# On Principles of Course Evaluation in Distance Learning Environment

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## Abstract

*Distance learning improves access to education and – in most cases – advances the quality of education delivery. Its key attributes are: openness, interactiveness and using multimedia teaching materials allowing: learning by anybody, at any place and anywhere. In order to assure high quality of learning, the offered courses should satisfy audience expectations and should convey knowledge in modern ways. To analysing teaching effectiveness we have evaluated a number of distance education courses. The paper describes evaluation aspects of distance learning environment and proposes the following criteria useful for this task: knowledge completeness, consistency and adequacy. Apart from knowledge passing, we have to deliver courses in an attractive form. We propose guidelines useful for evaluation of courses prepared in the LearningSpace (Lotus Notes application) environment s. The quality of education can be greatly improved by following these guidelines Two of the courses designed for MBA studies: "Business Plan Preparation" and " Management Decision Support Systems" illustrate the usability of the course evaluation method.*

Keywords: Distance learning, education via WEB, learning assessment, knowledge evaluation, open learning.

## Introduction

Distance learning, as relatively new option of education, can take different forms: broadcast TV, videoconferencing, audio, and video - to give few examples. All of them offer learning at a distance, yet still retain time and space limitations, and don't include student–teacher interactions in the learning process. Computer-based training methods offer more flexibility with regard to time when the learning takes place, but lack the collaboration between the instructor and other students (see Spronk, 1998).

Distance learning concepts offer almost unlimited learning materials as well as very interactive ways of teaching in a global sense (see: Hedberg, 1994). However, as any educational module, a distance learning course should be adequate to changing conditions in which it is used. Distance learning can provide environment in which the learning process is more dynamic and adaptable and creates better basis for group-ware approaches to the solutions of problems.

Despite many advantages of this form of education (teaching anybody at any place and time, customisation of courses etc.) there are disadvantages such as: distribution of teaching materials and difficulties with ensuring the course consistency. Because of the autonomy of course materials and the "invisibility" of developers and teachers, controlling and evaluation of the course seem to create some problems. This paper addresses the issues of course evaluation. In our opinion, techniques and criteria used for knowledge verification and evaluation can be applied in the described environments. The paper is organised as follows. Initially we discuss goals and context of course evaluation in distance learning. Then we present main facilities available in LearningSpace Next we introduce and explain principles useful during the evaluation phase. Conclusions are presented in the last section.

## Distance learning evaluation

In distance learning most learning tasks are automated, the roles of participants (teachers as well as learners) are modified significantly, ways of knowledge acquiring and its evaluation are supported by computers. Usually, the

following functions are accessible in distance learning environment (compare: Lotus, 1998):

1. Creation distance learning infrastructure – supporting a database administrator in defining course names, users and its characteristics and the like. Basically, this function is performed during the installation phase and repeated in case of changes.

2. Designing courses and its components – the main task of a course developer or teacher. This is very creative function – a course author uses specialised tools (mostly editors) for elaborating course components and integrating them into one coherent whole.

3. Delivering of teaching materials- different materials stored in libraries have to be properly linked to course(s). During learning processes – information and formalised knowledge items are transferred to students.

4. Servicing teamwork activities – this function supports discussions, joint solving of problems and other teaching activities aimed at groupware. This way, interactions between students and teachers can be very intensive and effective.

5. Student assessment – this task performed in a traditional way can be applied into distance learning option in a limited scope. There may even be a specialised module to support this task, but final exams are rather difficult to support.

6. Administration – a complex range of activities managed by a database administrator (because distance learning applications are database applications).

The course development process is similar to building any software application. Therefore, the methodology used for this purpose must cover typical application development phases: requirements analysis, modelling, designing and implementation. A course - as a software product - must be tested and evaluated during development and must undergo normal maintanance/evolution cycle afterwards. The course evaluation is a component of a system life cycle. As a task aimed at detection of application weak points is a valuable source of intended changes. A special aspect of course evaluation is the changing character of the domain knowledge (see: Bates, 2000 or Wood, 2000)

Classical methods used for application evaluation cannot be applied in a normal way. Software evaluation methods must be adapted and modified to reflect the essence and non-typical objectives of distance learning. In the next sections, we have introduced guidelines useful for the described environment (compare Yates, 1999).

## LearningSpace as a tool supporting distance learning

LearningSpace (an application of Lotus Notes) offers a generic environment for development of distance courses for students representing different levels of subject literacy. There are five specialized Lotus databases, which allow students to engage in problem solving activities, topical discussions, and classroom activities that incorporate the richness of group learning (compare: Owoc, 2000). Figure 1 shows the primary window of LearningSpace.


Fig 1. Starting window of LearningSpace

One of the databases – the *Assessments Manager* – is the specialized module for instructors and students to evaluate teaching outcomes, including students' self-assessment.

There are several techniques useful in assessment of specific knowledge delivered to students during the course, for example the following types of questions can be defined: True/False, Multiple Choice – Single Answer, Multiple Choice – Multiple Answer or Open Ended.

The record of student's test results over some period of time is a valuable technique of the course evaluation. In order to evaluate a course in wider perspective, we have to relate also to the *course contents* and to its *form* and compare it then with the subject knowledge as well as with possible solutions offered in distance learning.

In traditional face-to-face teaching, students' assessment process can be performed in many ways. Some of these techniques are still useful in distance learning environment, however roles of students and instructors may be dramatically changed. Let's have a look at facilities present in the LearningSpace context.

A special tool is designed to evaluate students' performance - it is called the Assessment Manager.

Using it the instructor can prepare sets of categorised questions. Questions have attributes such as:

- Category
- Type
- Description
- Point Value
- Difficulty Level

Questions also can include additional explanations. Categorisation of questions helps to quickly create an assessment for a particular part of material or subject.

There are four types of questions:

- True/False
- Multiple Choice – Single Answer
- Multiple Choice – Multiple Answer
- Open Ended

First three types of questions can be automatically graded according to their attributes.

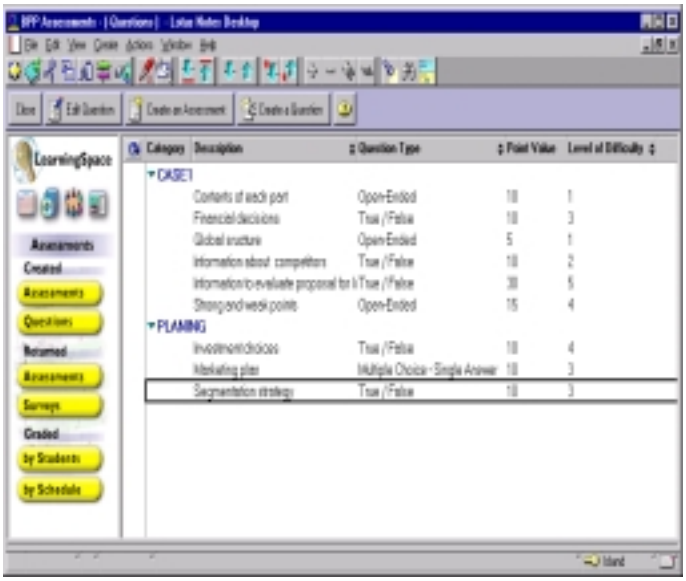

Fig. 2 Sample questions in a Business Plan Preparation course

Using a prepared set of questions, the instructor can create an assessment. Assessments have following attributes:

- Title
- Type
- Module

A prepared assessment is stored in the Assessment Manager files. They became visible and accessible for students in Schedule when the instructor posts them, see Figure. 3

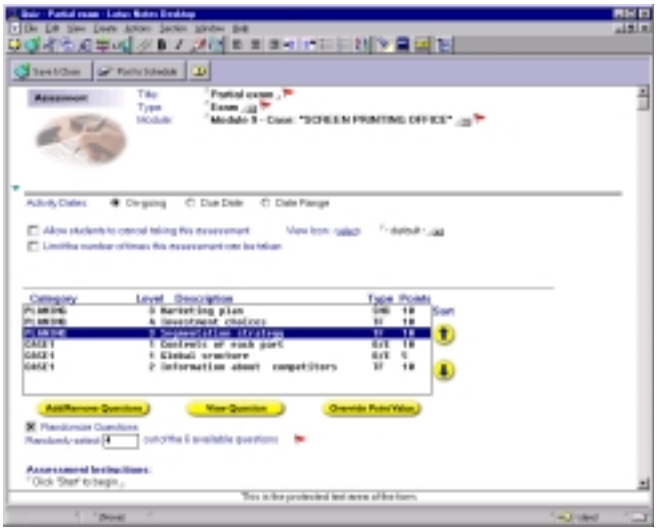

Fig. 3. Assessment Manager window

The Assessment Manager has the ability:

- to randomise questions (unique assessment for each student);
- to track assessment time;
- to prevent students from taking multiple assessment
- to return corrected assessments to students

The main advantages of course assessments using distance learning approach can be expressed as:

- flexibility of students' assessment (evaluation at any time and place),
- differentiation of evaluation techniques (answers can be false/true, single/multiple or open-ended types),
- easiness of combining tests and exams (the specific tests may be formulated in many versions),
- efficiency of the system evaluation (calculation of results and ready for use statistics),
- facility of self-assessment by students (accessible tests and quizzes delivered by instructors).

There are some disadvantages of systems' evaluation in the distance learning environment:

- losing of evaluation security (students can pose for other students during tests),

- difficulties with establishing clear-cut interrelationships between the learning material and the tests (questions have to take into consideration the unlimited knowledge resources instantly accessible via Internet).

The remarks show crucial strong and weak points of the assessment process in the described environment. Generally speaking, results of Assessment Manager function can be used during the course evaluation task.

## Guidelines for course evaluation

As it was stated earlier, the course evaluation is a very critical phase for course improvement. Lack of continuous or systematic evaluation of a course causes its stagnation and as a consequence its degradation. The goal of this sort of evaluation is to improve the course content, adjusting it to the current and future requirements. Evaluation as a phase detecting weak points of a course, allows for articulating of directions of its changes.

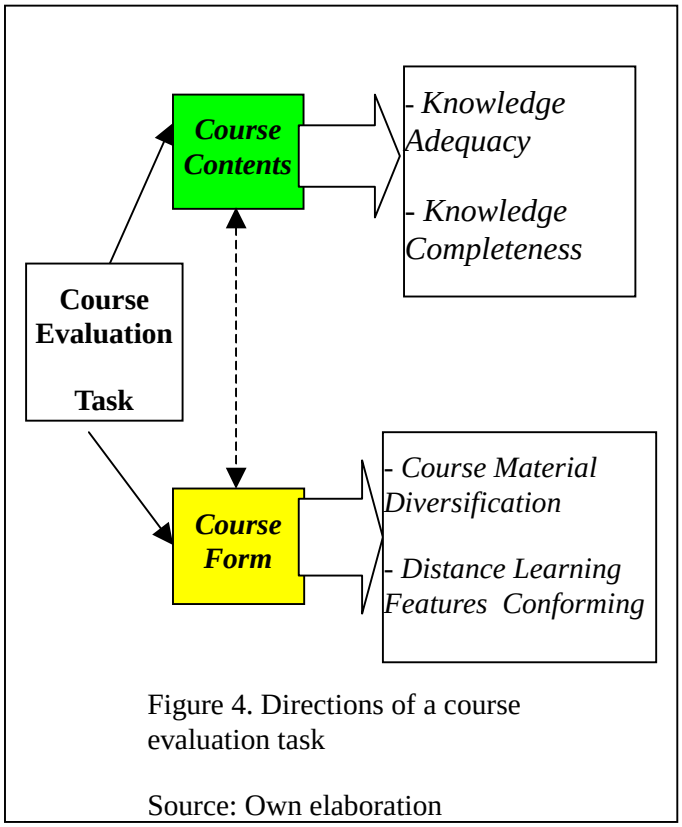


Figure 4. Directions of a course evaluation task

Source: Own elaboration

The course evaluation can be performed in several ways that are usually borrowed from related research areas. In order to make the task rational, we need to define a procedure that enables evaluating different features of a course. Undoubtedly, a course can be set up as a typical knowledge base (it consists of structured information with interpretation). Therefore we may apply techniques and criteria used for knowledge base validation (see: Ayel, 1991).

The model of the course evaluation task is presented in Figure 4.

We assume two main directions of evaluation: course contents and its form of presentation. The particular "knowledge base" passed to students can be evaluated using three crucial criteria: adequacy (to the defined aims of the course), completeness (comparing to the accessible knowledge domain) and consistency (relationships among knowledge parts). On the other hand, considering the course form, we pay attention to the way of presentation (including especially multimedia materials and the methods crucial for distance learning: group learning and solving and the Internet properties of any-time, any-where and any-body). Because any course can be treated as a specialized *knowledge base*, so we may apply the above mentioned criteria of adequacy, completeness and consistency inherited from the domain knowledge. Let's discuss potential techniques useful in such setting.

According to the first guideline called ***adequacy rule***, we have to pay attention to incorporating into a course materials that represent knowledge necessary for the achieving of the course goals. Very often, particular parts of a course are outside of the course topics. The adequacy criterion included to course evaluation may have different "dimensions". Firstly, the materials included in the course can be out-of-date (*time inadequacy).* Secondly, the knowledge attempted to be delivered to students may not suit environmental factors (*environmental inadequacy)*. Placing materials about knowledge base tools in a course "Business Plan Preparation" can be an example of course inadequacy (see: Figure 5).

The second principle refers to the inclusion of sufficient materials necessary for understanding of the course objectives. This principle can be termed as ***completeness rule.*** No knowledge parts, essential for the course, can be omitted. Usually, this is a matter of delivering of materials covering the whole "domain or problem knowledge" for the course's established goals. If in the "Business Plan Preparation" course, the characteristics of chosen steps of busi-

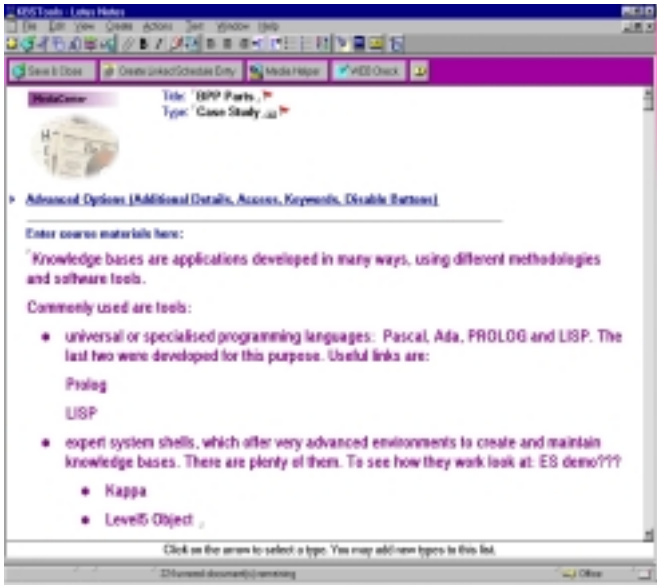


Fig.5 Inadequacy of Business Plan Preparation course content

ness plan preparation are included, but a lack of general overview of the process is discovered, then the completeness rule is not achieved. As before, we may detect course incompleteness during student assessments, when most answers on certain questions are incorrect. An example of incompleteness of Module 3 Knowledge Based System of “Management Decision Support System” is depicted on Figure 6.

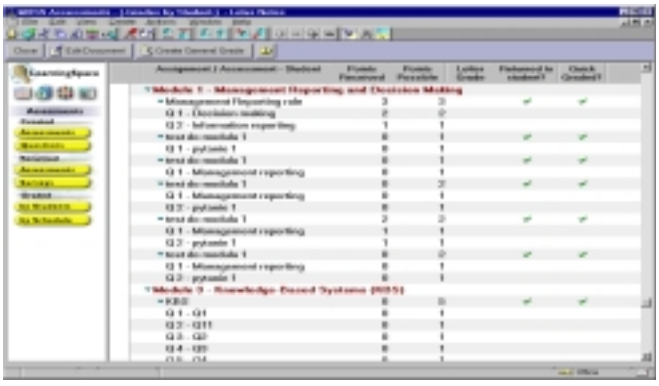

Fig. 6 Incompleteness of knowledge in a Management Decision Support System

The third guideline requires establishing effective links between specific parts of a developed course or among materials acquired from outer sources. This is the ***consistency rule***, which assures real connections between delivered parts of knowledge that create course contents. This means also the preparation of properly interconnected materials. Some kind of "knowledge" map embodied into a course can be useful for detecting of course inconsistency. In Figure 7 we demonstrate a failed link into media library existing in a course "Business Plan Preparation”.

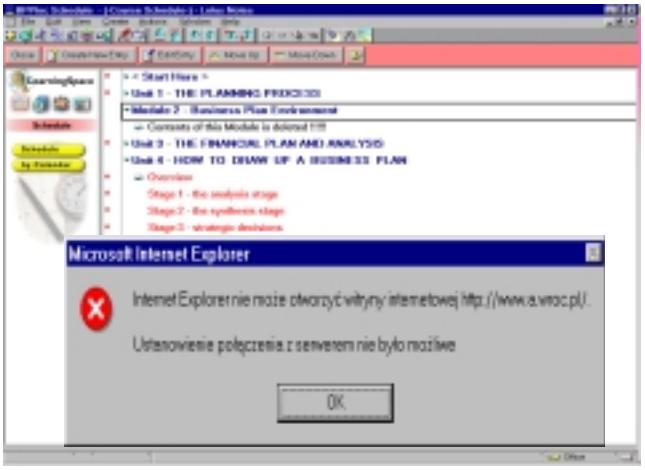


Fig 7. Inconsistency of Business Plan Preparation course materials

The next guideline (representing the second "direction" of a course evaluation) refers to form of materials used. In order to be effective, a course form should be attractive to audience. Course delivery requires using different techniques to assure proper understanding of different topics. This improves quality of teaching from the pedagogical point of view. For example, when showing different forms of business plan we should illustrate them using a multimedia library, where specific sorts of documents are stored (see Figure 8). This multimedia storage serves as a multimediea warehouse concept.

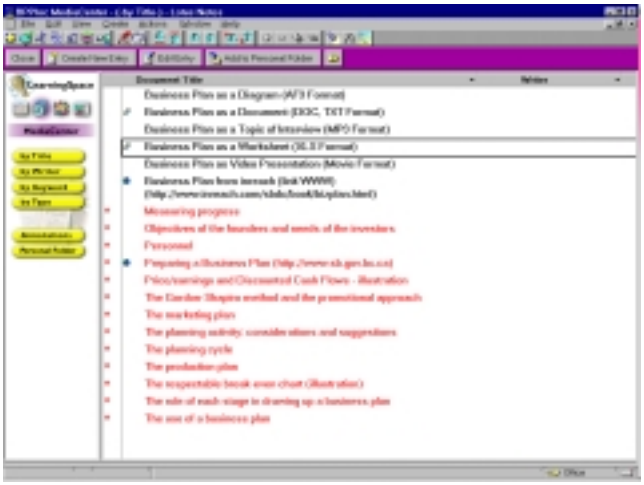

Fig 8. Different forms of Business Plan presentation

The last guideline refers to options that can be applied. As we stressed earlier, distance learning offers very attractive way of teaching. Therefore, we should search for inspiring forms of teaching. For example, when applying "a brain storming" technique we may use a special module devoted to group-ware tasks (compare: Schreurs, 1999), namely "Course Room", see: Figure 9.

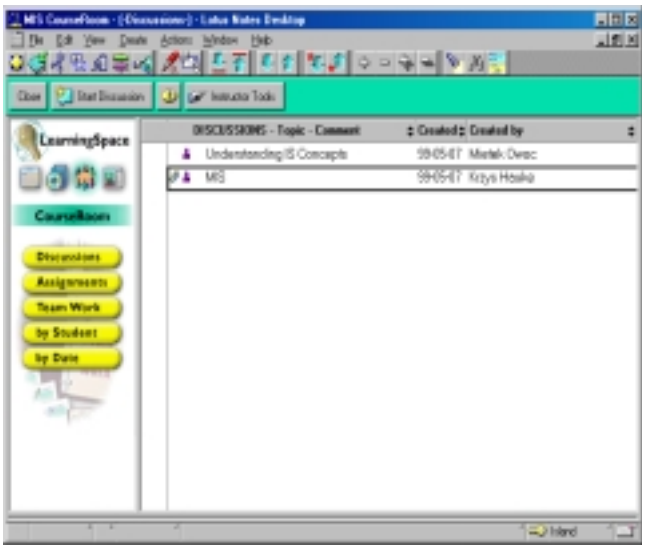


Fig 9. A Course Room module applied for a Management Decision Support System course

In this Section, we described the evaluation aspects of the LearningSpace environment in the defined context. In order to get reliable and measurable basis for the course evaluation (assuming making this via the *Assessment Manager* facilities), we may use results of tests and exams and relate them to the course content. A knowledge based application can be a solution for detecting weak points in the developed courses (see: Nycz, 2001). The set of criteria defined earlier can be used to formulate the knowledge to be incorporated in an expert system application. The guidelines relate to the ***adequacy*** of course materials and necessary knowledge domain, ***consistency*** of course materials and tests, limited ***completeness*** of tests with regard to the course content and the like. Necessary measures of fulfilment of distance learning objectives, from the viewpoint of the course content and the course form, have been presented. They have included the statistics of successful or failed answers to questions, defined and used knowledge descriptors, and matrices of delivered and tested knowledge.

## Conclusion

LearningSpace offers relatively developed forms of student assessment (especially for discussions, group-ware assignment and the like) but it lacks tools for course evaluation. In our opinion, this task is crucial for continuous improvement of a course.

In the paper we argued the need for the development of guidelines aimed at assessment of courses in the distance learning environments. After the analysis of solutions available in the LearningSpace software, we have proposed guidelines for the improvement of developed courses. The guidelines with regard to the contents of a course as well as to its form have been offered.

In the future we intend to intensify efforts on developing a knowledge-based system aimed at evaluating our existing distance education courses. The principles proposed in this paper will constitute the basis for such system. The insufficiently evaluated parts of teaching materials can be identified. This way the designer of a course can be supported by a useful facility to improve the course.

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## References

Ayel M. and Laurent J.-P.(1991): *Validation, verification and test of knowledge-based systems.* John Wiley & Sons Ltd. , Chichester

Bates B. and Leary J.J.(2000)*: Tele-education Environments: Issues of Learning Styles.* Proc. of the International Symposium on Telemedicine and Teleeducation in Practice - ISTEP'2000, Kosice (Slovak Republic)

Hedberg, J. and Alexander, S.(1994): *Implementation and Evaluation: The Forgotten End of Interactive Multimedia Development*. Paper presented at the APITITE Conference, Brisbane

Lotus (1998): *LearningSpace 2.5. Release. Instructor Guide.* Lotus Development Corporation, Cambridge

Nycz M., Smok B. (2001). Intelligent Teacher's Supporting System Conceptual Model. Proc. of the International Seminar Krzyżowa. Wroclaw University of Economics Pub. Co. (to appear)

Owoc M.L, Hauke K., Gładysz T. (2000): *Assessment as the Essential Function of Distance Learning Applications.* Proc. of the International Symposium on Telemedicine and Teleeducation in Practice - ISTEP'2000, Kosice (Slovak Republic)

Schreurs J., Theunissen M, Owoc M.L, Hauke K., (2000): *A Multimedia Warehouse Supporting On-Line Learning via Internet Proc. of the 5th Annual Scientific Conference on WEB Technology, New Media, Communications and*

*Telematics Theory, Methods, Tools and Applications - Euromedia 2000.* Antwerp (Belgium), F. Broecks and L. Pauwels (eds.) The Society for Computer Simulation International, Delft

Schreurs J., Baborski A., Owoc M.L., Kościukiewicz W. (1999): *Global University Enterprise and Inter-Enterprise Collaboration Based on Internet- and Group-ware Technology*. Argumenta Oeconomica Wroclaw Univeristy of

Economics, No. 1(8), Wroclaw 1999

Spronk, B (1998).: *Distance and Supported Open Learning: An Overview*. [In:] Distance & Supported Open Learning. Worldwide Edition. Hobsons Publishing PLC, 1998

Wood, H. (2000): *Designing Study Materials for Distance Students*. Accessed October 1, 2000 at

http://www.csu.edu.au.division/oli/oli-rd/occpap17/design.htm

Yates, S. (1999): *Distance Education Guidelines*. Centre for EducationalAdvancement. Accessed April 10, 1999 at: http://ceacurtin.edu/deguide section-1.htm

## Biographies

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