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USE OF E-LEARNING AND VIRTUAL LABORATORY TO AUTOMATION TEACHING

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ABSTRACT: In this paper is described the main ideas of national project "KEGA 3/7131/09 – Laboratory of production system program control". This project is focused to build of virtual laboratory and supplemental e-learning documents for several studying subject at our institute. This virtual laboratory serve for teaching automatic control principles and programming in flexible production via various control modes often used in the technical practice. In this laboratory there are applied real elements of control systems. By means of these laboratory students as future graduates of technical university can acquire and improve occupational competences demanded by actual labor market.
KEYWORDS: virtual laboratory, e-learning, production system, automation

❖ INTRODUCTION

Within the grant project KEGA being solved in the Institute of Production Systems and Applied Mechanics, STU Bratislava, in years 2009-2011, we endeavor to acquire and improve abilities and skills which employers expect graduates of technical universities to have in present circumstances.

Intent of this project is to create a laboratory for program control of production systems by pneumatics and a suitable teaching system supporting key and occupational competencies, abilities and skills of technical university students which at the same time would reveal strong point's and weak spots of their preparation for practice. In this paper we wish to present targets of this grant mission and its expected merit.

To achieve project goals it is necessary to revise curriculum and to use such teaching forms and methods that enable to exceed the scope of cognitive knowledge of scientific disciplines and professions that means to develop key competencies of students. These gain extraordinary significance not only for the personal development but also in term of lifelong education and employability of technical university graduates.

The present time brings along the need of superior education providing for:

- Ability to make decisions,
- Solve problems,
- Work with information,
- Ability to learn - lifelong education,
- Computer literacy,
- Communicative skills even in foreign languages,
- Self-activity and self-responsibility

Rapid changes put higher and higher demands on people nowadays. Obtained professional knowledge is out of date after a shorter and shorter time. Professional knowledge includes areas of „general basic knowledge and knowledge specific for particular major".

This one is usually obtained cognitively and stored in the left brain hemisphere. However, in the area of electronics and technology, changes will be more frequent.

Key competencies should help us deal with professional knowledge with aim to solve the problems. Competencies with focus on one particular situation are quickly out of date or totally useless. „Key competencies have longer lifetime than professional qualification. That's why these ares the basis for the next learning". Key competencies can be understood as a complex of universal abilities exceeding the boundaries of specific professional knowledge and abilities. They express abilities of people to behave adequately to a specific situation.

Working in virtual laboratory will develop and strengthen computer literacy, so important on the present and even more important in future as we presume and last but not least will absolutely support acquisition of other key and occupational competencies of our university graduates.

Graduates will acquire the needed skills, experience and knowledge of production system controlling design methodology. They can simulate functions of designed devices. For simulation

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specialized software will be installed on our intranet. By this software we can supervise every part of the designed control system. This control system includes only real industrial parts (PLC, stepper driver, servo driver, sensors, etc.).

By object-lessons and connection with practice we want to increase value of our graduates at the labour market.

❖ PROJECT TARGET AND IMPLEMENTATION

The Project target includes building of virtual laboratory for program control systems. That laboratory is instrumental to teaching architecture principles of pneumatic and electro-pneumatic and program control systems and to verification of these systems´ functions by simulations.

Students gain experience of working with real industrial parts and the learning process is more effective. The goal is to make the pedagogical process more attractive for students in several studying subjects e.g.:

- ❖ Automation and mechanization,
- ❖ Theory of automates,
- ❖ Production systems,
- ❖ Production systems operation,
- ❖ Production and manipulation devices programming,

Students learning in this planned laboratory will acquire necessary skills and will acquaint themselves with generation methodology of several systems (pneumatic, electro-pneumatic, and electric ones) what will markedly increase their value at the labour market. The Fig. 1 presents the mentioned virtual laboratory.

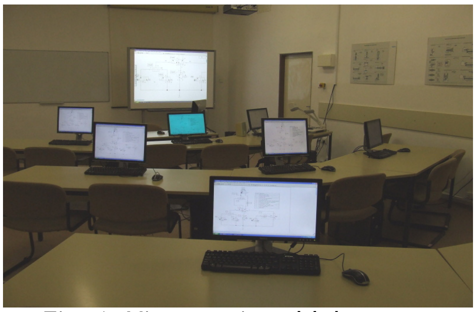

Fig. 1: View to virtual laboratory

Creation of virtual pneumatic or electro-pneumatic program control systems requires both individual work and decision making and cooperation including discussion on simulation of the proposed control circuit (Fig. 2).

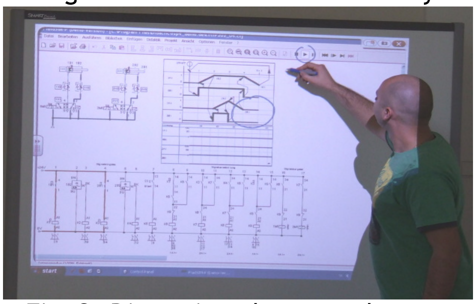

Fig. 2: Discussion about an electro-pneumatic scheme

By this laboratory students will obtain an opportunity to prepare assignments and projects of various subjects applying pneumatic and electro-pneumatic control systems and get ready for the real problem solving in practice. Thereby they also get a practice so important for employers. It widely develops and strengthens their technical occupational competencies and also their key competencies.

Within the project there will be developed study e-learning materials (manuals, methods, examples,...) and made available on Internet which will enable effective working in the laboratory and serve as a basis for further development of knowledge and skills of our students.

❖ E-LEARNING

Traditional learning design is indicative of the learning field's reluctance to change. In spite of advances in neuroscience, collaborative technology, and globalized business climate, learning is still largely based on design theories created during the early 1900's to 1960's. The environment in which we are immersed has changed. Media and technology has changed. The social environment has been altered. The world has become networked and connected. In this environment of colossal change, the design methodologies used to foster learning remain strangely outdated – created for a time and need which no longer exist. Learning Development Cycle (LDC) is a learning design model to bridge the gap between design approaches and knowledge needs of academic and corporate learners.

Much of LDC is rooted in more traditional design structures. We are currently still in the beginning stages of societal and technological alterations. The model is intended to simply open doors to new design approaches, while maintaining aspects from previous models that still serve learners. More developed (connectivist-centric models) will be required as we move forward. LDC is a transitory design approach, bridging traditional design and beginning to embrace internet-era design.

Different types of learning exist. Learning happens in a variety of ways – from courses, conversations, life experiences, personal thought, or working on a project. Each different type of learning requires a different design process (as the object of the design differs depending on learning type). LDC presents four broad learning categories: transmission, acquisition, emergence, and accretion. These categories will be discussed in greater detail in this paper.

Learning today has moved beyond courses (courses serve a static knowledge field). As a result, course-based ID is not as useful for designing alternative modes of learning. The more rapidly knowledge and information climates change, the greater the need for responsive dynamic models.

E-Learning – phenomena of education of the 21st century. It is astounding by its extensiveness, attracts by huge amounts of technical resources, and affects nearly all areas of human gnosis. The reason is time and change velocity in daily life of all of us. One option is to apply electronic education

– e-Learning in our lifelong education. Education is one of the most important life priorities for us but also for the modern society.

Electronic learning or e-learning (sometimes written as e-learning) has various definitions. E-learning is facilitated and supported via information and communications technology (ICT).

The American Society for Training and Development (ASTD) defines e-learning as a broad set of applications and processes which include web-based learning, computer-based learning, virtual classrooms, and digital. Much of this is delivered via the Internet, intranets, audio- and videotape, satellite broadcast, interactive TV, and CD-ROM. The definition of e-learning varies depending on the organization and how it is used but basically it is involves electronic means of communication, education, and training.

Many terms have been used to define e-learning in the past. For example web-based training, computer-based training or web-based learning, and online learning are a few synonymous terms that have over the last few years been labelled as e-learning. Each of this implies a "just-in-time" instructional and learning approach.

Regardless of the definition you chose to use, designers, developers, and implementers make or break the instructional courses and tools. E-learning is simply a medium for delivering learning and like any other medium, it has its advantages and disadvantages. E-learning covers a wide array of activities from supported learning, to blended or hybrid learning (the combination of traditional and e-learning practices), to learning that occurs 100% online.

Sound e-learning is founded on instructional design principles, pedagogical elements that take into account learning theories. Given its nature, online distance education is well matched with e-learning and flexible learning but is also used for in-class teaching and blended learning.

❖ E-LEARNING IN VIRTUAL LABORATORY

If we look at e-learning as at efficient utilization of information technologies in educational process then it actually means new opportunities that can be used in education. E-learning is a solution designed for education, however education conceived in full context. It is not limited to education of students only but is in a broad sense a method of information sharing and passing within lifelong education that is a necessity especially for technicians.

In contrast to classical information systems dealing especially with information sharing and a possibility to find information necessary in proper time; e-learning lays a big stress on method of representation. Nowadays it is not enough only to acquire correct information in due time but it also is necessary to understand it fully and see it in context. And just e-learning supports these abilities.

E-education as a progressive teaching form opens many new opportunities. This form can be used in all formal education grades and also in lifelong education.

E-Learning effectively measures every course by means of testing objects and control systems. It enables to set up desired goals without prejudice (e.g. student must answer correctly to test questions verifying his/her actual knowledge of studied subject after taking in the course). E-Learning gives immediately available information on individual students, how many points they achieved, how much time they spent in individual course parts, how they answered questions. Equally simply E-Learning evaluates statistically fruitfulness of individual courses and thereby identifies courses to be revised. Likewise E-Learning brings new forms of communication and cooperation among students and between students and lectors which would be inconceivable without using information technologies.

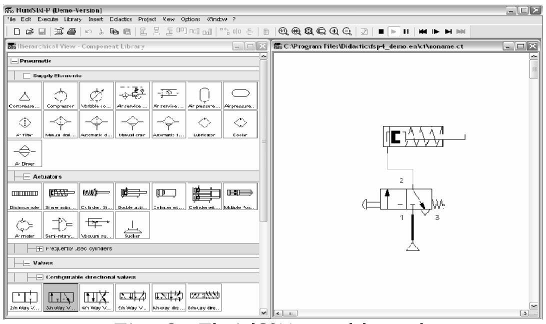

Fig. 3: FluidSIM workbench

E-Learning turns teaching into an addressed, individual, interactive and interesting process integrated with daily life of students.

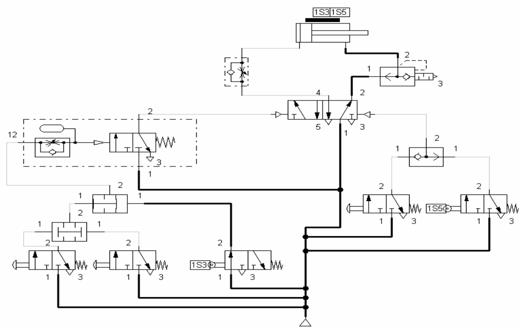

Fig. 4: Circuit scheme in FluidSIM

E-learning means a process which describes and solves creation, distribution, managing and feedback realization of the pedagogical process by computers and network. These applications contain simulations, multimedia, combinations of text and graphics, audio, video and electronically testing of students. Every student can choose individual form of study that is suitable for him. E-learning is a high quality extension of existing possibilities of study.

The virtual laboratory applies a combination of classical way of teaching and e-Learning courses.

For working in the virtual laboratory of pneumatics and electro-pneumatics we use software environment FluidSIM that is one of many software enabling to set up various pneumatic and electro-pneumatic control circuits as well as to verify their function by simulation of these control circuits (Fig.

3). Software FluidSIM was compiled by the company FESTO and serves the purpose of control simulation of pneumatic and electro-pneumatic circuits.

Step by step students learn creation principle of pneumatic and electro-pneumatic control circuits by means of e-Learning materials and with participation of a lector. On the basis of e-Learning courses they pass step by step through creation principles of control circuits at first, thereafter through verification by simulation of control circuit function. Control circuit diagram can be seen in Fig. 4.

Work of students in the virtual laboratory is a part of e-Learning courses where they can create their own pneumatic and electro-pneumatic control circuits for control of specific equipment and thereafter verify its reliable function via simulation.

❖ CONCLUSIONS

We have "learning centers" and "training departments" – treating learning as if it were a compartment or corporate activity in which we sometimes engage, rather than a constant, ongoing process – a thread through the fabric of daily activities. Learning is a thread that runs through all of life. We do not belong only in corporate training rooms. The act of learning is ongoing and constant.

An organization's ability to adapt is important to ongoing survival (even innovation, if you will). But the adaptation must be of a particular type. It must be progressive, ongoing, punctuated with periodic bursts (the transformation), but many about a progressive, but not overly reactionary trends to what is going on in the larger learning landscape. Few organizations will be positioned to adopt wholesales the ideas I've presented. To do so would damage many elements of the system continuing to work well. But to survive, all organizations need to embrace experimentation – an ongoing "blood in the corporate veins" type of experimentation. Policy-induced change can be effective, but most often, if we follow the lessons of evolving organisms, developing corporate competence progressively is the best approach for long-term sustained change.

The needs of continual learning, often tightly linked to work, required a new approach and model. LDC has been designed to create an alternative, less-linear view of learning. Learning is the intent of any development activity – communities, courses, networks, or ecology. Selecting the most appropriate design approach will assure greater a more positive and valuable experience for the learner.

❖ ACKNOWLEDGMENT

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