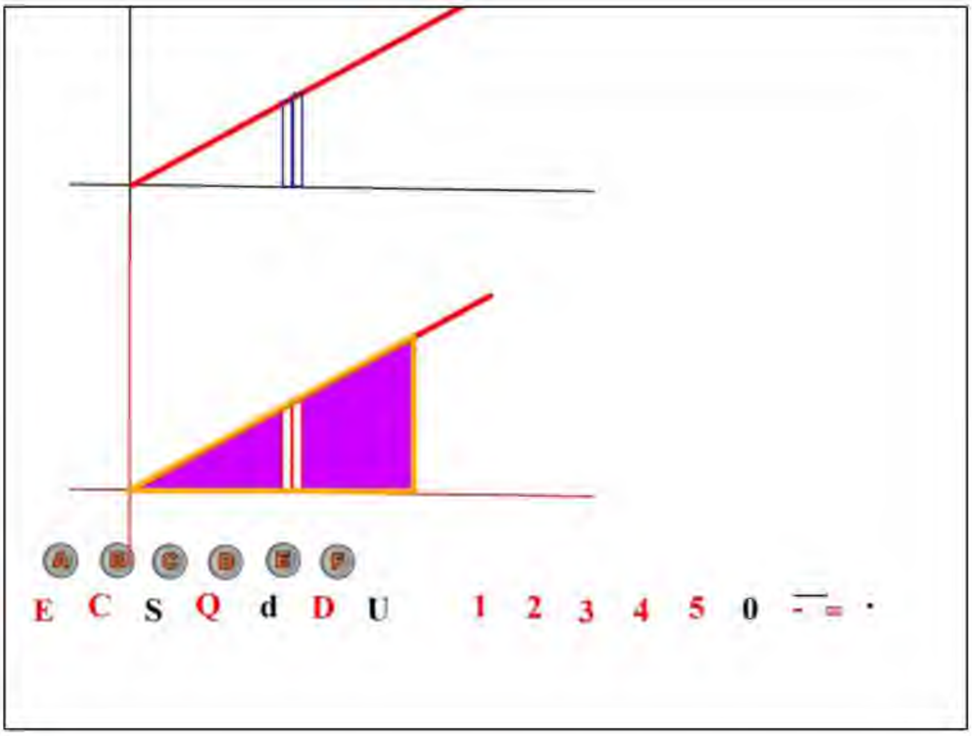


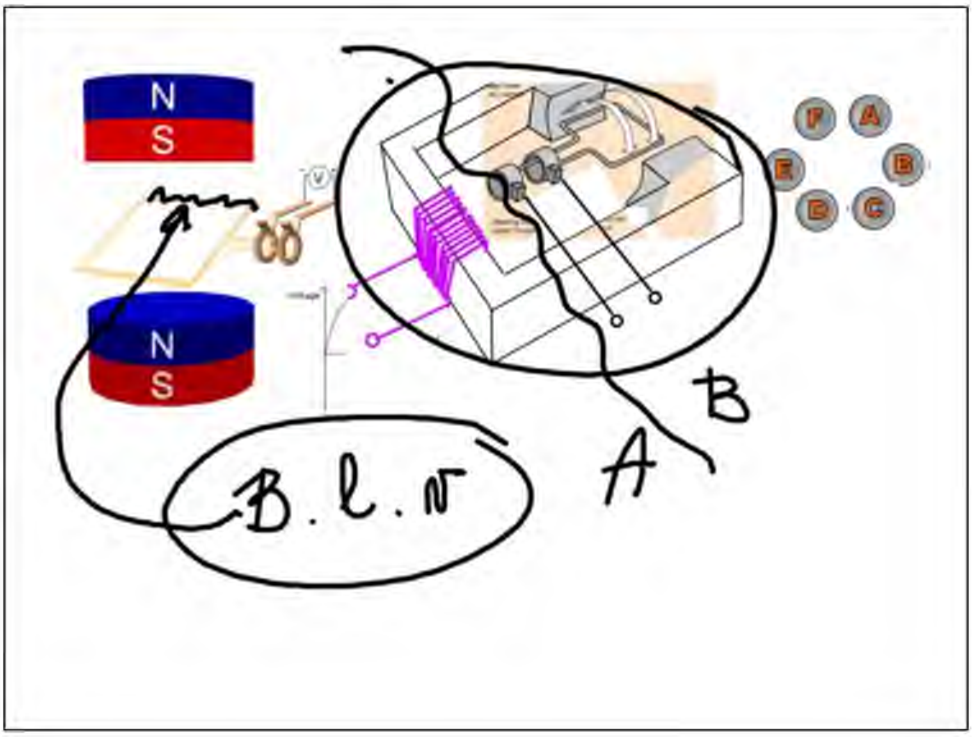
A B C D E F

$s\ \Delta\ V\ r_2\ (\ q\ \ U\ \ V_1 E\ )\ \ r\ \ r_1\ \ F$

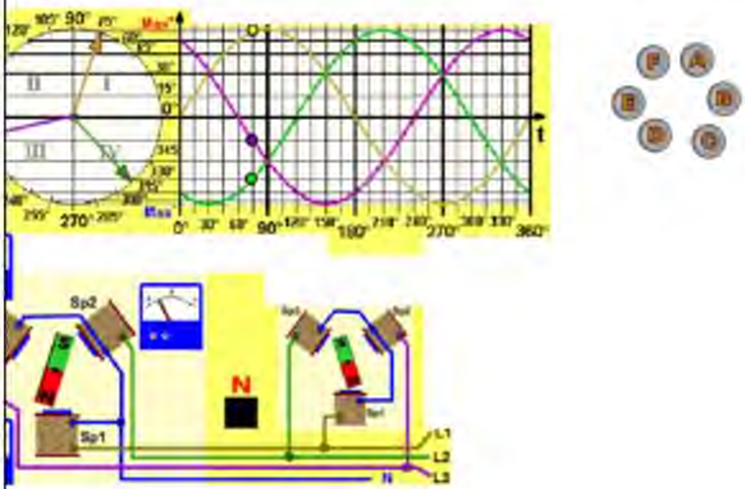

F
A
E
B
D
C

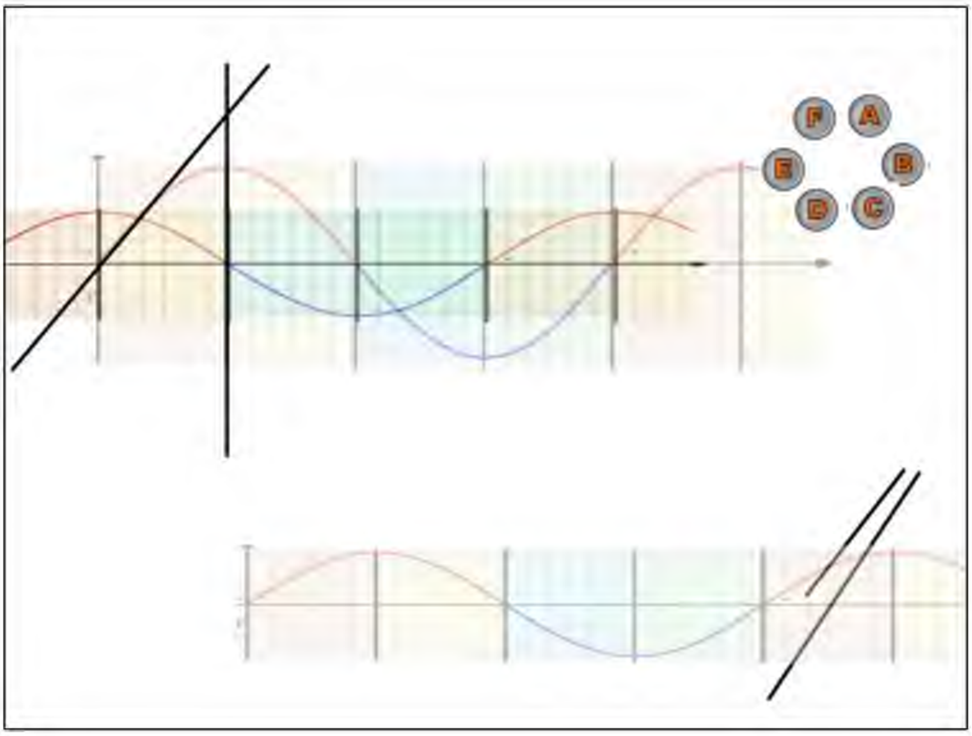

U
q
D =
C = d
Q = C . U
E C S Q d D U ε 1 2 3 4 5 0 - = ·

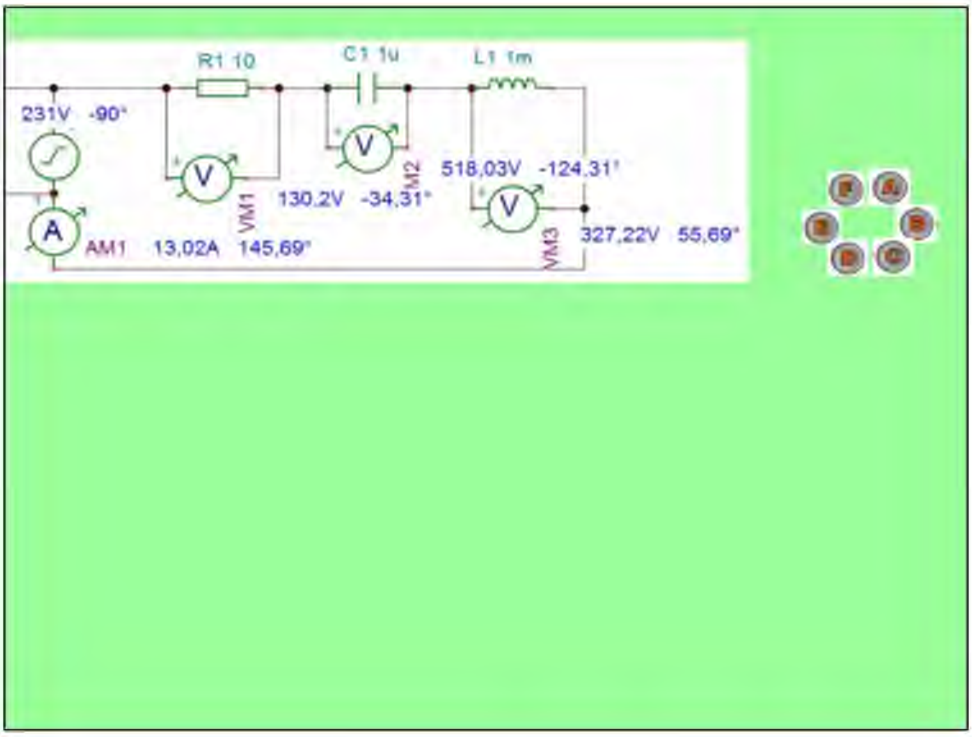

A B C D E F
E C S Q d D U 1 2 3 4 5 0 - = ·

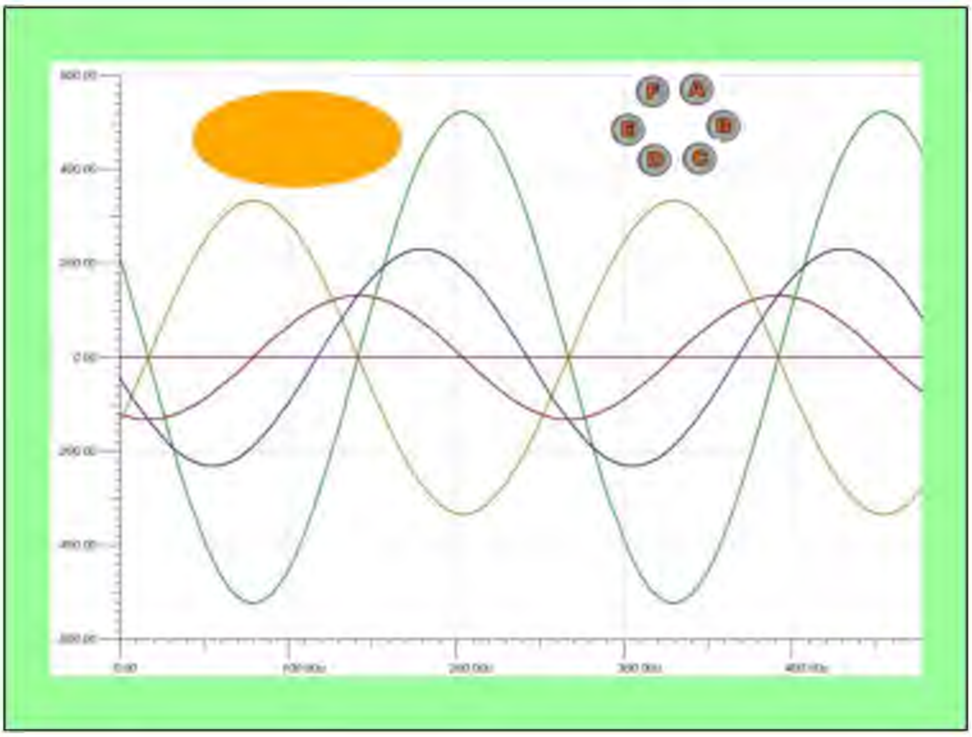

N
S
N
S
F A E B D C
B.l.v
A
B

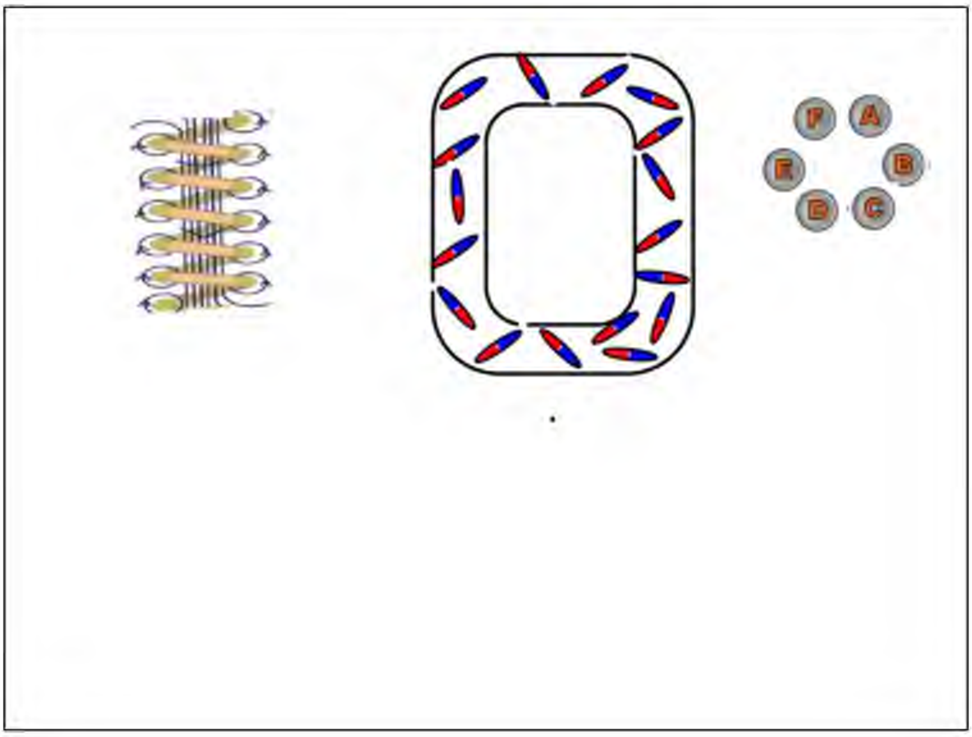

I
II
III
IV
t
0°
90°
180°
270°
360°

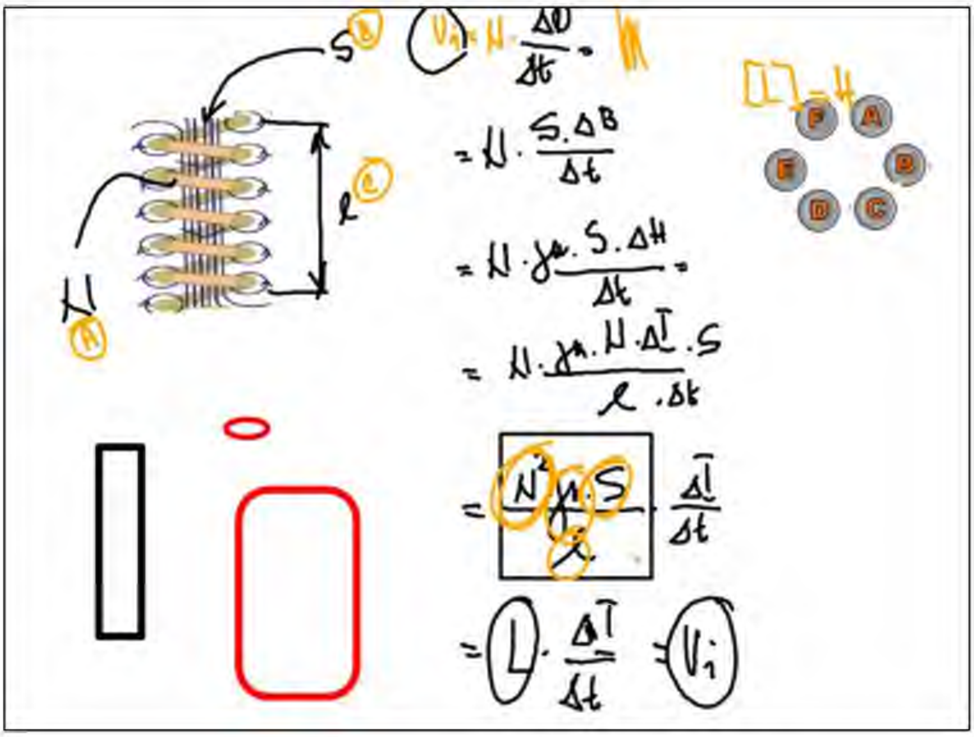

t
0°
90°
180°
270°
360°
Sp2
Sp1
N
L1
L2
L3

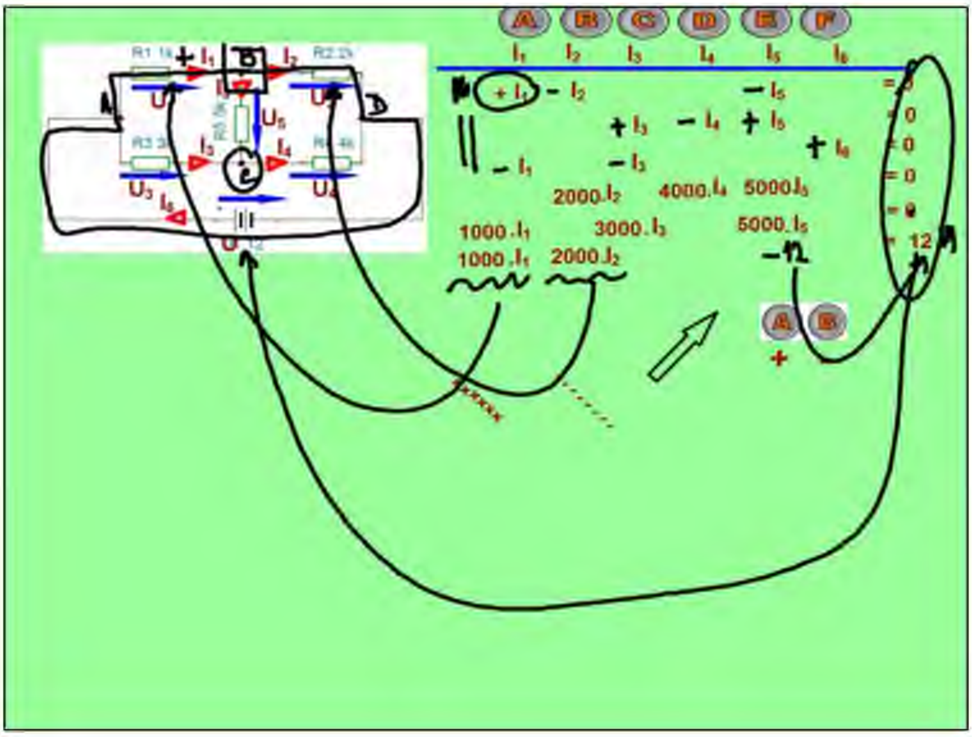


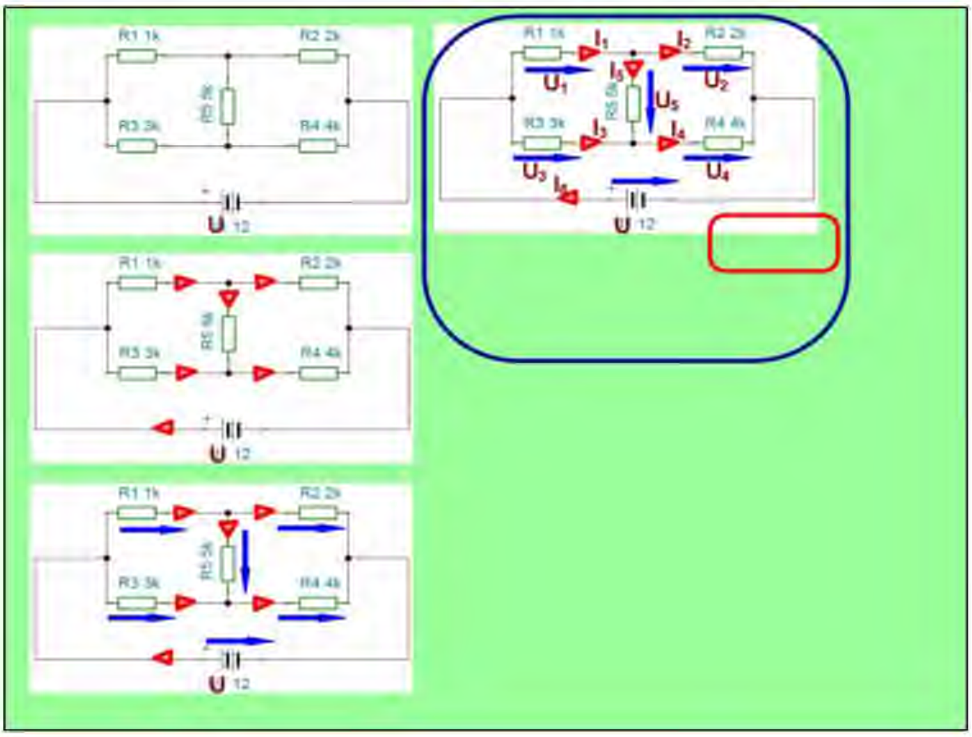

R1 10
C1 1u
L1 1m
231V -90°
518,03V -124,31°
130,2V -34,31°
AM1 13,02A 145,69°
327,22V 55,69°
VM1
VM3

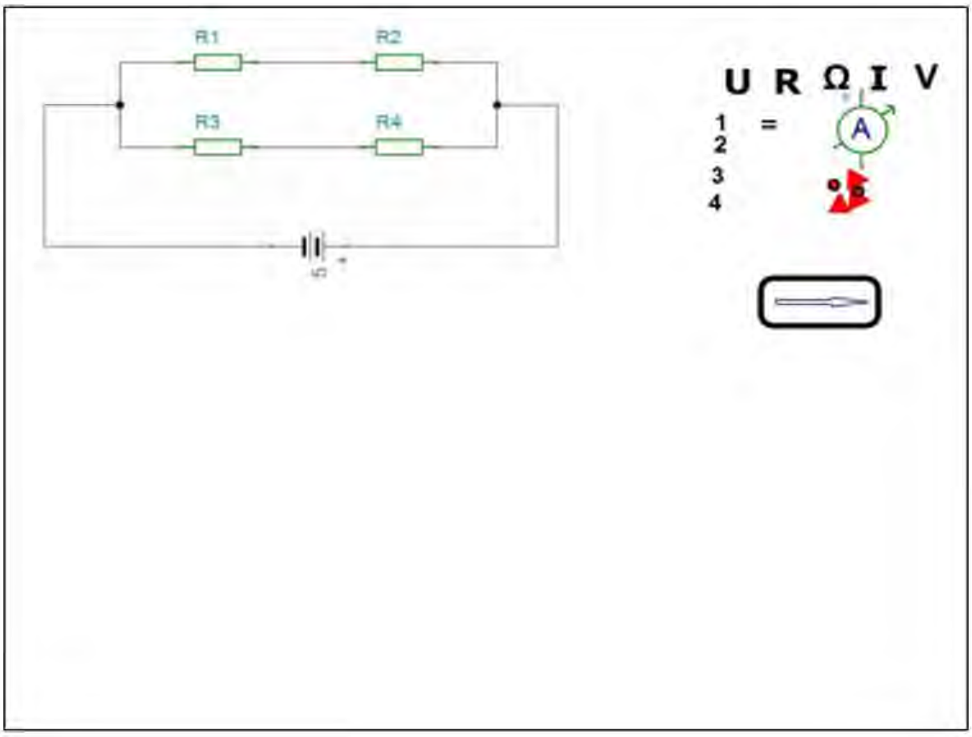

F
A
E
B
D
C

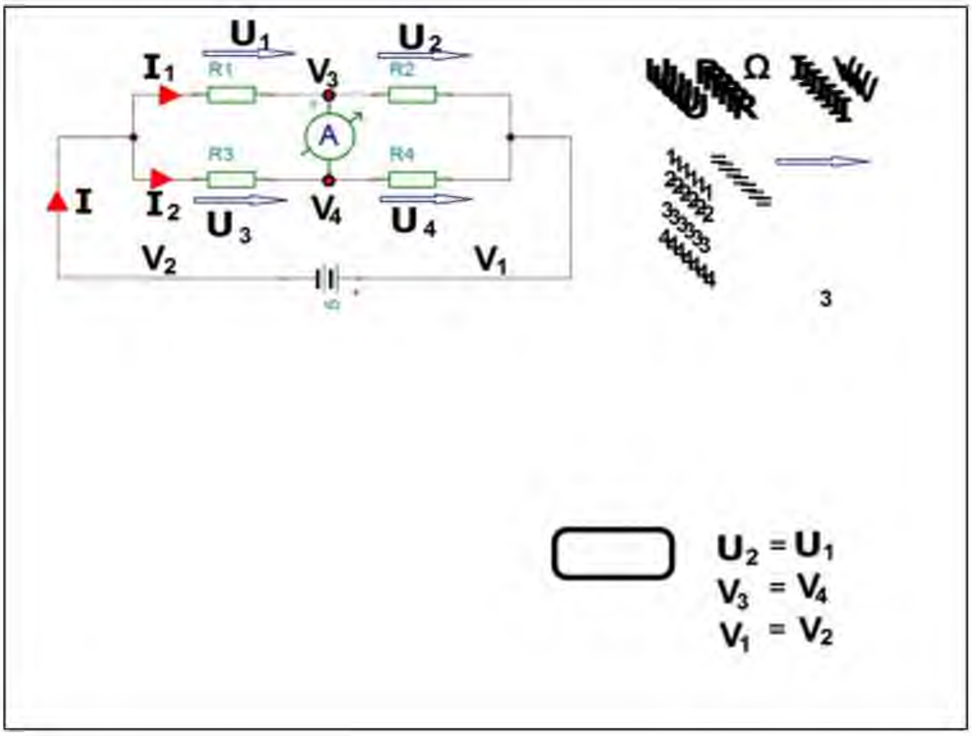

F
A
E
B
D
C

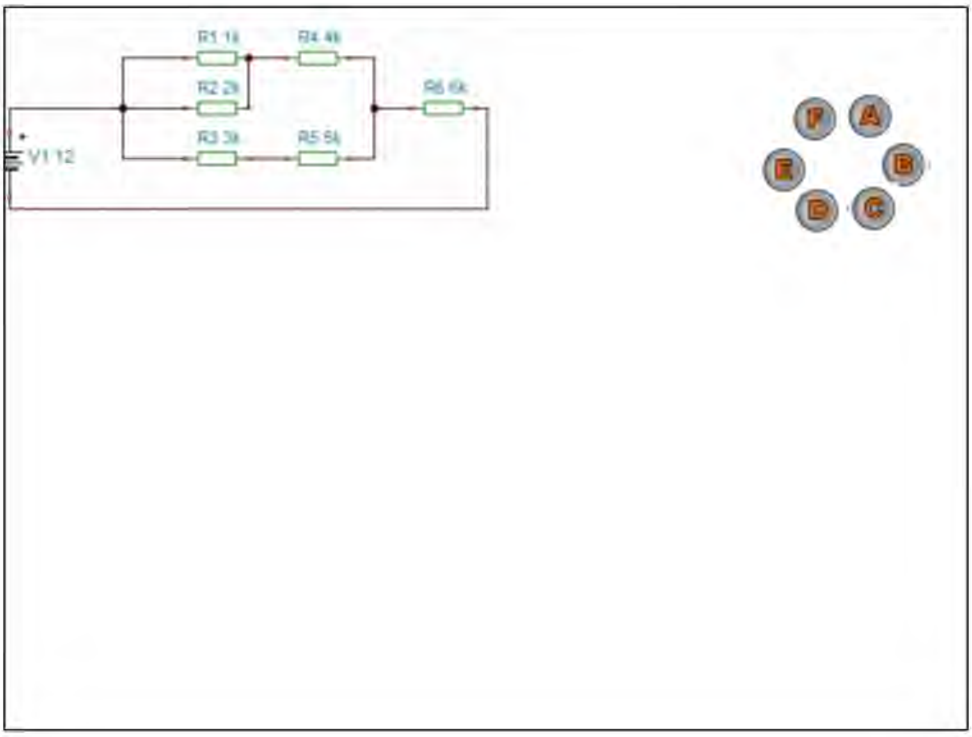


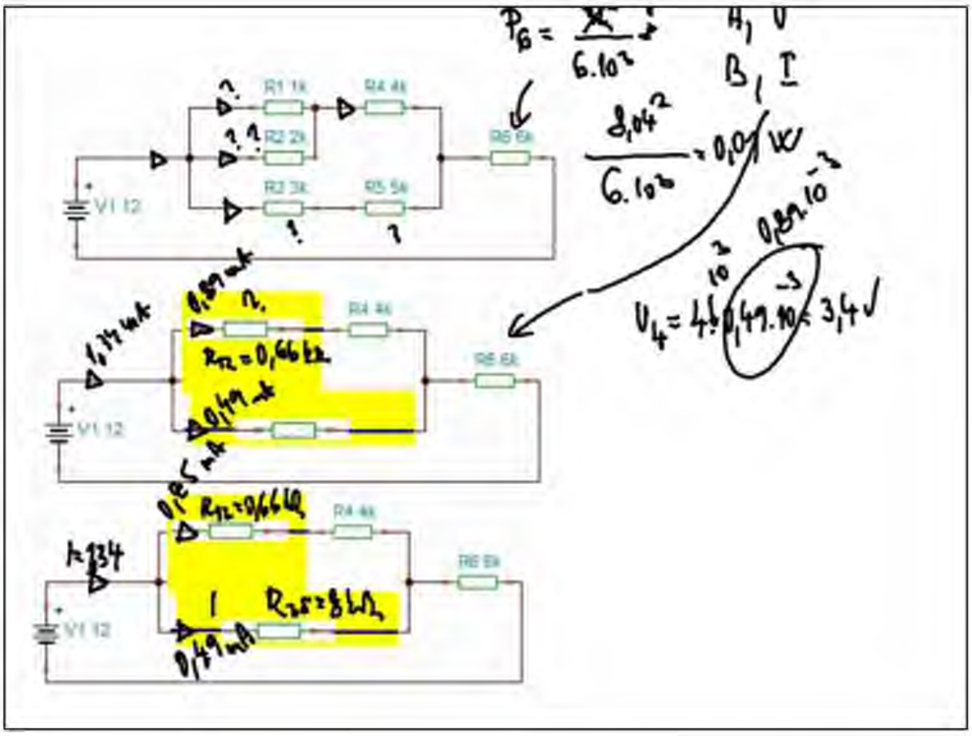

A B C D E F
I1 I2 I3 I4 I5 I6
2000.I2 4000.I4 5000I5
1000.I1 3000.I3 5000.I5
1000.I1 2000.I2

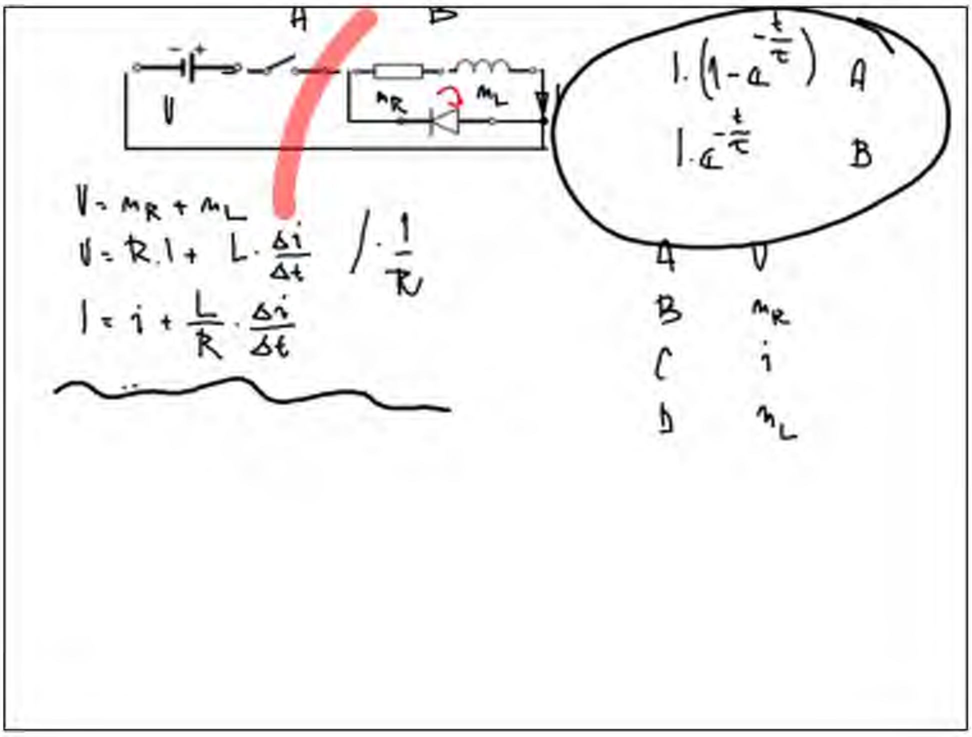

R1 1k
R2 2k
R3 3k
R4 4k
R5 5k
U 12
U1
U2
U3
U4
U5
I1
I2
I3
I4
I5
I6

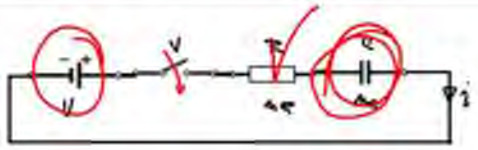

R1
R2
R3
R4
U R Ω I V
1 =
2
3
4
A


U1
U2
I1
R1
V3
R2
A
R3
R4
I
I2
U3
V4
U4
V2
V1
5
Ω
3
U2 = U1
V3 = V4
V1 = V2


R1 1k
R4 4k
R2 2k
R6 6k
R3 3k
R5 5k
V1 12
F
A
E
B
D
C


R1 1k
R4 4k
R2 2k
R6 6k
R3 3k
R5 5k
V1 12


V = uR + uL
V = R.I + L·Δi/Δt
I = i + L/R·Δi/Δt



$$Q = C \cdot U$$

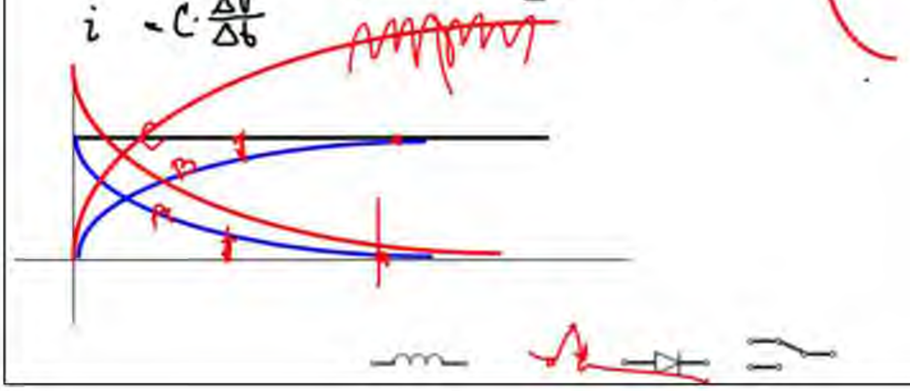
$$\frac{\Delta Q}{\Delta t} = C \cdot \frac{\Delta U}{\Delta t}$$

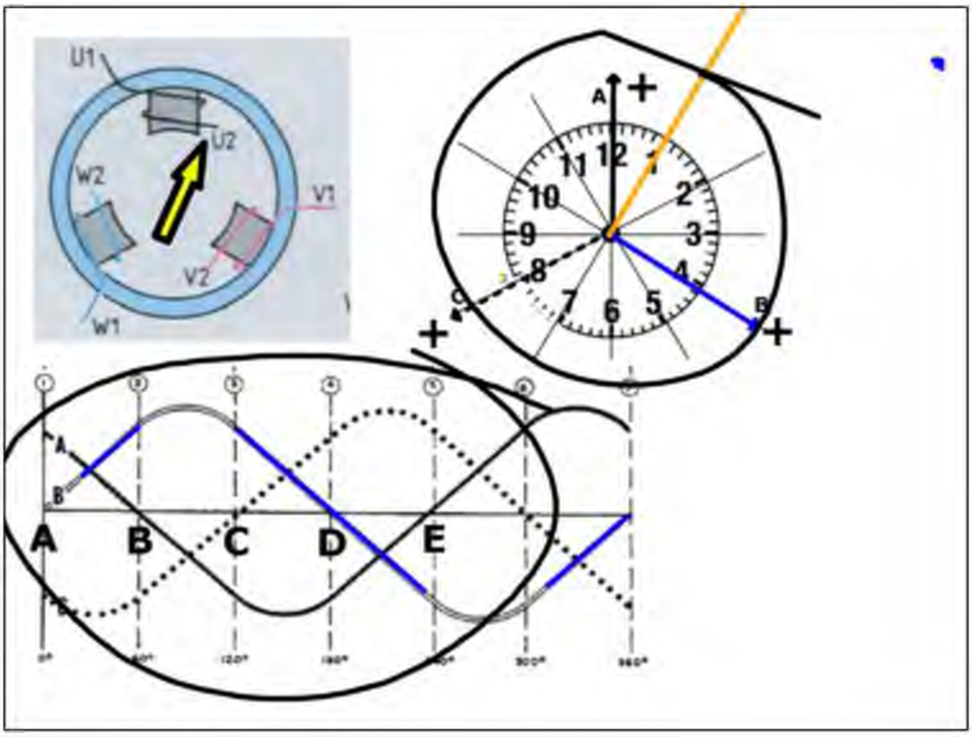
$$i = C \cdot \frac{\Delta U}{\Delta t}$$

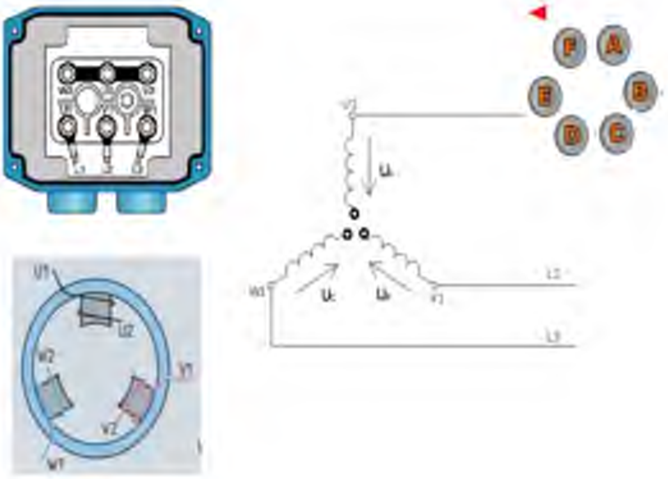
$$U = u_R + u_C$$

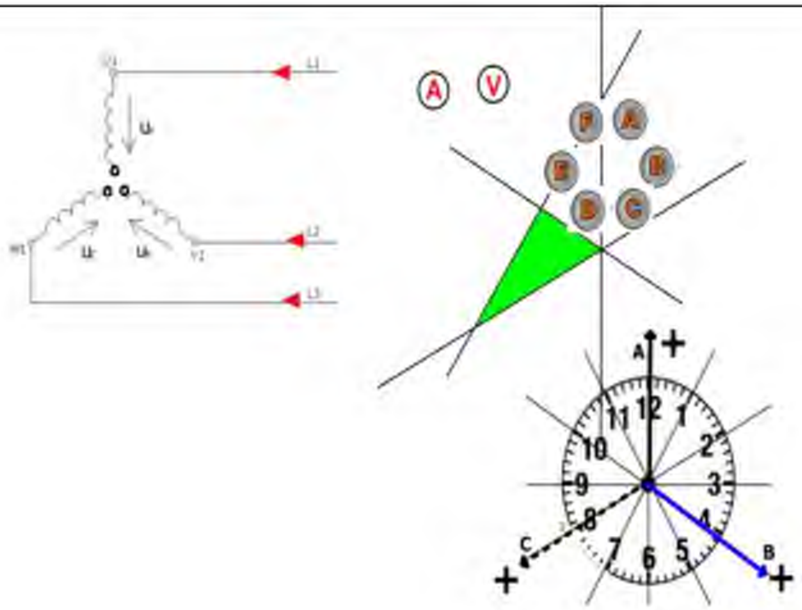
$$U = R \cdot i + u_C$$

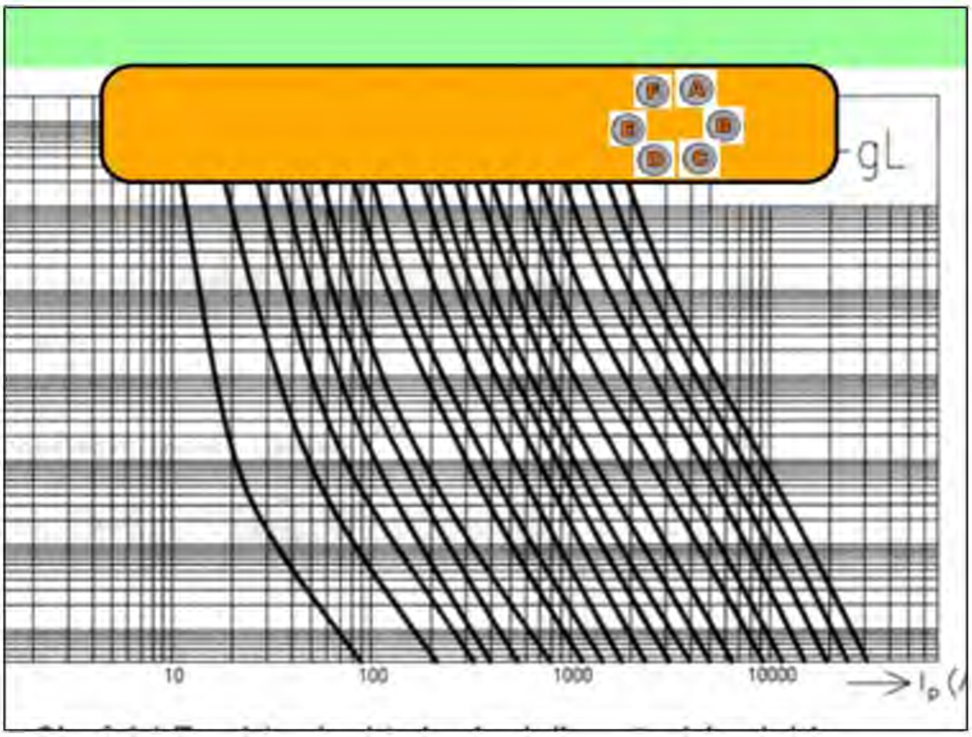
$$U = R \cdot C \cdot \frac{\Delta U}{\Delta t} + u_C$$

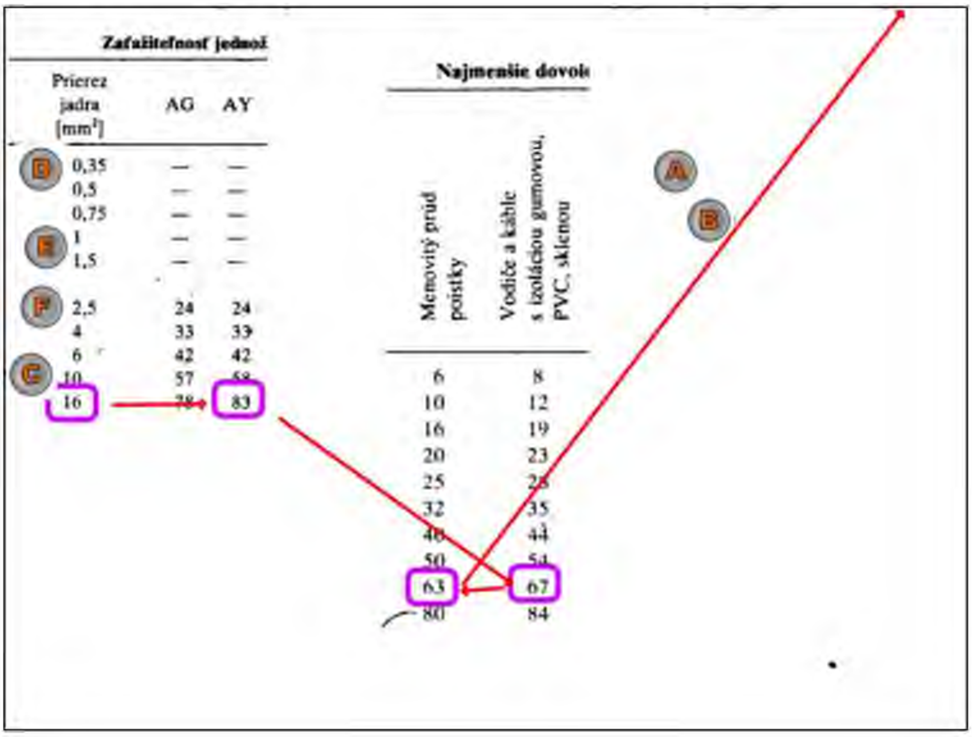





U1
U2
V1
V2
W1
W2
L2
L3
F
A
E
B
D
C


L1
L2
L3
W1
V1
A
V
F
A
E
B
D
C
A
B
C
12
1
2
3
4
5
6
7
8
9
10
11



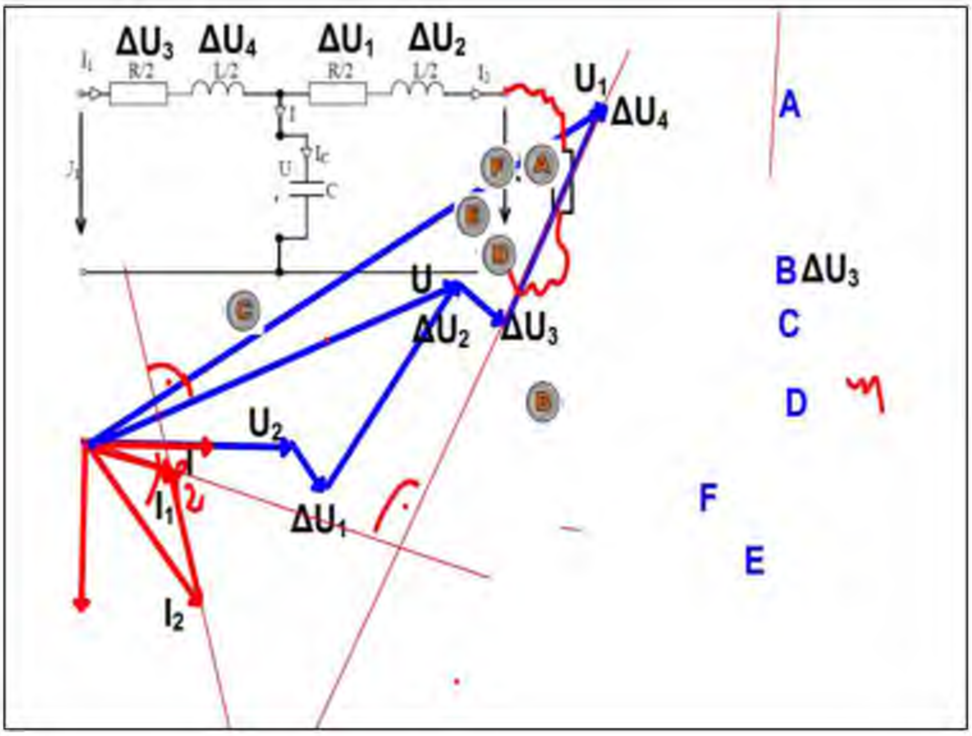


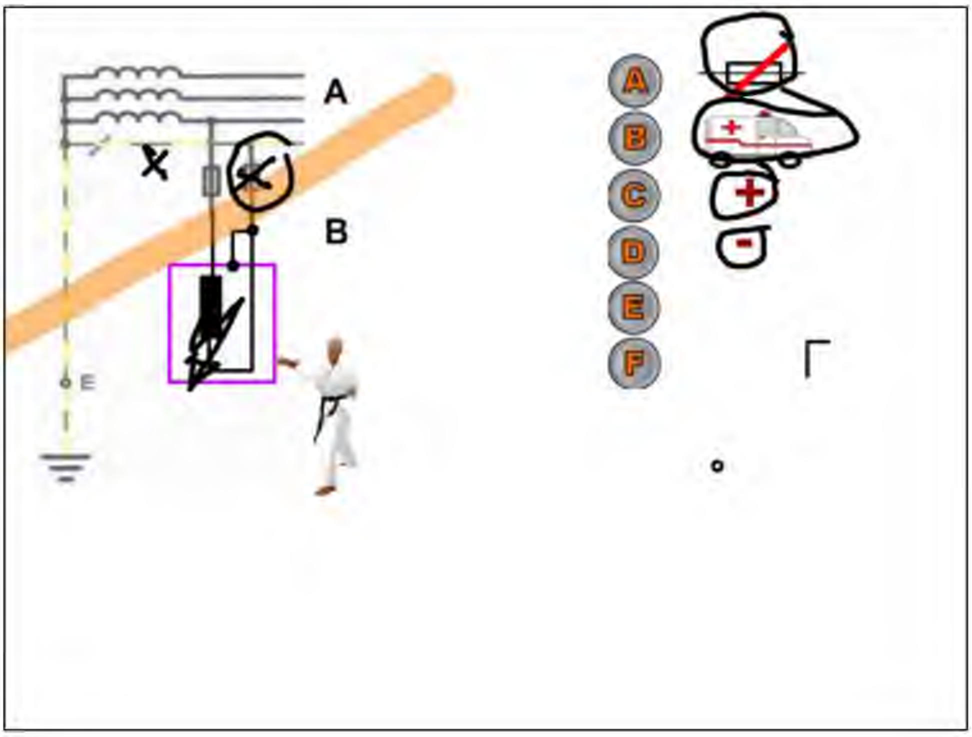
Zaťažiteľnosť jednož

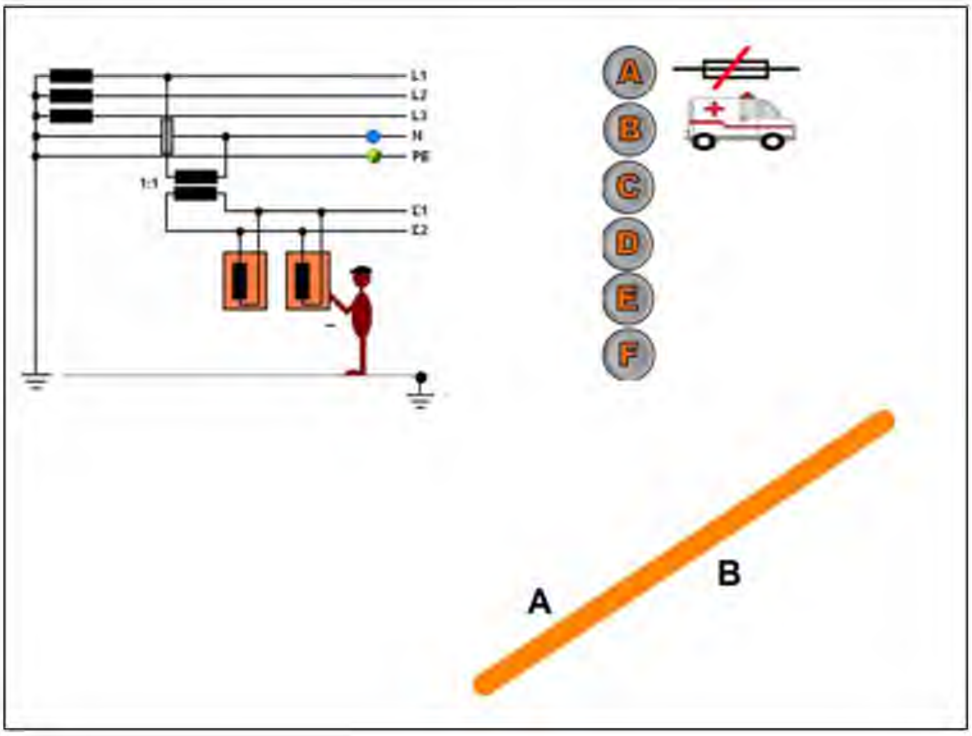
Prierez jadra [mm²]	AG	AY
0,35	—	—
0,5	—	—
0,75	—	—
1	—	—
1,5	—	—
2,5	24	24
4	33	33
6	42	42
10	57	[illegible]
16	78	83

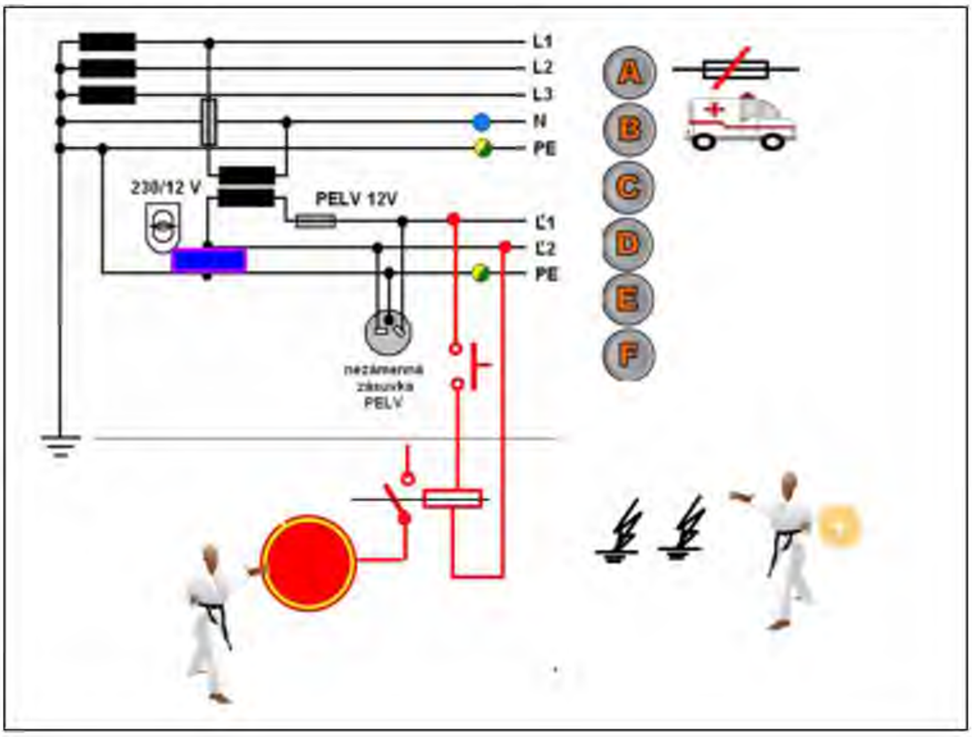
Najmenšie dovol

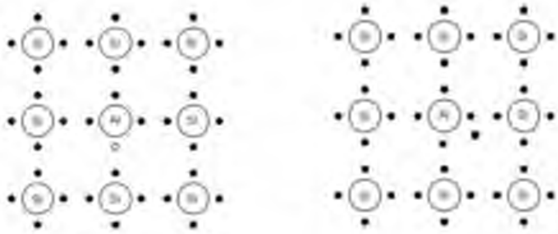
Menovitý prúd poistky	Vodiče a káble s izoláciou gumovou, PVC, sklenou
6	8
10	12
16	19
20	23
25	[illegible]
32	35
40	44
50	54
63	67
80	84


ΔU3
ΔU4
ΔU1
ΔU2
U1
ΔU4
A
B ΔU3
C
D
F
E
U
ΔU2
ΔU3
U2
I1
ΔU1
I2


A
B
E


L1
L2
L3
N
PE
1:1
L'1
L'2
A
B
C
D
E
F
A
B


L1
L2
L3
N
PE
230/12 V
PELV 12V
L'1
L'2
PE
nezámenná
zásuvka
PELV
A
B
C
D
E
F



III 26,98 2 700 **13 Al** 1,61 Hliník Aluminium	IV /IV 28,09 2 330 **14 Si** 1,9 Kremík Silicium	II V, II 30,97 1 820 **15 P** 2,1 Fosfor Phosphorum
III 69,72 5 910 **31 Ga** 1,8 Gallium Gallium	IV 72,59 5 350 **32 Ge** 2,0 Germanium Germanium	III V 74,92 5 720 **33 As** 2,2 Arsén Arsenium
III 114,82 7 310 **49 In** 1,5 Indium Indium	II IV 118,69 7 300 **50 Sn** 1,7 Cín Stannum	III V 121,75 6 690 **51 Sb** 1,8 Antimon Stibium

?

A $A + A = A$

B $A \cdot A = A$

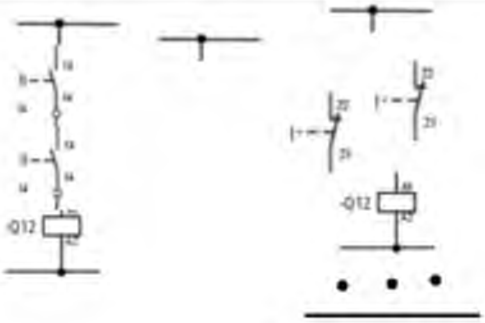
C $A + \overline{A} = 1$

D $A \cdot \overline{A} = 0$

E $A \cdot (B + C) = A \cdot B + A \cdot C$

F $A + (B \cdot C) = (A + B) \cdot (A + C)$

$A + (\overline{A} \cdot B) = A + B$



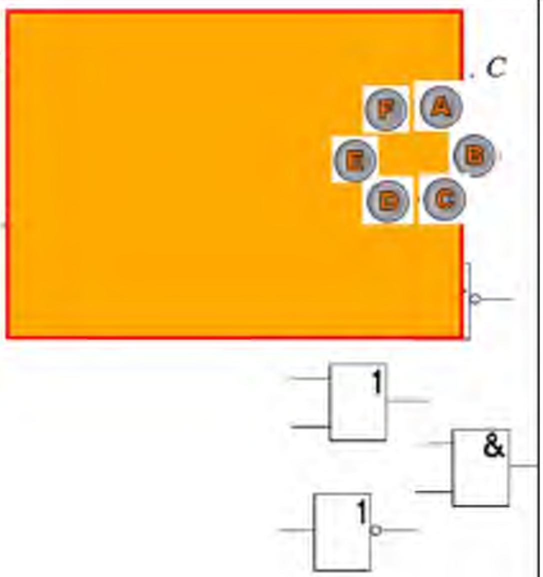
$$A \cdot B = \overline{\overline{A} + \overline{B}}$$

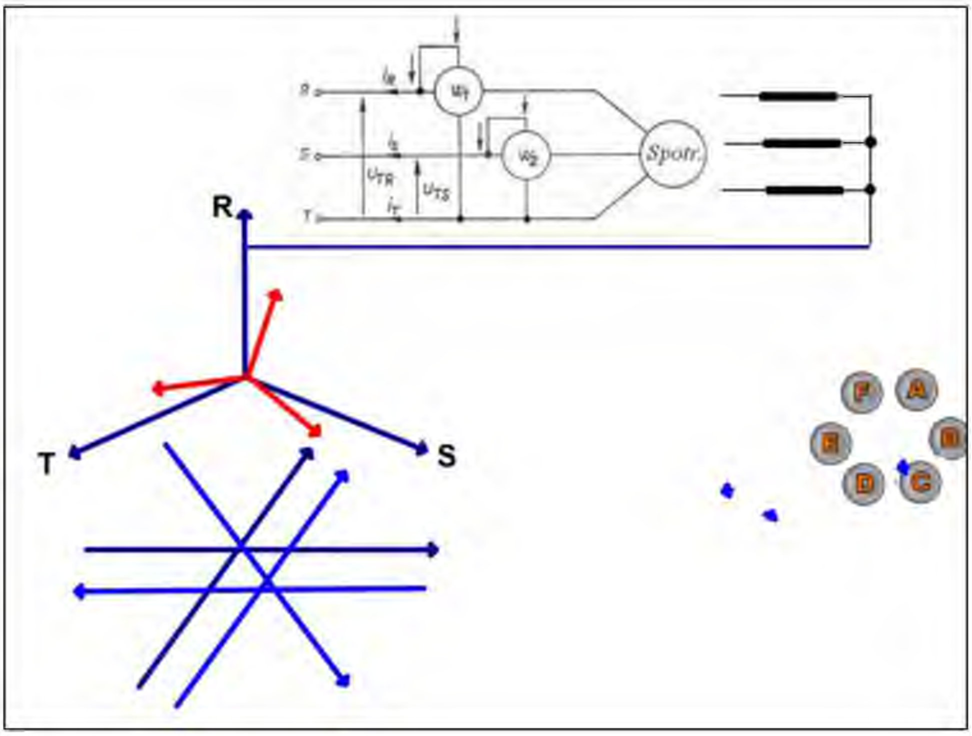
$$A + B = \overline{\overline{A} \cdot \overline{B}}$$

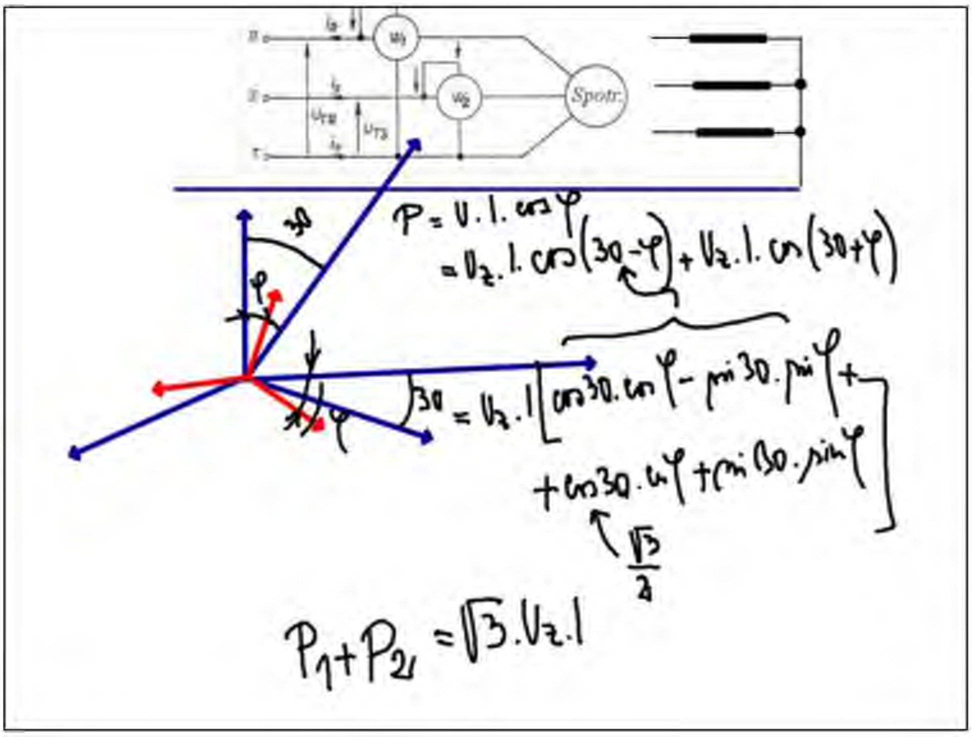
A	B	C	Y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

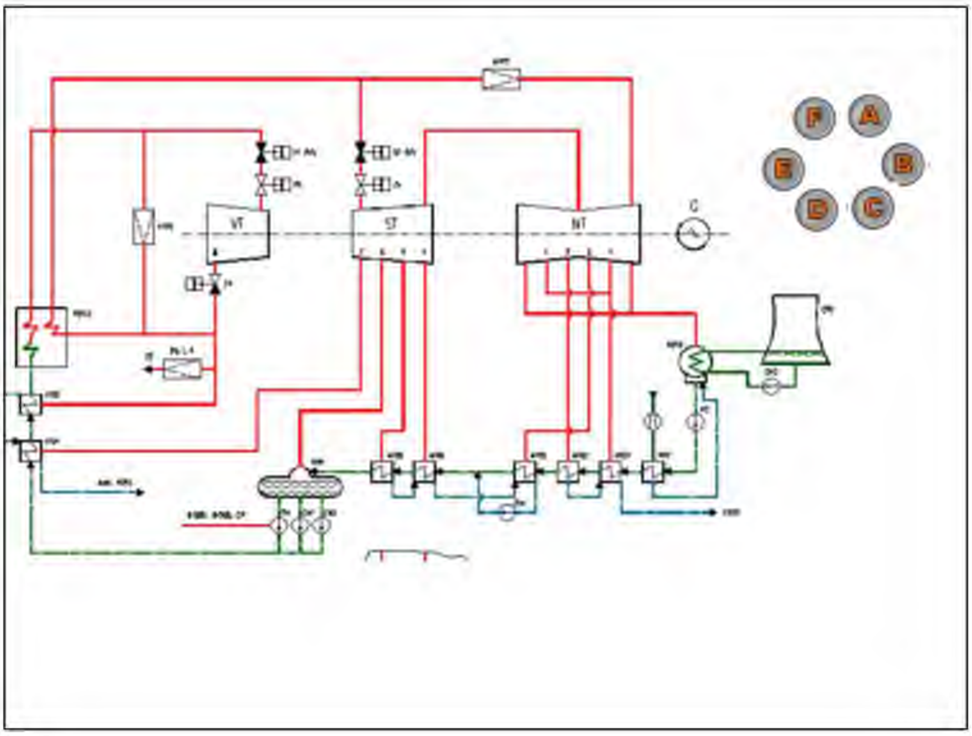
$Y = \overline{A} \cdot \overline{B}$ ... $\cdot C$

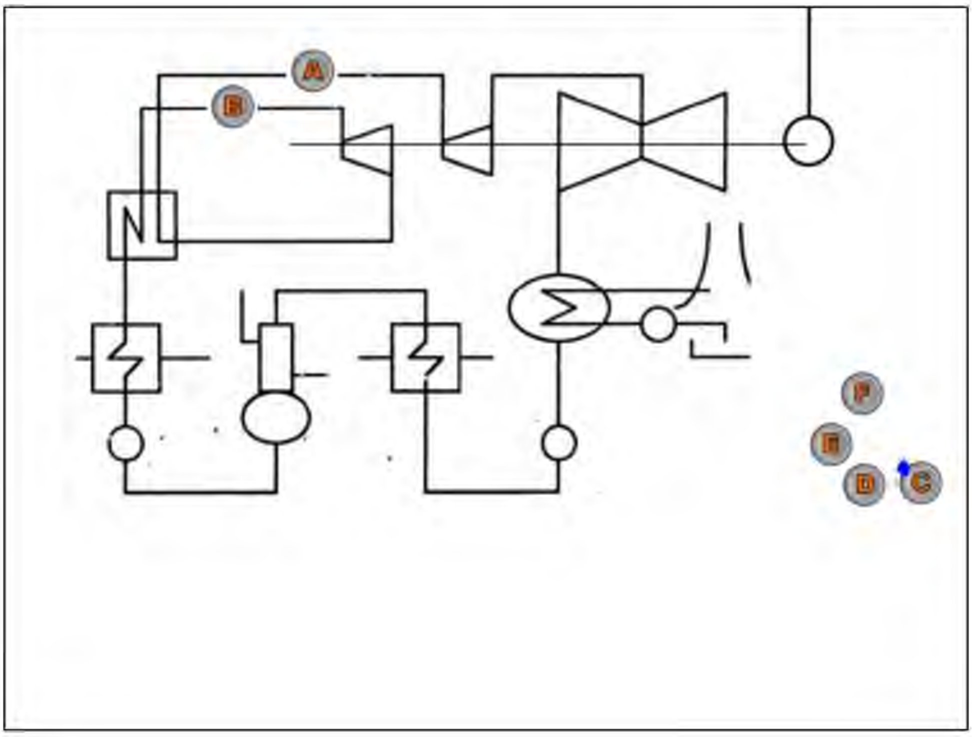
$= \overline{A} C$

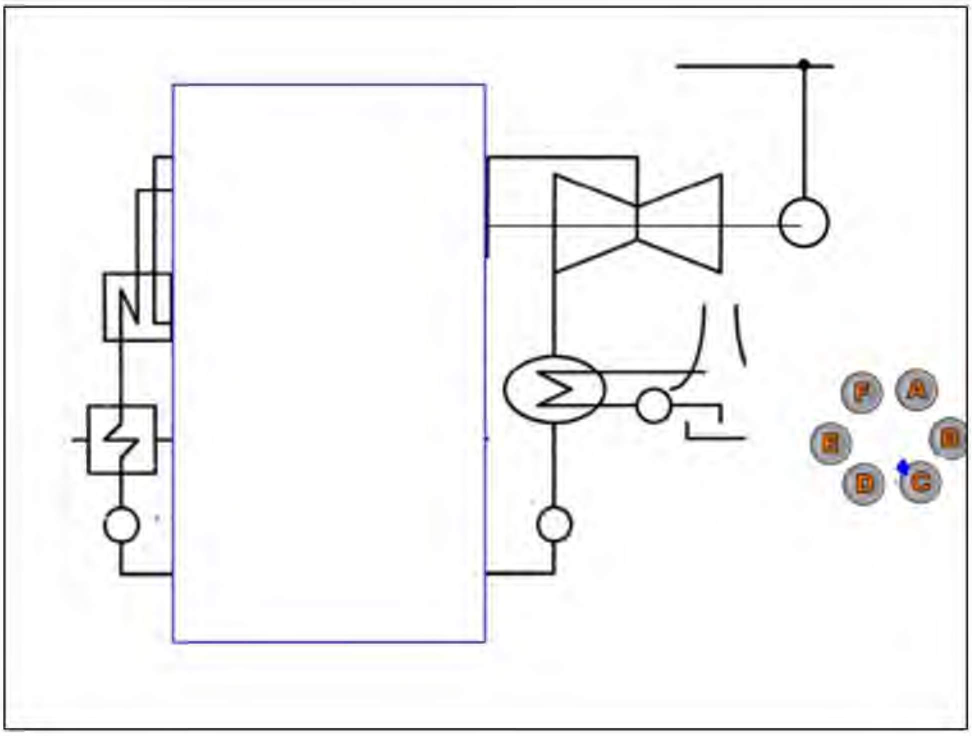


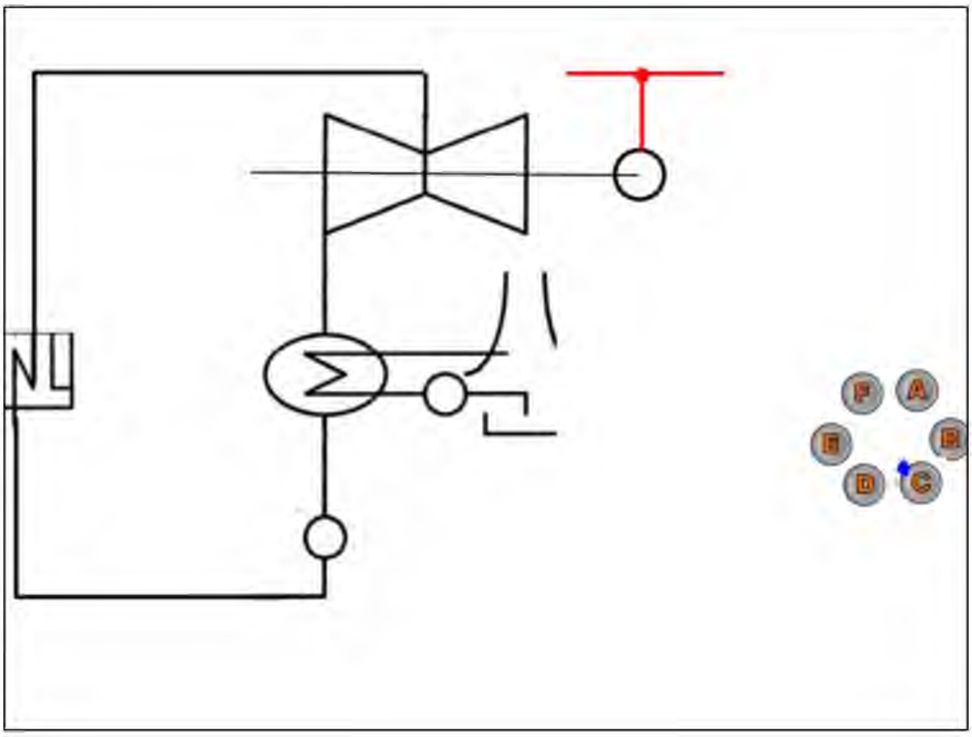

R
S
T
i_R
i_S
i_T
u_{TR}
u_{TS}
W_1
W_2
Spotr.
A
B
C
D
E
F

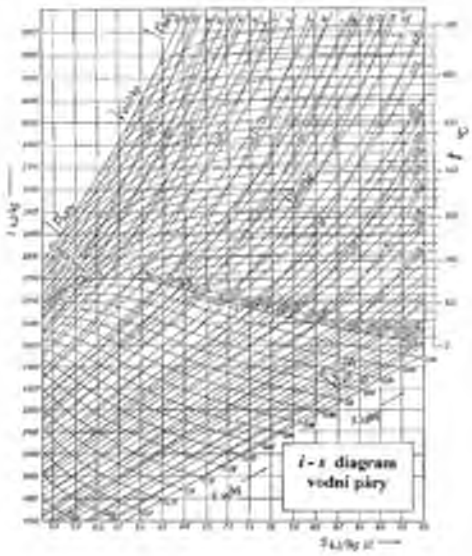

i_R
i_S
i_T
u_{TR}
u_{TS}
W_1
W_2
Spotr.
30
φ
$P = U.I.\cos\varphi$
$= U_z.I.\cos(30-\varphi) + U_z.I.\cos(30+\varphi)$
30
$= U_z.I[\cos 30.\cos\varphi - \sin 30.\sin\varphi +$
$+ \cos 30.\cos\varphi + \sin 30.\sin\varphi]$
$\frac{\sqrt{3}}{2}$
$P_1 + P_2 = \sqrt{3}.U_z.I$


VT
ST
NT
G
F
A
E
B
D
C


A
B
F
E
D
C


N
F
A
E
B
D
C

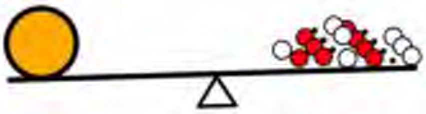

N
F
A
E
B
D
C

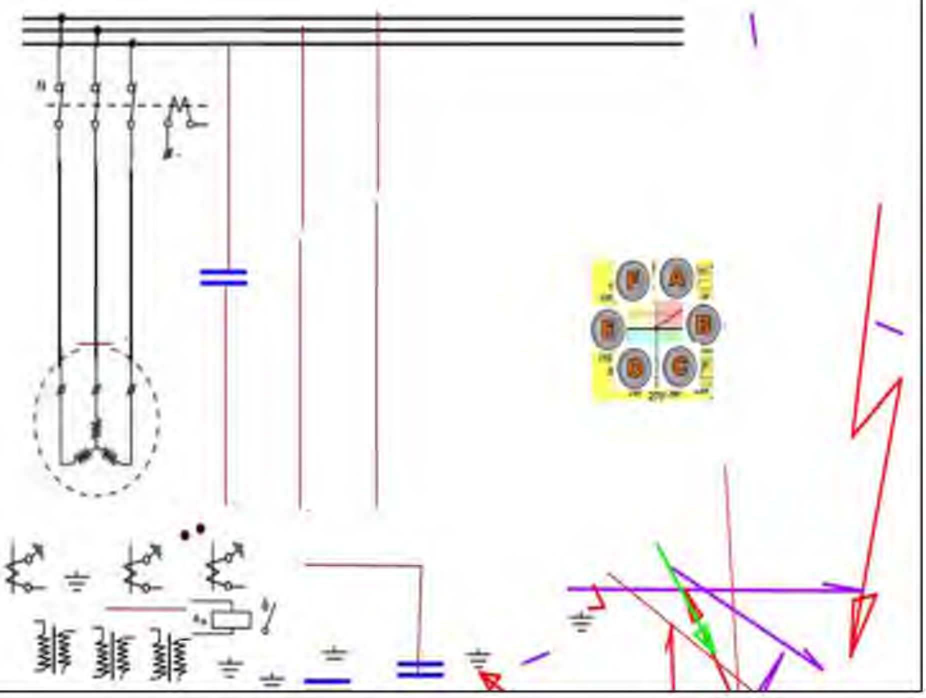


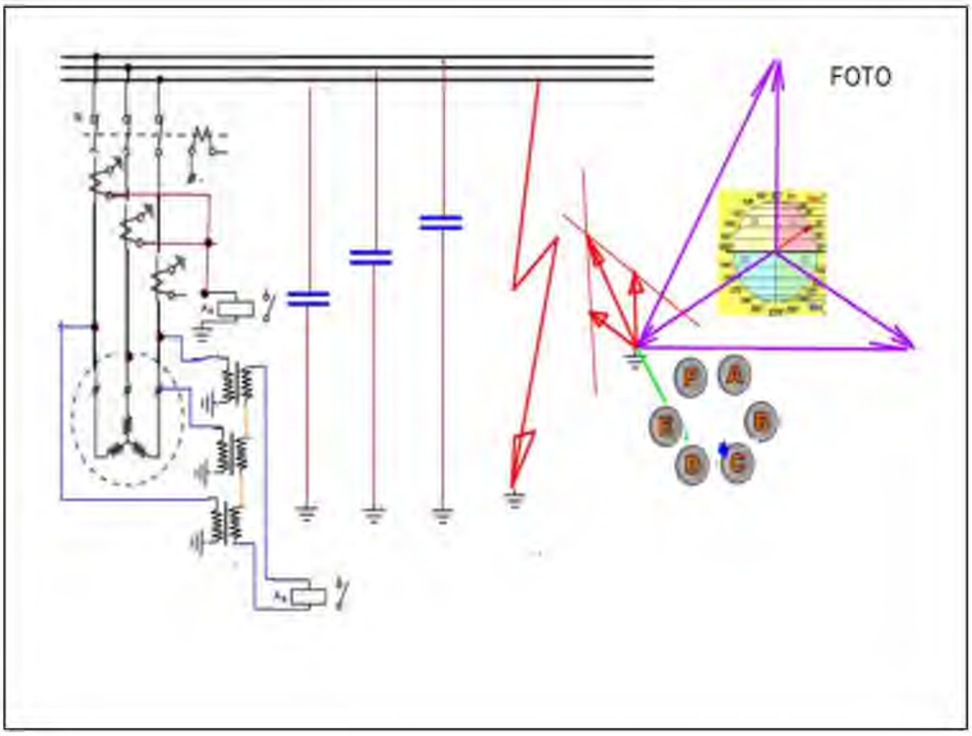
	I
	1,008
	0,0899
1	H
	2,2
	Vodík

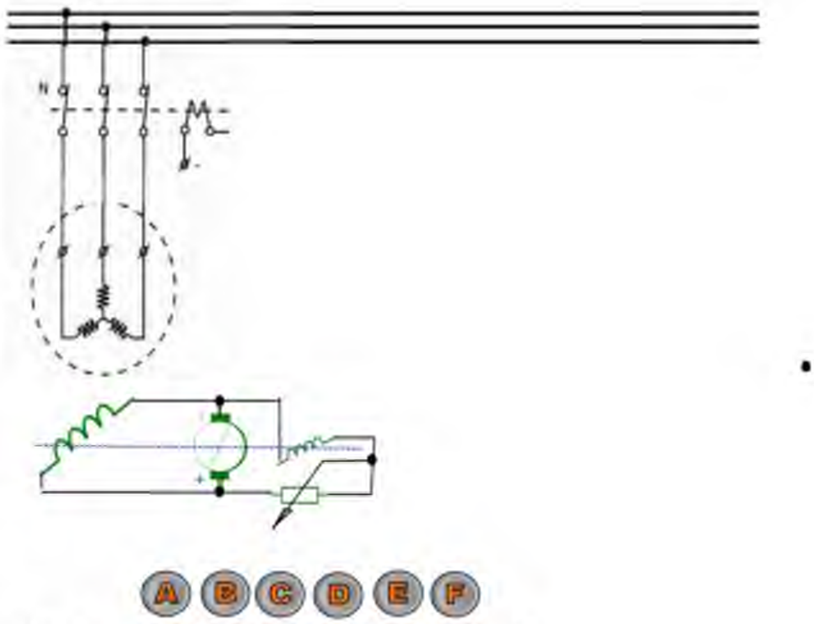
	90 Th		91 Pa		92 U		93 Np		94 Pu
2	IV	2	IV,V	2	III,IV,V,VI	2	III,IV,V,VI	2	II,IV,V,VI
10	232.04	9	231.04	9	238.03	8	237.05	8	244
18	11 700	20	15 400	21	19 000	23	19 500	24	19 800
32	90 Th	32	91 Pa	32	92 U	32	93 Np	32	94 Pu
18		18		18		18		18	
8	1,1	8	1,1	8	1,2	8	1,2	8	1,2
2	Thorium	2	Protaktinium	2	Uran	2	Neptunium	2	Plutonium
	Thorium		Protaktinium		Uranum		Neptunium		Plutonium

$E=m.c^2$



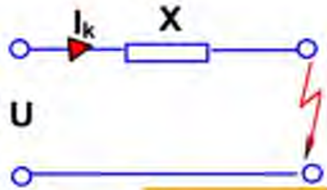






U_i I_b I ϕ_r ϕ_b U_s U_b ω Δ

Tempus DesIRE

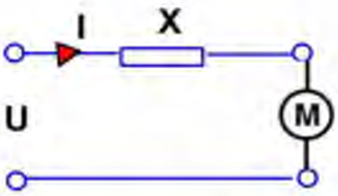


A B C D E F

S	X_1	2	$x_1\%$	S_2
x%	I_k	Δ	U	S_v
S_1	X_2	$x_2\%$	u_k	I
U_1	U_2	100	S_k	X
=	+	u%	$x_2^*\%$	I_n

$I_k = \frac{U}{\ldots}$

( )



A B C D E F

S	X_1	2	$x_1\%$	S_2
x%	I_k	Δ	U	S_v
S_1	X_2	$x_2\%$	u_k	I
U_1	U_2	100	S_k	X
		u%	$x_2^*\%$	I_n

$x\% = u\% = \frac{\Delta U \cdot 100}{\ldots}$

$x\% = u\% = \frac{X \cdot I}{U \ldots}$

$x\% = u\% = \frac{X \cdot S \cdot 100}{U^2}$

I

Tempus DesIRE

THE ESSENTIAL SKILLS OF THE TEACHER

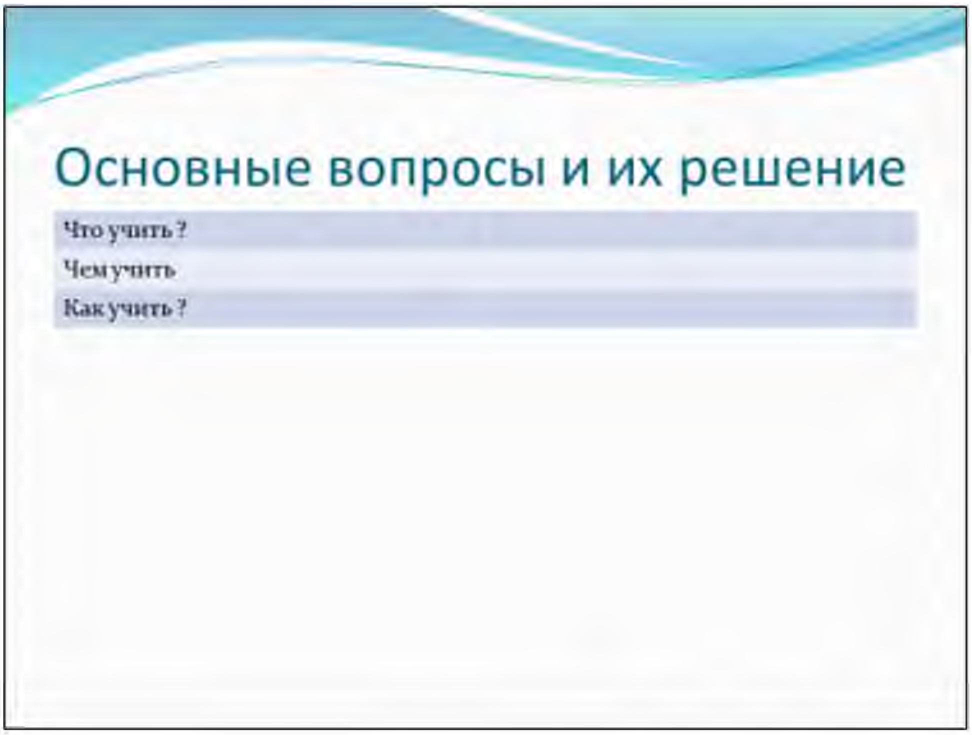
- asking questions as a main tool in activating the students
  - creating sources for the questions
  - formulating questions
  - offering possible answers

? A B C D E F

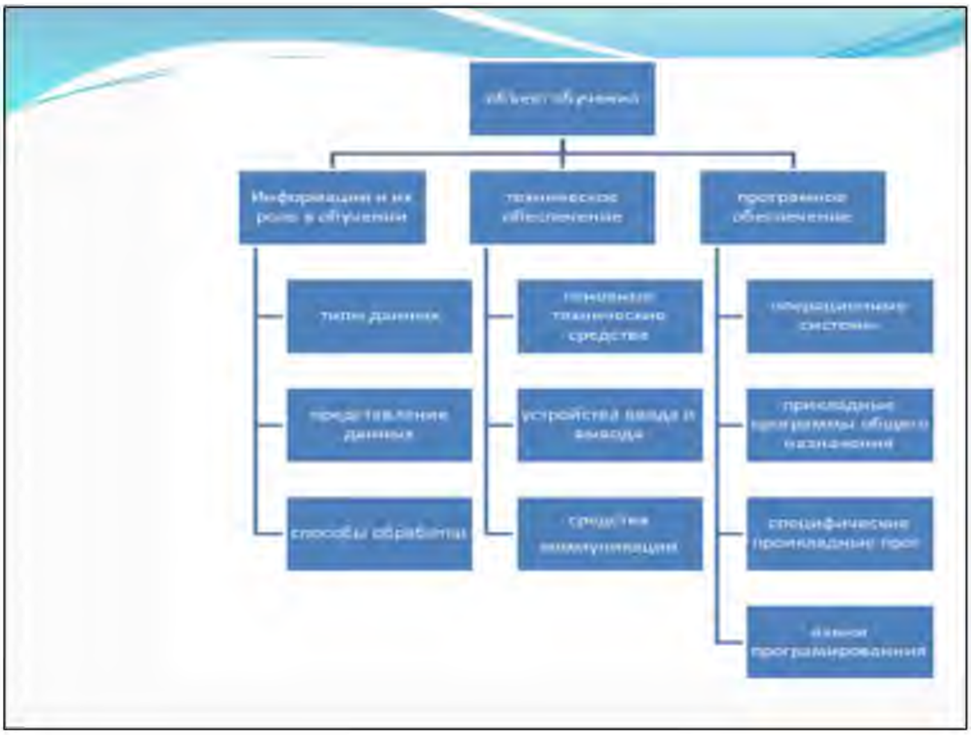
Tempus DesIRE

Summer Course Nitra 15-21 September, 2014
Ing. Štefan Švarc, PhD.


Часть 1.
Информационные технологии
объект-средство-инструмент
обучения
Ярослав Култан


Основные вопросы и их решение
Что учить ?
Чем учить
Как учить ?


средства обучения
ИТ в экономике
IT в промышленности
ИТ в корпоративном управлении
ИТ в управлении научного знания
Объект обучения
Информация, распространение, сортировка, формы
Техническая поддержка
Програмное обеспечение безопасности
Языки программирования
Инструмент образования
Изучение системы управления обратная связь
Выбранный моральные аспекты использования ИТ
Развитие международного сотрудничества


объект обучения
Информации и их роль в обучении
техническое обеспечение
програмное обеспечение
типы данных
представление данных
способы обработки
основные технические средства
устройства ввода и вывода
средства коммуникации
операционные системы
прикладные программы общего назначения
специфические прикладные прог
языки програмирования

Средство обучения

Инструмент обучения

Методы и формы обучения и ИТ

METÓDY FORMY	prednáška	diskusia	demonštrácia	didaktické hry	problémový výklad	práca s textom, schémami, grafikou
prednáška	PowerPoint MsPaint		WinMediaPlayer RealPlay	Excel, špeciálne prog.	[illegible]	Word, Notepad, AcrobatReader
prezentačná	CAD systémy ACAD,ORCAD		PowerPoint, InternetExplorer, ShockwavePlayer, FlashPlayer, WinMediaPlayer		ORCAD AUTOCAD	
kontrola a hodnotenie		MS Paint, FireWorks, WinMedia Player		Excel, Access, vytváranie prog.		
riešenie		MSN Messenger, VEVS, Chat	LogoLego, RoboLab, špec. programy		InternetExplorer, Mozilla, Opera	Word, OpenOffice, [illegible]
[illegible]	PowerPoint Excel Word	Videokonferencia WinMediaPlayer			InternetExplorer, Mozilla, Opera	

Методы и формы обучения с применением ИТ

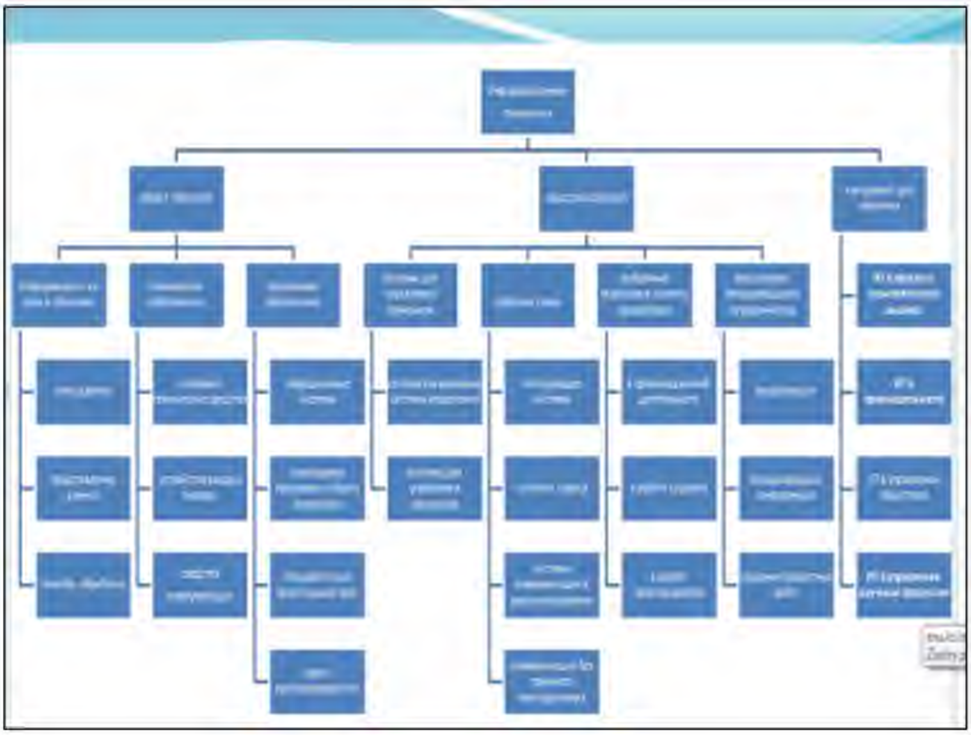
Методы Формы	лекция	дискусси я	показ	Дидактичес кое тестирован не	Проблемная лекция	Работа с текстом, схемой
занятие основного типа	PowerPoint MsPaint		Win.MediaPl ayer RealPlay	Excel, špeciálne prog.	špec.programy (Cabri geometria	Word, AcrobatRe ader
семинар	CAD systémy ACAD,ORC AD		PowerPoint, InternetExplo rer FlashPlayer WinMediaPl ayer		ORCAD AUTOCAD	
экскурсия	PowerPoint Excel Word	EVO WinMedia Player				

Применение ИТ для создания обратной связи

Tab. 1 Применение ИТ для создания обратной связи

применение	LMS					другие прикладные программы		
форма	тест	чат	форум	короткий текст	фай	табличная программа	текстовая программа	презентация
дидактический тест в конце семинара	x			x		x		
промежуточные тесты	x		x				x	
контрольные вопросы		x		x	x	x		
анализ								x
дискуссия		x	x				x	
сочинение						x	x	x
тест с открытыми вопросами	x			x	x		x	
курсовая работа					x	x	x	
заключительный экзамен								

Опасности применения ИТ



Роль современных создателей информационных технологий

- Создание ИТ широкого доступа
- Создание ИТ позволяющих создание активной обратной связи в:
  - системе образования
  - органах самоуправления
  - развитии внедрения граждан с ограниченной способностями в активную жизнь
  - системах управления предприятием
  - другие

Возможное решение поставленных задач /1/

- Использование баз данных
- Использование хранилищ данных и систем БИ
- Использование облачных технологий
- Повышение качества владения ИТ
- Создание открытых терминалов в городах и селах
- Создание систем с большой скоростью переноса данных
- Расширение беспроводных сетей
- Повышение безопасности ИС
- Внедрение систем дистанционного обучения с использованием информационных технологий

Возможное решение поставленных задач /2/

- Повышение скорости общения с использованием ИТ
- Создание виртуальных предприятий в области
  - Производства
  - Службы
  - Образования
  - Управления
- Реализация дистанционных систем взаимного сотрудничества с целью продвижения результатов научных исследований в практическую жизнь

заключение

- *Данная статья направлена на определение основных моментов использования информационных технологии /ИТ/ в сфере обучения, науки и научных исследований.*
- *ИТ представляют объект обучения и развития науки. Их исследованию необходимо уделить большое внимание т.к. их развитие ведет за собой возможность развития остальных направлений науки и жизни.*
- *ИТ помогают решать многие научные задачи.*
- *Старательно необходимо рассмотреть роль ИТ в системе обучения. ИТ могут стать не только помощником в процессе приобретения знаний, но и средством понижения уровня обучения.*
- *Приведенные моменты использования ИТ представляют не только обобщение опыта но и направление дальнейшего развития науки в данной области.*

Спасибо за внимание

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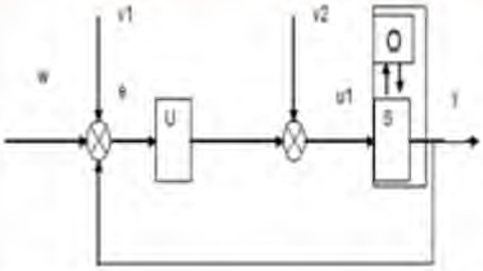
Slovakia
jkultan@gmail.com

Часть 2. Обратная свъязь в процессе обучения

Култан Ярослав

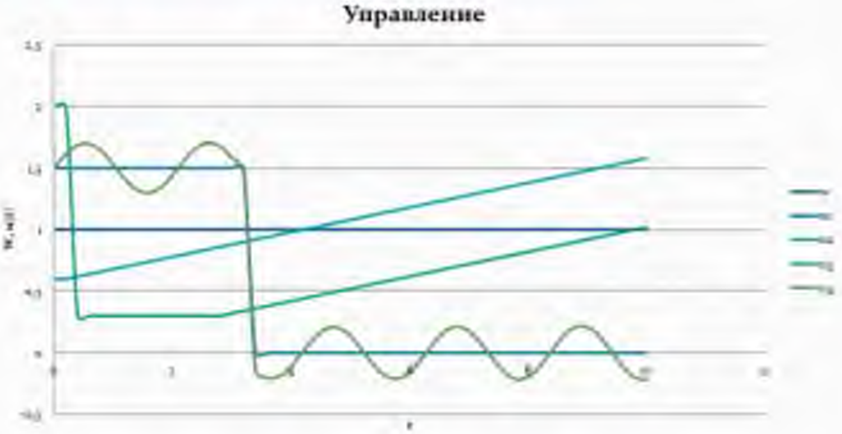
- Главной задачей каждого учебного заведения должна быть реализация ожиданий, потребностей и пожелания клиентов, и это на **основе точных и достоверных данных** и не только по интуиции и опыте преподавателей.
- Это требует регулярной обратной связи (исследование знаний, навыков и способностей учащихся, обследование отношения учащихся к обучению в учебном заведении).

Сравнение процесса обучения с техническим процессом - создание обратной связи

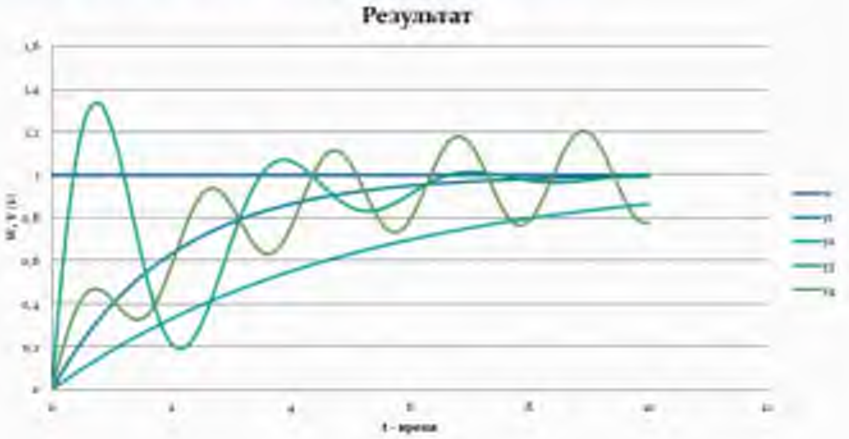


U - учитель; S - студент; w – цель обучения; y – результаты обучения; e - отклонение; v1 – влияние среды на учителя; v2 - влияние среды на студента ; u1 – управление деятельностью студента

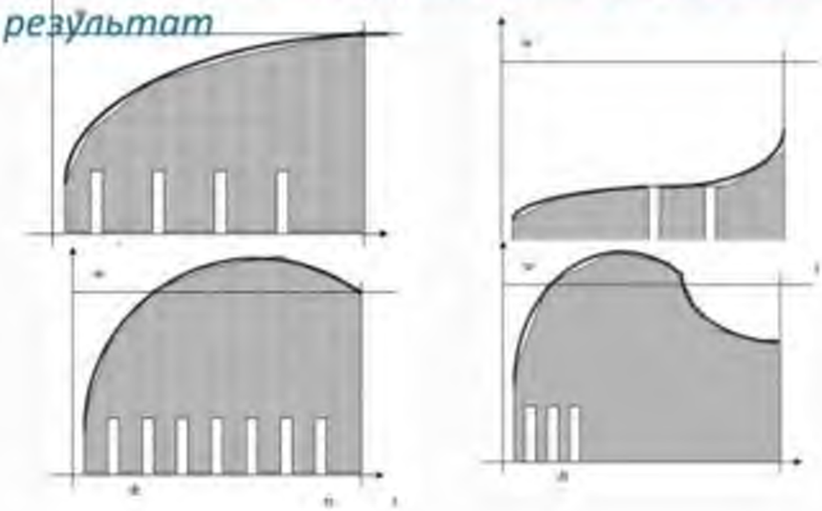
Управляющий сигнал



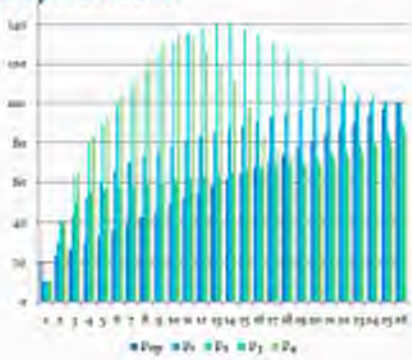
Результат системы

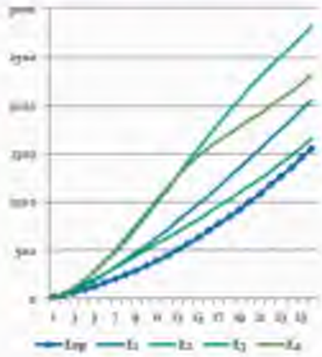


Влияние объектов управления на конечный результат



Влияние объектов управления на конечный результат

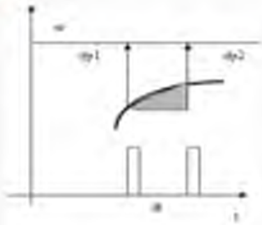




$$E = \int_{t1}^{t2} P\,dt$$

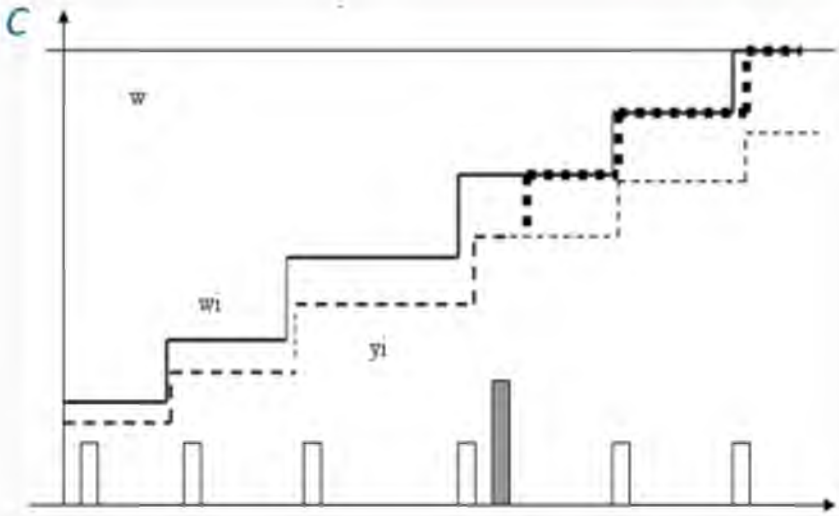
Результаты опытов

prvok SV	st1	st2		sti				stn	Pi
kratky DT	p1, 1								
fórum									
chat									
DT									
				pij					
seminár na práca									

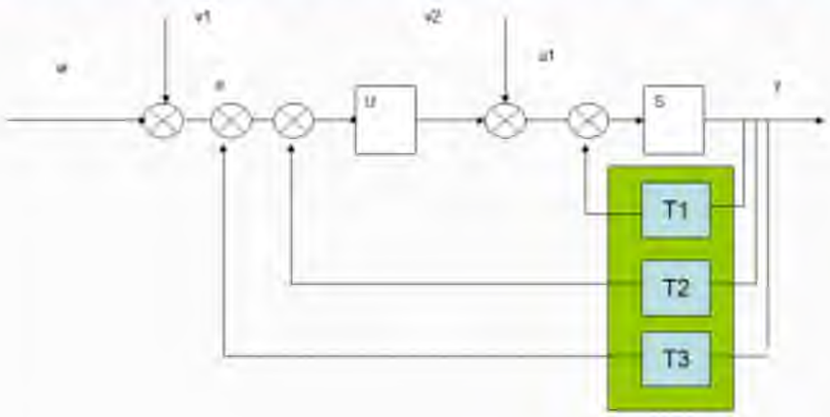


$$P_i = \sum_{j}^{n} p_{i,j}$$

$$P_i = \operatorname{mod}\left(p_{i,j}\right)$$



Многоуровневая обратная связь



Критерии разделения обратной связи

Применение ИТ для создания обратной связи

Применение	**LMS**					**Другие прикладные программы**		
форма	тест	чат	форум	короткий тест	файл	табличная программа	текстовая программа	презентация
дидактический тест в конце семинара	x			x		x		
промежуточные тесты	x		x				x	
контрольные вопросы		x		x	x	x		
анализ								x
дискуссия		x	x				x	
сочинение						x	x	x
тест с открытыми вопросами	x			x	x		x	
курсовая работа					x	x	x	
заключительный экзамен								

Часть 3.
LMS - MOODLE

Култан Ярослав

Learning Management System – (LMS).

- существуют системы, ориентированные на подержу обучения - Learning Management System - (LMS)
  - Moodle,
  - WebCT,
  - Tutor2000,
  - uLern.
- Можно проводит обучение дистанционным методом
- Одним из недостатков - отсутствие визуального контакта с учителем
- E-Learning – система обучения, которая состоит из различных типов обучения: традиционного, дневного, заочного и компьютерного. Эта система получила свое развитие благодаря развитию компьютерных сетей, когда студенты имеют возможность получать новые знания в произвольном времени и месте.

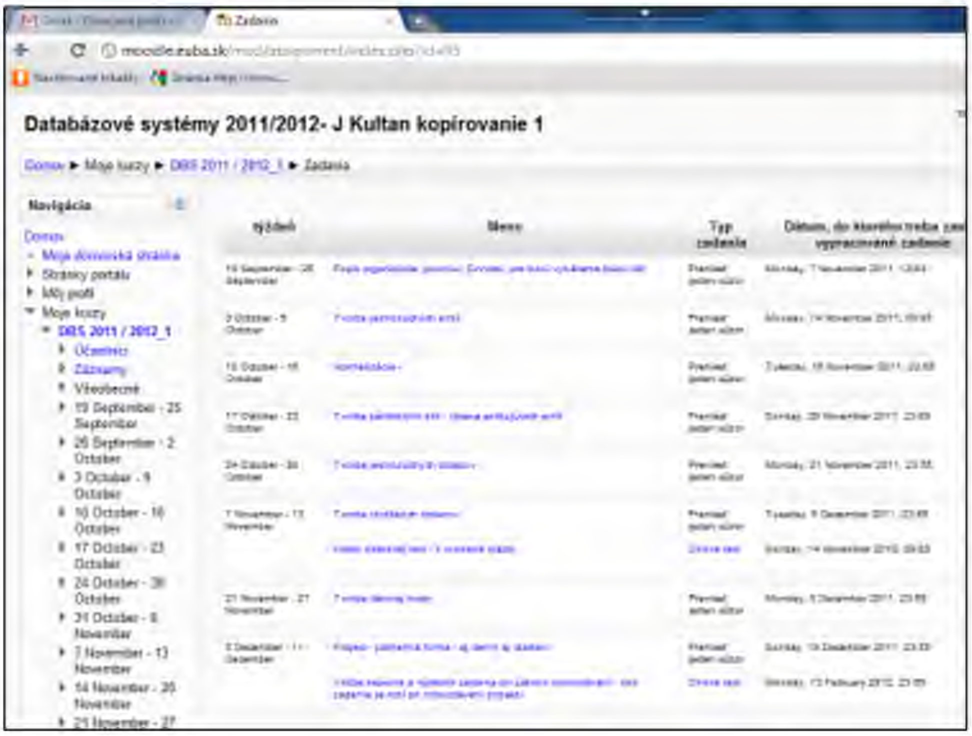
Примеры LMS

LMS - MOODLE

LMS - MOODLE


moodle.euba.sk
Databázové systémy 2011/2012- J Kultan kopírovanie 1
Navigácia
Moje kurzy
DBS 2011 / 2012_1
19 September - 25 September
26 September - 2 October
3 October - 9 October
10 October - 16 October
17 October - 23 October
24 October - 30 October


moodle.euba.sk
Databázové systémy - prednáška
3. Systém riadenia bázy dát (SRBD)
centralizovaná architektúra
architektúra klient/server
distribuovaná architektúra
4. Dátové modely
SELECT
PROJECT


moodle.euba.sk
Databázové systémy 2011/2012- J Kultan kopírovanie 1
Moje kurzy
Zadania
Navigácia
Moje kurzy
DBS 2011 / 2012_1
Účastníci
Všeobecné


moodle.euba.sk
Databázové systémy 2011/2012- J Kultan kopírovanie 1
Moje kurzy
19 September - 25 September
Krstné meno / Priezvisko
Známka
Komentár
7 / 10
5 / 10
8 / 10
10 / 10
8 / 10
7 / 10
0 / 10
6 / 10


Задания


расчет основных статистических параметров 2009/2010
Расчет основных статистических параметров 2010/2011


Зависимость достигнутого результата от
количества решений

Tempus DesIRE

Часть 4
ИСПОЛЬЗОВАНИЕ ТЕСТИРУЮЩИХ СИСТЕМ ДЛЯ ПОВЫШЕНИЯ КАЧЕСТВА ОБУЧЕНИЯ

Култан Ярослав

ПРЕИМУЩЕСТВА ВНЕДРЕНИЯ СИСТЕМ ТЕСТИРОВАНИЯ

- **повышение качества образования в форме**
  - самоконтроля знаний учащихся;
  - проверка ответов на отдельные лекции или вопросы в целом, с целью нахождения частей, которые необходимо решать;
  - Обнаружение слабых учащихся с целью введения индивидуального обучения
- **улучшение характеристик личности ученика**
  - развитие способности себя проверку и самоуправления;
  - повышение мотивации;
  - уменьшить стресс и устранить страх тестирования
- **улучшение работы преподавателей**
  - уменьшить нагрузку на преподавателей;
  - повысить объективность проверки;

Практические исследования

- ***Вариант 1.*** Возможность самостоятельной проверки знаний путем проведения дидактических тестов приводит к улучшению результатов обучения
- ***Вариант 2***. Возможность самостоятельной проверки знаний позволяет улучшение общих результатов класса /группы/, т.е. среднее значение оценок и также уменьшает различия между отдельными студентами.
- ***Вариант 3.*** Постоянная работа студентов с тестирующими программами, возможность сравнить свои результаты с требованиями учителя улучшает отношения студентов к данному предмету, повышает интерес к этой теме, улучшает отношения между студентами и учителями.
- ***Вариант 4 4.*** Увеличение общего успеха студентов зависит от возможности преподавателей регулировать прохождение следующих лекций в зависимости от промежуточных результатов студентов

Распределение отдельных тем/ выходной дидактический тест,

p.č.	Tematický celok	rozsah (2+2)*13		Количество задач				
		abs	%	Память	Специфический трансфер	Неспецифический трансфер	Совсем	
				вес 1	вес 2	вес 3		
1	Informačný systém	3	5.66%	2	1	0	4	4.21%
2	Databázové systémy	5	9.43%	3	2	0	7	7.37%
3	Systém riadenia bázy dát	4	7.55%	1	2	1	8	8.42%
4	Dátové modely	8	15.09%	0	4	2	14	14.74%
5	Relačná databáza	8	15.09%	1	4	2	15	15.79%
6	Databázové jazyky	10	18.87%	4	1	4	18	18.95%
7	OLAP, OLTP, Warehousing	2	3.77%	0	3	0	6	6.32%
8	Distribuované DBS	5	9.43%	2	1	0	4	4.21%
9	Oracle	6	11.32%	2	1	3	13	13.68%
10	DBS platformy	1	1.89%	1	1	0	3	3.16%
11	SAS	1	1.89%	1	1	0	3	3.16%
		53	100.00%	17	21	12	95	100.00%

Пример дидактического теста - заключительный

Meno a priezvisko: ______________________ číslo študenta: ____
Predmet ______________________ skratka: ________

p.č.	T.C.	Otázka	úro.	náč.	body
	1	čo je to informačný systém	1	1	
	1	informačný systém je pozostáva z: ________ ________ ________ ________	3	2	
	1	vymenuj aspoň 4 základné funkcie informačného systému: ________ ________ ________ ________	4	1	
	2	definuj databázový systém	1	1	
	2	vymenuj etapy vývoja dbs si: ________ ________ ________	3	2	
	2	základné komponenty dbs si: ________ ________ ________	3	1	
	2	Napíš rozdiely medzi konceptuálnou a logickou úrovňou konceptuálna logická	2	2	
	2	základné požiadavky na databázu	4	1	
	3	základné funkcie SRBD	4	1	

Дидактический тест –промежуточный

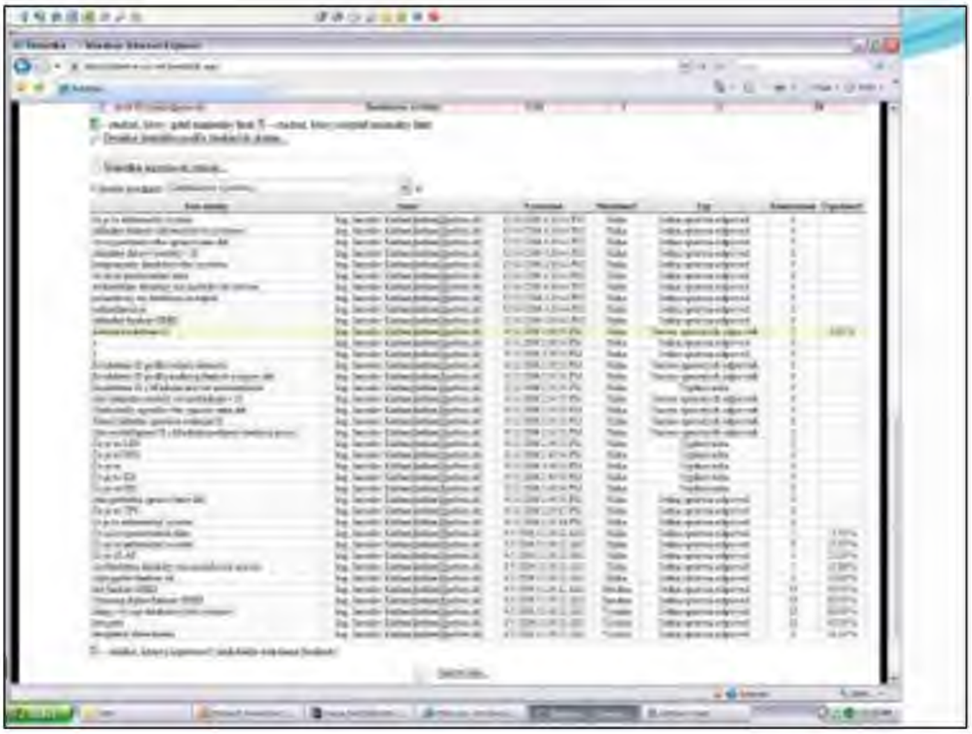
		Количество часов		Количество задач		Разделение задач		transfer	
téma	názov témy	abs	%	abs	%	zap.	pas.	špec.	nešpec.
1	Definícia a rozdelenie databázových jazykov	2	25%	4	25%	3	1		
2	SQL- DDL- základné príkazy	1	13%	2	13%		1		1
3	SQL DML - základné príkazy	3	38%	5	31%	1		4	
4	SQL - DAL DSL a iné útvary	1	13%	2	13%	2			
5	Relácie a operácie s nimi	1	13%	3	19%		1		2
	súčet	8		16		6	3	4	2

Пример промежуточного теста по теме Язык SQL

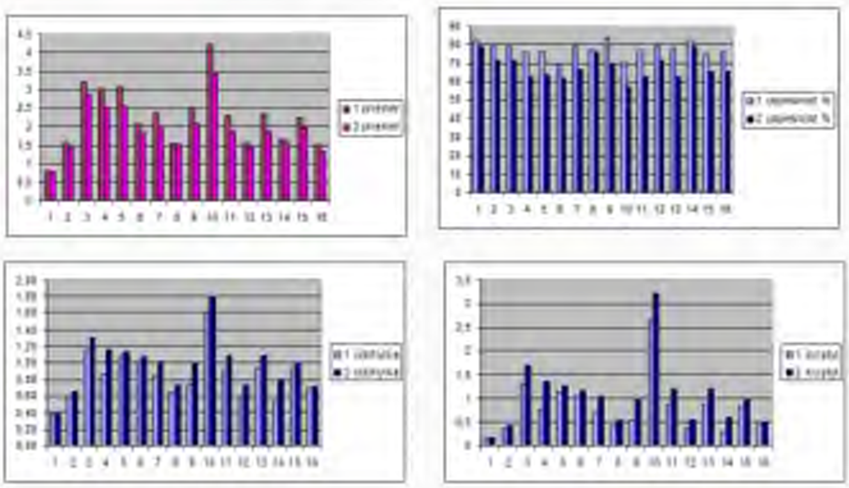
p.č.	úloha	[illegible]	[illegible]	[illegible]
	napíš definíciu programovacieho jazyka.	1	1	1
	databázové jazyky delíme na: 1. 2.	2	1	1
	vymenuj aspoň 4 základné časti jazyka SQL 1. 2. 3. 4.	4	1	1
	DDL GRANT DML INSERT DAS CREATE VIEW DIS UPDATE CREATE SELECT DISTING FROM	4	7	1
	[illegible]	4	4	2

Просмотрите результаты дидактических тестов

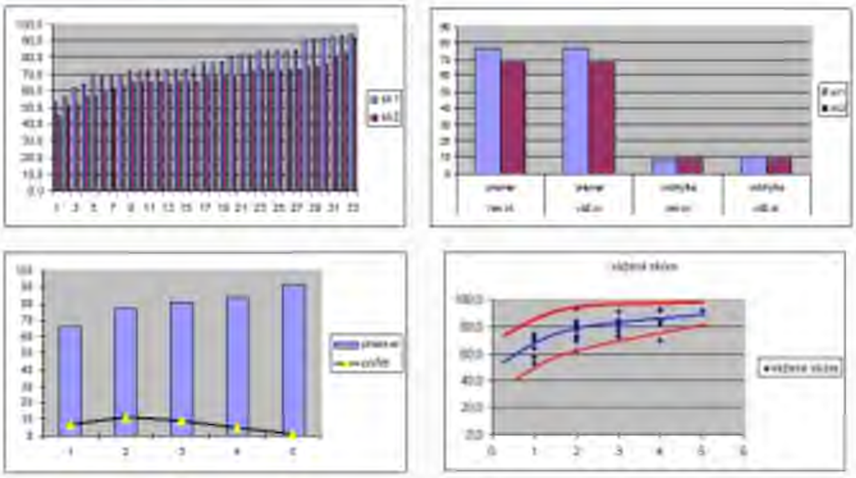
p.č.		[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	spolu	skóre	
			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	47	[illegible]	[illegible]
p.č.																			[illegible]	[illegible]	[illegible]
1			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	31	[illegible]	66,0
2			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	31	[illegible]	70,6
3			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	31	[illegible]	52,8
4			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



Гипотеза1



Гипотеза 2.



Описание результатов

- Успеваемость по каждому вопросу в опытной группе выше чем в группе сравнения
- Среднее значение полученных результатов в опытной группе выше чем в группе сравнения и отклонение ниже
- Среднее значение успеваемости возрастает по мере повышения количества тестов
- Отклонение значений достигнутых результатов уменьшается по мере повышения количества тестов

Описание результатов

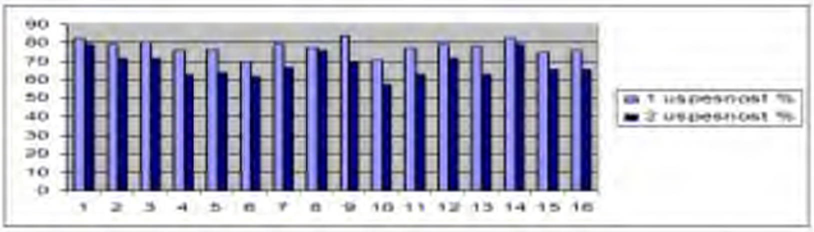
- Среднее значение полученных результатов в опытной группе выше чем в группе сравнения
- Успеваемость в группе сравнения ниже чем в опытной группе
- Отклонение от среднего значения выше в группе сравнения
- Дисперсия результатов в опытной группе ниже чем в гр. сравнения

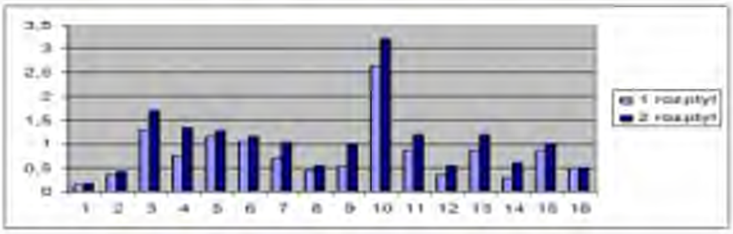
Гипотеза 3

Описание результатов

- В исследуемой группе произошли изменения в отношении к данному курсу
- В группе сравнения не произошло почти ни каких изменений

Гипотеза 4





Описание результатов

- При анализе результатов было выявлено что относительная успеваемость по вопросу 10 была ниже всех
- Отклонение по вопросу 10 было выше чем в остальных
- Эти изменения были в каждой группе заметными
- Можно сделать вывод – тема касающаяся вопроса 10 была не понята одной и другой группами – может ошибка преподавателя

ЗАКЛЮЧЕНИЕ

- система может быть одним из компонентов системы управления качеством в школах.
- система решает одну из задач управления мониторинга качества
- система может быть весьма полезной для контроля и оценки деятельности студентов.
- система устраняет некоторые формы субективизма в тестировании,
- система удаляет хаотичность в работе студента и под.

Результаты исследований

- **Увеличение качества образования студентов, возможно:**
  - внедрение систем тестирования, основанных на Интернете.
  - возможность непрерывной проверки
- **Отношения преподавателей к ИКТ:**
  - многие учителя не в настоящее время готовы воспользоваться преимуществами современных ИКТ в полном объеме
  - они предпочитают простое приложение с простыми программами
  - необходимость представления результатов, полученных от испытаний, в простой форме
- **Поэтому уместно создать тестовые программы, которые будут укреплять связь между студентами и преподавателями**
- **Простая тест система**
  - позволяет студентам без стресса узнать уровень подготовки.
  - позволяет выборочное улучшение подготовки
  - повышение эффективности работы учителя
  - Позволяет иметь промежуточный обзор о состоянии знаний и тем возможно сделать исправление в течении семестра

- ***Это позволяет создать методику использования тестирующих систем в виде системы управления***.

Часть 5
Видеокогференции в процессе обучения.

Култан Ярослав

Видеоконференция- одна из форм качественного электронного обучения

- это возможность коммуникации (текстовой, аудио, видео) между участниками находящимися в различных местах, которые могут быть удалены на сотни километров.
- позволяют приблизить дистанционное обучение к классическим формам обучения,
- снижают стресс, возникающий в результате недостатка контакта с преподавателем,
- улучшают взаимную коммуникацию между студентами и преподавателями,
- сокращают срок ожидания обратной связи, который в случае классической формы дистанционного обучения во многих случаях достаточно длительный (несколько дней и недель).
- можно транслировать лекции преподавателей в реальном времени.
- непосредственно связаться с преподавателем во время лекции.
- лекцию можно записать и пользоваться ею многократно.
- создается возможность для коммуникации, для развития сотрудничества между студентами проведения семинаров, конференций и т.п.
- **улучшение качества лекций благодаря привлечению специалистов;**

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Улучшение качества лекций благодаря привлечению специалистов

- стремление привлечь специалистов или преподавателей из других вузов
- возможность проведения лекции одновременно с примерами из практической жизни без ухода со своего рабочего места
- международные лекции

EVO – enabling virtual organization. Это web-ориентированная система видеоконференцсвязи через IP сети. Данная програ

Системы для поддержки видеосвязи

- **EVO** – enabling virtual organization.
- Это web-ориентированная система видеоконференцсвязи через IP сети.
- Данная программа EVO в настоящее время применяется в Экономическом университете для различных целей
- Данная программа позволяет записывать несколько источников (видео, презентация, whiteboard) с тем, чтобы в будущем можно было их снова использовать.

EVO – enabling virtual organization. Это web-ориентированная система видеоконференцсвязи через IP сети. Данная програ

Системы для поддержки видеосвязи

- **Pinnacle studio** от фирмы Pinnacle systems Inc.
- Данная программа очень интересная благодаря своим широким возможностям.
- Кроме того, она очень простая и удобная для пользователя.
- Захват изображения с экрана в настоящее время достаточно широко распространенный метод. Изображение с экрана можно снимать непосредственно программными возможностями компьютера, но также существует возможность передачи данного изображения в реальном времени на другие компьютеры или сохранения для его последующего использования. К программам для захвата изображения относятся:

EVO – enabling virtual organization. Это web-ориентированная система видеоконференцсвязи через IP сети. Данная програ

Системы для поддержки видеосвязи

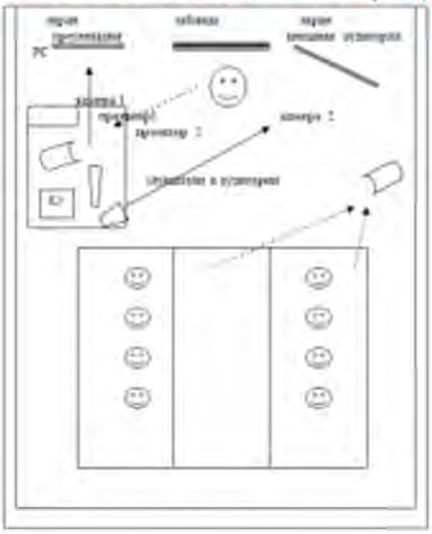
- **Quick Screen Capture** –мощный и очень удобный инструмент для захвата изображения экрана и их просмотра.
- Позволяет выполнять захват с любой части экрана более чем десятью способами и сохранять в форматах BMP/JPG/GIF.
- Данная программа имеет многофункциональный графический редактор, который позволяет менять простые снимки экрана в впечатляющие изображения, которые могут использоваться для презентаций, флайеров или брошюр.
- Вы можете увеличивать или уменьшать изображения, обрезать, копировать и вставлять все или толькочасти изображения, изменять их размер, переворачивать, обрезать или сохранять. (http://www.etrusoft.com/)

EVO – enabling virtual organization. Это web-ориентированная система видеоконференцсвязи через IP сети. Данная програ

Системы для поддержки видеосвязи

- **Super** Screen Capture – Это широкодоступная программа all-in-one, для мгновенного снятия скриншотов с экрана. В программу встроен режим пересмотра созданных скриншотов, с использованием миниатюр. Поддерживаются несколько форматов для создаваемых файлов (BMP, GIF, JPEG, PNG, TIFF). Вся функциональная часть размещена всего лишь в одном окне. http://www.free-screen-capture.com/
- **CaptureWizPro** – Особенностью данного программного продукта является возможность создания видеоролика, данная программа предназначена для захвата, просмотра, распечатки, сохранения или отправки по почте изображения с экрана компьютера. Большинство операций можно выполнить при помощи всплывающих меню и окон, которые автоматически появляются и сами исчезают. http://www.snapfiles.com/features/capturewiz-8092-40052.php

Система разложения тех.средств



Размер применения видеоконференций

Участники видеоконференций

SVOC 2012 -účastnici

UIB

МГИМО

Санкт-Петербургский государственный университет

ŠVOČ 2011 – referát z Kazane

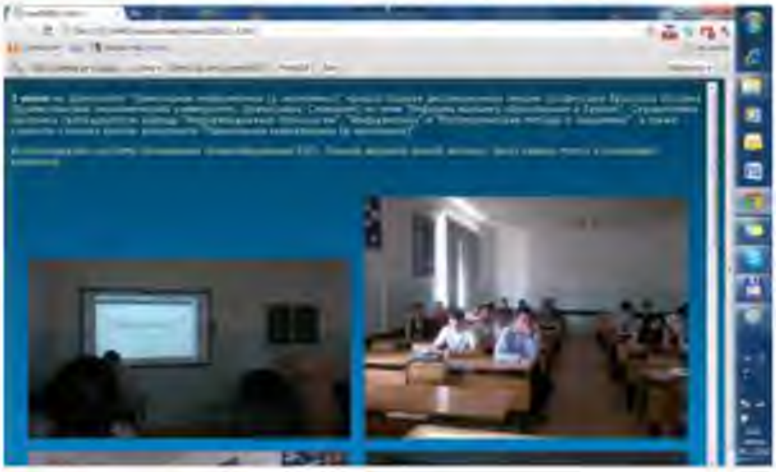
ŠVOČ 2011- pohľad na účastníkov

Видеоконференции в системе обучения

Zimná škola – ENU Astana


EKONOMICKÁ UNIVERZITA V BRATISLAVE

Дистанционная лекция ДГИНХ



Дни Словакии в Казахстане

Электронная казань

Казаньский приволжский университет

МЭИСИ Москва

РГУПС Ростов на Дону

ИГС Саратов


Часть 5
Заключение
Култан Ярослав


Выводы
Не смотря на приведенный метод активного использования ИТ необходимо подчеркнуть роль преподавателя, который может внести существенный вклад к повышению качества образования.
Никакие новые технологии, автоматические или автоматизированные системы проверки, тестирования, других форм проверки или поиска не принесут свои результаты, если за ними не видно будет душу педагога.
Необходимо подчеркнуть что ИТ
могут стать средством облегчения труда студента,
улучшить доступ к учебным материалом,
но нельзя их считать средством, которое само научит студента думать.

Выводы

- Для эффективного использования ИТ необходимая работа качественных педагогов, которые с помощью ИТ могут:
  - создавать:
    - новые методики,
    - учебные материалы,
    - пособья,
  - могут их распространять тем студентом, которые проявляют стремление изучать что-то новое.
- ИТ могут стать
  - средством повышения квалификации преподавателей,
  - средством облегчения их труда,
  - средством ускорения проверки некоторых заданий.
- ИТ могут помочь преподавателям создать активную обратную связь направленную на сотрудничество со студентом, что может способствовать их взаимному профессиональному росту.

Návrh spolupráce- предложение сотрудничества

- Určenie vplyvu jednotlivých prvkov spätnej väzby na zmenu stavu vedomostí študentov určený pomocou testov;
- vyhľadávanie vhodných foriem a prvkov spätnej väzby;
- formalizácia výpočtu/odhadu vplyvu zavedenia dodatočného prvku do spätnej väzby;
- vytvorenie optimalizačnej funkcie a jej riešenie pri zostavení kontrolného mechanizmu študentov;
- výpočet počtu a zloženia spätnoväzbových prvkov pre vybrané predmety

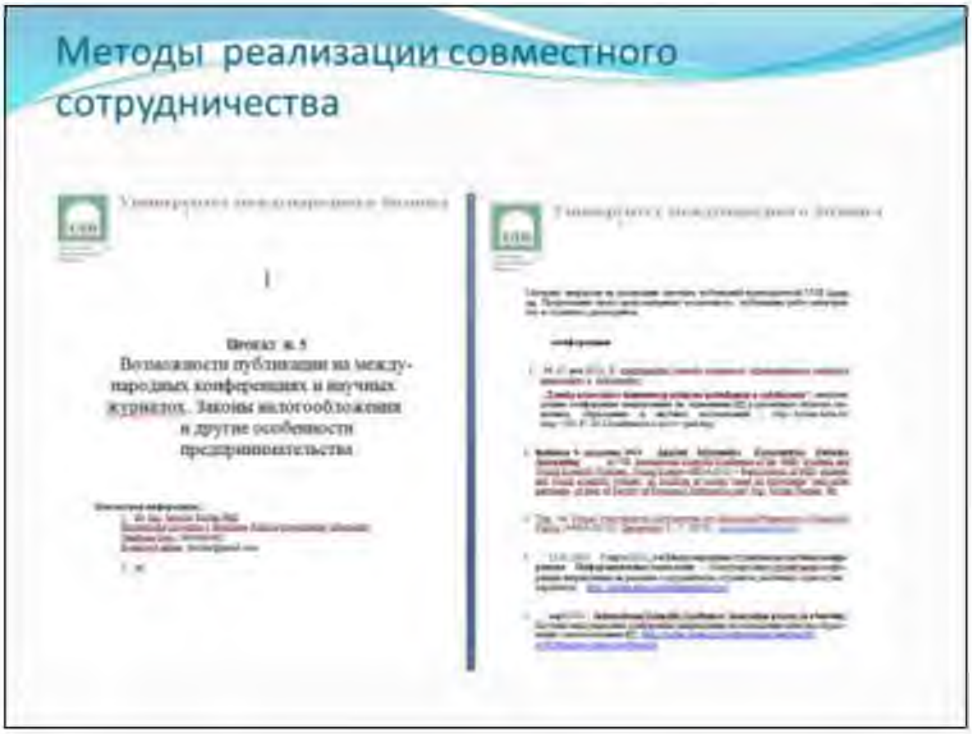
- Определение влияния элементов обратной связи на изменение состояния знаний студентов
- Научный поиск подходящих форм и элементов обратной связи
- Формализация расчета влияния дополнительного элемента обратной связи
- Создание функции оптимизации и ее решение в процессе создания контрольного механизма
- Расчет количества и сложения элемента обратной связи для выбранных курсов

Предложения взаимного сотрудничества

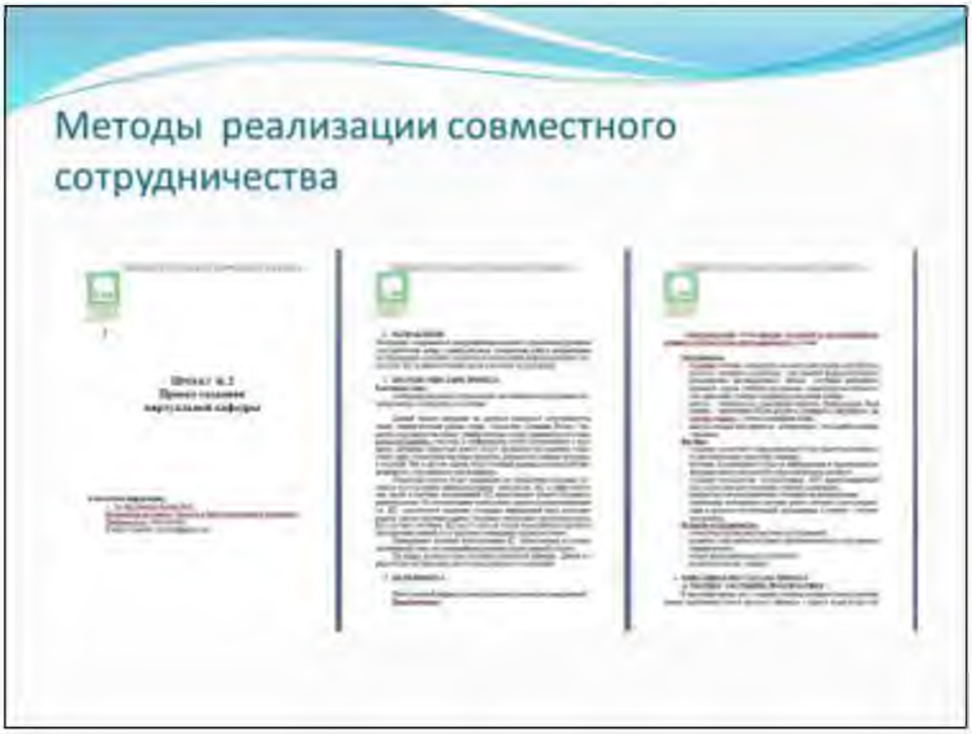
- создать учебные материалы на данном языке в письменной форме и электронной форме, с использованием систем LMS в системе Moodle;
- использовать для взаимной коммуникации между преподавателями и студентами коммуникационные каналы, которые позволяют коммуникацию и между несколькими участниками одновременно;
- создать параллельно две группы – группу словацких студентов и группу иностранных студентов;
- проводить лекции лекторов из-за рубежа, для которых данный язык является родным- рабочим;
- организовывать взаимные семинары с использованием систем видеоконференций;
- организовывать студенческие конференции с использованием систем видеоконференций;
- организовывать рабочие встречи словацких и иностранных лекторов;

Методы реализации совместного сотрудничества


Методы реализации совместного сотрудничества
Проект № 4
БУХГАЛТЕРСКИЙ УЧЕТ ОБЩЕЕ И ЧАСТНОЕ


Методы реализации совместного сотрудничества
Университет международного бизнеса
Университет международного бизнеса
Проект № 5
Возможности публикации на международных конференциях и научных журналах. Законы налогообложения и другие особенности предпринимательства


Методы реализации совместного сотрудничества


Методы реализации совместного сотрудничества

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Articles about Remote Experiments and Laboratories

E-learning Environment for the Remote Study in Material Properties Courses"

P. Arras[1], Y. Kolot[2], G. Tabunshchyk[2], T. Kozík[3]

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Abstract: *In this paper a newly developed e-learning environment for the support of the study on Material Properties is presented. It was developed to support the blended learning of the material and shape stiffness. Course structure is organized in HTML content, and virtual and remote laboratories are integrated in the computer aided learning module (CALM), which support both teachers during the hand-on teaching and students during self-study.*

Keywords: *CALM, remote laboratory; virtual laboratory; material stiffness, shape stiffness.*

1. INTRODUCTION

The field of material science is defined as a key knowledge area for engineers. Many – if not all – innovations in modern technologies are related to the use of new materials, or new technological methods of using existing materials. However, study time in existing curricula is limited and new findings in material sciences cannot be fitted in. E_learning modules could help make up for this lack of time. This paper is devoted to the Computer Aided Learning Module (CALM) [1], developed for the supporting e-learning courses in Material Science Properties.

2. STRUCTURE OF THE COMPUTER AIDED LEARNING MODULE

A complete driving learning module for material sciences is constructed. The structure of it can found in fig. 1. It is the framework in which fits the theoretical courses, and the different laboratories described.

The present remote lab in the Computer Aided Learning Module (CALM) is intended to be used to study the phenomenon of material versus shape stiffness. The CALM contains all the learning contents students are supposed to study on the subject. The CALM will be used in classroom teaching and demonstrated to instruct students on how to use the remote lab.

Figure 1. – Structure of the course on material science, integrated in the CALM

Students will study theory afterwards at their own pace, using the hypertext environment, and next simulate different combinations of materials and shapes in the virtual laboratory. Finally students can experiment on real material and shapes in the remote laboratory.

Different techniques are combined: hypertext linked contents, virtual lab (using Shockwave Flash) and a remote lab (controls for it using Javascript) (fig.2). Slideshows are provided for documentation purposes and to include the classroom presentations (fig.3)

The structure of the theory on the CALM reflects the materials in the students physical course books. As such the look and feel of the e_learning environment is similar to what students experience in the classroom sessions [2].

Figure 2. Navigation in the hypertext

Figure 3. Lectures presentation

3. VIRTUAL LABORATORY

The virtual laboratory is a simulation of a test in the physical laboratory for material properties study [2]. It was constructed using the basic formulas for the bending of a cantilever beam. In the virtual lab a number of specimen with standard sections can be tested. Applied force, shape is changeable to offer a wide variety of possibilities. The only limitation with the basic formulas is that asymmetrical test specimens will yield erroneous values, because bending outside the plane of the specimen is not considered in the basic formulas (fig.3).

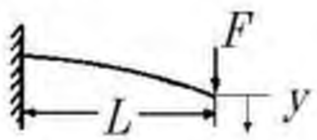

Figure 4. Deflection of a cantilever beam.

Used formulas for bending of a cantilever beam [3]:

Maximum deflection at the free end:

$$y=\frac{F\times L^3}{3\times E\times I} \qquad (1)$$

Maximum bending stress in the cantilever beam (at the supported end):

$$\sigma=\frac{FxL}{I/v} \qquad (2)$$

Moment of inertia (I): e.g. of a rectangle:

$$I=\frac{b\times h^3}{12\times I} \qquad (3)$$

TABLE I. USED SYMBOLS

Used symbols		
Symbol	***Name***	***Unit***
E	Young's modulus	MPa
I	Moment of inertia	mm^4
F	Load	N
σ	Maximum bending stress in the cross-section	MPa
y	Maximum deflection	mm
L	Length of beam	mm
v	Distance to neutral fiber	mm

A. Functional requirements for the virtual lab:

1. Calculation and visualization of the deflection of a cantilever beam, with measurement of deflection at the end and indication of maximum stress and force.

2. The values for different Young's modulus for a variety of materials should be chosen according to reported values [3] .

3. For a variety of shapes (rectangular section, H-beams, U-beam, hollow shapes…) the shape stiffness can be used.

4. For different orientations of the same shape (increment angles 1°) about the principal axes.

5. For a variety of dimensions in the same shape. (cross section dimensions and length). The different values should be entered by the student experimenter.

B. Supplementary Requirements for the virtual lab.

Experimenting students should be able to select all different possibilities with the aid of pull down menus and selection panels, and dialogue boxes for dimensions.

Readings of deflection, force and stresses with the aid of lookalike analogue meters.

Force should be applicable with the aid of a slider bar, and real time adjustment of readings should be taken care of.

Readings should be exportable: available in a window from which to copy, together with material and cross section data. This feature is necessary for the students to make their reports. As such they can copy the data without retyping, but also without any special formatting in the virtual lab, so it can be fit in any report.

C. Virtual Laboratory Realisation

For the virtual lab realisation were used HTML5, ActionScript and JavaScript. The component diagram of developed application is presented on the fig 5.

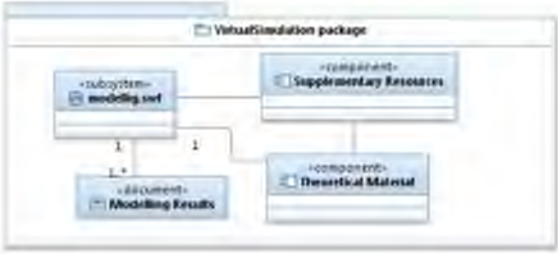

Figure 5. – Component Diagram for Virtual Lab

Subsystem "Modelling" is an interactive animation, based on Flash and ActionScript. Its consists of 3 components: a visual component, a component for calculations and the component showing different shapes. Such realizations make it possible to easily add new shapes.

The realization of the calculation for different shapes is realized by classes put in package beam, which is part of subsystem "modelling" shown on the fig. 6.

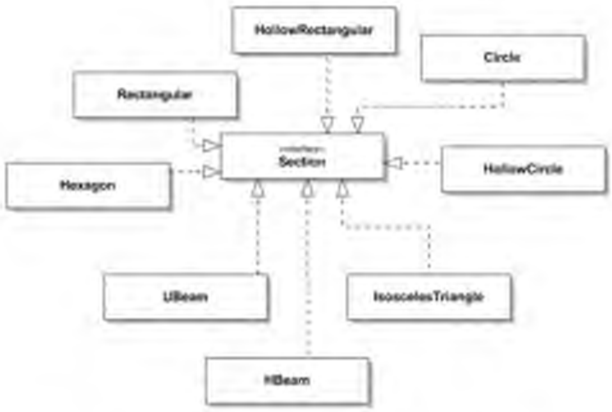

Figure 6. – Class Diagram for the cantilever beam calculation depending from the shape

C. Virtual laboratory functionality

To run the experiment on the client side user should use any web-browser with an installed Flash Player. The main screen of the virtual lab is in figure 7.

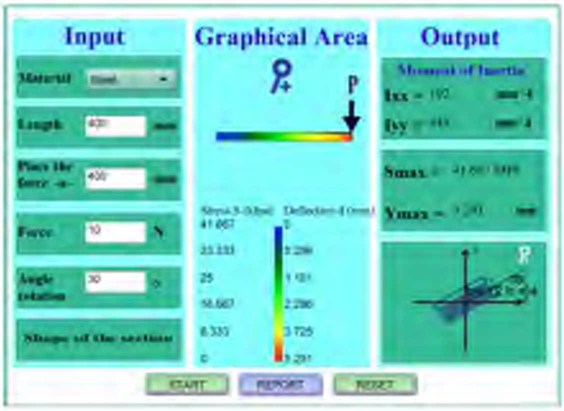

Figure 7. – Screen shot of the actual virtual lab.

All results can be viewed in an additional window and printed (fig. 8). The report window is a simple text window which allows the student/experimenter to copy paste these results in his lab reports, without having to type all texts.

Figure 8. Screen shot of the report screen.

4. REMOTE LABORATORY

The objective of the experiment in the remote lab is similar to the objectives of the real physical lab on bending. First objective is to see and to measure the deflection of the cantilever beams. These values can be compared to the theoretical results from the virtual laboratory. Second goal of the physical lab which is substituted by the remote lab is to let students understand the influence of errors in measuring values on the uncertainty of their results. Students need to calculate the (possible) error on their values by means of the theory of errors, considering all sources of errors in the experiment (accuracy of tools, uncertainty of loads, distances...)

A. *Hardware construction*

The construction of the experiment consist of sets of beams. The beams can be any basic shape (round, square, rectangular, hollow). The beams as deformed by pulling them with pneumatic cylinders (fig.9). A reading scale is attached at the front end to measure the deflection by means of a camera. The reading scale resolution is 1 mm. The improve the read-out of the deflection, at the end of each beam, a blue marker was attached, to contrast as much as possible with the reading scale. Electronic control of the lab is with a simple relay board, on the USB-port of the computer.

In the lab uses an IP-cam for the measurement (reading the scale) and a web-cam for board control and monitoring the deflection.

Figure 9. The hardware construction

B. Remote Laboratory realization

The control software driving the remote lab and integrating it in the CALM-website was developed with the collaboration with ZNTU, leading to a graphical user interface containing camera pictures and controls in one screen.

In general the software for the remote lab consists of three main subsystems:

- for control of the cameras;

- for board control;

- for lab control;

The subsystem for lab control is a controller which allows to control the process: initiate the session, safety control, process the logic of the experiment, close the session (fig.10).

Figure 10. Remote Laboratory functionality

The subsystem for board control task is for switching the relays on the relay board.

In figure 11 is shown the class diagram for these two subsystems.

The subsystem for camera control is an independent system, which allows to output video-streams using the rtsp-protocol and to save screenshots of the device with high resolution for further measurements. Using the rtsp-protocol allows to display the video in browser after installing the vlc-plugin.

For the realization was chosen the Spring MVC Framework. The basic logic was realized with java, for visualization were used HTML, CSS, Javascript, JQuery, JSP.

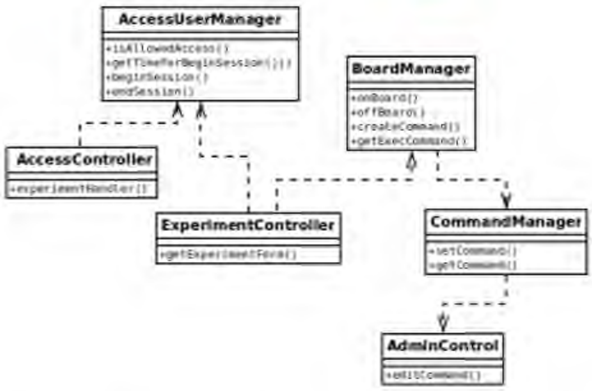

Figure 11. Class diagram

C. Functionality of lab-control module

After getting access to the remote lab student can choose the force applied to the beams and activate the forces on the different test specimen (beams) by pressing the different valve buttons.

To cope with possible problems on images and video, a section for saving screenshots was integrated for offline working with the experimental results. The different screenshots can be reviewed to measure the deflection at the end of the beams. As such experimenting time could be reduced to 10 minutes per student. Security measures are installed to avoid automated/hacked control of the lab.

The view of remote laboratory control through web interface can be seen in figure 12.

Figure 12. Remote Laboratory: left IP-cam for measuring, right webcam for viewing the deflection.

First evaluations of the lab show that overall functionality of the lab is appreciated by the students. Most of the problems arise with the video (speed of connection for life-streams) and the interference or no connection with plug-ins. Also the use of the lab in different browsers (Internet Explorer, Google Chrome, Firefox) show causes of ineffectiveness as all 3 browsers treat videos differently. This makes it somewhat difficult for the students, as they (sometimes) need to tune their browser first.

5. CONCLUSION

The blended learning approach shows the most efficient results among different approaches with the usage of e-learning systems. The developed e-learning environment CALM is useful both for students needs (self-study needs) as for teachers (central source of all course related materials). It consists of different e-learning tools – html content of learning material as theoretical background and recommendations for practical tasks, tools for lecture presentation, elements of experiments with material properties simulation and remote laboratory, which give possibilities for a more practical approach to learning.

In future, new tasks on expanding the CALM are to modify the architecture to incorporate new infrastructure for other remote laboratories and to enhance the security model, as there are plans to increase number of students using the remote labs. Security is necessary to ensure the safety of the equipment and to avoid early wear or destruction by unwanted use of the remote labs.

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Remote Experiment in Terms of View of Didactics of Education

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Abstract: The preparation and use of remote experiments in the education system consists of the solutions of two, at first glance, single and independent issues. The first one, on the part of the provider - the administrator of the remote real experiment, is a solution of technical design for the remote experiment and consequently its implementation. The second one, on the part of the remote experiment user, is a solution of the tasks related to didactics of the application of remote experiment in the different stages of a lesson. To achieve a positive educational effect from the application of remote experiments in education, solution of didactic tasks is as important as solution of technical design of the experiment. The authors in this paper propose a procedure for making solutions, implementation and operation of remote experiments. They come to the conclusion according to which maintaining the long-term functionality and regular innovation of the remote experiment has the nature of the development spiral. They define the essential role of pedagogical research in relation to the application of remote experiments in education. In addition, they refer two examples of technical solution of remote experiments, in which for the control and management, the programmable logic controller (PLC) is used.

Keywords: *Remote experiments; Internet; School experiments; didactics*

INTRODUCTION

Real experiments (RE) in natural and technical sciences are integral and inseparable parts of the teaching process. Their fundamental educational aim is to provide a widening of knowledge in the frame of particular topics of the curriculum. The most frequently used method is the verification of the existing laws and dependences between physical quantities or technological parameters. By performing experimental measurements pupils or students:

- obtain the ability to apply theoretical knowledge in the frame of practical activities,
- improve their practical skills with aids and measuring apparatuses,
- gain laboratory experience,
- confirm and widen their knowledge from the course of previous study.

Laboratory experiments cause interaction between previously obtained knowledge and newly gained experience and so they support what we call a metacognition [2] while hand in hand pupils/students learn to cognize methodology of scientific and research work. They also positively influence our youth in the process of their deciding regarding future professional orientation in the area of natural scientific or technical spheres.

Besides educational influence, practical school experiments also have the edifying function. Thanks to them students improve their:

- relationship towards purposeful research and technical work,
- habits in precise execution of work activities,
- sense of fulfillment after successful experiment,
- cognition of the mutual relation between abstract theoretical thinking and practical activities,
- experience in work in the laboratory and in the team.

Progress in the area of Information and Communication Technologies (ICT) changes the environment of laboratories, their technological configuration, methodology of measurements, the way of recording and evaluation of the obtained data. ICT have become a tool that provides conditions enabling the transfer of real experiments from the real laboratory to any place on the Earth via the Internet. Usage of school experiments enables teachers to perform educational activities while emphasizing individual demands [5]. According to the authors [9], usage of the remote experiments enables higher flexibility that is required in the experiments with real phenomena; and above all, the Internet on-line laboratories enable more effective deployment of the laboratory equipment by students themselves, since thanks to the Internet they can use them from any place and at any time. Such sharing of the created laboratory experiments decreases expenditure needed for building and running the laboratories and on the other side it increases accessibility of the experiments for a higher number of students. Nowadays, it is possible to connect more e-laboratories via the Internet that are placed especially in the university workplaces.

STARTING POINTS OF THE REMOTE EXPERIMENT APPLICATION IN EDUCATION

The creation of a real remote experiment that fulfills demands for its reliable and safe running while meeting methodical objectives is not a simple task. The challenge and specification of this task requires a close cooperation of real experts – specialists. (fig.1)

Implementation team			
Teacher	Designer	IT technician	Engineer

Figure 1. Implementation team of experts

So that real remote experiments can become an effective teaching aid it is important and needed to keep the valid principles regarding the preparation and running of the remote experiment as may be seen in the developmental spiral (fig.2).

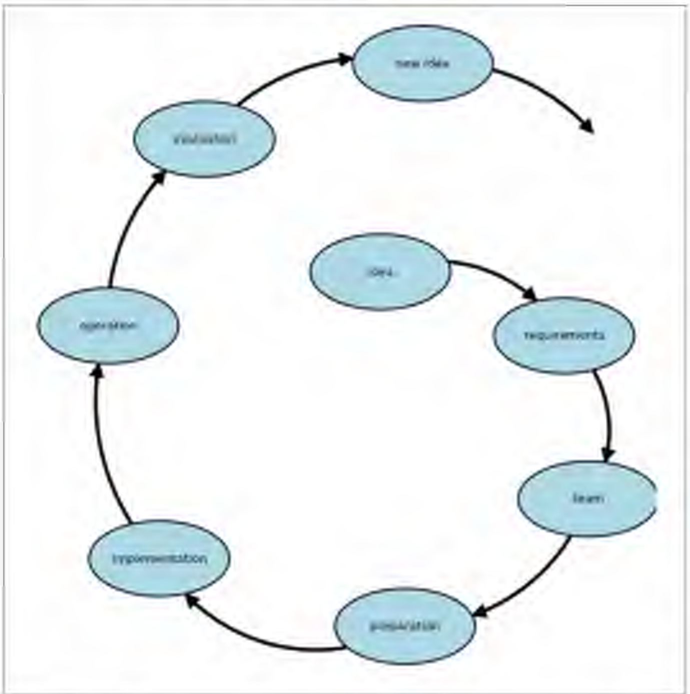

Figure 2. Developmental spiral of remote experiment

The basic idea comes from a designer – a pedagogue, who specifies a task for the experiment from the particular topic of a curriculum, defines fundamental demands for the creation and running of the experiment from both technological and didactical points of view. Last but not least there is a task regarding the creation of an appropriate work team. The outcome of the cooperation of such a team is the created experiment ready to be verified and consequently offered to users on the Internet. Another important phase in the process of further development of the experiment is the evaluation of its functioning that is closely connected to the design of innovative ideas and their implementation in the next developmental cycle.

To provide a sustainable remote experiment we need to guarantee both its sufficient maintenance and continual innovations where demands from the side of users who in practice are teachers and pupils/students must be taken into consideration.

The crucial demand of teachers regarding remote experiments (RE) is to provide a higher level of fulfillment of educational and edifying aims in teaching process.[7]

The design and application of a remote experiment represent two separate troublesome areas. The first one deals with a technical solution and the running of a remote experiment on the side of a provider who is responsible for the:

- design and construction of a remote experiment on a specific theme,
- system of management and control of functionality of particular experiments,
- philosophy of collecting and processing of the observed data,
- hardware and software support of the remote experiment via the Internet.

On the side of a user of a remote experiment the situation is completely different. The most likely, user of the RE is a pedagogue – teacher, who decided to use the RE as an innovative tool in the lessons. Such a user is primarily interested in the didactic side of the experimental topic and how the experiment can help him/her improve the level of education. Technical and programming issues of the RE are usually just secondary from the point of view of users – teachers.

When working with RE we deal with real laboratory equipment that is perceived indirectly on the side of a user. According to [8] one part of students do not perceive remote laboratories as the real ones and that is why we should try to reach the state where the display and controlling of the experiments are as authentic as possible. It must enable accessibility to all the possible settings of the experiment. Possible faults in the setting of incoming parameters of the experiment cannot be filtered out automatically, but the users must detect them and consequently try to correct them. Outcomes of the measurements should be obtained in the same way as if students take them in direct work with real equipment. [4]

SOCIAL CONDITIONS OF APPLICATION OF INNOVATIVE TEACHING SUPPORTED BY REMOTE EXPERIMENT

In the last 20 years there is an obvious decrement in the interest in study of natural scientific and technical disciplines among students of elementary and secondary schools in the SR. Experience of the authors from numerous study stays abroad show that there is similar development visible also in other European countries. It is generally known that subjects like mathematics, physics or chemistry are not very much preferred and favorite among pupils/students at elementary/secondary schools. A really sad fact is that similar opinions are heard also from the graduates and postgraduates of technical universities.

Successful study of these subjects is generally contingent on the adequate level of abstract thinking, and good spatial visualization connected with logical and analytical thinking. These attributes are not automatically given to all people and even among those who have such skills it is needed to intentionally develop and improve them through the educational process.

Thanks to information technologies much scientific knowledge is accessible to wide layers of inhabitants in the early decades of the 21. century. E-technologies and their continual applications seriously influence traditional educational systems. It is a contemporary issue for the pedagogical staff to answer the questions what to teach, how to teach it and when. The philosophy of education itself changes constantly. There is a tendency to divert from the philosophy of education orientated towards a lifelong occupation and consequently the philosophy of education for constantly changing conditions on the Labour Market comes forward.

What we know is that lifelong education is being emphasized more and more in today´s world. Our society starts to realize the meaning and importance of real fulfillment of a term knowledge society or so called learning society in relation to its permanently sustainable development [6].

In the abovementioned social-economic environment there are also educational systems of particular countries whose fundamental aim should be the provision of such an educational level of inhabitants that has a potential to create preconditions of its future development.

Specification of teaching technical branches is in the necessity of applying a whole range of creative methods for every particular technical or technological problem. This approach in education represents the very substance of innovative educational forms in which a teacher is in the position of a partner for pupils/students and at the same time he represents a role of authority and personage. The basic role of a teacher in this model of the educational process lies in the activation of learners towards the subject of education thanks to which a needed place for individual activities of learners will be created orientated on the already mentioned attributes (abstract thinking, spatial imagination, logical thinking etc.).

In the history of the development of human societies there had never been recorded such a huge acceleration of updating knowledge as it was in the 20. and at the beginning of 21. century. As a consequence of quick mass widening of the ICT applications, new information regarding advances in science, research and social development have become easily accessible for people practically of all social groups. E-technologies are more and more frequently used in the area of education. Step by step the whole society gets to know the meaning and content of the term knowledge society in connection to the perspective of sustainable industrial growth [6].

In the abovementioned social environment there are acting and developing various educational systems. Specification of teaching technical specializations lies in preferential implementation of creative methods in the process of solving various tasks or problems. Getting familiar with this approach from the very beginning (ideally already at the level of pre-school education) creates positive predispositions for further successful understanding of more complicated technical principles in the course of further study and the elegant mastering of various technically orientated activities in everyday life.

REMOTE EXPERIMENTS AND THE DIDACTIC CYCLE

The creative approach is the substance of an innovative form of education where a teacher stands in the position of a partner while keeping his authority. So that a pedagogue/teacher can reach the required educational aim, he must be able to attract the attention of learners to the particular topic. And the implementation of experiments (hands-on, remote, simulated) in education is the mean that enables it [11].

In both vocational and pedagogical literature there is no straightforward answer to the question regarding minimal ICT competencies of a pedagogue for the creative application of remote experiments in the teaching process that would enable one to design and create one´s own educational experiments while being supported by e-technologies. There is also one reasoned definition of didactic demands for this type of experiments missing, which should be taken into consideration in the process of their design, construction and running. The teaching process has got its specific attested sequence of activities on the side of a teacher as well as on the side of a learner that have been proven in the course of time. This didactic cycle consists of the [12]:

- formulation of the aims of teaching process and consequently their acquisition by learners,
- reiteration of previously obtained knowledge that is closely connected to the new study content,
- exposition and acquisition of a new study content,
- consolidation of newly received information,
- check of the attained outcomes in the educational process,
- setting tasks for a home preparation.

In every one of these phases a teacher can use different methods [10]:

- motivational (supporting interest in learning),
- expositional (getting acquainted with the new study content),
- fixative (reiteration and consolidation of information),
- diagnostic and classificatory (examination and evaluation).

Teaching supported by information technologies has recently become a favourite way of teaching among pedagogues galore and it is positively accepted by students themselves [11][3][2]. This fact itself supports expectation for reaching better educational effect when compared to the traditional forms of education.

If we take into consideration all the mentioned didactic demands in the process of designing and running RE, then such a system should fulfill the following criteria:

- easy accessibility on the Internet,
- simple orientation on the web site of the experiment,
- easily understandable guide regarding handling the experiment,
- assignment with clear definition of educational aims,
- corresponding theory to the theme of an experiment at the appropriate educational level of a user,
- definition of a way of communication between users and provider of the experiment,
- recommendations for pedagogues regarding the deployment of the experiment in particular stages of a teaching unit (in didactic cycle).

From a technical point of view the experiments should be constructed in such way so that:

- the created experiment is in accordance with theoretical knowledge which it is based upon,
- it is technically resistant against user´s failure in the process of control of the experiment.

It is obvious that the deployment of a gradually widening net of e-laboratories that are used in pedagogical practice is going to be the subject of serious pedagogical research in the nearest future. The issue of development of new universal systems in management and control of remote laboratories that would provide safety and needed economy in the process of their running shall also be one of the topics of the research.

TECHNICAL SOLUTION OF REMOTE EXPERIMENTS WITH DEPLOYMENT OF PLC

Authors in the process of designing remote experiments and constructing remote laboratories have decided for the philosophy of applying the elements of industrial automation. In the process of searching for suitable technical solutions to ~~of~~ managing and handling the experiments in remote laboratories they decided to try to use technical parameters and attributes of PLC. PLC (Programmable Logic Controllers) are used in solutions of automatized tasks at different levels of technical difficulty. When deciding about deployment of PLC, the fundamental and original idea was the creation of a universal system of handling and managing. A system constructed in such way will be exploitable also in teaching the subjects orientated on automation.

The system of remote administration of PLC on the Internet is provided via web server which represents the graphical interface (GUI) between PLC and users. Communication between the web application and PLC itself is provided via OPC server (OLE for Process Control).

In technical experimental tasks from the area of electro engineering we frequently may see a task regarding regulation of revolutions of an electric engine. The authors have decided to use the frequency transducer in their remote experiment. In fig.3 is displayed overall configuration of the remote experiment for the regulation of revolutions of the 3-phase electric engine by the 3-phase frequency changer.

Figure 3. Configuration of the real experiment regarding regulation of the engine revolutions by a frequency changer

Parameters of the frequency changer are set in a way so that revolutions of the engine can be regulated by a time width of the input impulse. It means that if there is a logical 1 at the A master input of the frequency changer, then the speed of the engine will continuously rise all the time while the logical 1 remains active at this input. B input will react similarly in relation to the decrement of revolutions. In the case that at both inputs (A, B) are logical 0 or 1, revolutions of the engine will not change. In this configuration the PLC made by EATON EASY 512 was used. It is the bitwise combinative automaton managed through OPC server.

In the process of constructing remote experiments in remote laboratories the question of their economic efficiency becomes more and more important. Running the experiments in the remote laboratories is a difficult task from the point of view of the illumination of the workplace. It is required to provide a permanent source of illumination of particular experimental configurations even in such cases when there is nobody logged in on the server.

An interesting decrement in operating expenses can be obtained through the installation of a system that after user´s entry turns the light in the laboratory on and consequently activates particular experimental components. This function can be added into the remote experiment that is operated by programmable logical automaton [13].

A model of a remote experiment simulating the abovementioned processes may be seen in the fig4.

Figure 4. Model of regulation of illumination of the remote experiment in the real laboratory

Nowadays, it is not a problem to create practically any experimental configuration and consequently to make it accessible for users via the Internet. Still one open problem remains - how the experiment from the point of view of a user can be deployed in education, or in other words, how it will be implemented into the teaching unit so that a teacher can reach the demanded educational goals.

CONCLUSION

Already nowadays there are obviously visible changes in the educational environment at practically all types and levels of schools as a consequence of implementation of up-to-date applications of the information technologies in education. RE make a good example of their penetration into the teaching process especially in natural scientific and technical areas where there is an emphasis put on the deployment of methods regarding the work with experiments. In parallel, they are a challenge for pedagogical research in the area of searching for the answers to the questions regarding their implementation into the teaching process and the impact on knowledge level and specific skills of postgraduates from natural scientific and technical fields. The already published outcomes regarding deployment of the RE in educational sphere point at their benefit especially in the area of shortening the time needed for practical vocational training of pupils/students. We want to state that deployment of RE in education does not automatically mean total exclusion of real experiments from the teaching practice. Ideally, the RE should be combined with the real experiments [11]. The potential of deployment of remote experiments lies in the individual approach of every teacher, their ability to prepare a good experiment and the overall pedagogical mastership considering innovative principles of teaching and the effective exploitation of educational time.

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Remote Experiment Using Elements of Industrial Automation

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Abstract: *A new concept of solution for control of remote real experiments (RRE) is designed in this work. The designed concept is based on the use of elements of industrial automation at the construction of the RRE. Their use in applications of design of the RRE brings substantial technical and economic benefits in comparison to the previously used systems. A relevancy of the used concept for designing of the RRE in education has been proved by the successful application of the elements of industrial automation in the particular RRE "Measurements of fluid flow" created by the Department of Technology and Information Technology at Faculty of Education, Constantine the Philosopher University in Nitra.*

Key words: *experiment, remote control experiment, PLC system, industrial automation, construction system*

INTRODUCTION

By the progressive expansion of internet services and by the progress made in the field of automation and control technology the remote control/real experiments (RCE/RRE) have been gaining in popularity not only in university education but in the other types of schools – as elementary and grammar schools. The extension of the RRE applications is caused by looking for the teacher´s answers: WHAT, WHEN and HOW to teach?

Advances in science and technology and the resulting new unconventional technical solutions together with development of informational technologies create an environment in education which necessarily requires a change in the educational contents and in the forms of education. It is expected that the newest knowledge of science and technology and also more information will be smoothly available for a human during his whole active life due to the development of information technology and other scientific and technical progress. In the educational system there is allowance for an exchange of requested knowledge and abilities for everyone in lifelong learning.

There has been occurred a task for teaching science and professionals working in education how to solve education at this level of development of scientific and technical knowledge and at the requirements of the society. Furthermore, a very important requirement is to propose a solution with signs of economic approach.

Situation in technical and natural sciences is even more complicated due to formation of practical skills and experience during preparation for the profession which is essential part of the preparation and of the education of future specialists. It is very costly to build laboratories and technically complicated workplaces as well as their run and innovation.

One of the possible solutions how to reach the requested quality in education of technical and natural branches (subjects) in connection with the gaining of practical skills when working with measurement equipment and systems is an application of RRE in education.

Thanks to the internet there is a network of the remote real laboratories where the experiments are installed with the possibility of remote control by computing. An ambition of the Department of Technology and Information Technology at Faculty of Education, Constantine the Philosopher University in Nitra is an active entrance into the global network of existing remote laboratories by creating own remote laboratory complying with exacting technical and educational parameters.

The aim of this work is to show the authors´ approach to engineering solution of the RRE, measurement of fluid flow, by using elements of industrial automation.

REMOTE CONTROL EXPERIMENTS - RCE

The experiment is defined as the basic method of scientific knowledge. It serves to obtaining or testing of new theoretical results. However, the experiment is not a domain for scientists and specialized scientific institutions only. The experiment is applied as one of the teaching methods in teaching practice. This type of experiment differs from the original scientific experiment in its requirements and objectives. Pupil or student will understand an experiment only if he makes it by himself. Therefore it is important that every pupil/student participates actively in control and evaluation of an experiment. The ideal solution would be to make several identical experiments in parallel in groups. Pupils/students would have more space for personal practice in the implementation and control of the experiment. At the same time pupils/students could compare the achieved results to each other and analyze them. It is well known that the school instrumentation for realization of experiments is often insufficient. Studies in the field of educational research show (e.g. results of educational research by Thorton [1]) a didactic suitability of demonstration of the natural science and technical effects and principles in teaching. At such a teaching the pupils/students better understand the link between theory and practice. Science achievements are directly related to observing and studying of events in nature. From this point of view the experiment becomes an important teaching and learning tool. Currently pupils/students of many schools do not have any possibility to confront their theoretical knowledge with practice. A large range of science lesson´s theory leads students to memorize the learning knowledge. (The authors reached this conclusion on the basis of discussions with teachers of primary schools at workshops). This approach does not allow pupils / students adequately understand the discussed topic. The result is an inability of pupils / students to apply the acquired theoretical knowledge in practice. Under the influence of this approach, pupils / students take a negative attitude to the subject which results in a reduced interest of pupils/students in the study of natural science and technical subjects. Currently it is showed a significant reduction in a number of students of natural science and technical subjects what is perceived as a result of the longtime school practice. [2],[3],[4],[5]

One of the possibilities how to solve the current situation in the teaching of science and technology in relation to the use of experiments is the use of remote control experiments. Remote control experiment (RCE) is a real physical, chemical and technical experiment which is realized in a real laboratory. The difference from „classical“ real experiment is that an observer and an executor of the experiment is out of the laboratory and whole running of the experiment is controlled and monitored through the commands and image transmission via a computer network Internet. The design of this type of experiment requires much more time, personnel and financial costs in comparison with the classical real experiments. It is necessary to realize that such an experiment, which is installed in one of the educational workplaces (laboratories) via the Internet, can be used by Slovak, whether European or global electronic network. Accessing of the RCE in a global scale can help to sort out a problem of financial unavailability of experiments in schools of all types. [6]

The results of research of the examination of the application of the executed RCE in teaching and their influence on education level show that the use of the remote control experiments clearly improves quality and efficiency in teaching of science and technology. Thorton research [1], which aimed to compare the success of teaching with the support of the RCE to the classical teaching without experiment showed much better results of the teaching with the support of the RCE. According to research results:

- 30% of the respondents were successful at the use of the classical teaching method, it means teaching method without experiment and
- even 90% of the respondents were successful at the use of the teaching method with the support of the RCE bolo.

Score in favor of the teaching with the RCE use was even more significant in understanding of physical effects and principles. The subject of the study with the use of demonstration of the RCE was understood by up to 90% of pupils/students (respondents) in comparison to 15% of the respondents educated by traditional way without experiment. According to Thorton the high efficiency of the RCE is achieved thanks to the following factors:

- the RCE has a positive influence on an activity of the students,
- independent work of pupils/students on the research technique,
- immediate feedback,
- reduction of the time need for theoretical calculations in relation to deepening the knowledge of students

[1],[7],[8]

STRUCTURE OF THE RCE

The idea of remote control and monitoring of remote experiment brings special technical requirements for the methods and technical means. In terms of technical requirements of the implementation the technical means of the RCE can be divided into the following groups:

a) Technical means carrying out the very natural principle of the experiment

Technical means carrying out the natural or technical principle of the experiment are all the components of the content essence of the experiment itself. These components are often completely identical, whether it is a real implemented experiment or remote control experiment. In this category in case of the RCE (experiment of measuring of fluid flow) there are following components represented: three-phase motor, fan, flow tube, Venturi or Pittot (Prandtl) tube and plastic tubes.

b) Measuring device of physical quantities

This group of components is created by all the measuring device of physical quantities which are involved in the measurement. In case of the remote control experiment there is necessary a measuring device which is equipped with communication ports for sending out the value of measured physical quantity into the control system of the remote experiment.

c) Technical means providing remote control of the experiment

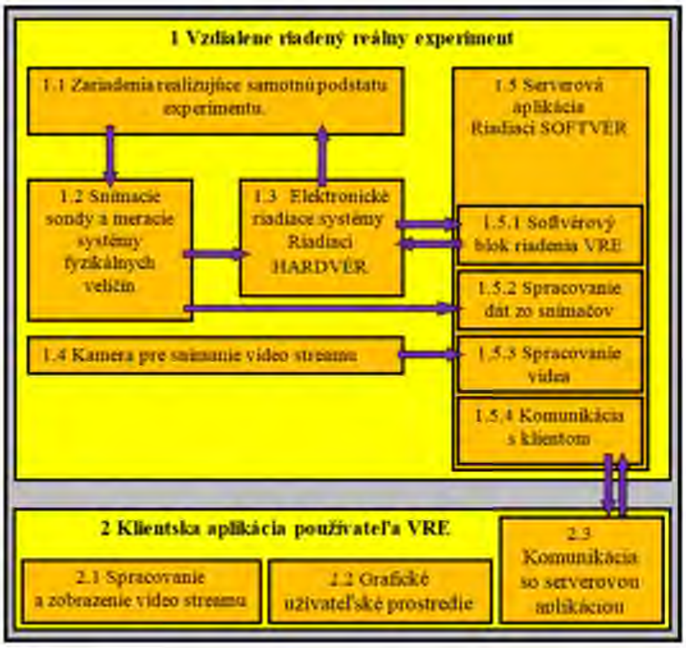
Technical means are a specific group providing remote control of the experiment. Here we include all the hardware and software systems which provide for control of the RCE, communication with user, sensing and processing of measured values and also for software control algorithm throughout experiment.

d) Devices for scanning and transmission of a video stream

Success of the RCE in teaching practice depends on the quality and speed of transmission of the video stream which provides a general view of experiment course for the user. Transmission of poor and low quality of the video stream can be a key reason for their absence in teaching process. Also in case of excellent technical structure or didactic support the use of the RCE by teacher or by users (pupils/students) can be refused because of the poor video stream. From this reason it is necessary to pay a close attention for this group of devices at the preparation of the RCE.

BLOCK DIAGRAM OF THE RCE

The RCE shown in the block diagram (pic. 1) is divided into two basic parts. The first part is the experiment itself which is controlled by the user, client over the Internet by the client application. To explain the function of each part of the block diagram we are presenting an illustrative example of the start of measuring evoked by the user. The user presses the START button in his graphical user interface /2.2/. Client application /2/ evaluates the request and through the communication block /2.3/ sends data via computer network of a server application. The server application /1.5/ receives data about client´s requirement using the communication block. /1.5.4/



Picture 1: Block diagram of the RCE

The entered information is evaluated (e.g. if the requirement is valid or if its realization is not implemented under the previous command, etc.), after that it is prepared and it is sending a command in the form of electrical signals via software control block of the RCE /1.5.1/ to the appropriate electronic device /1.3/. Components of the electrical control system /1.3/ are implementing the appropriate clients request in the space of the experiment itself /1.1/. Feedback of the control is realized by sensing probes and measuring instruments /1.2/, which are sending the obtained data to the control electronics/1.3/, or via server application /1.5/ using the relevant blocks /1.5.2/ and /1.5.4/ directly to the clients application /2/. Received data are processed by client´s application /2.3/ and they are displayed on the computer screen/2.2/. Feedback function is also realized by scan and video stream transmission system. The picture is scanned by using the camera /1.4/ and it is processed by server application /1.5/ in the block /1.5.3/. The processed video stream is transmitted over a computer network to a client application /2/, which is processing and displaying the received video data in the module /2.1/.

The set of all software and hardware components providing the remote experiment control by users is called structural framework or constructive system. During the development there were more constructive systems designed and successfully implemented. One of the most well known systems is LABView constructive system.[9]

PURPOSE-DESIGNED CONTROL CONSTRUCTIVE SYSTEMS OF THE RCE

Based on economic and technical problems related to the RCE design several designers came to draft of their own control electronics and their own software control through the serial structural systems. Such a design framework is usually very closely and purposefully designed for specific task what causes an inefficient handling with time and effort of the designer. The designed closely specialized system which is used for one specific purpose only is waste of the time, knowledge and technical abilities of the designer in comparison with incurred effort. Low economic attractiveness of design of constructive systems for the RCE is logically reflected in the low number of such experiments. [10],[11]

Construction and operation of the RCE is difficult to funding, the organization and the technical knowledge of designers. From our experience we know that the operation of the RCE in the market system is not sufficient to cover even the overhead costs associated with their operation. To keep the operational capability they need to be subsidized. Discontinuance of the operation of several RCE is a result of ran out of the financial resources necessary for their operation and maintenance. [12],[13]

INDUSTRIAL AUTOMATION SYSTEMS

Word „automation" is becoming one of the most frequent words of the present. It is obvious because along with the development of information technology enters into all areas of human activity. Automation has become one of the important criteria in assessing the capabilities and the overall level of the individual, society and humanity as a whole.

The term automation means the use of control systems (e.g. regulators, sensors, computers, ...) for control of the industrial devices and processes.

In terms of industrialization it is a step following the mechanization. While mechanization provides people with mechanical means and tools to facilitate their work, the automation means reduction of human need in the performance of certain activity. Under certain conditions (complex automation – beginning of artificial intelligence) there could theoretically come up to the total disappearance of man from the production process. However, in practice this possibility seems to be impossible yet. [14]

From the point of view of the designers it is possible to understand the remote control experiment as a remote control automation system. New possibilities for solutions have been opened for the implementers by changing the view of the RCE construction. The existing broad range of elements of industrial automation and their mutual smooth compatibility have created an unbounded space of technical combinations and possibilities of the problems. The structural design of remote control automation system with the use of industrial automation has become a challenge and motivation for verification of the technical skills of the executive team of the RCE of the Department of Technology and Information Technology at Faculty of Education, Constantine the Philosopher University in Nitra. To handle this challenge it required at first an extensive study of the problems of design and creation of the remote control automation systems. [15]

INTEGRATED SYSTEM OF INDUSTRIAL AUTOMATION

Hierarchical arrangement of the elements of industrial automation in an integrated control system is shown in the form of a pyramid with more levels (pic. 2). [16]

Picture: 2 Levels of automation system [17]

From a functional principle, all automation systems show the presence of devices on the 1st and 2nd level (pic.2). Using sensors and measuring devices, the system detects the state of the controlled process. Through activators it interferes with running of the process what means its affection and control.

A crucial element in the regulation system is a regulating or control system (member). On the basis of the inputs it evaluates the current state of the system and decides on the activity of activators.

Levels 3 and 4 in the pyramid model present optional features of the regulatory system. These are mostly occurred in more complicated control systems. In accordance with the model scheme (pic. 2), below we will pay attention to technical and application analysis of elements which are going to be used in a technical design solution of the control of a model remote control experiment. [17]

PLC – PROGRAMMABLE LOGIC CONTROLLER

The very process control, in the scheme (pic. 2) it is marked as a regulatory or control system, is mostly provided by PLC automats. Even from the shortcut PLC - Programmable logic controller it is obvious that the PLC automat is a control computer in its principle. Hardware and software means of the PLC automats are created at the same principle as the classic PC-type computers are. However, due to the special requirements of industrial automation they differ significantly from conventional computers in many structural modifications. The demanding requirements for parameters of working environment such as dustiness or moisture are an example of it. Another important requirement is for compatibility which requires to be able to communicate with various group of peripheral sensors, measurement system or activators. These, as well as the other special requirements for PLCs affect their technical solutions so they are completely different form classic computers at first sight (pic. 3). [14]

Picture 1: Sample of the PLC system [16]

PLCs are used for solution of automation tasks with different technical difficulty. The impact of this fact together with a strong commercialization of their production is a development of a wide range of the PLC´s types and formation of a big group of the producers.

Programming of the PLCs is realized in a development environment which is specific for every type of the PLC. The development environment is a software executable on most classic computers of PC series. The finished control code is at first tested on simulated PLC system which is normally part of the development environment. The finished program is transformed from a PC to the PLC memory system using standard communication lines such as RS232, RS485, TCP / IP, WIFI, USB, or is transmitted through normal memory cards. Control program can be run in the PLC in different ways depending on the setting of the PLC system parameters :

a) automatically when you turn on the PLC,
b) by setting the appropriate digital input (RUN) to the logical drive,
c) by switching the manual switch to position (RUN).

The PLC has got a different internal system architecture in comparison with a classical computer. Its programming is therefore different from program creation for classical computers. At the programming of the PLC there are five programming languages preferred : [13]

a) Assembler – machine code of the system processor in the PLC system,
b) Programming language C and its variations – extension to the machine code,
c) STL (Statement List) – list of orders, very similar to the Assembler,
d) LAD (Ladder Diagram) – contact scheme, very similar to electrical schemes,
e) FBD (Function Block Diagram) – scheme of function blocks.

It depends on the specific manufacturer of the PLC system what language will be supported by its development environment. The languages STL/LAD/FBD are considered to be an industry standard which are currently supported by almost all the PLC systems. The Assembler and programming language C are understood as expanding opportunities for the programmers. [18]

REMOTE CONTROL OF THE PLC SYSTEMS

Systems of remote control of the PLC control systems had been developed much earlier than we started to use the computer network Internet massively. It is understandable because also in the past the PLC system mounted in the electrical distributer of the automation system had to communicate with computers in the „control center "which were often apart for several hundred meters. It was directed at the development of industrial communication systems whose role did not lie in the ensuring of communication of the PLC system with computers of the control center only but also with other elements of industrial automation. Sensors, measuring devices, probes, frequency converters, pneumatic valve matrixes, switches, valves, stepping motors are nowdays equipped with industrial communication systems. The best known systems are ProfiBUS, ProfiNET, CanOpen a FieldBus. All these systems have been designed for their use in severe operating environment of industrial automation. Massive arrival of the Internet meant also new challenges and opportunities in application of remote control of the PLC systems. The distance between computers of the workers and the PLC systems themselves are nowdays measured in thousands of kilometers. There are several elegant ways how to implement remote control of the PLC systems via the Internet.

COMMUNICATION MODULE SUPPORTING TCP/IP PROTOCOL

TCP/IP protocol is communication standard in the Internet. The PLC system with such a communication module has got a physical IP address which is able to identify the system on the Internet and the related client applications can establish direct communication with it. It is necessary to say that the communication module for easier PLC systems is often more expensive component than the PLC system itself. At the same time the programmer has to bear a lot of problems in his client application which are related to communication between the PLC and the client PC.[19]

COMMUNICATION MODULE TCP/IP WITH INTEGRATED WEB SERVER

The PLC system with integrated web server is an elegant solution for remote control systems in real time. Such a PLC system has a control web page saved directly to its internal web server. Response speed of the control applets running on the internal web server of the PLC system itself is not limited anymore. The use of this type of the PLC system in this case would be an ideal technical solution. Unfortunately, these systems are designed for commercial applications and they are equipped with other technical elements which would not be used in our solution (extended number of inputs, outputs, modules of industrial communication, DNS server, SMTP server, WIFI router, ADSL modem, network switch, backup power system,...) The price of such a PLC system is thousands of euros what is an impossible barrier at designing of the RCE. [19]

COMMUNICATION VIA A COMPUTER CONNECTED TO THE INTERNET

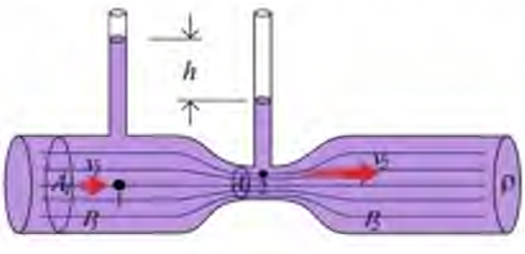
Paradoxically, the cheapest and most appropriate solution is to bring a classic computer which will be acting as a communication port between the Internet and the PLC system itself. Such computer is becoming a server and is acting as a communication interface between a remote client application and the control algorithm in the PLC system. Software ensuring these tasks is running on the mentioned computer and it is called OPC server (OLE for Process Control). „Classic" technology OLE (Object Linking and Embedding – object connection and insertion) is a server service (Server OLE), which enables the applications to use the services of another applications. For example you will insert a drawing created by AutoCAD in text editor Word. Despite the absence of any possibility to edit the drawing in Word, it is possible to use AutoCAD functions and to create directly in Word (by double-clicking on the drawing) a workspace for editing drawings, along with all the functionality of AutoCAD. For software developers such a system means that they do not need to have any knowledge of processing of the video stream when they want to play video in their application. The application using the OLE server can manage to share functions of any video players. But let's get back to our OPC server. The short cut OPC in the figurative sense means OLE for process control. When programming the client application the programmer does not have to even assume what way the communication with the PLC system or server application established is. In this way the programmer does not have to think about any complications during solving many difficult problems. Communication between client applications and PLC systems via OPC servers is currently the most widespread and financially affordable solution in application practice. The producers of the PLC systems offer the designers also their own OPC servers designed for communication with their type of PLC automat. Price of the OPC server depends on the model of PLC system for which it is designed or on its technical parameters (response speed, number of simultaneously communicating clients, range of processed data, etc.). Strong competition among manufacturers of components for industrial automation has resulted in the release of licenses for OPC servers with lower technical parameters and for simpler and cheaper versions of PLC systems in recent years. [20],[21]

RCE – MEASUREMENT OF THE SPEED OF GASEOUS ENVIRONMENT

Remote control experiment for measure of the speed of gaseous environment was model experiment, which is applicated and verified of the PLC control system. Theoretic basis of this experiment is Bernoulli formula for fluid:

$$\frac{1}{2}\,\rho\, v_1^2 + \rho\, g\, h_1 + p_1 = \frac{1}{2}\,\rho\, v_2^2 + \rho\, g\, h_2 + p_2 \qquad (1)$$

ρ is density of flowing environment, h_1 a h_2 are surfaces levels of fluid in U – tube, g – gravity acceleration, h – is difference of surfaces levels (h_1 – h_2), v_1 a v_2 are velocities of fluid in points 1 a 2.



Picture 4: Venturi tube. [22]

According to this formula the assuming of kinetic and potential energy of volume element and pressure is the same in flow environment everywhere.

MEASUREMENT OF AIR FLOWING VELOCITY IN TUBE

Measurement of air flowing velocity is realized in plexi tube with internal diameter D in this experiment. Van is connected to one of the ends of the tube. Measurement elements are installed inside of the tube. View at this remote control experiment is on figure 5.

Picture 5: View of realized RCE

Velocity of air flowing in the tube is defined by difference of surface levels in U manometer, which is connected to Venturi (Prandtle or Pitot) probe. According to

$$v_1 = d_2^2 . \sqrt{\frac{2.(p_1 - p_2)}{\rho .(d_1^4 - d_2^4)}} \qquad (2)$$

Pressures p_1, p_2 are measured by air gauge in practice. Thiers values are inserted in to formula (2). If air gauge is not available then pressure value will be calculated as difference of height level h_1, h_2, which is shown in figure (pic. 4). To calculate pressures p_1, p_2 we can use:

$$p_1 = \rho_{tek} . g . h_1 \qquad (3)$$

$$p_2 = \rho_{tek} . g . h_2 \qquad (4)$$

ρ_{tek} is density of liquid in tube, g – gravity acceleration and h_1, h_2 height levels in tubes.

Industrial measurement instrument KIMO CP 300 was used for validation of measurement in the tube and calculated result in this experiment. Principe of this industrial measurement is same as measurement in the tube.

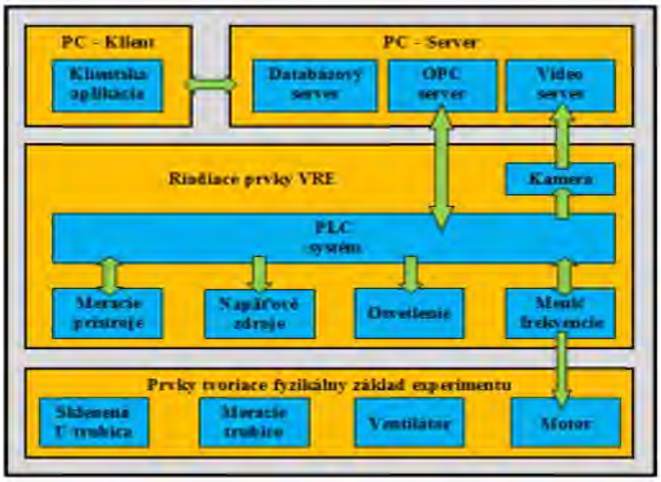
Didactic and educational aims are very important for designers of remote experiments. The aims for this remote experiment were as follows:

- to deepen the knowledge of students on relations between the basic physical parameters,
- to understand the essence of experimental measurements in solution of the physical and technical applications

- to understand procedures of physical variables measured in the experiment and to use correctly in calculations
- to understand procedure of validation and interpretation of measured functionalities
- to deepen an interest of students in creative access to solution of physical and technical tasks
- to motivate students to positive relationship to physical and technical subjects

Design and construction of this remote experiment have defined more technical problems:

- to control and to change of the rpm of the van
- to scan difference of level height in U manometer and at the same time to watch another parts of the remote experiment block scheme of the realized experiment is in figure



Pictrue 6: Blocks scheme of RCE

SELECTION OF CONTROL PLC SYSTEM

After considering more possibilities we chose PLC EATON EASY 512 DC RC for control of remote experiment. Regulation of the rpm of van was realized by 3 phase invertor OMRON SYSDRIVE 3G3MV. For communication between client PC and PLC system there was used our own OPC server, which was programed for this solution. Connection between OPC server and PLC system was realized by serial port RS 232.

Second key aim was to find a solution for video transmit. The first trial video stream was realized by VLC video server. Delay time of this solution was not acceptable, because value of this was 12 seconds. Such delay time was not useable for remote experiments. This problem was solved by our own video server, which was designed and programed for this solution too. Delay time of our own video server was 0.5 -0.8 sec. which was acceptable. Such a good result was achieved by our video server, which saved captured picture directly in data block of RAM memory without saving in hard disc. Data block from RAM memory was sent to users by the Internet. This system of capturing, saving and sending pictures is faster than usually used by common video-servers.

Client application was created in programming development environment MS Visual C#2008 Express Edition.

CONCLUSION

These initial results have been achieved by solving the RCE design – measuring of air flow speed and by the implementation of the design:

- There has been designed a new software system for rpm control of three phase asynchronous motor by frequency converter, also useable for easy PLC sytems which did not have such possibilities initially.
- There have been achieved better technical communication parameters by programming our own OPC server for implementation of the RCE in comparison with original communication OPC server from producer.
- Creation of video server based on its own software algorithm, without lengthy compression methods, allowed to speed up the transfer of the video stream to match the needs of the RCE.
- The new design concept of the RCE using the elements of industrial automation has been designed and tested in practice.
- By preparing a specific RCE for measuring of fluid speed another RCE has been added to portfolio of didactic tools for teaching purposes which is useful in teaching of science and and technology.

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INTRODUCTION

The question of virtual and remote labs development and integration in common e-learning infrastructure is very popular last years.

Many engineering and science studies, including on material sciences, are based on theoretical knowledge. Engineering students nevertheless also need a lot of practical work/laboratories to acquire the knowledge and skills in procedures they will have to use in their professional career. Since time and other resources are limited to make available real life infrastructure in a classroom teaching environment, the introduction of a remote and virtual lab environment is considered as an efficient tradeoff between the necessity for lab work, and the above mentioned boundary conditions [1].

The blended learning approach shows the most efficient results among different approaches with the usage of e-learning systems. Blended learning is the combination of different methods of learning and teaching.

For the realization of a blended learning environment a multi-disciplinary team needs to be put together: the design and construction of the labs needs a lab specialist, the programming and net-integration needs software engineers and programmers, the use of the tool needs pedagogues. Only a sound cooperation will yield useful results.

REQUIREMENTS FOR VIRTUAL AND REMOTE EXPERIMENTS

Virtual labs are a supporting tool for quick checking of experimental results, for simulated experiments. It is very useful for mass experimenting on a phenomenon at a very low cost. As it is only simulated, it does not offer the same sense of reality as a remote lab, but it gives the student the opportunity to repeat the experiment endlessly. Simulation means software made experiments. Although simulations can be used to overcome the disadvantages of traditional laboratories, any simulation is simply a model of a physical process, which is just an approximation that cannot reproduce every aspect of the real phenomenon. Some of the advantages of virtual laboratories are the availability of the experiments 24/24h, 7/7 days a week, the low cost of the experiment (only cost is the computer cost, and development cost of the software experiment) and possibility to simulate hazardous experiments. Since it is only virtual (software), no safety precautions have to be taken by the user, nor the provider of the experiment.

Remote labs aims to give students the opportunity to test on (less complicated) infrastructure, still experimenting on real experiments. Students can vary parameters, make choices, observe, measure and analyze as in the real lab. It is in fact a real lab, controlled from a different (distant) place.

EXAMPLE OF AN E-LEARNING ENVIRONMENT FOR STUDYING FOR ENGINEERING STUDENTS

In the faculty of engineering technology of KU Leuven –campus De Nayer the Computer Aided Learning Module (CALM) was developed for supporting students in their study on material sciences. The CALM is a blended learning platform, combining classroom teaching, an e_learning platform, physical, remote and virtual labs. For the 2-point bending test (to determine Young's modulus) a remote laboratory to measure material stiffness and its relation to shape stiffness was constructed, in combination with a virtual lab.

Different techniques are combined: hypertext linked contents, virtual lab (ActionScript) and a remote lab (For the realization was chosen the Spring MVC Framework. The basic logic was realized with java, for visualization were used HTML, CSS, Javascript, JQuery, JSP.) [1].

CONCLUSION

The requirements for the construction of a virtual lab and remote lab can be clearly divided in 2 categories: the technical requirements and the pedagogical requirements.

The most important question is how to use the lab in the pedagogy of a subject. The use of the lab has an impact on its technical requirements.

For pedagogical purposes the visualization and interactivity of the remote and virtual laboratory are among the most important features. This means the lab should be easy to operate, contain self supporting help, should be visually attractive and should be as fool-proof as is possible.

Developed environmental for the material science courses is an example of multi-disciplinary and multinational team work.

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In 2002 **Dirk Van Merode** finished his engineering studies in Electronics to become a Master in Science. His first educational experience was in secondary education in electricity and electronics, to earn his certificated in pedagogical aptitude. Dirk moved to Lessius University College, currently renamed Thomas More University College, in 2007, to take up a teaching assignment and to do research. His field of expertise is in digital systems design, printed circuit board design and production, and audio-video production. Research topics are mainly in European projects, both on curriculum development and student and staff mobility with countries outside the EU. Dirk also did some in-depth research in space applications and satellite development. Currently he is project coordinator of the DESIRE Tempus project, Development of Embedded System Courses with implementation of Innovative Virtual approaches for integration of Research, Education and Production in UA, GE, AM " – 544091-TEMPUS-1-2013-1-BE-TEMPUS-JPCR. For the department electronics – ICT he is the international coordinator.

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A REVIEW of the Proceedings from Summer Course Nitra

The submitted text is an output of the summer course which took place at Constantine the Philosopher University in Nitra on 14th – 21st November 2014. Individual contributions are part of the Tempus DesIre Project aimed at creating practice-based curricula and modules for Embedded Systems, with particular emphasis on the improvement of education in Ukraine, Georgia and Armenia. Constantine the Philosopher University is one of the partners participating in the project.

The text begins with prof. Kozík´s introductory reflections on the changes information-communication technologies (ICT) brought to education, especially the changes affecting methods, content and objectives of education. While in the past young people were prepared for one job, the present puts emphasis especially on the need of flexibility and lifelong education. In the field of technical education, the ICT are applied especially in the so-called remote experiment. The introduction is followed by the presentations of other research team members.

Prof. Malá in her presentation discusses the Bologna Process as well as the European Higher Education Area, explaining main principles of the contemporary academic system, such as, for example, ECTS, study program, individual educational cycles, joint degree, etc. The attention is also paid to the principles of internal and external quality assurance systems at higher education institutions, as well as at the UKF as one of the project partners. In the following presentations, prof. Kozík a dr. Ölvecký are concerned with e-learning methods in education and their influence on the traditional definition of education and its individual factors.

The presentation entitled "Information Technologies in Remote Experiments" serves as a kind of transition from the general and theoretical part to the more particular focus on "remote experiment", which is, in fact, the main objective of the whole project, including this seminar. The contribution explains main categories and terminological apparatus which must be definitely mastered by participants in such courses. In addition to the introductory part, dr. Peter Arras´s contribution deals with the concrete problems of "remote lab" and "virtual lab". The Dirk Van Merode´s "Formula Flowcode" offers another technical solution of the problem. The following contributions in Russian language are also more or less concerned with the methodological aspects of ICT education in the given field.

In general, it may be said that the submitted text is a result of the trends which make education more dynamic, both in its content and as the process. It draws on a changed sensibility of the present world - the world in which information-communication technologies play a vital role. Their projection into educational activities is important especially as regards the preparation of the coming generation to an increased sophistication of not only theoretical, but also practice-based education, and the resulting increasing demands necessary for its mastering.

Based on the mentioned facts, I consider the proceedings to be very useful and therefore recommend it for publication.

Nitra, 26. 11. 2014 Prof. PhDr. Anton Pokrivčák, PhD.

Mgr. Juraj Miština, PhD.

Review of the "Summer Course Nitra 2014 - Proceedings of Lectures" by T. Kozík, et al.

The content of the "Summer Course Nitra 2014 - Proceedings of Lectures" by T. Kozik et al. corresponds to the intention of the course. The published lectures are evidently based on the experience and research results of authors, their projects outputs and the teaching practice confirming the authenticity and originality of published texts. The editors resorted to an interesting experiment. Besides the papers, they published images of PowerPoint slides from the Course presentations. This is undoubtedly interesting and useful for the target group of trainees, but in some cases, the original interactivity of the PowerPoint animations is lost, since the Proceedings are able to provide only static images. Eighteen contributions to the Proceedings are introduced by the baseline lecture dealing with the Bologna Process and the European Higher Education Area (EHEA). The remaining contributions are thematically focused on technical education, and trends in the application and implementation of modern technology to this environment. They feature high methodological level. Trendy approaches to education through modern technology are thematically predominant; e.g. remote experiments, embedded system design, e-learning, CNC technology in primary education, etc. Eleven authors contributed to the Proceedings, ranging from renowned experts in the field didactics to PhD graduates in didactics of technical vocational subjects. This generational linkage represents the distinctive trace of the long-term systematic activities of the Department of Technology and Information Technologies in Nitra that was the initiator, organiser and facilitator of the Course.

The other positive features of the Proceedings are:

- Approach and methods of the text processing are new and stimulating.
- The Proceedings offer new and original insights.
- The main contribution of publication (compared with similar studies published in Slovakia and abroad) lies in the unique interconnection of pedagogy, didactics in the field, technology, as well as in the views and provision of practice-based experiences and research from geographically different learning environments with different historical and societal development, which provided a unique opportunity for comparison and mutual enrichment.
- Scope of Proceedings is proportional to its importance.
- Linguistic and stylistic level is good.
- PowerPoint slides provide a dense text material, suitably supplemented by images, charts and diagrams.

Proceedings will be beneficial to the target group of trainees – participant of the Course, for students of technical subjects, doctoral candidates in the field didactics of technical vocational subjects, as well as for experts and teachers in educational practice.

Reviewer: Mgr. Juraj Miština, PhD. (Faculty of Natural Sciences, University of SS. Cyril and Methodius in Trnava, Slovakia)

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Title: **NEW TEACHING APPROACHES IN ENGINEERING**
Proceeding of Lectures of the Summer Course Nitra 2014

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