



DT1.1: Draft of training concept specification

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| DELIVERABLE NO | DT1.1: Draft of training concept specification |
| DATE | 04.05.2006 |
| WORK PACKAGE NO | WP T1 |
| VERSION NO. | 0.6 |
| ELECTRONIC FILE CODE | dt1.1_0.6 |
| CONTRACT NO | 507100 PROMISE A Project of the 6th Framework Programme Information Society Technologies (IST) |
| ABSTRACT: | This document describes the first Instructional Design draft of the training architecture that will distribute the PROMISE concepts throughout the Consortium. |

| STATUS OF DELIVERABLE | | |
|------------------------------|------------------|-------------------|
| ACTION | BY | DATE (dd.mm.yyyy) |
| SUBMITTED (author(s)) | Andrea Matta | 05.05.2006 |
| VU (WP Leader) | Duncan McFarlane | |
| APPROVED (QIM) | D. Kiritsis | |

Revision History

| Date (dd.mm.yyyy) | Version | Author | Comments |
|----------------------|---------|--------------|--|
| 03.04.2006 | 0.1 | Andrea Matta | Draft of the document structure Submitted to all WP partners for approval |
| 20.04.2006 | 0.2 | Lutz Rabe | Draft content for Learner Analysis chapter |
| 22.04.2006 | 0.21 | Andrea Matta | Comments on Draft content ver0.2 |
| 25.04.2006 | 0.22 | Lutz Rabe | New draft content for Learner Analysis chapter 3.2 |
| 24.04.2006 | 0.3 | Hong Bae Jun | Draft for 3.3.1 and 3.3.2 |
| 27.04.2006 | 0.4 | Andrea Matta | Integration of drafts 0.22 and 0.3 |
| 03.05.2006 | 0.41 | Andrea Matta | Updating: Purpose, Instructional model, feedbacks from BIBA and EPFL |
| 04.05.2006 | 0.5 | James Brusey | Various minor corrections |
| 04.05.2006 | 0.6 | Andrea Matta | To be submitted to the Quality manager |
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Abbreviations:

| | |
|------|---------------------------------------|
| BOL | Beginning Of Life |
| LMS | Learning Management System |
| MOL | Middle Of Life |
| EOL | End Of Life |
| DSS | Decision Support System |
| PDKM | Product Data and Knowledge Management |
| PEID | Product Embedded Information Device |



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1 Purpose of this document

This document is the first draft of the training specifications on which the training infrastructure will be designed and developed in TT1.2 and TT1.3. This preliminary set of specifications will be further refined in the next deliverable DT1.2.

In more details, this document describes preliminary specifications about:

- **Why** do we need to train people?
- **Who** will be trained? (That is, who are the users or learners to which the training concepts will be delivered?)
- **What** technologies are we going to teach? (That is, what content will be delivered?)
- **How** do we intend to go about producing and delivering the training materials? (That is, what infrastructure will be used to deliver the training content?)

A preliminary instructional strategy used in Promise training is presented in this document.

2 Introduction

PROMISE is a very complex project for several reasons. First of all it aims to realize the needed breakthrough in PLM theory and practice by proposing new methodologies, technologies and concepts to improve the competitiveness of European enterprises. As a consequence all the intermediate and final results are not easy to be acquired and applied in practice. Furthermore the number of partners working in the project is high, this means to have the PROMISE knowledge distributed through the PROMISE Consortium and to have different points of views of the same problems, concepts and practices. The fact that the Consortium is highly heterogeneous and people work in different places in Europe do not facilitate the exchanging of the PROMISE knowledge. Mainly for reasons the workpackage WPT1 aims at:

“facilitating and disseminating key PROMISE outputs, namely research and technology, to other members of the consortium. In addition to providing a ‘hands on’ environment for understanding and demonstrating PROMISE developments and progress, this work will inspire potential developments and uses of PROMISE results, as well as enabling PROMISE tools and methodologies to be transferred to other developers in this area”.

Thanks to the development of the PROMISE training model PROMISE partners will be a better knowledge about :

- Concepts
- Technologies
- Advanced tools
- Technical problems
- Marketing ideas
- Business cases
- Standards

This first document aims at deriving a first set of main specifications needed to properly design the PROMISE training model. Other documents will follow as described below:

- DT1.2: final specifications of the PROMISE training model.
- DT1.3: storyboard of the PROMISE training model.
- DT1.4: implementation of the PROMISE training model.

3 Training model

3.1 Model description

In this section the reference instructional design model used to design and develop the training architecture is now presented. This model is taken and adapted from literature (Ranieri 2005), which inspires to the main works on instructional design (Khan 2004).

According to the Ranieri's model, an instructional design project is divided into three phases:

1. Macro phase: the phase in which specifications of the instructional project are derived. In this phase it is necessary to analyze the potential learners who will use the training infrastructure, to define their learning necessities and the training goals of the project, to identify the main concepts to deliver and the resources to be used for training. In more detail specifications are about:
 - Users: specifications about the characteristics of learners who will use the training architecture. These specification deeply affect the storyboard of the instructional project.
 - Goals: the learning goals on which the instructional design will be based.
 - Contents: the selection of the research and technology contents to be delivered to learners.
 - Infrastructure: the resource constraints, both human and technical, limiting the training delivery.

2. Micro phase: the instructional strategy is designed on the basis of the specifications defined in the macro phase. Furthermore specifications on users, goals, contents and infrastructure are further detailed following a spiral approach. The instructional strategy is composed of the following elements:
 - Instructional Model: description of the instructional model to be adopted and implemented by specifying the integration between presence and distance, the learner autonomy, the learning assessment and the training strategies (collaborative learning, self-learning, student centered, teacher centered, group centered, ...).
 - Architecture Design: description of both the training content structure, possibly decomposed in modules and sub-modules, and the IT infrastructure (Learning Management System: technology tools).
 - Delivery mechanisms: description of the tools used to deliver training contents, e.g. syllabus, multimedia, forums, tutoring, etc.

3. Implementation phase: in this phase the instructional strategy design is developed. In particular training material and IT infrastructure will be developed.

This deliverable mainly deals with the first phase. DT1.3 and DT1.4 will deal with the micro and implementation phases respectively.

3.1.1 Macro analysis

The macro analysis consists of defining specifications related to:

- Users
 - Role of users in Promise.
 - Physical distance among learners and teachers
 - Number of potential learners
 - Accessibility of technology to learners
 - Learners' domain expertise
 - Homogeneity/Heterogeneity of interests among learners
 - Learners' availability to share information and concepts and to collaborate in educational projects.
- Goals
 - Promise
 - Homogeneity/Heterogeneity of interest among learners
 - Availability to sharing and collaborating
- Contents
 - Main Promise concepts.
 - Main Promise components: PDKM, DSS, Middleware, PEID, etc.
 - Promise processes: design for X, adaptive production, predictive maintenance, product decommissioning.
- Infrastructure
 - Human resources available to deliver training contents.
 - Technologies available to deliver training contents.

This set of specifications will help to define the instructional design problem in the micro analysis. This deliverable together the DT1.2 will contain these specifications.

3.1.2 Micro analysis

The micro analysis consists of designing the training architecture:

- Instructional Model:
 - Define the integration degree between presence and distance of the training delivery.
 - Define the learner autonomy during his/her learning path.
 - Design the assessment method.
 - Define the training strategies
- Architecture design
 - Define the IT components needed to deliver training contents (LMS):
 - Define the training contents module by module.

- Learning objectives >strategies >activities >content >feedback
- Define the relationships among modules (sequences, flexibilities, requirements, wideings, ...).
- .
- Delivery mechanisms:
 - IT based
 - To manage the planning (syllabus, agendas, calendar, ...)
 - To publish content (multimedia modules, text modules, video modules, ppt modules, exercises, quiz, test, ...)
 - To communicate (forum, chat, mail, ...)
 - Human based.

The output of this design phase will provide all the information for the implementation phase.

Deliverable DT1.3 will contain this storyboard of the training architecture. Deliverable DT1.2 will contain a first draft of the structure design, which will be finally presented in DT1.3.

3.1.3 Implementation phase

This phase consists of developing the training architecture:

- IT infrastructure development:
- Training material development
- Set-up training courses.

4 Instructional design analysis

4.1 Learner analysis

The goal of the training work package is to ensure that all PROMISE partners are familiar with the progress and activities of their colleagues, as well as being in a position to receive secondary training outside PROMISE activities. Thus, in a first step a learner can be specified in the context of this work package as employee (or owner) of an organisation which is member of the PROMISE consortium or associated to the consortium.

Categorization criteria for the members (employees, owners etc) of these organisations are various. A first approach to structure relevant categorisation criteria is given in Figure 1.

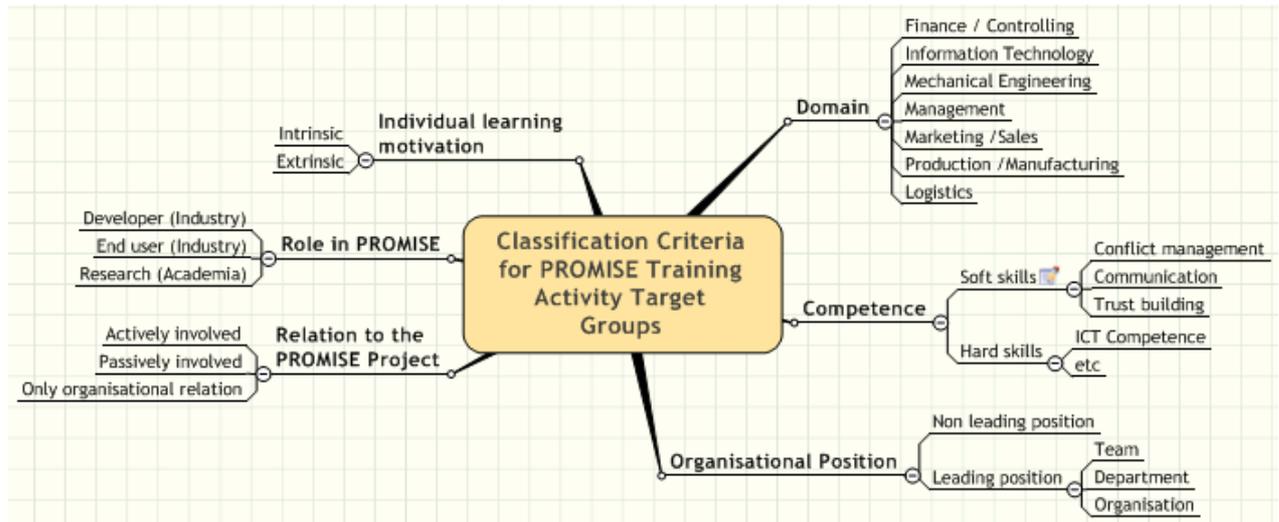


Figure 1: Classification Criteria for Training Activity Target Groups

4.1.1 Physical distance

Members of the promise consortium are European wide special distributed into nine different countries. Joining a consortium meeting requires an average travel effort in time of up to 5 (???) hours (one way) for a partner to bridge the physical distance of up to 2700 km (???) linear distance. Consequently a notable physical distance should be taken into account not only between the individual learners but also between learners and tutors/trainers. In addition it should be mentioned here that the physical distance includes also a difference in time of up to two hours within the group of the consortium. This time shift is even more considerable for including affiliated partners from other continents such as Australia or Japan.

Previous research has indicated that working in different time zones has a negative influence on trust building and, as a consequence, the ability to exchange knowledge. Apart from that, working across time zones makes scheduling meetings more complicated.

Due to the fact that the special distribution of learners as well as the distance between learners and trainers has a major impact on the development of a training strategy it is considered as a major issue for the training concept specification.

4.1.2 Number

The expected number of learners can be estimated on the bases of organisations which are member of the consortium. The PROMISE consortium consists of 22 organisations located in nine European countries as shown in Table 1.

| | Participant name | Participant short name | Country |
|---|---------------------------|------------------------|---------|
| 1 | SINTEF | SINTEF | N |
| 2 | BIBA | BIBA | D |
| 3 | BOMBARDIER TRANSPORTATION | BT-LOC | CH |
| 4 | CAMBRIDGE UNIVERSITY | CAMBRIDGE | UK |
| 5 | CATERPLILLAR | CAT | F |
| 6 | CIMRU | CIMRU | IRL |
| 7 | COGNIDATA | COGNIDATA | D |
| 8 | CR FIAT | CRF | I |
| 9 | ENOTRAC | ENOTRAC | CH |

| | | | |
|----|--|-----------|-----|
| 10 | ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE | EPFL | CH |
| 11 | FIDIA | FIDIA | I |
| 12 | HELSINKI UNIVERSITY OF TECHNOLOGY | HUT | FIN |
| 13 | INDYON | INDYON | D |
| 14 | INMEDIASP | INMEDIASP | D |
| 15 | INTRACOM | INTRACOM | EL |
| 16 | ITIA-CNR | ITIA | I |
| 17 | MTS | MTS | I |
| 18 | POLITECNICO DI MILANO | POLIMI | I |
| 19 | INFINEON | INFINEON | D |
| 20 | SAP | SAP | D |
| 21 | STOCKWAY | STOCKWAY | F |
| 22 | WRAP | WRAP | I |

Table 1: Member organisations of the PROMISE consortium

Although organisational size of the members organisations vary between 10 and 10000 (???) it is expected that at least an average of 5÷10 individuals per organisation have to be served by one of the different training activities. Thus, the estimated number of learners is about 330 within the consortium. In addition it is estimated that in a wider project context about 500 learners from affiliated projects or the European commission need to be served which leads to an estimated overall number of learners of about 500 to 1000.

4.1.3 Access to technology

The access to technology can be understood in two ways. One is access to technology that can be used as training infrastructure. Basic technology components are computers and devices, software and network access.

The second is access to basic PROMISE technology such as devices (PEID), software (PDKM, DSS, Middleware etc) and demonstration or training components.

The first aspect (access to training infrastructure) can be considered a minor one in the context of this task due to all partners of the PROMISE consortium having integrated standard office applications as well as broadband Internet access and related applications for communication and coordination into their daily work environment. The same is assumed for affiliated organisations, which are also acting in an international work environment.

The second aspect (access to PROMISE technology) deals mainly with the provision of physical training material. Basically all PROMISE components are available without any restrictions for the members of the consortium and there exist at least a possibility of restricted access to these components for the affiliated partners.

A problem that might occur in a distributed learning environment is that access to the physical training / demonstration objects may not exist for all learners. This might include not only the physical transport but also several instances of these objects. It should be noted here that depending on the individual learning strategies the access to physical objects is desirable or required.

Another problem that might occur is that it may be necessary to leave PROMISE components in the care of partners without a mechanism to keep control over them. This might raise issues of intellectual property security in the case of learners from affiliated organisation that are intended to only have restricted access rights to the PROMISE results.

4.1.4 Domain expertise

Expected learners are from various domains not only considering their individual functional domain within their organisation but also considering the business domain of their organisation.

It is expected that the following functional domains from the partner organisation have to be considered:

- Management
- Finance / Controlling
- Marketing / Sales
- Information technology
- Production / Mechanical Engineering
- Logistic.

With respect to the application areas represented by the partner of the PROMISE consortium following business domains have to be considered:

- Software
- Hardware
- Construction Equipment (crawler-mounted vehicle)
- Locomotive / Railway
- Automotive
- Recycling
- Metal cutting machine tools
- White goods / Refrigerator

4.1.5 Homogeneity/Heterogeneity of interest among learners

Interest of a learner in training activities is utterly based on his individual motivation which plays a crucial role in the learning process.

Wikipedia provides the following information about the role of motivation in the educational context:

Motivation in education can have several effects on how students learn and their behavior towards subject matter. It can:

1. *Direct behavior toward particular goals*
2. *Lead to increased effort and energy*
3. *Increase initiation of, and persistence in, activities*
4. *Enhance cognitive processing*
5. *Determine what consequences are reinforcing*

6. *Lead to improved performance.*

Because students are not always internally motivated, they sometimes need situated motivation, which is found in environmental conditions that the teacher creates.

There are two kinds of motivation:

- ***Intrinsic motivation*** occurs when an individual is internally motivated to do something because it either brings them pleasure, they think it is important, or they feel that what they are learning is morally significant.
- ***Extrinsic motivation*** comes into play when a student is compelled to do something or act a certain way because of factors external to themselves (like money or good grades).

Considering the various functional and business domains as well as the general conditions of the individual learners which should be focused by the training concept, it is obviously that not all the learners are fully intrinsically motivated. On the other hand it is hard to estimate the degree of motivation, due to the fact that external factors, such as rewards, incentives or punishment, are controlled by the individual organisation that the learner belongs to.

Initially it should be assumed that at least a basic interest in the overall complex of PROMISE themes is existent. Apart from this it there seems to be a wide range of particular interest depending on the functional and the business domain of the learner. For example, learners coming from the marketing department of a white good producer are obviously neither interested in information about technical details of the IT concept nor in information about applying these solutions in the construction equipment domain.

Clustering the different learners with respect to their functional and business domain as well as their position in their organisation helps to increase the degree of homogeneity of interests but also increases the effort in producing and delivering the training material.

Depending on the further findings a classification of learners with respect to their interest has to be made into the following categories:

- Business Domain (see 4.1.4)
- Functional Domain (see 4.1.4)
- Organisational Position
 - Manager
 - Team Leader
 - And so forth

4.1.6 Learner availability to sharing and collaborating

The ability of a learner to share knowledge and to collaborate in the training process is an essential prerequisite for the application of various training methods. These abilities are summarized in the literature as soft skills.

Wikipedia provides following information on soft skills

Soft skills refer to the cluster of personality traits, social graces, facility with language, personal habits, friendliness, and optimism that mark people to varying degrees. Soft skills complement hard skills, which are the technical requirements of a job.

Soft skills can also be an important part of the success of an organisation. Organisations, particularly those frequently dealing with customers face-to-face, are generally more prosperous if they train their staff to use these skills. For this reason, soft skills are increasingly sought out by employers in addition to standard qualifications.

Common Soft Skills include:

- *Following common Etiquette*
- *Using appropriate body language such as friendly gestures, head nods, facial expressions, body posture and good eye contact*
- *Using appropriate tone of voice and language*
- *Relating to individuals in common conversation, regardless of interests or background*
- *Making others feel comfortable in situations outside their normal sphere of action*
- *Clear and often persuasive manners of speech*

The existence of a certain degree of soft skills in particularly with respect to the ability to communicate and cooperate have to be considered as essential prerequisite for the transfer of knowledge in the training process. Efficient knowledge sharing requires a collaborative effort, which is not only depending on the recipient's absorptive capacity but also on the ability of the source to communicate its knowledge in a way the receiver can understand. If sharing process happens though ICT, the participating individuals additionally need to own a certain degree of ICT skills.

The overall ability of learners to share and collaborate can be considered in the context of the PROMISE project consortium as at least average due to the fact that working in an international research project requires a minimum of both soft and hard skill as described above. Nevertheless, training concepts should not rely entirely on these prerequisites due to the fact that learners from affiliated projects or organisations also need to be addressed by the training activities.

4.1.7 Categories of Learners

Based on the previous this chapter describes relevant categories of learners to be focused on for the further development of the PROMISE training strategy specification.

The categories described in **Errore. L'origine riferimento non è stata trovata.** are based on clustering of above discussed learner characteristic.

Grouping criteria: the role in PROMISE

- Developer (Industry)
- End user (Industry)
- Researcher (Academia)

Grouping criteria: domain

- Business domain experts
- Functional domain experts

Grouping criteria: relation to the PROMISE project

- Actively involved learner
- Passively involved learner
- Only organisational relation learner

Grouping criteria: Competence

- Soft skills
- Hard skills

Grouping criteria: Technical domain

- Mechanical engineering
- Information technologies
- Management
- Finance/controlling
- Production/manufacturing
- Logistics

Grouping criteria: Position

- Leading
- Not leading

4.2 Training concepts

In this section, we introduce training concepts, which are customized for each user group. As training concepts, we deal with PROMISE technological viewpoint and business viewpoint.

4.2.1 Promise components

This part provides the PROMISE concepts with PROMISE technologies aspects. It is divided into three parts: component level, sub system level, and system level:

- Component level:
 - *PEID*
 - *Middleware*
 - *PDKM*
 - *DSS*
 - *Data transformation*

- Sub system level:
 - *Data acquisition: PEID+Middleware*
 - *Data manipulation: PDKM+DSS+Data transformation*
 - *Etc.*
- System level:
 - *PROMISE PLM system*

For each classification of training contents, we consider the following contents for training.

- Contents (Component level)
 - *Definition of component*
 - *State-of-the art: Previous literature or relevant technologies*
 - *Role of each component in PROMISE architecture*
 - *Relations with business application issues*
 - *Introduction of case study or demonstration*
 - *Theoretical and Industrial effect or meaning*
 - *Lesson learned from PROMISE project*
- Contents (Sub system level)
 - *Definition of sub-system*
 - *Previous literature and relevant technologies*
 - *Main challenging points or issues of sub-system*
 - *Introduction of case study*
 - *Lesson learned from PROMISE project*
- Contents (System level)
 - *Definition of generic PROMISE concept*
 - *Concept of Closed-loop PLM*
 - *Previous literature and relevant technologies*
 - *Main components of PROMISE PLM system*
 - *System architecture*
 - *Lesson learned from PROMISE project*

4.2.2 Promise processes in the added value chain

This part provides the PROMISE concept with business aspect. It is divided into three parts: for each business issue, for each lifecycle phase, and for whole product lifecycle:

- For each business issue
 - *Design for X*
 - *Adaptive production system*
 - *Predictive maintenance*
 - *Maintenance/service optimization*
 - *EOL Product recovery optimization*
 - *Tracking and tracing EOL product*
- For each lifecycle phase
 - *BOL*

- *MOL*
- *EOL*

- *For whole product lifecycle*

For each classification of training contents, we consider the following contents for training.

- *Contents (for each issue)*
 - *Description of Business issue*
 - *Definition of business model*
 - *Objective*
 - *Relevant actors*
 - *Problem description*
 - *State-of-the art: Previous literature and industrial cases*
 - *How to solve them in the PROMISE framework*
 - *Solution approach*
 - *Integration with PROMISE technologies*
 - *Introduction of case study or demonstration*
 - *Example of PROMISE application*
 - *Theoretical and Industrial effect or meaning*
 - *Lesson learned from PROMISE project*

- *Contents (for each lifecycle phase)*
 - *Characteristics of each lifecycle phase*
 - *Business issues*
 - *Solution approaches*
 - *PROMISE system architecture*
 - *Introduction of PROMISE case studies*
 - *Lesson learned from PROMISE project*

- *Contents (for whole product lifecycle)*
 - *Product lifecycle concept*
 - *RFID technologies and product lifecycle*
 - *PROMISE system architecture*
 - *Relations among product lifecycle phases*
 - *Product lifecycle data and information flows*
 - *Data and process integration viewpoints*
 - *Lesson learned from PROMISE project*

4.2.3 Content characteristics

The detailed specification of the content characteristics will be the specific object of Deliverable DT1.2. In particular the following aspects will be considered:

- Degree of formalization:
 - *Are training concepts difficult to formalize?*
 - *Are concepts context specific?*
 - *Do concepts require different perspectives?*
- Stability:
 - *Are concepts static or dynamic during the project?*
- Interactivity:
 - *Do concepts require classic text information, multimedia, interactivity, or some combination?*

4.3 Goal analysis

This paragraph provides a first draft description of the instructional objectives of the training architecture for each learner category.

| GROUPING CRITERIA | GROUP | GOAL |
|----------------------------|---------------------------|---|
| Role in PROMISE | Developer (Industry) | To deliver the basics of the PROMISE IT architecture and its application to real business cases. To give some idea as to how built-up technologies are applied to real business cases. Developers will have some ideas on how to exploit PROMISE technologies. |
| | End user (Industry) | To deliver an understanding about the main functionalities provided by the PROMISE IT architecture to be used in the product life cycle processes. End users will have some ideas about how emerging technologies and product lifecycle operation problems are combined for maximizing profits of industries |
| | Researcher (Academia) | To deliver an understanding of the main technical needs from both end users and developers. |
| Business/functional | Business domain experts | To deliver an understanding of the potential business impact of the PROMISE results. Experts will have some inspirations on how to apply PROMISE concepts and technologies to their business domains. |
| | Functional domain experts | To deliver an understanding of the potential technical impact of the PROMISE results. Experts will have some information or knowledge related to their functional domains. |

| | | |
|--|--------------------------------------|---|
| Relation to the PROMISE project | Actively involved learner | To deliver a detailed knowledge of the PROMISE architecture and components. Learners will have some opportunities to summarize PROMISE concept, technologies, case studies, and receive feedbacks from the learners. |
| | Passively involved learner | To deliver rules and methods on how to interact with (or use) the PROMISE architecture and components. Learners will have some opportunities to acquire PROMISE concept, technologies, case studies in detail. |
| | Only organisational relation learner | To deliver an understanding of the overall PROMISE concept, its application and possible impact. |
| Competence | Soft skills | To deliver basic understanding of main technical content. |
| | Hard skills | To deliver sound technical contents. |
| Technical domain | Mechanical engineering | To deliver a detailed understanding of one of the PROMISE components/processes. |
| | Information technologies | To deliver a detailed understanding of one of the PROMISE components/processes. |
| | Management | To deliver a detailed understanding of one of the PROMISE components/processes. |
| | Finance/controlling | To deliver a detailed understanding of one of the PROMISE components/processes. |
| | Production/manufacturing | To deliver a detailed understanding of one of the PROMISE components/processes. |
| | Logistics | To deliver a detailed understanding of one of the PROMISE components/processes. |
| Position | Leading | Give some opportunities to summarize PROMISE concepts, technologies, case studies, and receive feedbacks from the learners. |
| | Not leading | Give some opportunities to learn PROMISE concepts, technologies, and case studies in detail. |

Table 2: Learning objectives.

4.4 Infrastructure analysis

In this paragraph we describe the technological and human resources that are available, or which will be available in the future, to deliver the training concepts.

4.4.1 Technological resources

The technological resources available to deliver training contents will be standard as in normal e-distance educational courses:

- Servers
- Clients

- Learning software platform (to be selected among the commercial ones)
- Web site
- Physical demonstrators (optional)
- Process simulators (optional)
- Component simulators (optional)

4.4.2 Human resources

The people potentially usable to deliver the defined training concepts are experts of WPT1 participants:

- BIBA (Academia)
- Cambridge (Academia)
- Enotrac (Developer)
- EPFL (Academia)
- HUT (Academia)
- InmediasP (Developer)
- ITIA (Academia)
- Polimi (Academia)
- Sintef (Academia)

5 Conclusions

The first set of specification has been defined in this document. This set will be further refined in the next deliverable and along all the training workpackage according to the spiral approach. Specification will be the constraints to the design phase of the PROMISE training model, which will be developed in tas T1.3.

6 References

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7 Contact Persons

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