



D 72.1 *General specifications of MSEE vocational training system*

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1. Executive Summary

The work described in the deliverable D72.1 of the MSEE Project is about general specifications of the MSEE Vocational Training System (VTS) and its development.

First we propose two main objectives for the MSEE Vocational Training System:

- To disseminate the basic concepts of the MSEE Project in order to improve the understanding by the end-users of the Service and SLM (Service Life Cycle Management),
- To provide an adapted pedagogical platform supporting the two training modules:
 - Concepts and categories of Manufacturing Services (Module M1),
 - Methodologies and tools for Service Modelling (Module M2).

Then, we identify the different kinds of targeted learners for MSEE VTS and the kind of company for whom the targeted learners work:

- Top managers who want improve the performance of their company by a servitization project,
- Company employees who are users of Manufacturing services,
- Consultants involved in a servitization project,
- Project managers and engineers in charge of the development of a servitization project,
- Researchers working in domains related to Manufacturing services.

It was established that these learners mainly work for industrial, IT or consulting companies but also that the VTS can be used also by researchers. Depending on the probable profile of the targeted learners, we suggest that the goal of the MSEE VTS will be to train future industrial users on the basic results of the MSEE. This is why our proposition is to develop the MSEE VTS in an e-learning approach in order that industrial users will be able to be trained at work, at home or anywhere else on a PC with Internet broadband access.

Then we defined the pedagogical objectives, the thematic scope, the duration, the needed resources, the kind of learner's support, the method of knowledge evaluation and the learners' skill required to attend the module.

To select the Learning Management System (LMS) supporting the MSEE VTS, we made a comparative study on the LMS (presented in Annexe 1) based on an update of the market study about LMS previously realized by the CNAM in the frame of the ISTA3 project. This study leads us to the three following propositions:

- Select the LMS supporting MSEE VTS on the open source market,
- Choose the LMS Moodle,
- Use the I-VLab Moodle platform to develop MSEE VTS.

For the development of the MSEE VTS, we proposed to apply the e-LITE Method developed by CNAM. e-LITE Method has four development phases (understanding of the training domains and needs, design, development and experimentation of the e-Learning system) and their steps, an inventory of the actions already done in the WP72 and the main short term (three months) actions to be done is made in order to develop, applying e-LITE Method with its e-learning approach, a suitable MSEE VTS.

The propositions made in the deliverable D72.1 need to be approved by the partners of the WP72. After this approbation, we shall continue the development of the MSEE VTS with the formalization of the pedagogical form and the design of the scenario of the first training Module.

2. Introduction

2.1 Objectives and content of the deliverable D72.1

Associated with the Work Package WP72 (Vocational Training and Education), the deliverable D72.1 has two main objectives:

- The first objective is to define the general specifications of MSEE VTS and its associated modules. In these general specifications we want to propose to WP72 partners some main orientations for the VTS and its modules about pedagogical objectives, targeted learners, training mode, supporting platform, etc.
- A second objective of this deliverable is to determine how to develop the MSEE VTS. We propose to WP72 partners to apply a method to MSEE VTS development in order that the partners involved in WP72 can work with efficiency.

In the first section of the deliverable we present the Executive Summary.

In the Introduction (second section), we recall the main objectives and the plan of the deliverable D72.1. Then we present the context in which the MSEE VTS will be developed, the WP72 Work Package, its goal in the MSEE Project, the partnership and our strategy of reusing results and approaches established in previous project experiences.

The third section proposes the main design choices for the MSEE VTS. The result of a comparative study on the LMS and our proposition to use the LMS Moodle in an open source environment are explained.

The fourth section describes the general specifications of the two modules which form the training system.

The fifth section presents the e-LITE Method proposed by I-VLab/CNAM in order to develop, in an e-learning approach, a suitable training system.

We conclude by stressing the importance of having completed and approving the deliverable D72.1 so as to prepare the design and the production of the MSEE VTS.

2.2 General context of the MSEE Vocational Training System and WP72

Generally, in a research project, the dissemination of the results is not complete because it is often underestimated and sometimes not even budgeted. Nevertheless, there are important reasons to develop a Vocational Training System (VTS) about the concepts from such a research project. **The most important reason to do so is the fact that for a good dissemination in an industrial work environment, it is necessary to facilitate the appropriation of the research project results** by using an efficient vocational training system capable of translating scientific results in the language accessible to industrial workers. This is particularly true for SME where workers have a lower level of education and very little time allocated for training. Otherwise, from the internal point of view of the research project during research activities, the knowledge whose construction is in progress or produced by the research process is unstable, often poorly managed and poorly shared between partners. They do not necessarily share the same vision of knowledge or of a concept. This vision often depends on the point of view and on the expertise of the research partner. It may differ significantly, particularly between academic and industrial partners. In this context, the development of pedagogical resources about research results may contribute to a good sharing of knowledge between partners of a research project.

MSEE is a project with industrial finalities which aims to develop new concepts, methodologies and tools revolving around Manufacturing Services. This is why, during the design phase of the project, it was decided by the managers of the project that the WP72 would be dedicated to the development of a VTS devoted to support the dissemination of the new concepts produced by the MSEE Project.

2.3 WP72 Partnership and Workload

Among all the partners of the MSEE Project, the following organizations will be involved in the development of the MSEE VTS:

- BIBA (with a workload of 2 Persons * Month),
- DITF (with a workload of 2 Persons * Month),
- FhG-IAO (with a workload of 2 Persons * Month),
- POLIMI (with a workload of 2 Persons * Month),
- TECHNALIA (with a workload of 2 Persons * Month),
- UIBK (with a workload of 2 Persons * Month),
- I-Vlab/CNAM Pays de la Loire (with a workload of 8 Persons * Month)

The global amount of human resources for WP72 is 20 Persons * Month.

2.4 Strategy for reusing experiences and results from previous projects

A workload of 20 Persons * Month for the development of a VTS is a small budget, this is why the development of the MSEE VTS will focus on the design and the production of two training modules indicated in the main objectives of the MSEE project (Concepts and categories of Manufacturing Services, Methodologies and tools for Service Modelling). In such context, we will reuse as much as possible the experiences, methods, tools and pedagogical raw materials developed or previously used by our partners for their own needs or in previous research projects (INTEROP NoE [1] , ATHENA [2], ASICOM [3], ISTA3 [4],...). For this, we shall make an inventory of the main existing pedagogical resources related to the topics of the MSEE VTS and usable with free access. Then, if the content of an existing resource may be really useful for a MSEE training module, we shall determine the development necessary to integrate the pedagogical resource in the MSEE VTS. If the added value of the pedagogical resource integration is sufficient regarding its development cost we shall choose to integrate the pedagogical resource in MSEE VTS.

3. Main design choices made for the MSEE Vocational Training System

In this section of the document we describe the **main points on which we base our propositions to choose the technical, organizational, and/or pedagogical aspects** for the MSEE VTS general specifications.

3.1 Main objectives for the MSEE VTS

Proposition 1: The two main objectives of the MSEE Vocational Training System will be:

- To disseminate the basic concepts of the MSEE Project in order to improve the understanding by the end-users of the Service and SLM (Service Life Cycle Management),
- To provide an adapted pedagogical platform supporting the two training modules:
 - Concepts and categories of Manufacturing Services (Module M1),
 - Methodologies and tools for Service Modelling (Module M2).

The first proposition is very important because it concerns the pedagogical objectives of the MSEE VTS and several future design decisions will depend on these pedagogical objectives.

3.2 Targeted learners

The identification of the different kinds of targeted learners is also necessary to specify a VTS.

Proposition 2: The VTS will be targeted toward:

- Top managers who want to evaluate how to improve their companies by a servitization project,
- Middle management of the enterprise who are users of Manufacturing services,
- Consultants involved in a servitization project,
- Project managers and engineers in charge of the development of a servitization project,
- Researchers working in domains related to Manufacturing services.

These VTS will be developed for industrial, IT or consulting companies.

The VTS can be used also by researchers who work mainly in high schools and universities but sometimes also for industrial companies.

3.3 Preferential training mode

Once the main pedagogical objectives are defined, and the types of participants identified, it is important to propose a choice regarding the training mode of the MSEE VTS which has several consequences on the technical and pedagogical characteristics of a VTS.

Proposition 3: The MSEE VTS will be made up of vocational courses and modules of short duration (few hours) about the main thematic hereafter. In this way industrial users will be able to train at work, at home or anywhere else on a PC with Internet broadband access.

Indeed, the goal of the MSEE is not to develop academic training, but to dedicate its resources to train future industrial users to the results of the MSEE. This is why our first proposition will be to develop the MSEE VTS in an e-learning approach.

Main thematic keywords:

- Business processes,
- Interoperability,
- Manufacturing Services,
- Model Driven Interoperability,
- Service modelling,
- Service Life cycle Management,
- Servitization,
- Virtual Manufacturing Enterprise (VME).
- Innovation Manufacturing Services Ecosystem

In such condition it will not be necessary to establish equivalency procedures between the MSEE VTS and the academic curricula or diploma.

3.4 Technical/pedagogical platform

Given the amount of time affected to the WP72, it was not possible to do an exhaustive study concerning the choice of the technical / pedagogical platform supporting the MSEE VTS. A comparative study on the LMS (presented in Annexe 1) based on an update of the market study

about LMS realized by the CNAM in the frame of the ISTA3 project¹ [4] [6] is used. Our approach to select the LMS supporting the MSEE VTS consisted in the following filtering procedure:

- Selection of the kind of LMS market,
- Selection of the best adapted LMS of this market,
- Selection of the LMS provider.

This procedure leads us to make the three propositions (4, 5 and 6) below.

MSEE project aims to develop solutions for servitization projects based on open source software. Regarding this orientation of the futures solutions proposed by the MSEE Project, it is consistent to propose to develop and exploit MSEE VTS with an open source LMS.

Proposition 4: The LMS supporting the MSEE VTS will be chosen in the open source market.

For the LMS study made by CNAM on the open source LMS market around twenty pedagogical platforms (referenced in the following table) had been compared.

| | Name | Editors |
|----|----------------------------------|----------------------------------|
| 1 | <u>AbulEdu</u> | RyXéo |
| 2 | <u>Acolad 3D</u> | Université Louis Pasteur |
| 3 | <u>ADA</u> | Linxlab |
| 4 | <u>AnaXagora - LCMS</u> | AnaXagora - C R Henri Tudor |
| 5 | <u>Claroline</u> | Université de Louvain |
| 6 | <u>Dokeos</u> | Dokeos |
| 7 | <u>Duevera, Training manager</u> | CRP Consulting |
| 8 | <u>Eclass.Builder</u> | Tulane University |
| 9 | <u>efron</u> | Epignosis |
| 10 | <u>electure</u> | electure |
| 11 | <u>Eledge</u> | University of Utah |
| 12 | <u>eTutor</u> | Universté d'Ottawa |
| 13 | <u>Ganesha</u> | Anema Formation |
| 14 | <u>Ilias</u> | Université de Cologne |
| 15 | <u>LON - CAPA</u> | Michigan State University - LITE |
| 16 | <u>LRN</u> | MIT Sloan, Un. Heidelberg |
| 17 | <u>Moodle</u> | Moodle Comm. |
| 18 | <u>Olat LMS</u> | OLAT |
| 19 | <u>Sakai</u> | Sakai Project |
| 20 | <u>Uportal</u> | JA-SIG |

A first selection was established on the following general criteria:

- LMS language is Multilingual,
- Platform have the basic LMS functionalities,
- Public: LMS adapted to the economic world ,
- Communities of developers and users,
- Documentation in English,
- Possibility of operation in all browsers, at least in Internet Explorer and Firefox.

At the end of the first selection round, six platforms were selected: AnaXagora, Claroline, Dokeos, efron, Ganesha and Moodle. A second selection round was established with more technical criteria:

- Products must offer user-friendly interface,
- Platform have advanced LMS functionalities,

¹ ISTA3 is a French research project which the acronym means "3rd generation Interoperability for Aeronautic Subcontractors".

- The products have at least 5 possible profiles of users,
- The platforms meet the relevant standards for resource format: SCORM and AICC,
- Absence of plug-in installation on the client side to simplify the use of platforms.

At the end of these two selections the two LMS Moodle and Ganesha were the most adapted platforms.

In a last step of our LMS comparative study, the LMS Moodle appears to be better than the LMS Ganesha to support the development of the MSEE VTS for the following reasons:

- The larger number of functionalities of this LMS is adapted to the MSEE VTS development,
- Its possibilities of accurate parameterization ,
- Its wide international distribution and the large community of users and developers for this open source product,
- The experience of some MSEE partners with this LMS.

Proposition 5: The LMS Moodle will be used to develop and exploit the MSEE VTS.

The I-VLab owns a Moodle LMS on which a lot of results from other research projects in the same domains as the MSEE Project have been stored and capitalized for many years. I-VLab is ready to give a free access to the partners of the MSEE Project. So, it seems interesting to us to use the I-VLab Moodle LMS for a lot of practical reasons:

- After a preliminary checking, there is a correspondence between the offered functionalities of the I-VLab Moodle LMS and the needs for the development of MSEE VTS,
- The I-VLab Moodle LMS is updated and maintained for free by Bordeaux University in order to run efficiently,
- Some of the MSEE partners (especially I-VLab/CNAM main contributor in WP72) have an experience of the development of VTS on the I-VLab Moodle LMS,

Proposition 6: The I-VLab Moodle LMS will be adopted to develop and exploit the MSEE VTS.

It will imply the possibility for MSEE partners to exploit with few adaptation efforts the developed pedagogical resources on others LMS because the MSEE VTS pedagogical resources will be developed with multiplatform development tools.

4. General specifications for the two modules of the VTS

In accordance with the main propositions concerning the MSEE VTS made in the previous section, now, we will present the general specifications of the two training modules identified at the level of the MSEE VTS as main objectives:

- Concepts and categories of Manufacturing Services (Module M1),
- Methodologies and tools for Service Modelling (Module M2).

A synthetic training matrix describing the position of these two modules in a standard training plan of an industrial company and definition of who has to attend the different training modules in the frame of a servitization project is presented in annexe 4.

4.1 Module M1: Concepts and categories of Manufacturing Services

This module presents the notion of Manufacturing Services and all related concepts useful to industrial workers who participate in a servitization project by adopting an e-learning approach,

4.1.1 M1 - Thematic scope and Pedagogical objectives

For the thematic scope of the Module M1, the pedagogical content will be decided in detail during the design of the module itself. At this level of general specifications, we propose to give to the learners a general knowledge about:

- The main topics related to MSEE project :
 - Business processes,
 - Innovation Manufacturing Services Ecosystem
 - Interoperability,
 - Manufacturing Services,
 - Model Driven Interoperability,
 - Service modelling,
 - Service Life cycle Management,
 - Servitization,
 - Virtual Manufacturing Enterprise (VME),
- Different kinds of Manufacturing Services,
- Detailed study of Service Life cycle and Service Life Cycle Management.

At the end of the Module M1, the learners will be able to understand the main concepts related to manufacturing services. They will be able to identify the different kinds of Manufacturing Services and the important steps of the Services Lifecycle Management (SLM) in order to apply these in their enterprises.

4.1.2 M1 - Duration and training mode

According to the proposition 2 made in the previous section, the training mode of Module M1 will be e-Learning.

It is difficult to predict the duration of the training session before having a detailed design of the module M1. However, considering the workload affected to the WP72 in the MSEE project, and the relative importance between the modules M1 and M2, our estimation of the duration of the module M1 is: :

- Theoretical courses: 3 hours,
- Practical exercises: 1 hour.

These hours will be divided in short sequences of courses (between 10 and 15 minutes).

4.1.3 M1 - Learner's support

The kind of learner's support that we propose is a light distant tutoring. With this kind of learner's support, the learners have an identified tutor. They can exchange ideas with other learners on a forum moderated by their tutor. They can ask/answer to questions with their tutor via e-mail. This kind of learner's support is good in a context where there are few interactions between the learners and the tutors or when tutors are not very available.

4.1.4 M1 - Knowledge learner evaluation mode

Concerning the evaluation mode of the learner's knowledge acquisition, it is not necessary to organize formal examination because Module M1 is vocational training not related to a diploma. Nevertheless, each learner at each step of the course will be able to do an auto-evaluation with the help of on-line exercises.

4.1.5 M1 - Course location and needed resources

As indicated in a previous section, the access to the e-learning for the MSEE VTS will be supported by Internet on a PC with a broadband connection. The learners will be able to use the e-learning module M1, when and wherever they want. This possibility is very interesting for industrial workers who will be able to easily access the module M1 at work and at home.

4.1.6 M1 - Skill requirements for learners

For the learners of the module M1, no particular skill is mandatory because an industrial worker involved in a servitization project must be able to use this module to train himself and acquire the necessary concepts related to Manufacturing Services in order to be efficient in his company. Nevertheless, because of the complexity of some Manufacturing Service concepts, a level of education equivalent to a Licence is recommended to use the module M1 with efficiency.

4.2 Module M2: Methodologies and tools for Service Modelling

In this section, we are going to define the general specifications of the second module of the MSEE VTS, the module M2, which allows learners to be trained about MSEE development methodology.

4.2.1 M2 - Thematic scope and Pedagogical objectives

For the thematic scope of the Module M2, the pedagogical content will be decided in detail in the design phase when we shall build the pedagogical forms and scenarios of the module but at this level of general specifications, we propose some guidelines about the content of the module:

- The scope of the MSEE development Methodology,
- The MSEE development methodology approach,
- The main concepts, technologies and tools associated to the MSEE development methodology
- The application of the MSEE development methodology.

At the end of the Module M2, the learners will be able to apply the MSEE development methodology (with an additional practical experience in the industrial workplace) in order to participate in the development of a servitization project and Manufacturing Services in an industrial company.

4.2.2 M2 - Duration and training mode

According to the proposition 2 made in the previous section, the training mode of Module M2 will be e-Learning.

Before having a detailed design of the module M2, it is difficult to predict the duration of the training session of the module. However, this module seems heavier than the module M1 because it needs more technical knowledge and more time for practical exercises in order to be able to apply MSEE development Methodology to a realistic case study. Our estimation of the duration for the module M2 is:

- Theoretical courses: 4 hours,
- Practical exercises: 4 hours (Case study).

Like for the module M1, these hours will be divided in short sequences each lasting between 10 and 15 minutes.

4.2.3 M2 - Learner's support

For the module M2, we propose a distant tutoring support. Like with the light distant tutoring, this kind of learner's support gives the learners an identified tutor. They can exchange ideas with other learners on a forum moderated by their tutor and interact with their tutor via e-mail. The difference between distant tutoring and light distant tutoring is that the frequent exchange of documents via the LMS is possible between learner and tutor. For instance, the tutor can send the case study to a learner and assess his work through document exchanges. The tutor can give a grade to the learner via the LMS at the end of the case study.

4.2.4 M2 - Knowledge learner evaluation mode

For the same reason as the module M1, at the end of the module M2, it is not necessary to organize a formal examination. The module M2 is also vocational training not related to a diploma. An auto-evaluation with the help of on-line exercises will be possible for each learner at each step of the course.

4.2.5 M2 - Course location and needed resources

Like for the module M1, the access to the e-learning in the MSEE VTS will be supported by Internet on a PC with a broadband connection. The learners will be able to use the e-learning module M2, when and wherever they want.

4.2.6 M2 - Skill requirements for learners

For an efficient participation in this second module, it is necessary to have a certain level of understanding in Manufacturing Services equivalent to the module M1. For the learners of M2, the level of education required is a Master's degree or an engineer degree with competencies in Enterprise Modelling, Information Technology and Software Development.

5. Proposed method for the VTS development

In this last section of the deliverable, we are going to specify how we propose to develop this VTS. The method which we propose to apply for an efficient development of the MSEE VTS is based on the method e-LITE [5] developed by the CNAM in the ISTA3 Project, a French project on the 3rd generation Interoperability for Aeronautics Subcontractors.

Before presenting the development phases, we are going to make a short general presentation of the e-LITE method.

5.1 The e-LITE method

The scientific research projects are aimed to produce new knowledge generally in domains of high specialization. Some of these projects, like the MSEE Project, aim at improving the performance of companies. In this context, the issue of the capitalization and transfer of scientific knowledge and its rapid transformation into skills is directly addressed. We are going to present the e-LITE Method designed to support the process of development of an e-learning system in order to disseminate research results in an industrial environment while promoting a better capitalization and sharing of knowledge between partners of a research project.

The aim of the e-LITE method is to facilitate the construction and a better sharing of scientific knowledge and professional skills in the realization of an applied research project.

This method is used to develop efficient e-learning systems designed to support the production, the update and the dissemination of the scientific knowledge resulting of an applied research project. Also, it targets to transform these results in professional skills easily accessible for firms, particularly for the SME. Finally, it shortens the time of transfer of scientific knowledge in the professional world. This method is especially well adapted to the cases where the research project results are used to new professions training.

The figure 1 shows how, in the spirit of the e-LITE Method [7], the three main processes of an applied research project run simultaneously and are coordinated to produce research results, which

are enhanced through formal training resources, assembled into e-learning courses, in order to build critical skills in the industrial world.

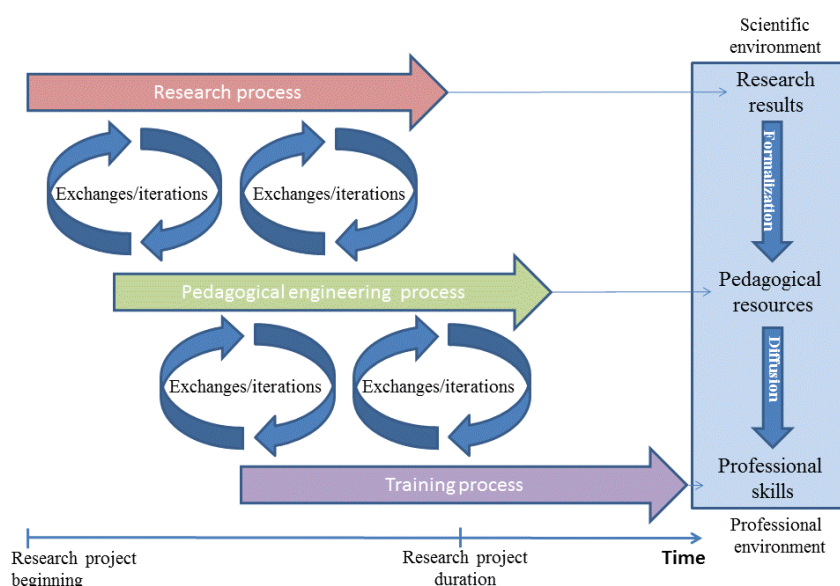


Fig. 1: the e-LITE Method principle

As presented in the Figure 2, this method is made up of four main phases of activities which are conventionally implemented when you want to develop a VTS supporting an applied research project. The first phase starts at the beginning of the applied research project.

During the project, it is possible to observe an overlap between the phases. For instance, as soon as the specifications and the design of a module are produced, it is possible to develop the corresponding pedagogical resources without waiting that all the modules of the VTS are designed. This is the same thing between the development phase and the experimentation phase of a module then also for all the others phases described in the method.

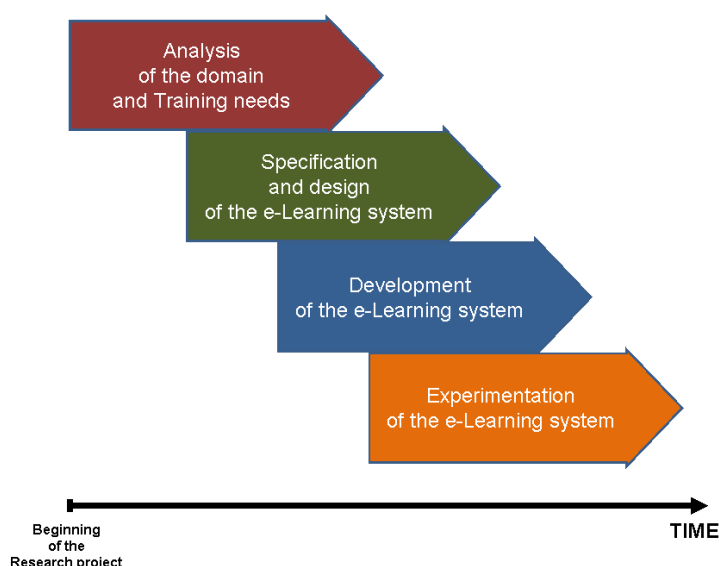


Fig. 2: The main four phases of the method

After this short description of the e-LITE method, we are going to explain how we propose to apply the e-LITE Method to the MSEE project and to the development of its VTS. This explanation will follow the four main phases of the method:

- Understanding of the project domains and training needs,
- Specification and design of the VTS,

- Development of the modules for the VTS,
- Experimentation and evaluation of the VTS.

5.2 Understanding of the project domains and training needs

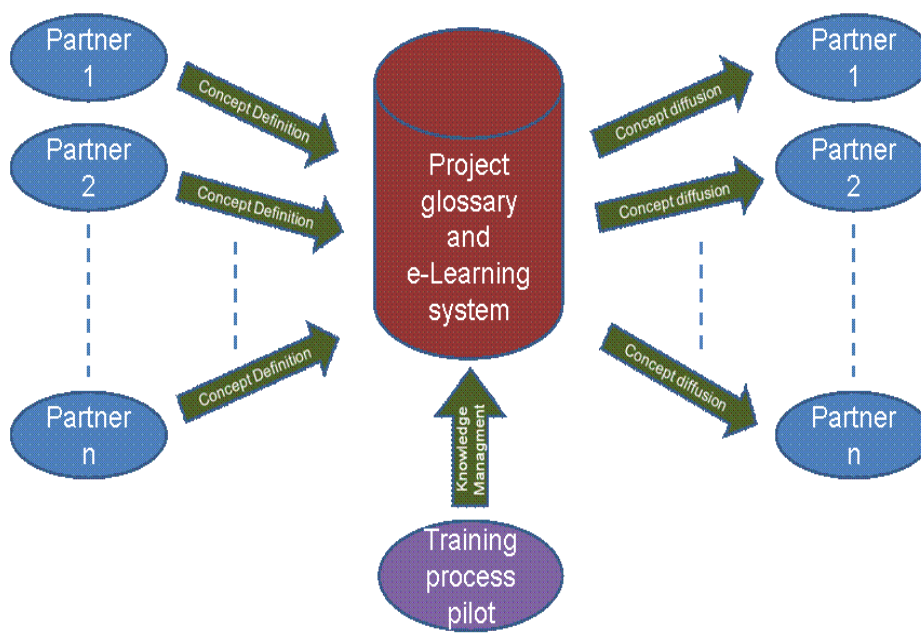
In this phase of the e-LITE method, the main tasks to assume are:

- **Step 1:** Understanding of the project domains and creation of a project glossary
- **Step 2:** Identification of impacted professions, targeted learners, skills and training needs.

5.2.1 Understanding of the project domains and creation of a project glossary

Before beginning the development of the VTS supporting an applied research project, it is necessary to have a good understanding of the project domains and of the training needs of the learners targeted by the dissemination of the results of the project.

The creation of a glossary to improve knowledge management and sharing between the partners of a research project is an important point recommended in the e-LITE Method. It is also a main principle of the e-LITE Method to consider the training process pilot as manager of the glossary of the project as we can see in Figure 3. The pilot of the training process has to collect the new concepts and knowledge produced by each partner and update the project glossary. Once this is done, they are made available to all the partners involved in the research project.



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Fig. 3: e-LITE vision of Knowledge Management

E-LITE Method recommends also that people involved in the VTS development, especially in the training process, participate to general meetings, technical meetings, workshops,... in order to improve their understanding of the research project domains.

At the end of step 1:

- People involved in the development of the VTS have a good understanding of the project domains,

- A project glossary about the main domains of the research project is created. It will be managed by the training process pilot. It will contribute to a better knowledge sharing between the partners of the project.

Application of the e-LITE Method in the MSEE Project:

Work done:

- During the MSEE project, the understanding by I-VLAB/CNAM, Pilot of the training process of MSEE Project will be built by:
 - Participation of I-VLAB/CNAM to MSEE general meetings,
 - Participation of I-VLAB/CNAM to some WP1 workshops,
 - Work of I-VLAB/CNAM with the Laboratory IMS of Bordeaux 1 University in the building of MSEE Glossary (see a draft in Annexe 2)

Short term work to do:

- Validation of the MSEE project glossary by all partners of the research project.

5.2.2 Identification of the impacted professions, targeted learners, skills and training needs

A research project produces results which, as it is often the case, will have an impact on the activities of some professions.

First, it is necessary to identify these impacted professions then, for each impacted professions, the e-LITE pedagogical engineering approach is based on the following activity cycle (see Figure 4):

- Do a detailed analysis of the different activities of the profession that you want to support with the e-Learning system in order to formalize an activity frame of reference.
- Define from this activity frame of reference the skill frame of reference for the profession.
- Create a training frame of reference to support the profession based on this skill frame of reference.

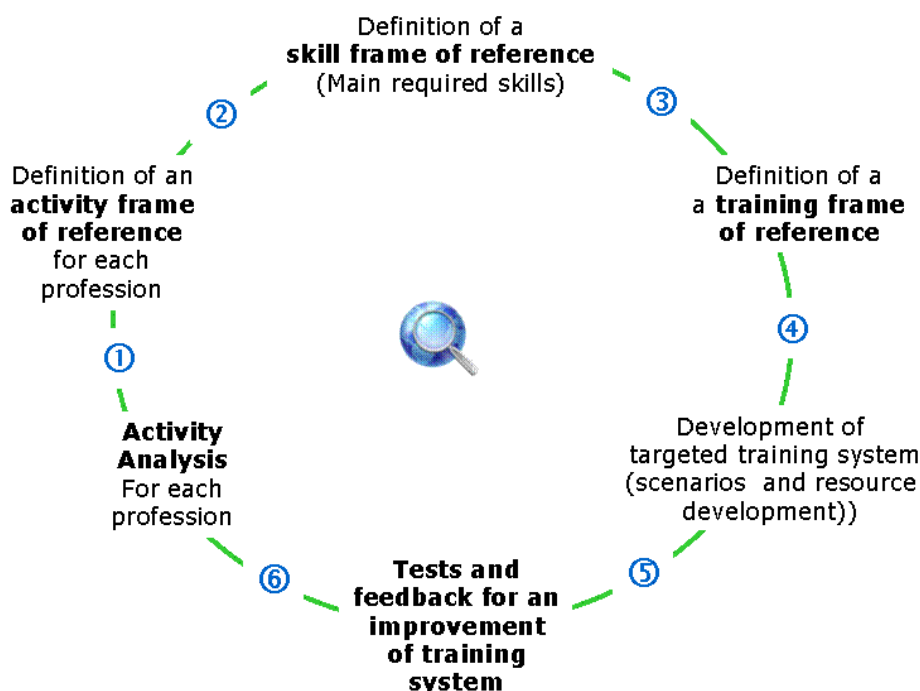


Fig. 4: e-LITE pedagogical engineering cycle

After that, you can develop a VTS, which corresponds to the main courses identified in the training frame of reference. This implies to define the pedagogical scenario of the course and develop the

corresponding pedagogical scenarios. Finally, you have to organize the experimentation of the e-learning system. The feedback from this experimentation will be used to improve the VTS.

Concerning the identification of the impacted professions, the targeted learners, the professional skills and training needs, in order to collect information for working, the e-LITE Method recommends these two following actions:

- Design a questionnaire with 4 sections:
 - Professions impacted by the MSEE project,
 - Targeted learners,
 - Activities and skills supported by the VTS,
 - Kinds of needed training acts.
- Interview a few expert partners.

When all the information is collected, an Analysis of this information can be done and three following frames of reference are formalized for the design of the VTS:

- Activity frame of reference,
- Skill frame of reference,
- Training frame of reference.

This information collected and these frames of reference formalized in this first phase will be used at the level of the design phase of the e-LITE Method.

At the end of step 2:

- All the information gathered from the results of the research project concerning the impacted professions, the targeted learners, the professional skills and training needs will be collected,
- Three frames of reference are available for the design of the VTS:
 - Activity frame of reference,
 - Skill frame of reference,
 - Training frame of reference.

Application of the e-LITE Method in the MSEE Project:

Short term work to do:

- Writing of a short questionnaire by I-VLab/CNAM in order to collect information from the MSEE project partners about the main professions impacted by the results of the MSEE project, the targeted learners and their corresponding main training needs.
- Analysis by I-VLab/CNAM of the information collected on the main impacted professions, the targeted learners and training needs and communication of the results to the WP72 partners.

5.3 Specification and design of the VTS

Once you have a good understanding of the domains of the research project and the training needs of the future learners you are able to specify and design the VTS. For this, it is necessary to achieve a succession of steps:

- **Step 3:** Choice of a pedagogical platform supporting the VTS,
- **Step 4:** Definition the general specifications of the VTS and its modules,
- **Step 5:** Design of the pedagogical forms,
- **Step 6:** Determination of the KPI for the VTS.

5.3.1 Choice of a pedagogical platform supporting the VTS

When you have a sufficient understanding of the training domains and needs, you have to choose a pedagogical platform adapted to the needs of the VTS development and exploitation.

For the choice of an adapted pedagogical platform, the e-LITE Method advises to define and use a formalized selection procedure in order to determine:

- The market in which we decide to choose the LMS that will be supporting our future VTS,
- The chosen LMS,
- The provider for the management administration and maintenance of the LMS.

Concerning the market of the LMS, it is not always necessary to select a specific kind of market. It depends on your exploitation strategy of the LMS. If you have the constraint to choose your LMS on a specific kind of market, the main kinds of LMS markets are:

- Open source LMS,
- Public LMS,
- Commercial LMS.

For the choice of a LMS, e-LITE Method recommends a three step procedure. In the first step, you use a filtering procedure where you select a LMS, based on marketing information corresponding to the defined general criteria.

In the second step, you compare some of the best LMS solutions filtered in the first step procedure based on complementary technical criteria.

At the end of the two first steps of the LMS selection procedure, you have selected the best LMS on the selected market perimeter.

The e-LITE Method advises to complete a third step in the LMS selection procedure. This last step consists of a comparison between the best selected LMS and the existing LMS of the different partners of the research project wishing to make available their own LMS for the development of the VTS. The final choice of the LMS supporting the VTS development will be made regarding technical, economical and organizational and human criteria by all the partners of the research project.

At the end of step 3:

- The LMS supporting the VTS development and the associated development tools are selected.
- The LMS provider is selected and approved by all the partners of the research project.

Application of the e-LITE Method in the MSEE Project:

Work done:

- Actualization by I-VLab/CNAM of the comparative study made by CNAM in the frame of ISTA3 Project in 2009.
- Proposition of choice of the LMS Moodle of the I-VLab to support the development of the MSEE VTS after a context analysis of the WP72 of MSEE project.

Short term work to do:

- Validation by the partners of the WP72 of the I-VLab/CNAM proposition to choose the Moodle platform of I-VLab as the supporting platform for the development of MSEE VTS.

5.3.2 Definition of the general specifications of the VTS and its modules

When you have sufficient knowledge about the research project domains and the training needs you can begin to make the general specifications of the VTS and its modules.

These general specifications consist of taking some main decisions about the characteristics of the VTS and its development. Among these characteristics, we can mention:

- Name of the VTS,
- Objectives of the VTS,
- Targeted learners,
- Main thematic domains,
- Preferential training mode,
- Expected modules,
- ...

After these general specifications concerning the VTS, for each expected modules of this VTS e-LITE method recommends also to specify some characteristics:

- Name of the module,
- Thematic scope,
- Pedagogical objectives,
- Theoretical course duration,
- Practical exercise duration,
- Training mode,
- Learner's support,
- Knowledge evaluation mode,
- Course location,
- Needed resources,
- ...

Once you have defined the general specifications of the VTS and its modules, it is equally useful for the general specifications to specify how you want to develop the VTS. In order to do this, you have to describe your development method, step by step, indicating the results at the end of each step.

At the end of step 4:

- The General specifications of the VTS and its module are defined and made available for the design phase.
- The development method of the VTS is defined and ready to frame the VTS development.

Application of the e-LITE Method in the MSEE Project:

Work done:

- Writing of the first version of the deliverable D72.1 concerning the general specifications of the MSEE VTS and its two modules:
 - Concepts and categories of Manufacturing Services (Module M1),
 - Methodologies and tools for the Service Modelling (Module M2).

Short term work to do:

- Diffusion of the D72.1 to the partners of the WP72 for comments and validation.
- After an internal validation of the D72.1 by the partners of the WP72, diffusion of the document to all partners of the MSEE project.

5.3.3 Design of the pedagogical forms

On the basis of the general specification of the modules and the different pieces of information collected through the means of questionnaires and/or interviews of experts about the modules, the next step of the development of the VTS is to design, for each module, a pedagogical form.

In each pedagogical form, it is recommended to define, all the necessary elements to identify the content of the module and who are the people interesting by the course and able to understand the course. The main necessary elements to describe in a pedagogical form are the following:

- Name of the VTS,
- Name of the Module,
- Creation date,
- Updating date,
- Number of hours of theoretical courses,
- Number of hours of practical exercises,
- Pedagogical objectives,
- Prerequisites
- Detailed content of the module,
- Learning mode,
- Learning support,
- Knowledge evaluation mode,
- Pedagogical method,
- Necessary resources,
- Bibliography,

...

It is important to describe, with a sufficient level of detail, the different elements of the pedagogical form, particularly the content of the courses, the pedagogical objectives and the prerequisites because the pedagogical form is the base for all the developments that make the quality of the modules and of the VTS.

At the end of step 5:

- The content of the different modules are defined and all the pedagogical forms are designed.

Application of the e-LITE Method in MSEE Project:

Work done:

- Design of the structure of the MSEE pedagogical form by I-VLab/CNAM (see annexe 3).

Short term work to do:

- Proposition by I-VLab/CNAM of the pedagogical form of the module M1: Concepts and categories of Manufacturing Services.
- Contribution of the partners of WP72 to the content of the pedagogical form of the module M1.
- Validation of the pedagogical form of the module M1 by the partners of WP72.

5.3.4 Determination of the Key Performance Indicator (KPI) of the VTS

In this step of the e-LITE method you have to define how you want to evaluate the performance of the VTS. It is recommended to specify a few KPI easy to evaluate. It is important that the set of defined KPI are consistent and significant regarding the performance of the VTS.

It may also be interesting to define the necessary forms useful to capture the information which gives values to the different KPI.

For instance, at this level, you can design a first version of the form to evaluate the learner's satisfaction about a course, a module...etc.

At the end of step 6:

- The main KPI to evaluate the performance of the VTS are defined.
- First evaluation forms are designed.

Application of the e-LITE Method in the MSEE Project:

Short term work to do:

- Proposition of KPI to evaluate the performance of the MSEE VTS by I-VLab/CNAM with the contribution of the partners of WP72.

5.4 Development of the modules of the VTS

On the base of the general specifications of the VTS and of its modules completed with the pedagogical forms of the different expected modules, the development of the module can start. For this development and for each module of the VTS, the e-LITE method advises to achieve the following steps:

- **Step 7:** Collection of pedagogical resources or elements from partners,
- **Step 8:** Design of the pedagogical scenario of the training module,
- **Step 9:** Production and test of the pedagogical resources of the module.

5.4.1 Collection of pedagogical resources or elements from partners

This step consists of asking the different partners for their contribution. The pedagogical forms are sent to all partners involved in the research project and each partner decides if there is a section of the module in the pedagogical forms with which he is concerned by. If he possesses pedagogical elements or resources related to this module, he has to transmit the pedagogical resource or element to the training process pilot who is in charge of collecting all the pedagogical elements from different partners of the research project.

Once all pedagogical elements are collected, a document is established by the training process pilot listing the pedagogical resources available and indicating the state of the resource:

- Ready to be integrated in the VTS,
- Possible integration in the VTS after modifications,
- No possible integration in the VTS.

This inventory of existing resources is an important step to know the pedagogical resources which are necessary to develop in order to obtain a suitable VTS.

At the end of step 7:

- An inventory of the existing pedagogical resources relating to each module is available in order to know what is necessary to develop.

Application of the e-LITE Method in the MSEE Project:

Short term work to do:

- Nothing to do in the short term (3 months).

5.4.2 Design of the pedagogical scenario of the training module

At this level of the development, for each training module of the VTS, you have to design the architecture and the pedagogical scenario corresponding to the designed module.

In the e-LITE method, the generic hierarchical architecture of an e-Learning VTS is a tree architecture with different levels as it is presented in Figure 5. In this architecture 8 levels may be distinguished:

- e-Learning VTS,
- Curriculum,
- Training module,
- Course,
- Sequence of activities,
- Pedagogical activity,
- Resource,
- Media.

An e-Learning system is composed of curricula. Each curriculum is made up of courses which consist of a sequence of pedagogical activities. Each pedagogical activity needs to develop the pedagogical resources using different media such as images, videos, texts, etc.

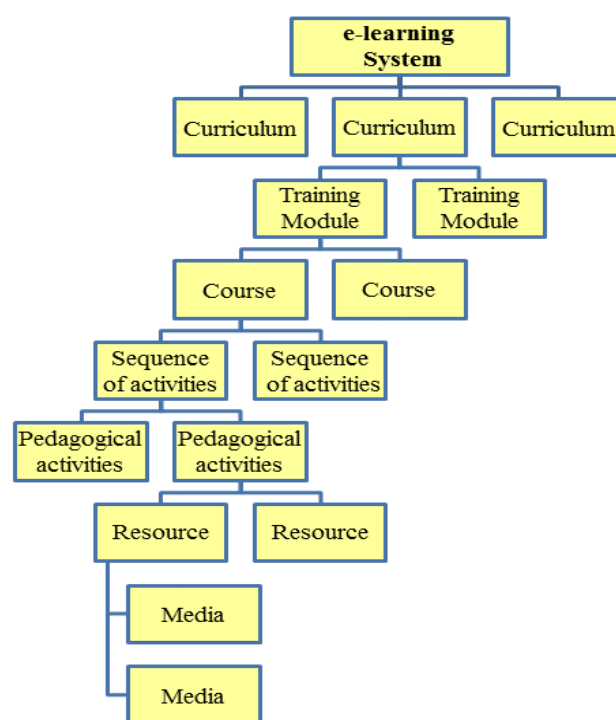


Fig. 5: e-LITE generic tree architecture of a VTS

When you want to define the pedagogical scenario of a module you have to define the hierarchical architecture corresponding to this module as in Figure 6. The division of the training module in sequences of activities then in activities needs a pedagogical thinking at the base of the pedagogical scenario design.

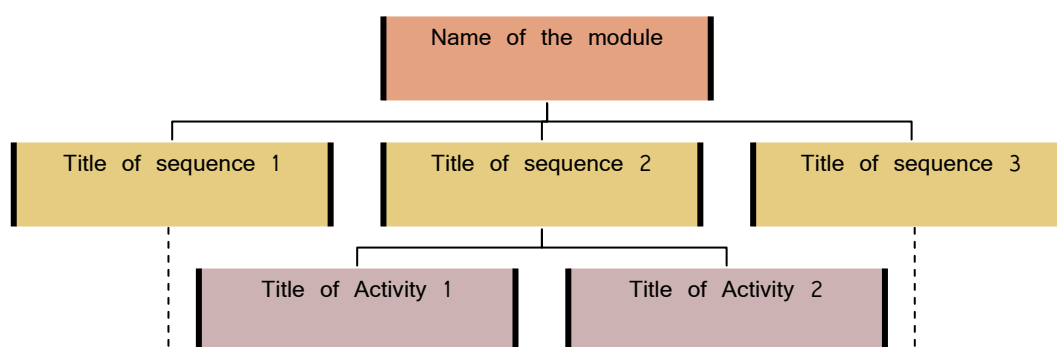


Fig. 6: Design of training module architecture

Once you have identified all the pedagogical activities of your module, it is necessary to describe them in a large synopsis table as presented in Figure 7.

The objective here is to visualize the structure of the module and the logic of this structure. In this synopsis table, there are specific milestones, objectives and activities, the pedagogical grains and the media used. In this synopsis table, the following elements are presented:

- Objectives of the sequence: acquire macro skills, knowledge to master, etc... "After this sequence, the learner should be able to ... "
- Objectives of the activity: acquire micro skills, knowledge to control, etc... "After this activity, the learner should be able to ..."
- Duration: number of minutes that the learners will spend on each activity.
- Actions to be performed: Context and content of the actions to do. An action is coded by an (L) if it is taken by the learner and by a (T) if it is taken by the teacher.
- Training mode: e-Learning but with what kind of learners support and group work?
- Title of the resources used and the author (s): titles include compound resources.
- Evaluation: the learner's assessment if the assessment is made during the activity and the type of evaluation: formative evaluation (F) or summative evaluation (S)
- Observation: information if necessary.

| | | Objectives of the activity | Duration | Actions (L:Learner, T:Tutor) | Training Mode | Resources and author(s) | Evaluation mode | Observation |
|------------|------------------------------|----------------------------|----------|------------------------------|---------------|-------------------------|-----------------|-------------|
| Sequence 1 | Objectives of the sequence : | | | | | | | |
| | Activity 1 | | | | | | | |
| | Activity 2 | | | | | | | |
| | Activity 3 | | | | | | | |
| Sequence 2 | Objectives of the sequence : | | | | | | | |
| | Activity 4 | | | | | | | |
| | Activity 5 | | | | | | | |

Fig. 7: Structure of the synopsis table to describe scenario

When the synopsis table is filled for a training module, all the design documentation is available and the module is ready to be developed.

At the end of step 8:

- For each training module, the architecture is defined and a synopsis table describes in detail the pedagogical scenario of the module.

Application of the e-LITE Method in the MSEE Project:

Work done:

- Definition by I-VLab/CNAM of the design approach and of the design documentation structure associated with a training module and its pedagogical scenario.

Short term work to do:

- Once the pedagogical form of the module M1 (Concepts and categories of Manufacturing Services) is designed, I-VLab/CNAM will start the design of the pedagogical scenario of the module M1, present this scenario to the partners of WP72 and ask for their contribution and validation.

5.4.3 Production and test of the pedagogical resources of the module

Once the pedagogical scenario is described in a synopsis table, the production of the pedagogical resources corresponding to the training module can begin.

Production of the pedagogical resources is a technical activity. Complementary to the LMS, this production often uses different kinds of pedagogical development hardware and software (Course studios, QCM editors, PowerPoint file editors,...). These tools are useful for a good efficiency of the production of resources, but the e-LITE Method doesn't recommend specific development tools.

After the definition of guidelines to develop with consistency the different resources of the training module, the production of the pedagogical resources is made, activity by activity, where a final integration is needed when all the pedagogical resources are produced. Figure 8 presents the production process of an e-Learning course.



Fig. 8: e-LITE course production process

In the e-LITE Method, from the design of the course scenario, the production process of an e-learning course is made up of the following steps:

- Development and test of the pedagogical resources of the course following ISTA3 specific guidelines,
- Integration and test by the author of the different pedagogical resources to constitute a course.
- Cross-validation of the courses between the different authors/partners of the project,
- Publication after final validation of the courses in the LMS.

Once the integration and test of a course is made by its author, e-LITE Method recommends a cross validation by at least two other partners of the research project. Then a qualification committee, on the advice of the partners who participated in the cross-validation of the module, takes the decision to validate the course. When a course is validated, it can be published in the LMS.

At the end of step 9:

- All expected modules, courses and pedagogical resources designed to support the results of the research project are produced, tested and validated.

Application of the e-LITE Method in the MSEE Project:

Short term work to do:

- Nothing to do in a short term (3 months).

5.5 Experimentation and evaluation of the VTS

The objective of this last step of the e-LITE Method is to experiment some courses of the VTS in order to verify that the VTS meets the needs of people external to the research Project who could be the targeted learners.

Step 10: Experimentation and evaluation of the VTS, in the e-LITE Method.

To realize step 10, it is necessary to achieve the following actions:

- Plan and organize the experimentation phase of the VTS,
- Involve the targeted learners,
- Realize training sessions using approved courses to experiment,
- Acquire information about learner's satisfaction,
- Take feedback on the experimentation into account in order to improve the VTS.

In the organisation of the experimentation, one of the major difficulties is to obtain a free participation of learners, teachers or tutors. To get learners, it is possible to ask for the participation of students from the academic partners and from the colleagues of our industrial partners of a research project. To find teachers or tutors who want to participate in the experimentation phase, it is interesting to solicit experts among the partners of the research project.

For the feedback on the experimentation, e-LITE Method suggests to acquire information about learners' satisfaction regarding course content, knowledge evaluation method, tutoring, etc. by the mean of an on-line questionnaire at the end of each training module. The exploitation of the evaluation forms is made in back office and the result of the analysis of learners' satisfaction is communicated to learners and tutors.

At the end of step 10:

- The experimentation phase is finished. Some courses of the VTS have been evaluated by people external to the research project.

- You dispose of information about the first learner's satisfaction and you have to analyse it to improve the VTS.
- After the experimentation, if the feedback about VTS is good, you dispose of a VTS ready for the dissemination phase of the research project.

Application of the e-LITE Method in the MSEE Project:

Short term work to do:

- Nothing to do in a short term (3 months).

6. Conclusion

In the deliverable D 72.1, we have presented the general specifications of the MSEE VTS and of its two associated modules. In these general specifications we present some main orientations which will be the guidelines for the MSEE VTS development. Then, we have described the e-LITE method and how we propose to apply it in order to develop this VTS.

This document and all the associated propositions made need to be approved by the partners of the WP72. After this approbation, we shall continue the development of the MSEE VTS with the formalization of the pedagogical form and the design of the scenario of the first training Module.

7. References

- [1] INTEROP NoE is an International network of Excellence in the domain of the Interoperability.
- [2] ATHENA (Advanced Technologies for interoperability of Heterogeneous Enterprise Networks and their Applications) is an integrated research project in the Interoperability domain.
- [3] ASICOM French research project which the acronym means “Architecture de Système d'information Interopérable pour les industries du COMmerce”.
- [4] ISTA3 French research project which the acronym means “3rd generation Interoperability for Aeronautic Subcontractors”.
- [5] e-LITE is the acronym for e-Learning as Integration Technology for research project Enhancement.
- [6] Zouggar N., Ducq Y., Deschamps J.C., Doumeingts G.
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8. Annexes

1. CNAM comparative study about LMS
2. First page of the MSEE Glossary (Draft)
3. MSEE Pedagogical forms of a module
4. Synthetic training matrix of industrial company for a servitization project

Annexe 1: CNAM comparative study about LMS

Step 1: LMS selection on general criteria.

Our study involved a search among all existing software. In 2012, the THOT directory had over 160 platforms. These platforms are open source, public or commercial. Given the choice made in the MSEE project to produce free software, we focused on the market of the open source LMS which consists of about twenty platforms. These training platforms were studied and the choice was based on the necessity to meet the following general criteria:

- LMS language is French or Multilingual,
- Platform have the main LMS/LCMS functionalities,
- Public: LMS adapted to the world of business,
- Communities of developers and users,
- Documentation in French or in English,
- Possibility of operation in all browsers, at least in Internet Explorer and Firefox to ensure proper dissemination of the platform.

These criteria are used as a filter: if the platform does not meet one of them, it is then removed. The array of open source platforms is established below.

Table 1: List of studied open source LMS

| | Name | Editors | Language | LMS/LCMS | Public | Community | Documents | Navigators |
|----|-------------------------------------------|----------------------------------|----------|----------|--------|-----------|-----------|------------|
| 1 | AbulEdu | RyXéo | 1 | 1 | 0 | | | |
| 2 | Acolad 3D | Université Louis Pasteur | 1 | 1 | 1 | 1 | 1 | 0 |
| 3 | ADA | Linxlab | 0 | | | | | |
| 4 | AnaXagora - LCMS | AnaXagora - C R Henri Tudor | 1 | 1 | 1 | 1 | 1 | 1 |
| 5 | Claroline | Université de Louvain | 1 | 1 | 1 | 1 | 1 | 1 |
| 6 | Dokeos | Dokeos | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | Duevera, Training manager | CRP Consulting | 1 | 1 | 1 | 0 | | |
| 8 | Eclass.Builder | Tulane University | 0 | | | | | |
| 9 | efron | Epignosis | 1 | 1 | 1 | 1 | 1 | 1 |
| 10 | electure | electure | 0 | | | | | |
| 11 | Eledge | University of Utah | 0 | | | | | |
| 12 | eTutor | Université d'Ottawa | 0 | | | | | |
| 13 | Ganesha | Anema Formation | 1 | 1 | 1 | 1 | 1 | 1 |
| 14 | Ilias | Université de Cologne | 1 | 1 | 1 | 1 | 0 | |
| 15 | LON - CAPA | Michigan State University - LITE | 0 | | | | | |
| 16 | LRN | MIT Sloan, Un. Heidelberg | 0 | | | | | |
| 17 | Moodle | Moodle Comm. | 1 | 1 | 1 | 1 | 1 | 1 |
| 18 | Olat LMS | OLAT | 0 | | | | | |
| 19 | Sakai | Sakai Project | 0 | | | | | |
| 20 | Uportal | JA-SIG | 1 | 0 | | | | |

Legend:

- 1: meet criteria
- 0: don't meet criteria

Step 2: LMS selection upon complementary criteria.

At the end of the first selection step, six platforms were selected: AnaXagora, Claroline, Dokeos, efron, Ganesha and Moodle. Wishing to choose the platform best suited to the needs of the future users, we compared the six selected LMS using technical complementary criteria:

- Products must offer user-friendly interface, this means that it is possible to use efficiently the LMS without too many hours of training.
- Functionalities: products must meet certain basic requirements of learners. They are intended to:
 - provide on-line educational content,
 - provide opportunities for communication and collaboration between stakeholders in the platform,
 - enable individualized lessons (individualized training plans, curricula or course types) and the monitoring of students by teachers throughout the learning.
- The products have ideally at least 5 possible profiles of users.
- The platforms meet the relevant standards: SCORM and AICC
- Absence of "plug-in" installation on the client side to simplify the use of platforms.

Table 2: Selected open source LMS with complementary criteria

| | Name | Enterprise | Functionalities | Ergonomics | Profiles | Standards | Plug-in | Sum |
|---|----------------------------------|-----------------------------|-----------------|------------|----------|-----------|---------|-----|
| 1 | AnaXagora - LCMS | AnaXagora - C R Henri Tudor | 1 | 1 | 1 | 0 | 1 | 4 |
| 2 | Claroline | University of Louvain | 1 | 1 | 1 | 0 | 1 | 4 |
| 3 | Dokeos | Dokeos | 1 | 1 | 1 | 0 | 1 | 4 |
| 4 | efron | Epignosis | 1 | 1 | 0 | 0 | 0 | 2 |
| 5 | Ganesha | Anema Formation | 1 | 1 | 1 | 1 | 1 | 5 |
| 6 | Moodle | Moodle Comm. | 1 | 1 | 1 | 1 | 1 | 5 |

Legend :

- 1: meet criteria
- 0: don't meet criteria

By observing the sum of the scores of the five criteria, we conclude that Ganesha and Moodle were the two platforms selected at the end of the second selection.

Step 3: LMS final selection.

In this last step of the selection procedure we shall compare the two LMS platform Ganesha and Moodle.

Ganesha and Moodle are open source and free LMS platform. The two platforms are multilingual, Moodle in particular offers a lot of linguistic possibilities

Ganesha is managed by the company ANEMA. This platform focuses on individualized courses. Ganesha organizes activities and educational resources around the learner rather than around a course.

Unlike Ganesha, Moodle is used to create learning communities around content and classroom activities. To a CMS (Content Management System), Moodle adds pedagogical or communicative functions to create an online learning environment. This is an application to create, through the network, interactions between teachers, learners and learning resources.

The comparative study made by the CNAM on the two platforms Moodle and Ganesha was used to develop Table 3 below.

Table 3: Synthesis of the comparative study Ganesha/Moodle

| | | Ganesha | Moodle |
|-------------------------|-----------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| During the MSEE Project | Advantages | <ul style="list-style-type: none"> - LMS easy to use - specialist of standard | <ul style="list-style-type: none"> - A lot of functionalities - Very large and dynamic community of users and developers - Possibilities of accurate parameterization |
| | Disadvantages | <ul style="list-style-type: none"> - Lack of documentation - Small users community | Difficulty of learning how to use the LMS |
| After the project | exploitation Strategy | Hosting and maintenance by Anema | Hosting and maintenance by IVLab |

We propose to select the Moodle LMS because Ganesha does not offer so rich functionalities as Moodle and its community of users is still small. Moreover, in the context of the MSEE project, I-IVLab and CNAM, which are the main contributors to the WP72 are experienced in the creation of a VTS in the Moodle environment.

Annexe 2: First page of the MSEE Glossary (Draft)

| Project Glossary | | | |
|----------------------------------------|----------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Term | Version | Date | Definition of the term |
| AS IS Model | V 1 | 09/05/2012 | This model aims to describe the existing system (structure and running) in order to analyse the present situation and to determine some point to improve. |
| Asset (tangible and intangible) | V 1 | 09/05/2012 | Assets are resources. Anything tangible or intangible that is capable of being owned or controlled to produce value and that is held to have positive economic value is considered as an asset (for instance, a tangible asset could be a machine tool, an intangible asset could be a specific human skill). |
| BPMN 2.0 | V 1 | 09/05/2012 | Business Process Model and Notation is a standardised graphical modelling language for Business Processes that is readily understandable by all business users, from the business analysts that create the initial drafts of the processes, to the technical developers responsible for implementing the technology that will perform those processes, and finally, to the business people who will manage and monitor those processes. BPMN aims to provide a bridge between the definition of enterprise procedures at a business level and their implementation. |
| BSM | V 1 | 09/05/2012 | Business Service Modelling is a modelling level of MDSEA Architecture which aims to specify the models, at the conceptual level, describing the structure, the functions, the processes, the information but also the dynamic evolution of the enterprise or set of enterprises as well as the links between these enterprises. The models at the BSM level must be independent from the future technologies that will be used for the resources. |
| Business Process | V 1 | 09/05/2012 | A business process is composed of a structured set of dynamic activities with an origin and an end. It could be use to describe the production of a product or a service. |
| Customer | V 1 | 09/05/2012 | The customer is the recipient of the product or the service provided by a considered business process. |
| Decision system | V 1 | 09/05/2012 | The decision system includes the decisions and their relations which aim to control the physical system of an organisation or an enterprise or asset of enterprises. |
| Decision variables | V 1 | 09/05/2012 | The decision variable is the action made available to the decision maker to control the physical system in order to reach the objectives. |
| Enterprise Modelling | V 1 | 09/05/2012 | <p>1-Enterprise Modelling aims to use modelling techniques or languages in order to represent an enterprise in terms of its structures, organisation and operations from various points of view. (Doumeings, 2000)</p> <p>2-It is the art of externalising enterprise knowledge. (Vernadat, 2003)</p> <p>3-A semantic unification space where shared concepts can be defined, mapped to one another and communicated in the form of enterprise models. (Goranson, 1997)</p> |

Annexe 4: Synthetic training matrix of industrial company for a servitization project

| Role | Awareness | Implementing | Auditing | Business and System Improvement |
|-------------------|--------------------------------|-------------------------------|-------------------------------|---------------------------------|
| Top Management | Management Briefing | Champion Module | Champion Module | Champion Module |
| Project Managers | M1 module | M1+M2 module | Internal Auditor Course | |
| Middle Management | M1 module | M1+M2 module | | |
| Researchers | M1 module | M1+M2 module | | |
| Consultants | M1 module | M1+M2 module | Internal Auditor Course | |
| All Employees | Awareness or e-Learning Module | Briefing or e-Learning Module | Briefing or e-Learning Module | Lean - 6 Sigma Projects |