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Dynamic Educational Process Efficiency Improvement for Students of Computer Production Technologies Support Subject

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***Abstract* — Engineering industry is besides fabrication innovations by progressive production technologies, focused also on qualification improvement and how to achieve perfect rank of employees working in this type of industry. Considering that engineering industry operators adopt basics of engineering production already by college education, many universities are aware of the importance of their educational system and are implementing modern educational techniques for students qualification increase. Therefore they consider knowledge, skills and practical experience as their top target and important indicator of competitiveness in between other universities, as well as students ability to be successful in labor market, by what they are indirectly doing " promotion'' of given university ,how properly it can prepare and refer students into praxis. This article's goal is therefore specify and present different ways of educational efficiency improvement , so-called dynamic education for students of computer production technologies support subject (later in short CPT), which nowadays belongs to very popular and demanded educational subject for students on labor market.**

***Keywords* – CA Systems, Dynamic Education, E-Learning, Visualized Education.**

I. INTRODUCTION

General trend of technical universities is forming of new profile of graduates, which is based on integrated knowledge from academic disciplines with focus on production technologies, CPT trough CA systems, logistic, information and software technologies, innovations and others. One of the effective methods of students education with goal of gaining practical skills is dynamic e-learning education of students in multimedia classroom. E-learning is a type of learning supported by information communication technology that improves quality of teaching and learning. Therefore, e-learning can serve as a catalyst for change in teaching and learning [1].

There are different options for implementing e-learning in the teaching process. Elearning can be used as a means of support to the already established systems of education i.e. blended - learning model, it can also be partially introduced (for single subject or agroup of subjects), or can be implemented as an independent form of teaching, in other words as a separate teaching programe [2].

Technology enhanced learning in the European Union represents one of the relatively newer research priorities in the field of ICT which requires the shared approach by both teachers (engineering / domain content) and ICT engineers (informatics tools) [3]. It is targeted to support creative abilities of students, so they are able to apply gained theoretical knowledge in solving tasks given as model situations and issues. Practical experiences confirm, that any information from internal and external school environment is necessary to consider, generalize, sort and analyze in the fastest possible way. Therefore the ground of dynamic education is to motivate students to adopt techniques of active work with informations, ergo searching process ,relevant information sorting and combining of knowledge, which leads to creation and vindication of own opinion.

II. PRINCIPLES OF DYNAMIC EDUCATION

The increasing acceptance of e-learning as choice educational environment for millions of learners affirms the shift to a collaboration driven social networking system. Most learners take advantage of the opportunities provided by e-learning, such as availability, reduced cost, flexibility and integration to acquire formal education, while preserving their family or business lives. It has been observed that interactivity is key to the success of e-learning initiatives [4]. The main difference between traditional educational approach , based on passive acceptance of knowledge and active dynamic education for students is , that the traditional education in form of lectures and seminars gives students ,,ready-made '' theoretical studying materials, while practical-dynamical exercises gives space for gaining skills, acknowledging principles of team work, resp. Solving of individually given tasks, when is necessary systematically search for and to gather the newest information about given subject. Combination of this two educational approaches is preferred to gain effective dynamic education model. Techniques of effective dynamic education leads students to individual identification of the issue, creativity, experiments, suggestion of problem solving variations, reevaluation of solutions, visualization, outcome testing and feed back.

It's implementation into educational process leads to transformation of student position from receivers of theoretical information to the problem solvers. Active action of students in education rise their motivation for gaining new knowledge and skills and experience and enable straight theory application on real conditions simulated in multimedia class [2].

Dynamic methods of education in general is possible to divide in three groups [5]:

1) Informational methods

Contains mainly lectures, seminars , conference, video projection, systematical observation, instruction with computer assistance , creativity exercise.

2) Simulation methods

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Contains examples, program group exercises .

3) Practical education

Involves practical education of students while real problem solving, e.g. production proposition

In teaching students of subject CPT were verified following educational approaches:

- lectures: conventionally realized definition of theoretical information,
- seminars : discussion in form of brainstorming , where emphases is laying on creative thinking,
- practical exercises : gaining skills on the ground of practical construction projection of the component and its manufacture with help CA systems (mainly of CAD and CAM systems),
- system studies: team work on model projects and layouts according to case studies , variation creation, analyses , evaluation and solution analysis,
- individual studying (self learning): use of recommended internet sources – electronic publications, magazines etc.,
- excursion tour as a form of gaining experience right in real manufacturing company.

Dynamic education is for students attractive form of education and gaining of new information, experiences and skills. Education but have to be focused on student, on his needs and should be adapted studying process [6].

Fig.1 represents factors determining educational process .

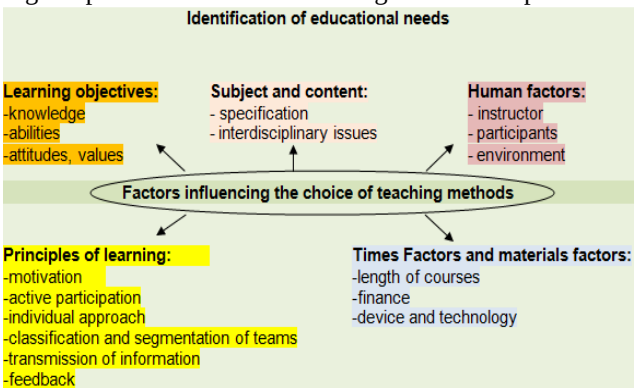

Fig.1. Factors determining educational process [7]

For optimal efficiency of education is always necessary to [7]:

- build cooperation of studying and practicing,
- invest into the new technologies and educational capacities (modernization of facilities and technical resources for education),
- ensure of favorable environment for education on team work basis,
- to awake active interest, attention and motivation of students,
- to ensure continual process of improvement of educational process (support different ways of learning, implementation of modern equipments and machines etc.).

The most common form of engineering companies and universities cooperation is through layout of diploma work, specialized praxis, excursion tours, internship offers, this is monitoring preparation of future graduates for future concrete job positions in the company [8].

III. Students Dynamic Education Process

Basic ways of applied dynamic education for students of CPT, is possible to summarize in following aspects [9]:

- allover system of education and practical education of students for all parts of base component production implementation (Fig. 2),

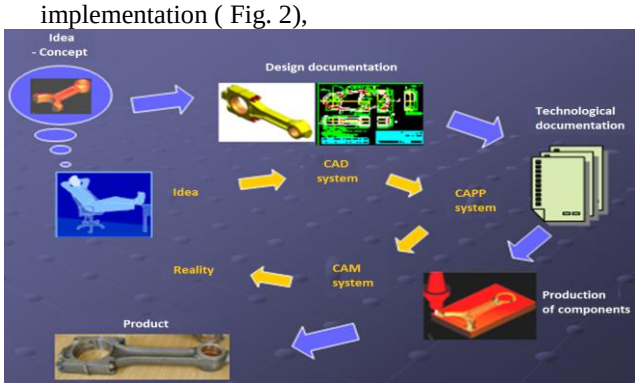

Fig.2. Component production implementation scheme

- education and practical education continuity throughout all the study on university,
- combining of education and practical education from engineering companies point of view (classes realized by companies, specialized practice for students offers and so on) with self education of students,
- learning“ become a part of given tasks and projects solving for students and is adequately appreciated , what is for them important motivation factor;
- application of modern educational and training methods (like e-learning, learning-by-doing, visual learning etc.) through multimedia and internet technologies.

IV. Multimedia E-Learning

Efficient student educational way is application of multimedia learning programs - E-learning.

E-learning might be defined as electronic education covering wide spectrum of application and processes, like web based education, computer technologies based education, virtual and multimedia classes and digital cooperation [7]. Concept e-learning introduces common title for providing instructions through computer (so called courseware),either online via public internet , private nets for distant education, or home to student via internet , or offline via multimedia CD/DVD educational programs. Concept multimedia in this case express connection of image, text or visual information- educational texts. Virtual education offers in electronic way many studying materials and information and by this form of education is maximally used IT and internet [10].

For education CPT students have been made and are from time to time actualized electronic textbooks , which contains simulations, animations and presentations . These are presented to students:

- on the official page of faculty, where students can download it anytime (Fig.3),

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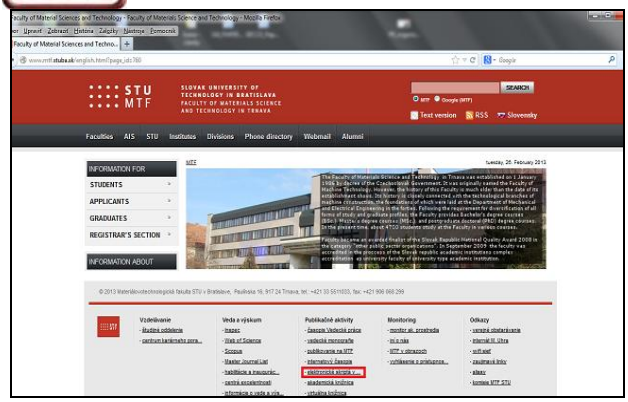

Fig.3. Electronic textbooks presented on the official page of faculty

- have been send to academic information system in section ,,documents'', where they can always check actualized materials and download it. Electronic textbooks are published mainly in hypertext form , and are appropriately elaborated even for self education of subject without a teacher. E- learning textbooks uses animations , voice guide, dictionary, text finder, cross reference related to the electronic publication theme on the internet (Fig.4).

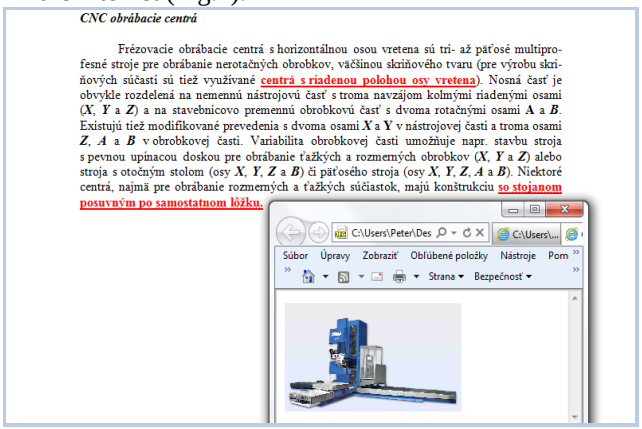

Fig.4. Chosen picture of electronic textbooks with hypertext form (hyperlink)

V. VISUALIZED EDUCATION AS PART OF E-LEARNING

Visualized education might be defined as giving information via illustrations, photographs, graphs, symbols, pictures or other visual models. Goal and assignment of visualized education is to simplify and shorten the process of introduction of complex information, in other words, enable to understand the thought on first sight. Higher level of visualized education presents the presentation of dynamic visual information, for example instruction video, video-clips and animations, instead of static visualization, as is defined above.

Techniques of visual education enable to [9]:

1) Clear their thoughts

With help of visual education, is possible thoroughly and simply understand even completely new concepts, if responsibly interlock with before gained knowledge.

2) Organize and analyses information

Students can use diagrams and pictures for displaying of large amount of information, in a way which enables their easy understanding and helps to uncover new relations and mutual connections. In some cases might be visual education used as replacement or at least support with education based on experience (learning-by-doing).

3) Integration of new knowledge

Many performed studies proved that students are better able to remember new information, if they are presented visually and verbally.

4) Thinking critically

Connection of verbal and visual information helps students to connect information, understand relations and remind of relevant details.

The most common forms of visual education used in e-learning for CPT students are components, which are usually part of content of advanced prepared lectures. These might be divided to static, which makes part of studying texts (pictures, schemes , graphs , diagrams, photographs….) and dynamic like PowerPoint presentations (Fig.5), Flash animations, video-clips (Fig.6), etc. [10].

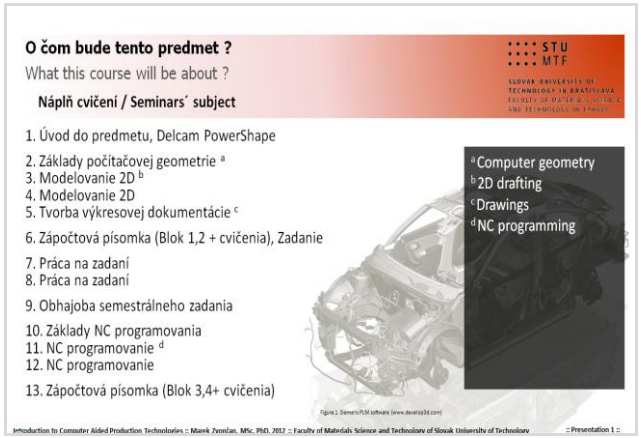

Fig.5. Chosen picture of PowerPoint presentation, for visual education for CPT students

Fig.6. Chosen picture of video-clip for manufacturing of component for visual education for CPT students

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VI. LEARNING – BY- DOING

It is clear that e-learning and blended forms of e-learning are on the rise in corporate training environments. Also obvious is that there is a growing demand for more authentic learning opportunities and simulated experiences which e-learning can provide. Fortunately, the web can bring the teaming, collaboration, problem solving, and coaching or mentoring that is required by all firms competing in the twenty-first century. To respond promptly with these changing times, there is a tilting of training toward using online technologies, at least as a supplement to face-to-face training [11]. Currently educationally promising developing area of teaching, is the use of on-line camera with high picture quality in solving of specific given tasks (projects), and troubleshooting. E-learning is more fun and interesting, it enables better visualization and simulation, encourages innovation and multimedia capabilities, allows dynamic interaction, adapts to the learner's style and implies numerous benefits, including "just in time – any time" approach, lifelong learning and possibility of parallel working and studying [12]. Teaching students by CPT is realized in the so-called. Multimedia classroom and focuses on teaching their own teaching methods for practical training in the field of engineering practice called. method learning-by-doing. This is the solution of practical examples of manufacturing components in the presence of the teacher, providing advices to solve of given project, practical skills training, using the same techniques as in engineering practice, analysis of failure technique and the like. This is the adaptation and development program for students who are preparing for target of specific job position or area of expertise in the field of drawing machine parts using CAD systems, programming and simulation of manufacturing parts using CAM system for the production and implementation of manufacturing machines using remote transmission via webcam from Centre of excellence of 5-axis machining in Trnava. Because instead of teaching students in Detached workplaces in Dubnica n/V that does not have a machinery, such a transfer via webcam from the parent University of Trnava seems to be a perfect solution for streamlining of dynamic teaching process by which students gain practical knowledge. Teaching takes the form videoconferencing (Fig.7). Model of such use can be generally described so that in the production hall is located at the workplace camera that detects a problem - the manufacturing operation. and the image is transferred to the student monitors, whose job is to watch and solve problem in team. All the team members have opportunity to see the transmitted image on their monitors as well as their real teachers. An on-line conference led by a teacher, team members communicate each other and suggest possible solutions to production of parts. A worker is physically present at the workplace where the cameras are located and carries out suggested and by team-approved measures. In this way, students can observe the impact and quickly evaluate the effectiveness of implemented solutions, or suggest further improvements.

Fig.7. Illustration of Videoconferencing

VII. CONCLUSION AND DISCUSSION

Unsatisfactory motivation of students for getting some new knowledge is being noticed what can be enhanced through the organization of teaching process suitable for students, i.e. importing forms and taeching resources for which students have tendency. One of the ways that should be applied into the classes is to bring in combinative system of education, i.e. the classic one and e-learning that would attract the attention of students and increase creative and exploring affect toward the specific matters. This will have effect only if all disciplines are united in creating e-learning contents and if we observe the standard of using IT and e-learning with regarding to infrastructure and learning objects [13].

Distance learning, and especially e-learning, represents a desirable and necessary form of help with learning at engineering faculties. It enables students to learn independently of time and space, but it also offers better communication between students and teachers and students' team work. On the other hand, it mitigates the problem of irregular learning and encourages students' independent work [14].

With the rapid development of the engineering industry in Slovakia is emerging need for retraining of workers and the need of training especially graduated at engineering (technical) schools. Their graduates require differentiated teaching for the needs of engineering production processes, especially in the use of Computer Supported manufacturing systems using the CA. In the presented article were suggested dynamic resources of teaching students in fields of study Computer Aided Manufacturing Technologies (CPT). This is in addition to theoretical knowledge instruction aimed mainly for practical training in the field of engineering. The theoretical knowledge of the students are then verified and so practically trained in solving the given tasks and projects using educational methods based on experience (learning-by-doing), which contributes for the development of creativity and on the other hand, supports an innovative approach for students to problem solving, as in the highly competitive environment of the engineering industry is a necessity to have a strong practical experience in machinery

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production. The most innovative teaching methods applied in teaching students CPT include visual learning (visual learning), learning experience (learning-by-doing) and creative project-based training, using technology tools and electronic learning (e-learning) to support the learning process.

The general hypothesis more of authors [1] - [2] - [3] - [13] - [15], there are relationship between the Five skill needed for virtual student (availability, openness, communication, cooperation, flexibility) and students' efficiency learning in the virtual schools [15]. This was confirmed also in our performed project.

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