Abstract—The first attempts to introduce e-learning appeared around the year 1999 in the Czech Republic, and since then the number of projects dealing with the topic has been increasing. The paper deals with the current problems of the electronic learning, and it is centered on survey of the electronic support of education at 6 technical universities in the Czech Republic.

The goal of the paper is to establish if and how the electronic support of education is utilized, and what are the attitudes of both faculty staff and students. In order to answer these questions, a questionnaire was administered, and we would like to present its outcomes. Motivation, methodology, experience, good practice, obstacles and other aspects of e-learning were analyzed.

Index Terms—E-learning, opinions, students, teachers.

I. INTRODUCTION

The quality of engineering education in many European countries is determined by the quality of the students, academics, administration, infrastructure and the intellectual climate of the university. Career procedure and remuneration of the academic staff is mostly determined by publication activities, projects and patents, less by the teaching quality. At the same time, the demanding work of technical studies is the reason why many students prefer the easier way to get the degree which is offered by less ambitious Czech colleges. Generally, the labor market in the Czech Republic has not taken into consideration the quality of different colleges and their graduates, but it seems the economic crisis might launch some changes.

There have been three main trends in the quality of European engineering education observed: elite, first rate and mass education. From the end of the 1960s for two decades or so, 8 % of youngsters belonging to the age of 18 to 25 years were full-day students in higher education in many European countries and from that amount roughly 50 % were dropped out during the first semesters. In that period engineering education could have been considered close to an elite education. It guaranteed the top quality of engineering education and high quality graduates. Also, the PhD students were outstanding representatives of the elite education graduates.

The situation considerably changed after political, economic and social changes after 1989 in part of Europe, and with the implementation of the Bologna declaration. The previous 8 % ratio went up to 40-55 % in some European countries, e.g. Czech Republic 38 %, Hungary 42 %, Norway 85 %, as in [3].

The number of students at technical universities has increased and technical universities with their actual mass education needs modernization of methods usually comprised the provision of information to mass education students on how to plan their learning in various ways mobilising all available infrastructure. When we compare the number of graduates from European technical universities with the total number of university graduates the ratio is 1:7 and it has been decreasing (1:4 in Japan, 1:9 in the US as in [6]). If Europe wants to keep pace with a successful technological development with the most developed countries in the world it is necessary to increase the number of engineering students. In order to do so technical universities should motivate future students for technical career, to show them prospects for their future careers, to encourage women to study engineering and to initiate involvement of young children into technical knowledge [5].

As already mentioned, in the past 20 years the number of higher education students in Europe increased by over 40 - 55 %. There is not even a single EU country which has followed this increase by raising the funds, employing the required number and quality of academics, or building new premises and laboratories. Now the majority of EU member states provide 1% of GDP to higher education [6]. Few countries like Sweden, Switzerland, Norway and the UK exceed this figure. Japan and the US lead the world by 4%, taking also well organised benefit of various foundations, companies' grants, etc. The crucial challenge of technical universities is how to find private/financial corporate resources/funds in addition to the 1% of the country's GDP [6].

The number of students at technical universities has increased and technical universities with their actual mass education have been facing some difficulties:

- an efficient conversion from elite education to mass education has not been worked out
- the academics are not prepared to teach such a large number of students efficiently
- mass education needs modernization of methods both for teaching and for the preparation of teaching materials [5]
- the task to implement quality into mass education still remains the key-problem [1].

There are hopes that new learning technologies will help to transform technical university learning and teaching into a more engaging experience for twenty-first-century students [7], [4]. But since 2000 the changes in
technical university teaching have been more limited than expected and there are discussions as to what extent technologies can replace traditional forms of teaching and what are the expectations of students [2]. Our paper intends to be a small contribution to these discussions.

II. CURRENT STATE OF E-LEARNING AT SEVERAL TECHNICAL UNIVERSITIES IN THE CZECH REPUBLIC

Survey objectives

The objective was to compare the state-of-the-art of e-learning at the 6 most prestigious technical universities of the country, to identify its strong points and weak points, quantity, quality and user-friendliness of electronic materials, ways for their expansion and distribution. In addition the survey hoped to find out whether didactic aspects in designing e-courses are reflected and to learn about attitudes of university staff and students toward electronic learning and teaching.

Methods

• we visited these universities to see the technical background for e-learning (computer classes, laboratories, offices).
• we checked through the university, faculty and department web pages and we analyzed more than 400 available e-resources - projects, tests, papers and hand-outs.
• we thoroughly examined the personal pages of teachers known in the academic community as enthusiastic creators of electronic courses. Then we e-mailed them and asked them to answer a few questions on didactic aspects of e-courses and possible development of electronic learning and teaching in their workplace. Our aim was to explore approaches and methodologies used by universities and academics and suggest the way for systematical co-ordination and co-operation.
• we administered a questionnaire to 189 students of the Czech Technical University in Prague in order to learn the students' view on e-learning

III. RESULTS

Six universities were included into our study. Four universities from the Table 1 are specialized in engineering (Czech Technical University in Prague, TU Brno, TU Ostrava, TU Liberec), Two are universities with at least one engineering faculty (University in Hradec Králové, Tomas Bata University Zlin).

TABLE I.

<table>
<thead>
<tr>
<th>Name of the University</th>
<th><a href="http://www.pages.cz">www.pages.cz</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Czech Technical University in Prague</td>
<td><a href="http://www.cvut.cz">www.cvut.cz</a></td>
</tr>
<tr>
<td>University Hradec Králové</td>
<td><a href="http://www.uhk.cz">www.uhk.cz</a></td>
</tr>
<tr>
<td>Tomáš Baťa University Zlin</td>
<td><a href="http://www.ubt.cz">www.ubt.cz</a></td>
</tr>
<tr>
<td>Technical University Brno</td>
<td><a href="http://www.vutbr.cz">www.vutbr.cz</a></td>
</tr>
<tr>
<td>Technical University Liberec</td>
<td><a href="http://www.tul.cz">www.tul.cz</a></td>
</tr>
<tr>
<td>Technical University Ostrava</td>
<td><a href="http://www.vsb.cz">www.vsb.cz</a></td>
</tr>
</tbody>
</table>

Web pages

The web pages of Czech technical universities substantially differ in structure, extensiveness, volume and user friendliness, and it is almost impossible to get a prompt orientation for a newcomer. Information on e-courses and other materials are generally „hidden” among information for students, specific links or department home pages. The names and classification of electronic courses are also different or even disguised. Electronic study materials are sometimes confused with electronic courses. Other links are well structured and easy to be reached. Some links are just partial e-projects where students prepare for exam and their knowledge level is tested. Availability of e-courses is limited to local students, there are only few open resources for external consumers. Information on e-learning courses was not included among frequently asked questions.

Technical background

LMS used by technical universities in the Czech Republic:

Moodle (http://Moodle.cz)
eDoceo (http://www.edoceo.cz)
Class Server (http://www.microsoft.com)
Lotus IBM
iTutor (http://www.e-learn.cz)

All technical universities from Table I which we visited have very good technical equipment, there is a sufficient number of computer classes for students with excellent audiovisual technology which enables them to watch lectures in other lecture rooms. There are more LMS used by technical universities, but Moodle is used as a basic platform for electronic learning. One reason why it became so popular in academia is financial – universities do not have to buy an expensive software, to pay extra fees for its administration. Moodle is quite flexible - it can be modified according to specific needs of universities and its esthetic parameters can be changed, too. But when we analyzed the structure of e-projects most of them were quite similar. Few courses of technical universities are opened to guest visitors, most are kept for faculty, students or other insiders. Orientation in Moodle might be difficult for beginners, The students might get confused if they look for an appropriate course, but in most cases there is a „help desk” as a didactic support.

Classification of electronic materials for students

More than 400 items of electronic support for students with a technical background were analyzed in our survey.

From the pedagogical point of view it is possible to classify electronic materials offered by Czech technical universities into 5 categories:

Pedagogical category:

• information/cognition
• practice
• correction/assessment
• learning management
• other purpose
Most of the electronic supports for information/cognition are e-courses, study materials for new contents (texts, pictures, tables, soundtracks, video-programs, demonstrations, animations). Model exercises, goal seeking and problem solving tasks are generally offered for practice. For correction/assessment there are many model exercises for repetition, “crib notes”, tests and their solutions for auto-evaluation/preparation for exams. Some recommendations and references for self-management represent the managerial category. Other electronic materials are represented by mutual co-operation of students, students give “reports” on teachers and “reports” on exams. There might be some ethical doubts about the unclear border between honest and dishonest use of electronic media by students.

IV. OPINIONS OF TEACHERS/AUTHORS/TUTORS

The next step of our study was an analysis of the experience of teachers – authors/tutors with the conditions under which they prepare the e-learning materials. Forty- two answered a short questionnaire with these results: some departments organise courses of Moodle for the academics and the younger staff seems more eager to take part in it. Electronic courses and other electronic materials for students are mostly activities of individuals or small groups within the department, less frequently co-ordinated activities of a faculty as a whole. They are generally financially backed by grants. Emphasis on content and purpose prevails but there is hardly a common methodology based on pedagogical rules. The teachers would appreciate it if such methodology existed. Their suggestions for possible research are:

- how to respect different student approaches, principles, solutions (divergent thinking support)
- to implement students ideas, views and attitudes (let students help to create electronic materials)
- to improve student practical skills
- to develop the students’ responsibility for their solutions
- to build a space for the student creativity
- to support the team work

V. STUDENTS’ ATTITUDES TO E-LEARNING

Parallel to teachers views we were interested in the student opinions on electronic learning and teaching they have been involved with. In a questionnaire, the students were asked to quantify the proportion of electronic study materials, their prevalent form, perceived quality and personal preferences, as well as opinions on weak points and strong points of electronic learning. More than 300 students were addressed and 189 gave answers to the items of the questionnaire.

In the first item, the students gave the answer to the question about proportion of electronic study material has increased in recent years, but it is still in the minority as a support of classical teaching.

### TABLE II

PROPORTION OF ELECTRONIC STUDY MATERIAL

<table>
<thead>
<tr>
<th>Proportion of electronic study materials</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 10 %</td>
<td>22</td>
</tr>
<tr>
<td>11 - 20 %</td>
<td>69</td>
</tr>
<tr>
<td>21 - 30 %</td>
<td>59</td>
</tr>
<tr>
<td>31 - 40 %</td>
<td>35</td>
</tr>
<tr>
<td>more than 40 %</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>189</td>
</tr>
</tbody>
</table>

### TABLE III

TYPE OF STUDY MATERIAL

<table>
<thead>
<tr>
<th>Type of study materials</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>power point syllabi</td>
<td>189</td>
</tr>
<tr>
<td>assignments</td>
<td>165</td>
</tr>
<tr>
<td>e-texts</td>
<td>172</td>
</tr>
<tr>
<td>other materials</td>
<td>189</td>
</tr>
</tbody>
</table>

Most of the e-texts are the syllabi presented on the web of the department, other texts, exercises for training and assignments. Students appreciate the quality of electronic materials.

### TABLE IV

QUALITY OF ELECTRONIC STUDY MATERIAL

<table>
<thead>
<tr>
<th>Prevalent quality of electronic study materials</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>outstanding, very good</td>
<td>31</td>
</tr>
<tr>
<td>good</td>
<td>107</td>
</tr>
<tr>
<td>average</td>
<td>36</td>
</tr>
<tr>
<td>below-average</td>
<td>15</td>
</tr>
<tr>
<td>poor</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>189</td>
</tr>
</tbody>
</table>
Although the students assess value of the electronic learning positively, only few would like it to become an exclusive form of study. More than 75% prefer either class teaching or a combination of e-learning and class teaching.

The students were also asked to describe their personal experience with e-learning and to specify the strong points and weak point of this form of learning. Their opinions can be summarized as follows:

**Advantage of e-learning:**

Students appreciate the availability of electronic support, they believe in a good quality e-learning as a source of motivation if there is an „additional value“ for learning process – an unusual, creative or amusing elaboration, graphical and illuminating processing, simulations or other way of supporting good explanation or demonstration of difficult subject matter.

**Disadvantage of e-learning:**

Students miss the personal contact with teachers and class-fellows. They can be (de)motivated if the class teaching is good or bad, they appreciate the social aspects of class presence. The presence and achievements of the class-fellows strengthen their will to learn. (…“learning at home by myself” demands diligence and persistence…sometimes I just cannot make it”).

„…Screen learning makes me tired…” - the students feel exhausted after long hours with computers. Iconic perception has a one-sided influence on the student individual learning style and inhibits other cognitive processes.

Several students also admitted electronic media might be misused for better assessment if teachers are not aware of the problem. Most frequent ways are plagiarism, collusion, “reports” on exams and “reports” on teachers.

VI. CONCLUSIONS

The current state of electronic learning at most of the technical universities in the Czech Republic can be described at 3 levels:

1) Electronic support backs the class teaching. In such a case it is more accurate to speak about blended learning, specific form of e-learning, when class teaching is mixed with the independent student work with electronic sources.

2) Electronic study material is enriched by elements of interactivity. Some class teaching is reduced.

3) Students gain access to the electronic courses/subjects or educational cycles. Class teaching is limited to a minimum or omitted. There is a high standard of interactivity implementation. The student knowledge is assessed electronically, too. In such a case we can talk about full electronic learning.

Technical universities in the Czech Republic have mostly reached the first to second level. The proportion of electronic study material has increased in recent years, but it is still in the minority, mostly as a support of classical teaching. Most of the e-texts are the syllabi presented on the web of the department, other electronic texts, exercises for training and assignments. The students mostly appreciate the good quality level of electronic materials.

Although the students assess the value of the electronic learning positively, only few would like it to become an exclusive form of study. More than 75% prefer either class teaching or a combination of e-learning and class teaching. Most of the students feel they need the presence of the “real” teacher and class-mates. The social contact represents an important source of motivation to students.

REFERENCES


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