On-the-Job E-Training – from Requirements to Design[1]

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Abstract: *The paper deals with some problems of the design and use of managed learning environment (MLE) for On-the-Job e-training. After brief presentation of the current MLE structures and some consideration about their use, the initial design phase of such environment is outlined.*

Key words: *Vocational e-training, e-Learning, Managed learning environment, Virtual learning environment.*

Introduction

E-learning is defined as "learning that is supported by information and communi-cation technologies (ICT). E-learning may encompass multiple formats and hybrid methodologies, in particular, the use of software, Internet, CD-ROM, online learning or any other electronic or interactive media.". E-learning typically occurs in Virtual Learning Environment (VLE) – term, used to refer to the "online" interactions of various kinds which take place between learners and tutors. The JISC MLE Steering Group has stated that VLE refers to the components in which learners and tutors participate in "online" interactions of various kinds, including online learning [1]. Term **Managed Learning Environment (MLE)** is used to include the whole range of educational information systems and processes, generally in an educational institution (including its VLE if it has one), that contribute directly, or indirectly, to learning and the management of that learning. From user's viewpoint a Virtual Learning Environment in current MLE is a single piece of software, accessed via standard Web browsers,

which provides an integrated online learning environment with following main functions [1]:

1) controlled access to curricula mapped to elements that can be separately assessed and recorded;

2) tracking student activity and achievement against these elements using simple processes for course administration and student tracking that make it possible for tutors to define and set up a course with accompanying materials and activities to direct, guide and monitor learner progress;

3) support of on-line learning, including access to learning resources, assessment and guidance; the learning resources may be self-developed, or professionally authored and purchased materials that can be imported and made available for use by learners;

4) communication between the learner, the tutor and other learning support specialists to provide direct support and feedback for learners, as well as peer-group communications that build a sense of group identity and community of interest;

5) links to other administrative systems, both in-house and externally.

Vocational E-training and On-the-Job training

Vocational e-training exploits the advantages and benefits of e-learning processes in existing vocational training schemes. It is based on the e-learning paradigm which means sound pedagogical methods, wide availability, user-centred learning and an evident removal of the classroom element from the learning process. These aspects are very important both for the employee and the employer, since they provide the opportunity for quality training while limiting the effect on work plan, since the schedule of training activities can be formed according to the needs and opportunities of the individual and its job obligations. Employees are thus able to enhance their skills and stay ahead of the requirements of jobs positions they are interested in. Employers are able to provide cost-effective training to their employees when needed, in order for them to successfully handle their work tasks, without severely disrupting the budget and production processes of their businesses (since organisational costs and training fees are kept comparatively low).

On-the-job training (OJT) is a form of individualized training that allows an employee in need of training to receive the necessary knowledge, develop the required skills and improve performance – all while on the job. OJT offers many advantages over other learning approaches, especially when large numbers of employees need to be trained or when they are widely dispersed, making group-based training very expensive. When appropriate learning methods used in knowledge transfer are combined with methods used to impart skills and attitudes – in a setting where they will be immediately useful – the result is a comprehensive and very effective learning approach.

OJT reclaims the workplace itself as a legitimate environment for training and learning.

The educational specialists define the following essential criteria for on-the-job training activities:

- The location in which the learning takes place is a work place and the nature of the learning process is largely similar to the working environment.
- The trainees produce regular working products and services.

- The activities include "hands-on" experience.
- The training is highly similar to the current or future everyday tasks.

OJT can be designed and delivered to the trainees using two basic approaches. The OJT programs with little or no prior planning which pair a worker to be trained with an experienced worker are referred to as unstructured OJT. OJT programs that are adapted from effective training model and thus built on an organised process are known as structured OJT. The latter implies the existence of a definitive set of formal rules and instructions for the training-related actions to be taken in the frames of the program, while in the former rules and instructions may be rudimentary, trivial or even absent: the trainee is "self-guided" to the required information that adds to his training.

Use of E-Learning environments and training materials

Current commercial Managed Learning Environments provide simple processes and procedures for rapid production of on-line courses from available author's materials, e.g. Word or HTML files. There is no need of special technological knowledge of the authors, while learning technology knowledge is assumed in faculty staff. In the same time the need for careful course design and development with understanding of relevant pedagogical issues and delivery potential of the media became even more important than in the classic learning.

Nowadays the authors of E-Learning educational materials are often trying to use similar programming systems and tools for authoring as those used for business presentations. This tendency seem to be supported (possibly not purposefully) by the designers and producers of MLE for use in colleges and universities, integrating in their authoring tools techniques and styles borrowed from presentation tools and/or commercial website design tools. As a consequence sizeable part of E-Learning educational materials is found to be too much influenced by business presentations. Such materials demonstrate the following characteristics [3]:

•They have more declarative rather than explanatory style of narrative.

•They formulate and answer mainly "how"-type questions, while serious systematic learning is expected to formulate and answer "what"- and "why"-type before "how"-type questions (not neglecting "why not"– and "how otherwise"– questions).

•They use slide-type style of presentation, which is more relevant for additional than for main training materials.

•Most of the content is presented in thesis form, which supposes frequent lecturer explanations. In E-learning forms lecturer is often available only asynchronously or even practically is missing at all during most of the learning process.

•Attractive graphical design of the slides is applied, but often without considering cognitive and ergonomic factors (e.g. too much objects situated on a slide/screen, use of too much colours and visual effects etc.).

The tendency for similarity of e-learning materials and materials for business/ website presentations may lead to production of attractively looking, but "anonymously" addressed materials as they do not consider enough the different aims and target groups of business presentations or commercial websites, which:

– are oriented to possible customers rather than to learners;

– are aimed to impress than to educate;

– are oriented to short-term effect rather than to longer-term results.

This clearly observed tendency facilitates in most cases the authoring of e-learning materials. In the same time it may lead to somewhat misguiding impression, especially among IT specialists, that production of e-learning courseware is easy and mainly comes down to digital multimedia content production. An undesirable consequence of this attitude is the creation of shallow courseware, concerning unfavourably both the quality of learning and learners expectations. A declarative mostly receipt-like courseware is hardly stimulating for learners unless they have very strong external motivation to learn the material.

VLE functions and user groups needs

It should be noted nevertheless that the abovementioned critical remarks concern more the e-learning applications for systematic institutional education and may be not too significant for smaller and more dedicated e-learning applications e.g. in vocational training forms. In all cases VLE should support customisation for different key elements like visualization of elements and ability to support different kind of learner activities depending on the target group auditory. Different groups have different type of learning needs and habits. Most common target groups may be defined as follows [2]:

1) Corporate learners – this type of learners works for the different type of organization, and the management staff – usually training department makes decision for staff learning depending of organization needs and plans.

2) Professional experience learners – this kind of learners usually make decision for learning because of need for career development.

3) Degree completion learners – learners of this type are working adults that have to complete their education as their current job requirements have changed or are expected to be changed.

4) College learners – persons in this group typically have no working experience. This is the group of traditional students.

5) Test preparation learners – learners from this group learn for different type of examination passing, e.g. persons that learn for professional certificate issued by technological company like Cisco, Oracle, Microsoft, etc.

6) Life long learners, learning to enhance their knowledge, competence and competitiveness outside any formal education scheme and not oriented directly to any qualification certification.

Depending on the classification users that are expected to be typical learners for On-the-job training comes from groups 1), 2), 3) and 6). A Managed Learning Environment that is designed to support OJT has to focus on the characteristics for learners that perform learning activities on their work places.

Desirable characteristics of MLE for On-the-Job training

The necessity to have OJT (taking place on a working place and oriented to regular working products and services) especially for IT and connected knowledge and skills requires the following MLE features:

- Operation in Internet mode by distance learning delivery of OJT courses.
- Support of learning-by-doing practice.
- Operation in working conditions (with real software systems).

The current E-Learning practice and the orientation to constructivist principles require providing the following functionality of the learning process:

F1. It has to support sufficient level of interactivity for learning-by-doing operation mode.

F2. It has to supply courseware for skills acquisition.

F3. It has to store (automatically) the current status on exiting the learning environment.

F4. It has to allow fast restoring and continuation of the e-training.

F5. It has to permit operation in apprentice mode – following exemplary solutions of practical problems.

F6. It has to allow easy and natural communication of the learner with trainer/ advisor and possibly with peers.

The access to MLE for OJT is shaped by the following features:

A1. Controlled access for different types of users.

A2. Mixed initiative in activating the courseware modules/sections/units.

A3. Implementation of assessment/self-assessment mode inside/outside the direct learning operation mode.

A4. Possibility to   follow/measure the learners actions.

A5. Means to facilitate the activities of the environment administrator.

The set of functional characteristics for OJT learning environment, formulated above, together with some pragmatic considerations about the learners community show that the following features are desirable for MLE implementation:

O1. Asynchronous connection with the teacher/tutor.

O2. Sufficiently intuitive interface for the end-user, removing the need of special training how to use the environment.

O3. Work with standard/not-excessive computer power.

O4. Use of a standard browser from the learner's part, avoiding the need to download programs/files on the learner's computer (this feature imposes lesser requirements to the learner's computer resources and increases learner's trust in the security of his company confident information).

O5. Allowing the learner to work and practise with real software system on a remote computer without the need to purchase the system for his/her exercises.

Envisioning and Design Phases

The next part deals with the initial design phase of MLE for OJT based of the above mentioned characteristics. In fact, common requirements for general purpose MLE have to be taken into account because MLE that support On the Job e-training is a variant of MLE in many aspects. There are three design processes for building MLE system's design: conceptual, logical and physical. For writing requirements in expressive way, a set of use case diagrams is used. Use case diagrams are standard way to describe interactions between actors and processes. Use case diagrams are used to define main building blocks, classes and components of the desired system.

The design process begins by identifying actors for every use case. Main actors that interact with MLE are Learners and Staff members. Learners are primary users because VLE is build to satisfy their educational needs. Potential Learners are internet visitors that are interested of educational service offered by MLE, but are not registered

or assigned to particular course. Staff members [6] are aggregation of Trainers, Authors, Mediators, and Administrators roles. Trainer is responsible to help learners in their daily learning activities, to answer questions and evaluate learner's projects. He/She evaluates learners' grades and he/she may issue a creation component request to an author. Author is responsible for building learning components and deriving new from old ones to address special learners' needs. Administrators are two types: System Administrators - responsible for the administration of the system and the coordination of the system processes and Course Administrators- responsible for organizational aspects of MLE. Every role actors interact with MLE in a specific way defined by using specific tools [6] appropriate for this role. Overall description of the use cases are shown in following table with a brief description.

Table 1

UC#	Level	Primary Actor	Goal	Brief
1	Primary Task	Potential learner	General information	A potential learner can receive general information about the available learning materials and courses
2	Primary	Potential learner	Expression of interest	The potential learner communicates with a Course Administrator to find out appropriate available courses and to ask specific questions
3	Primary	Potential learner	Record learning needs	The system records the learning needs in terms of learning objectives so that the learner can have a control over the learning process and the system is able to track his progress
4	Primary	Admin Learner	Register learner	The learner is registered in the system
5	Sub-function	Learner Course adm. Trainer	Login	Identification of the user depending on the user class
6	Sub-function	Learner Course adm.	Show learner's status	An authorized staff member wants to see the status of a specific learner. Learner can see his/her own status
7	Summary	Learner	Follow lesson	The learner follows a lesson
8	Summary	Learner Trainer	Evaluate lesson	The learner takes an exam about a specific lesson that he has followed
9	Summary	Learner Trainer	Follow course	The learner follows the lessons associated with the course
10	Summary	Learner Trainer	Evaluate course	The learner follows an evaluation test for a course or lessons
11	Sub-function	Learner	Take exercise	The learner works on projects as part of the evaluation process for a lesson or for a course
12	Summary	Trainer	Modify course – learning objectives	The trainer modifies the lessons in a course depending of the learner progress
13	Summary	Learner	Send questions	Questions of the learner that arise during a lesson are sent to the trainer and the answers are sent back to the learner
14	Summary	Learner	Communication with peers	The learner communicates with other learners to receive answers to questions and/or associate the acquire knowledge with real life problems

Table 1. Continued

UC#	Level	Primary Actor	Goal	Brief
15	Summary	Author Trainer	Request for new lessons/ modifications	New lessons are added or modified so that the learning courses offered by the system are best fitted to needs of learners
16	Summary	Course Admin	Match trainer with learner	Assign trainers and Learners for course
17	Primary	Trainer Author	Assemble course	The lessons of the course are adapted to meet a particular learner's needs
18	Primary	Trainer	Reception of projects	Learner projects evaluated
19	Primary	Trainer	Send corrections	Notification about corrections is sent to learner along with suggestions for further studying
20	Primary task	Trainer	Give grades	The grades for a test or a project are inserted
21	Primary	Trainer	Answer questions	The trainer answers learner's questions
22	Summary	Trainer Author	Inform Author	The trainer informs the Author about the average progress of learners. The Author may change the course or the learning objectives. Initially course objects are created by the Author's vision
23	Summary	Trainer	Insert lesson	The Trainer inserts or modifies a new lesson in a course for a learner
24	Summary	Admin Author	Install software	The Administrator installs software on the server as required by the Author
25	Summary	Trainer	Send discussion topics	A trainer creates discussion topics for a group of learners

Table columns have following meanings: UC# number is index that is used to exclusively identify an Use Case. Use Cases are classified in three levels: summary, primary task or sub-function. Summary level use cases (or strategic use cases) describe a complex interaction and set the context for lower level use cases. Primary task use cases describe ordinary interactions that usually are done in one session. Finally, sub-functions, the third level of use cases, describe tasks required to carry out primary tasks. Primary actors are main users for a given Use case. Goal is used for short reference for particular use case. Brief is short description of Use Case.

The next part briefly discusses consideration for implementation of some of the specified requirements (F1- F6, A1-A5, and O1- O5) during conceptual design phase. Requirements F1 and F2 could be achieved by simulation of the real tasks that the learner has to solve or by enabling direct work with real software for solving learning tasks. Preparing all simulation for all individual learning paths will lead to huge overtax of the authors and the need of simulation software specialists even for simple tasks. Effectiveness of simulation strategy depends of how well simulations present real software application that the learner use. In fact most efficient way for skills acquisition (F2) is direct work with real software application that the learners use. The process of enabling working with real software is described by UC10, UC11, UC18, UC19, UC20, and UC24. Generally, steps are following: System Administrator installs required software for course by communicating with author (UC24); Author creates projects templates (UC22), according to requirements of F5; Learner works on the project

UC11 as part of UC10. Essential feature is that learner works with an instance of author's template leaving author's templates not affected. Learner's project is kept separately, giving ability to the learner to continue his/her work at the point he/she was interrupted (F4); Learner's Project is evaluated and corrected (UC18), and notification is sent back to the Learner (UC19); The grades for a project is inserted by the trainer (UC20) or by the system if project can be evaluated automatically. There are many other sub- processes like learner-learner, learner-trainer and trainer-author communication for supporting learning (F6) defined at UC13, UC14, UC19 and UC25. The first three mentioned Use cases support asynchronous message exchange (O1), and UC25 is asynchronous by nature.

Because learner uses his/her work place for all learning activity, he/she can interrupt the learning process on each stage. This requires MLE used for On the Job training to "remember" last point of activity performed by the learner (F3). When learner returns back, he/she have to be positioned on the last used object (F4) taking into account needs for controlled access to the resources according to requirements (A1) . The Use Case diagram on the Fig. 1 illustrates the process. Use Cases are described by UNL notations but generally, each of them has the following meaning: UC5.1 – check user name and password if they match minimal security requirements, for example minimal length of password; UC5.2 – Check if the previously saved password for the user matches the provided; UC6.2 – retrieve last used resource. State management is responsible for automatically save and retrieve learner status. Because of the need of fast restoring continuation of work (F4), last used object is explicitly saved. When Learner comes to the course for the first time, he/she is positioned on the specific learning object (UC5.8), defined by the trainer by following author's notes.

Developing strategy based on the controlled access to the resources described in A1 requires role based security implementation. Roles have assigned appropriate rights and all learners and staff members are required to Log-on each time they use MLE (UC5). Members can use MLE functionality according to the roles they belong. Possibility to measure the learner's actions (A4) is made by saving test results UC20, and results of the learner's work on the project UC 18. Trainers can view learner's status and depending on the learner's progress they decide to change or not the learning objects assigned to the learner as required in A2.

Based on the use cases and use case diagrams on the Fig.2 is proposed main subsystems for the desired MLE for OJT and links between subsystems.

Learning space, Trainer's space, Authoring Space represents a set of tools that particular user use for interacting with VLE. The figure assumes that if the user is using his/her personal space he/she has already been registered and logged in. Personal spaces are adapted according to user needs by both the
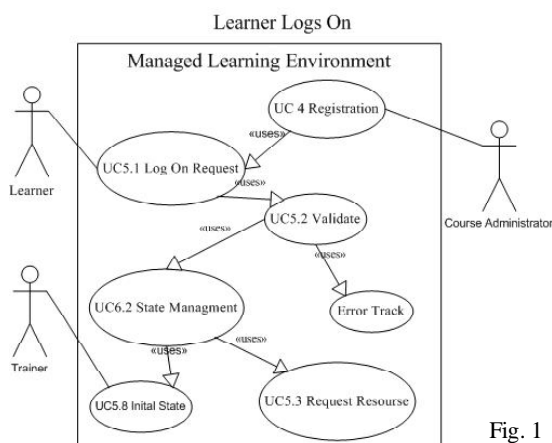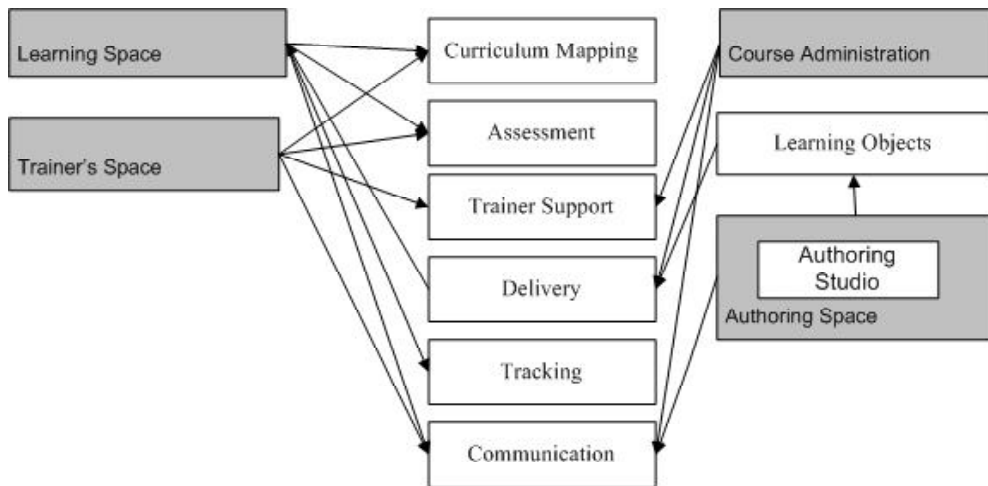

Fig. 1

Fig. 2

system and the user itself. Aggregated subsystems shown on Fig. 2 have following meaning:

• Curriculum mapping- Sub system that by using controlled access to curriculum can provide different learning plan for particular Learner on the bases of the learner's needs, trainer's assignments and learner's progress.

• Assessment-Sub system responsible for assessment management.

• Tutor Support- Sub system that helps trainers to define and set up a course with accompanying materials and activities to direct, guide and monitor learner progress.

• Delivery-Sub system that support delivery of different learning objects to the learners.

• Tracking-Sub system that is responsible for gathering learner's activity and saving learner status in context of helping tutors to prepare personalized learning content.

• Communication sub system enables communication between trainers, learners, administrators and authors.

Taking into account requirements O2 up to O4 it is obvious that conceptual model has to be mapped to the solution that operates on internet. Using WEB server for the middle tier logic and standard browser for showing user interface can satisfy all requirements. Specific need for working with real software (O5), without installing any additional software on the learner's computer can by achieved by using remote server so the solution has to be able to use it throw web interface.

Conclusions and future work

Development of the system that supports On the Job training is not an easy process because it has to support working environment with specific characteristics. The MLE that serve for OJT has to be open for modification and compatible with industrial standards like IMS for interoperability and reusability of learning objects. Deriving logical design of ADONIS project based on the concepts mentioned above is the next step for realization of the MLE for OJT.

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Електронно обучение на работното място – от изисквания до проектиране

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(Р е з ю м е)

Статията касае някои проблеми на дизайна и използването на управляеми среди за обучение, приложими за обучение по време на работа. След кратко представяне на съвременните управляеми среди за обучение и някои специфични особености относно тяхното използване, са описани началните фази на проектиране на такава среда.