THE EVALUATION OF eLEARNING STUDY SUPPORTS

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ABSTRACT
eLearning has become a phenomenon of the current learning knowledge society. Within our project "Evaluation of eLearning – System Approach" we are looking for the tools which can be used for the system evaluation of eLearning. We would like to find the factors which can influence quality, effectiveness and economics of eLearning. Results of one part of our research are presented in the paper. It deals with the evaluation of eLearning study supports which have been developed for fifty-six study subjects at three technical faculties. The evaluation was made both by pedagogy-psychological professionals and experts in the particular subjects. We used evaluation questionnaire. A series of statistical analyses was made over the obtained data and their results were used as feed-back for improving both the study texts and the evaluation form.

KEYWORDS
eLearning, factors of evaluation, study support, evaluation form, statistical analysis

INTRODUCTION

The evaluation of eLearning seems to be similar to that of any other learning. Nevertheless, it is necessary to accept particular factors to be assessed. We review many theoretical studies and examples of good practice. For our purposes, we prefer the following theoretical works:

- Kirkpatrick's Four Levels of Evaluation (Winfrey, 1999);
- A Framework for the Evaluation of eLearning (Huges, Attwell, 2002);
- System concept and system approach (Klir, 1972).

We intend to accept the system approach. In the system purposely defined for evaluation of eLearning, we intend to specify its structure and to find their properties (Kapounová, 2007).

When looking for a suitable model for eLearning evaluation, we investigated the existing status of the issue being resolved. The Model of assessing quality in eLearning elaborated by The Swedish National Agency of Higher Education (Åström, 2009) seemed as most appropriate one. The model comprises ten quality aspects:

- Material/content
- Structure/virtual environment
- Communication, cooperation and interactivity
- Student assessment
- Flexibility and adaptability
- Support (student and staff)
- Staff qualification and experience
- Vision and institutional leadership
- Resource allocation
- The holistic and process aspect

So far, in our project, we have not determined the individual parts of the system, which kind of characteristics we want to explore, or even the system structure. We are aware that we are close to the Swedish model in many respects, yet we must carry out the ensuing research.

eLearning quality indisputably stems from the quality of study materials which can be of various types: printed books, audio and video recordings, electronic texts displayed on the screen, etc. All stated forms

are offered by existing possibilities of the computer technology; well even conventional books are edited and published on computers.

We were assessing eLearning supports developed for specialities at the VŠB-Technical University of Ostrava.

RESEARCH OBJECTIVES

In the project entitled "eLearning Elements for Study Support in Special and Technical Subjects" (within European Structural Funds – ESF), which was developed at VŠB-Technical University of Ostrava between 2006 to 2008, eLearning study supports were created for fifty-six subjects presented at three technical faculties involving the Faculty of Civil Engineering, the Faculty of Electrical Engineering and Computer Science and the Faculty of Mechanical Engineering. The stated supports were evaluated both professionally and in terms of pedagogy (Šarmanová, 2009).

The project objectives involved processing of eLearning study supports for basic subjects of Bachelor and Master studies. These study materials complement conventional printed textbooks by multimedia and distance elements for improving quality of teaching students. They involve automated feed-back elements for making the job of teachers easier when evaluating tasks and tests. Moreover, they provide a possibility of mutual communication of students and teachers mainly in the distance form of study.
At the same time, teachers – the authors of the study supports - were systematically learning in terms of didactics during development of multimedia tools (animations, video and audio sequences) and use of a suitable LMS (Learning Management System).

In the paper, we aim to evaluate and analyze the study supports in pedagogical terms. Results of the analysis should assist in obtaining feedback about:

- pedagogic quality of developed study supports;
- quality of the pedagogic questionnaire for study support assessment.

MATERIAL FOR ANALYSIS

In the course of the project a series of data was monitored and filed in a database. Objects (lines) form individual study supports of subjects, and attributes (columns) form data. The filed data involve for example the planned and actual scope of texts, scenarios, several animations, video, HTML, pages, and LMS elements, followed by numbers of points allocated to the study supports by the professional opponent and opponent assessing compliance with distance elements. Moreover, data on authors, pilot operation students and results from the evaluation questionnaire from students were monitored.
The evaluation form was created by the project developers due to the non-existence of a standard available for assessment of pedagogic quality of eLearning study supports. The author of the evaluation form is professor Mechlová (Mechlová, 2008).

Evaluation form

The evaluation form is a structured questionnaire consisting of twenty-six questions split into four areas:

I. Basic characteristics of text
   1. Guide through the course at the introduction and in individual chapters;
   2. Break-down of the course into chapters;
   3. Statement of objectives in student performance for the whole course and for each chapter;
   4. Well-arranged overview of the course;
   5. Comprehensibility of the communicated content for students;
   6. Overall design of the course influenced by the author (not LMS): pictures, schemes, graphs;
   7. Use of multimedia (presentation, video, audio);
   8. Quality and adequacy of additional sources, reference of basic study literature;
   9. Imaginativeness.

II. Encouragement of students
    10. Applying instruction to "think about" directly in the text and mobilizing questions
    11. Applying content of study in practical examples, case studies;
    12. Support of communication tools (discussion, chat, e-mail);
    13. Work groups of students and development of common partial or long-term projects.
III. Planning and organizing of study activities
    14. Syllabus;
    15. Requirements for students (calendar);
    16. Use of basic elements according to guide for individual chapters;
IV. Feedback and evaluation
    17. Key words (new terms at the beginning of chapter);
    18. Summary at the end of the chapter;
    19. Repeating and mobilizing questions in the text;
    20. Solved tasks in the text;
    21. Solution tasks – short tasks across the text;
    22. Solution tasks – more demanding tasks with summary of chapter (correspondence tasks to be sent to lecturer);
    23. Tests;
    24. Auto-tests;
    25. Key to tasks in the text;
    26. Glossary.

Each question was answered by opponents verbally and evaluated by a point of 0 to 10; the higher point, the higher the quality. If a question was not evaluated, its answer was allocated number -1 (minus 1). The record of those data resulted in establishment of the matrix counting fifty-six lines (study supports, i.e. subjects) and twenty-seven columns (one is sequence number of study support and twenty-six involve attributes, i.e. answers to questions in the questionnaire). Generally it is not the rule that each support was developed by a single author. Some textbooks were developed by multiple authors, or some authors developed more than a single study support. A series of analyses was conducted over obtained data.

METHODOLOGY

For the purpose of analysis, several statistical and data mining methods were used (Berka, 2003; Šarmanová, 2007):

- descriptive statistics basic characteristics from acquired data were calculated – means, extremes, frequencies of each attribute;
- principal component analysis – deals with the question of possibly correlated variables in a questionnaire or on the other hand, if there are such items that do not influence the results of evaluation. The result may simplify the form for opponents of eLearning study support while the quality of evaluation will be same;
- analysis of associations – deals with relations among sets of attributes. The result brings rules that enable determination of the value of some attribute on the basis of known values of other attributes. The result may determine reasons for a positive or negative evaluation of some important qualities of study support;
- cluster analysis – these methods generally examine a set of observed subjects so that some subsets (clusters) are similar in some sense. In our research, here are subsets of similar study supports from the pedagogical point of view. The result may determine sets of study supports (and their authors) of the similar quality or mistakes. Then recommendation can be addressed to authors to improve their study supports.

RESULTS OF ANALYSIS

On the basis of analysis, we can summarise the following substantial conclusions.

Basic static characteristics of data

Results of statistic characteristics, mainly in terms of frequency of occurrence of point evaluation of individual questions, were as follows:

- Authors of study supports were evaluated best for attributes of Segmentation to chapters, Formulation of objectives, Well-arranged overview and Comprehensibility of content. Those are vital requirements even for conventional textbooks. However, only half of authors use elements of the Guide through the course and Use of multimedia. Only few of them include references or deal with "artistic" aspects of the text. The imaginativeness of supports is evaluated as only average.
- Required characteristics of the area of Encouragement of students have not been met with a prevailing majority of supports, i.e. instructions "think about", practical examples, use of discussions, chat, e-mail and group solving of tasks and projects. The evaluation of items such as communication and groups did not exceed the number 7, the majority of supports were allocated 0.
- A similar result was observed in Planning and organizing of activities. Only half of evaluated study supports were evaluated positively.
- The last area of Feedback and evaluation was also not assessed too well. Auto-tests were met in nearly none of the cases, Tests and Glossary at the end of the support, and other attributes were met only by some half of supports.

Principal component analysis

The result shows:

- the attributes of Requirements (calendar) + Solution tasks + Task key divide quality of study supports most;
- the next group of attributes dividing supports involve Quality of additional sources + Syllabus + Summary at the end of chapters;
- followed by Use of multimedia + Application of case studies + Requirements (calendar) + Questions in text + Glossary;
- we can also add the group, dividing study supports of Key words + Solved tasks in the text.

The following attributes occur only in vectors and are of low significance level for differentiation of supports quality:

Stating objectives, Well-arranged overview, Comprehensiveness of conveyed content, Overall design, Imaginativeness, Use of instructions "think about", Support of communication tools, Work groups of students and solving common projects, Use of basic elements according to Guide, and finally, Auto-tests.

All those characteristics are either always met, or not met at all, therefore they do not mutually differentiate subjects.

Analysis of associations

Test 1

This test deals with the issue which of the attributes has impacts on comprehensiveness of the conveyed text.

Comprehensiveness of content highly depends on characteristics of Segmentation to chapters, Well-arranged overview of the course, Stating objectives, Solved tasks in the text, and Use of multimedia. On the contrary, the Summary at the end of chapters, and Key words for Comprehensiveness are not presented as important.

Summary: Stating objectives, Well-arranged overview and Use of multimedia can have positive impact on Comprehensiveness of the conveyed content.

Test 2

This test deals with the issue which of the attributes has impacts on Well-arranged overview of the course.

A Well-arranged overview of support highly depends on characteristics of Segmentation to chapters, Key words, Use of basic elements according to Guide, Glossary and Summary at the end of chapters.

On the contrary, characteristics such as Stating objectives, Guide through the course, Solved tasks in the text, Use of multimedia, Comprehensiveness of content, Use of instruction "think over", are not presented as important.
Summary: For Well-arranged overview, the item of Key words is probably important.

Tests 3 a 4
This test deals with the issue of which attributes have impact on Imaginativeness.
Evaluation of Imaginativeness highly depends on characteristics of Segmentation of the course and Key words.
On the contrary, characteristics of Guide through the course, Stating objectives, Well-arranged overview and Comprehensiveness were not used in evaluation of Imaginativeness.
Summary: Study supports vary in the level of professionality of texts, yet they all feature the same level of Imaginativeness and over-average to excellent Well-arranged overview.

Cluster analysis
Regarding conclusions of statistics, three clusters were expected – of best, average and worst supports. In terms of development of eLearning supports, such result would split teaching supports (and thus their authors, too) to the groups of mature, advanced and beginners. According to the relevance of the group next seminars and courses can be organized, and perhaps the particular author can be asked to complete the text of the study support.
Clustering was made according to individual areas of questions.

Basic characteristics of the text
Three discovered clusters really confirm the establishment of three levels of groups of authors.
The first cluster involves under-average study supports. Specifically, apart from characteristics of Comprehensiveness and Study support, all other characteristics are evaluated very low. Those involve subjects of nine study supports. It is interesting, that four supports are from same authors.
The second cluster involves supports evaluated as very good, mainly the first six attributes from the area of Basic characteristics of the text. But even others are above average. In particular, twenty-five supports are involved.
The third cluster involves supports dealing with excellent evaluation – Segmentation of the course, Comprehensiveness of conveyed content, and Overall design of the course. Others are evaluated as average and the attribute of Guide through the course is evaluated very low. The obvious requirements of each textbook are generally positively evalutated characteristics (and conventional printed lecture notes); those eLearning supports are average.

Encouragement of students
Three discovered clusters confirm expected segmentation of supports to best, average and only partially worst.
The first cluster involves supports of a relatively high level of the attribute Practical examples, but low level of Use of instruction "think about" and zero evaluation of Support of communication and Work groups. Those involve seventeen study supports.
The second cluster involves supports evaluated very low or zero in terms of all characteristics. Those involve twenty study supports.
The third cluster involves supports evaluated as excellent in Use of instruction "think about" and Applying of content of study in practical examples, and evaluated low in Support of communication tools and Work groups of students. Those involve eleven study supports.

Planning and organizing study activities
Three discovered clusters confirm the precondition of segmentation into best, average and only partially worst. The first cluster involves thirty-nine supports evaluated very low or zero in terms of all characteristics.
The second cluster involves sixteen supports evaluated very good in attributes of Key words and Summary and less in Repeating and mobilizing question.

This cluster is the only study support without Key words, but with excellent results in Summary and Repeating and mobilizing questions.

Another method which involved Planning and organizing study activities and Feed-back and evaluation, divided supports to three clusters differently, but such division is not of any other significant meaning.

Cluster analysis divided teaching supports (i.e. subjects and perhaps their authors) into three groups:

- the group of relatively competent authors of eLearning supports, who were recommended only minor additions and improvements of their study materials;
- the group of authors who meet well only a part of requirements on support while fail in meeting the other part of requirements; those are recommended to participate in a workshop to get additional information and practice;
- the group of authors whose supports are evaluated well professionally (via different type of assessment), yet they are not fully suitable as distant or eLearning supports; for that group, a new training on this issue will be organized.

CONCLUSION

In conclusion, we can state that analysis meet both aims:

1. evaluation of pedagogical quality of study supports and division of their authors into qualitative groups;
2. evaluation of pedagogical questionnaire for assessment of study supports and proposal for its improvement.

We can summarise the results of analysis:

I.

Result: Some questions as:

Syllabus (item 14);
Requirements for students / calendar (item 15);
Use of basic elements according to guide for individual chapters in the form (item 16)

were assessed differently by different opponents.

Discussion: **Perhaps the question is unambiguously formulated; different opponents understand them in different way.**

Proposed measures: **The wording of the question in the form should be modified.**

II.

Result: Some required characteristics of study supports as:

Applying instruction to "think about" directly in the text and mobilizing questions (item 10);
Applying content of study in practical examples, case studies (item 11);
Support of communication tools (discussion, chat, e-mail) (item 12);
Work groups of students and development of common partial or long-term projects (item 13);
Tests (item 23);
Auto-tests (item 24);
Glossary (item 26)

were not generally met.

Discussion: **Perhaps requirements are difficult to meet and the authors did not manage it.**

Proposed measures: **The methodology guide should be revised and authors trained.**

III.

Result: There are some authors of study supports which did not meet certain criteria for eLearning materials, even though other authors of study supports met them.

Proposed measures: **Individual assistance for those authors should be provided.**

Generally, the proposed form as the standard for pedagogic evaluation is suitable, yet certain formulations of questions should be revised and made more precise so that the assessor understands them quite clearly according to above-mentioned conclusions.

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