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# SEnDIng

## D2.4

### TRAINING METHODOLOGY

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## Delivery Slip

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## PROJECT SUMMARY

SEnDIng project aims to address the skills' gap of Data Scientists and Internet of Things engineers that has been identified at the ICT and other sectors (e.g. banking and energy) at which Data Science and Internet of Things have broad applications. To achieve this goal, SEnDIng will develop and deliver to the two aforementioned ICT-related occupational profiles two learning outcome-oriented modular VET programmes using innovative teaching and training delivery methodologies.

Each VET program will be provided to employed ICT professionals into three phases that include: (a) 100 hours of online asynchronous training, (b) 20 hours of face-to-face training and (c) 4 months of work-based learning. A certification mechanism will be designed and used for the certification of the skills provided to the trainees of the two vocational programs, while recommendations will be outlined for validation, certification & accreditation of provided VET programs.

Furthermore, SEnDIng will define a reference model for the vocational skills, e-competences and qualifications of the targeted occupational profiles that will be compliant with the European eCompetence Framework (eCF) and the ESCO IT occupations, ensuring transparency, comparability and transferability between European countries.

Various dissemination activities will be performed – including the organization of one workshop at Greece, Bulgaria and Cyprus and one additional conference at Greece at the last month of the project – in order to effectively disseminate project's activities and outcomes to the target groups and all stakeholders. Finally, a set of exploitation tools will be developed, giving guides to stakeholders and especially companies and VET providers, on how they can exploit the project's results.

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# 1 Introduction

## 1.1 Scope

The purpose of this deliverable is to describe the training methodology of SEnDIng. The link between the form and content of training and its delivery, the so-called training methodology and techniques, constitutes one of the basic educational principles.

This document provides to trainers and VET providers the guidelines and suggestions regarding training methodology and tools suitable for the delivery of the three phases of SEnDIng VET programs a) on-line training, b) face to face training and c) work-based learning (WBL). Furthermore, companies will be consulted on the implementation of work-based learning procedures in order to guarantee the up-skilling of their employees.

In explaining how various methods can be combined into an effective constructivist approach, we also employ into the proposed methodology the principles of adult education as well as the principles of soft skills, ICT training and e-learning. The outcome of this process is the provision of a practical yet theoretical grounded corpus of guidelines regarding ICT professionals' training in Data science and Internet of Things (IoT) which expands from the narrow limits of a constructed learning pathway and takes the form of an effective participatory experience that will motivate learners and enhance their professionalism.

## 1.2 Audience of the document

The audience of the Training Methodology is a) the SEnDIng project partners who shall undertake the implementation of the project's training, b) the enterprises that employ ICT professionals which will participate in the WBL part of the provided VET programmes, c) other enterprises that employ ICT professionals, potential users of the SEnDIng training, d) HEIs and VET providers that could provide the full training scheme or implement parts of the training courses, e) trainers who could use the theoretical background and practical suggestions on how to design and deliver the SEnDIng courses in Data Science and IoT technologies.

The document serves as a source of the training methodology to be undertaken by the project participants in the piloting of SEnDIng training.

## 2 Content elements of the training

### 2.1 Target group of the training

The target group of SEnDIng training is ICT professionals and more specific Data Scientists and IoT engineers who work at the ICT sector and other sectors where the Data Science and IoT technologies are applied (e.g. banking, assurance and energy).

### 2.2 Structure of the training

The modular form of the curriculum allows the flexible implementation of the courses on the basis of the participants' needs. Each educational module is divided into training units at three levels of proficiency:

- **Introductory (I):** The educational module is introduced and its most important facts are given.
- **Core (C):** All core aspects, principles and methods of the module are covered in sufficient detail as necessary to apply the knowledge and skills on the job. The learner becomes able to discuss matters with other stakeholders and acquire more knowledge when necessary.
- **Advanced (A):** Advanced aspects of the module are covered in sufficient detail as necessary to apply the knowledge and skills on the job.

The order of the modules delivered depends on their content. It is suggested for the modules to be delivered progressively, with the transversal skills module being more flexible in the order of delivery.

Up-skilling needs can be met through a diversity of routes, depending on the participants' needs. For example, only one module or specific unit/level of proficiency from each module can be selected by the learner according to the competences, skills and knowledge he/she wants to acquire.

The curriculum is designed to be delivered as a blended learning course of e-learning, face to face training and work-based learning.

The recommended structure and duration of each module is presented in table 1 for the Data Science curriculum and in table 2 for the IoT curriculum.

For piloting purposes and participation in the certification exams provided during the implementation of SEnDIng project, the trainees have to complete the proposed face to face, e-learning and WBL training as depicted in the tables 1 for Data Science curriculum and 2 for IoT curriculum.

Table 1: Recommended modules of Data Science

<b>Modules</b>	<b>Duration</b>
<b>Module 1: Introduction to Data Science (DS-EM1)</b>	<b>3h</b>
<b>Module 2: Python for Data Science (DS-EM2)</b>	<b>20h</b>
<i>Training units</i>	
Python for Data Science – Introduction (DS-EM2-I)	2h
Python for Data Science – Core (DS-EM2-C)	12h
Python for Data Science - Advanced (DS-EM2-A)	6h
<b>Module 3: Statistics for Data Science (DS-EM3)</b>	<b>20h</b>
<i>Training units</i>	
Statistics for Data Science – Introduction (DS-EM3-I)	2h
Statistics for Data Science - Core (DS-EM3-C)	10h
Statistics for Data Science – Advanced (DS-EM3-A)	8h
<b>Module 4: Storing and retrieving data (DS-EM4)</b>	<b>20h</b>
<i>Training units</i>	
Storing and retrieving data – Introduction (DS-EM4-I)	4h
Storing and retrieving data - Core (DS-EM4-C)	10h
Storing and retrieving data – Advanced (DS-EM4-A)	6h
<b>Module 5: Applied machine learning (DS-EM5)</b>	<b>20h</b>
<i>Training units</i>	
Applied machine learning – Introduction (DS-EM5-I)	2h
Applied machine learning - Core (DS-EM5-C)	10h
Applied machine learning – Advanced (DS-EM5-A)	8h
<b>Module 6: Data Visualization (DS-EM6)</b>	<b>20h</b>
<i>Training units</i>	
Data Visualization – Introduction (DS-EM6-I)	2h
Data Visualization - Core (DS-EM6-C)	10h
Data Visualization – Advanced (DS-EM6-A)	8h
<b>Total duration of e-learning</b>	<b>103h</b>
<b>Face to face training in transversal skills</b>	<b>20h</b>
<b>Work based learning</b>	<b>4 months</b>

Table 2: Recommended modules of Internet of Things

<b>Modules</b>	<b>Duration</b>
<b>Module 1: Introduction to IoT (IoT-EM1)</b>	<b>3h</b>
<b>Module 2: IoT Devices (IoT-EM2)</b>	
<i>Training units</i>	<b>20h</b>
IoT Devices – Introduction (IoT -EM2-I)	2h
IoT Devices – Core (IoT -EM2-C)	6h
IoT Devices – Advanced (IoT-EM2-A)	12h
<b>Module 3: IoT Communication Technologies (IoT-EM3)</b>	<b>20h</b>
<i>Training units</i>	
IoT Communication technologies – Introduction (IoT -EM3-I)	2h
IoT Communication technologies – Core (IoT -EM3-C)	8h
IoT Communication technologies – Advanced (IoT-EM3-A)	10h
<b>Module 4: Architectural Design and Applications in IoT (IoT-EM4)</b>	<b>20h</b>
<i>Training units</i>	
Architectural Design and Applications in IoT – Introduction (IoT-EM4-I)	4h
Architectural Design and Applications in IoT - Core (IoT-EM4-C)	8h
Architectural Design and Applications in IoT – Advanced (IoT-EM4-A)	8h
<b>Module 5: IoT Security and Privacy (IoT-EM5)</b>	<b>20h</b>
<i>Training units</i>	
IoT Security and Privacy – Introduction (IoT-EM5-I)	2h
IoT Security and Privacy - Core (IoT-EM5-C)	8h
IoT Security and Privacy – Advanced (IoT-EM5-A)	10h
<b>Module 6: IoT Business Value (IoT-EM6)</b>	<b>20h</b>
<i>Training units</i>	
IoT Business Value – Introduction (IoT-EM6-I)	2h
IoT Business Value - Core (IoT-EM6-C)	12h
IoT Business Value – Advanced (IoT-EM6-A)	6h
<b>Total duration of e-learning</b>	<b>103h</b>
<b>Face to face training in transversal skills</b>	<b>20h</b>
<b>Work based learning</b>	<b>4 months</b>

### 3 Theoretical background of the recommended training methodology in SEnDIng

The theoretical background of the recommended training methodology in the frame of SEnDIng project is leaning on the following pillars:

- The constructivist approach
- The principles of adult education
- The principles of soft skills training
- The principles of ICT training
- The principles of e-learning
- The principles of work based learning

As a result, the proposed training methodology is based on both theoretical and empirical approaches that have been proven successful in adult education and training in the field of ICT.

#### 3.1 The constructivist approach

The SEnDIng courses adopt the constructivist learning theory. In the constructivist paradigm, the learners are in the centre of the learning process and they are active creators and constructors of their own knowledge [1]. Active learning methods that give to trainees significant autonomy and control over the learning process are used. Learning outcomes follow a holistic, generalized concept of competence which is viewed from the perspective of the individuals and learners' personalities and capabilities.

The main implications of constructivism adopted in SEnDIng courses [1,2] are:

1. The trainees construct their own reality based on their previous experience and mental structures and beliefs.
2. Pre-existing conceptions and knowledge of learners are very important. Through training are explored, addressed and new knowledge is built on them.
3. The trainees reflect on their own experiences, assumptions and expectations, and develop critical thinking by analysing and assessing ideas and schemes in safe environments. By this way, they are able to reach a new understanding of things in their profession.
4. The learners assume responsibility for their own learning, by participating actively in the training process and exploring.
5. The trainers act as facilitators, helping trainees to construct knowledge rather than to reproduce a series of facts. Under this scope, problem-based learning, investigational work, situated learning, experimental learning, action learning

have a pivotal role. Discovery is facilitated by providing resources and effective use of questions.

6. The training in workplaces is very important since trainees can deal with real tasks within communities of practice and coaching by experts.
7. The trainees develop metacognitive skills. Becoming aware of the learning process they are able to analyse monitor and evaluate it. They need to know how to learn by developing effective learning strategies.
8. The collaborative learning is supported by encouraging group work and collaboration in constructing knowledge and not competition. Peer learning and the use of peers are supported. Trainers are encouraged to provide opportunities for more expert and less expert participants to learn from each other. Discussion and debates are promoted.
9. The trainees construct their own reality. Constructivism allows for multiple interpretations and expressions of learning. It is accepted and expected that each trainee will interpret information in different ways.
10. The assessment is performance oriented and does not claim absolute objectivity. It is mainly based on portfolios, projects, role-playing, case studies, self-evaluation etc.

### 3.2 Adult education principles

Adult education is based to a great extent on the assumptions and principles of the constructivist approach. In the development of the training methodology of SEnDIng the following adult education principles are applied [3,4,5,6,7]:

Principles	Application
Adults bring life experiences and knowledge to the learning environment. Experience is considered a resource of learning	<ul style="list-style-type: none"> <li>– The experience and expertise of adults should be recognized.</li> <li>– Training should build on them and encourage the learners to actively participate in the creation of new experiences and share their experience and knowledge.</li> <li>– Learning activities should be created in a way that reinforces the use of past experience and knowledge.</li> </ul>
Adults tend to prefer self-directed, autonomous learning	<ul style="list-style-type: none"> <li>– Adult learners need control over the learning process. That gives and requires more responsibility and initiative of them. It also allows them to select, manage and evaluate their learning.</li> <li>– Learners should be involved in setting goals and making decisions.</li> </ul>

	<ul style="list-style-type: none"> <li>– The trainer should act as facilitator, coach and supporter, by finding ways to involve participants and investigating of what participants want to learn.</li> <li>– Opportunities should be provided to learners to direct their own learning.</li> <li>– Action-planning tools and templates to learners should be provided in order to help learners to develop and focus their self-directed efforts and facilitate learning.</li> </ul>
<p>Adults have preferences for the way in which they learn</p>	<ul style="list-style-type: none"> <li>– Acceptance that not all learners respond to a given teaching method or technique.</li> <li>– Providing a customized learning approach according to learners need and developing the appropriate learning strategy.</li> <li>– Use of a wide variety of methods corresponding to all learners' preferences in training delivery.</li> <li>– Make trainers aware of their own learning preferences.</li> </ul>
<p>Adults learn best through collaboration and reciprocity. An environment where people learn with others while sharing what they already know</p>	<ul style="list-style-type: none"> <li>– Low-risk environment for learning should be provided, capitalizing the different levels of knowledge and skills within the learning groups.</li> <li>– The learners' self-esteem should be strengthened through team-based learning on mutual trust and respect.</li> </ul>
<p>Adults are motivated to learn by a wide variety of factors</p>	<ul style="list-style-type: none"> <li>– Adults are motivated by a variety of factors such as personal aspirations, expectations, internal desire or interest, escape from a situation.</li> <li>– Adults need internal motivation for learning rather than external.</li> <li>– Learning should respond to their needs, interests and real-life problems, in other words, be meaningful and relevant.</li> <li>– Relevance is the key factor to motivation so it is important to inquire into the reasons why participants are interested in learning.</li> <li>– The learners should be invited to identify the link between learning and satisfaction of their personal needs.</li> </ul>

	<ul style="list-style-type: none"> <li>– A connection should be made between the learning content and the long term objectives of each learner, in work and life.</li> </ul>
Adults learners are goal oriented, relevancy oriented and practical	<ul style="list-style-type: none"> <li>– Learners should be asked to identify what they would like to learn.</li> <li>– Clear learning objectives should be established and it should be explained how they relate to training activities.</li> <li>– Learners should be engaged in identifying the challenges they face and the value of addressing these challenges.</li> <li>– Training must show relevance to the job or other interests.</li> <li>– Learning has to be applicable to adult work duties or other responsibilities and focus on practical skills, tools, methods.</li> <li>– Opportunities should be given to trainees to apply the knowledge to practical skills and use methods to solve problems.</li> </ul>
Adult learners need to be respected and learn in an appropriate learning environment	<ul style="list-style-type: none"> <li>– Respect, trust and acceptance are vital for successful adult training.</li> <li>– Learners need to feel safe in order to participate freely, take initiatives, experiment, and express themselves.</li> <li>– Mistakes have to be viewed and used as improvement aids and not as failures.</li> <li>– Creativity and an agreeable atmosphere are important, but they have to be balanced with cognitive achievements, stability, and clarity of purpose.</li> <li>– The wealth of knowledge and experiences the participants bring to training should be acknowledged.</li> <li>– Learners should be treated as equals.</li> <li>– The participants should be allowed to voice their opinions freely.</li> </ul>
Adult prefer active learning	<ul style="list-style-type: none"> <li>– The more actively engaged the learner is, the more learning takes place.</li> <li>– Different training methodology and techniques have greater rate of retention.</li> </ul>
Adults want guidance	<ul style="list-style-type: none"> <li>– Adults want information that will help them to improve their situation.</li> <li>– Adults do not want to be told what to do, but they want</li> </ul>

<p>Adults have different learning styles</p>	<p>to choose options based on their needs.</p> <ul style="list-style-type: none"> <li>– Every individual has his/her own learning style depending on the preferred perception channel - visual, auditory, or kinaesthetic.</li> <li>– Techniques appropriate for all types of learners should be used and combined in such a way that different perception channels are employed.</li> <li>– There are also different personal learning styles referring to order, analysis level, abstraction and type of information presented and processed, that may be influenced either by the individual's personality and cognitive characteristics or by the educational system, cultural factors and professional specialization.</li> <li>– The learning styles preferred by each group of trainees should be found, in order for the learning experience to be modified accordingly.</li> </ul>
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### 3.3 Soft skills training principles

Even though there is lack of consensus on how to define soft skills [21], there is a common understanding that soft skills are the interpersonal human and behavioural skills needed by someone in order to apply technical skills and knowledge in the workplace [22]. Five categories of soft skills constructs have been identified by academics [23] such as communication skills, problem-solving and thinking skills, leadership and team working skills, ethical and moral values, and self-management. The EQAVET working group [21] suggested another typology introducing three interrelated categories of soft skills: a) communication skills, including aspects like oral communication and conversation, b) interpersonal skills, namely the ability to work in teams, relate to people, manage/mediate conflicts, discussions, negotiations and bargaining, and c) problem solving.

Given that soft skills have been positively linked to a strong performance level of professionalism, it is essential for the SEnDIng project to follow the common principles of soft skills training given below, as they have been detected in a broad literature review in order for the training to be successful [8, 21, 23].

- The success of training in soft skills depends on the facilitation of experts, the contextual awareness, and the provision of support, real-world application, self-study and self-awareness.

- Soft skills are more experienced-based and need to be reinforced throughout a person's lifetime. Their development is a dynamic process that needs to be refreshed over time to reflect on career and education changes.
- Active participation of learners, employees and employers is a guarantee that an intervention for soft skills development is "fit for purpose".
- Not everybody learns soft skills in the same way; active learning (cooperative learning, problem-based learning), transformative learning, and making meaning of learners' experiences through reflection, are important.
- Soft skills are imparted in small groups and innovative material is needed. Training material needs to integrate a number of sources in order to achieve real and impactful results and external providers are needed to be brought.
- Since behavioural change happens over long periods of time, individual soft skills development interventions or courses are not enough. Such interventions require multidisciplinary teams to create complex real-life scenarios and simulations.
- Tools should be used interactively, there must be interaction between heterogeneous groups, and learners should act autonomously.

### 3.4 ICT skills training principles

The variety of areas covered in SEnDIng training implies that the teaching approach should follow the principles for teaching ICT skills [12] such as:

- Embedding and integrated: learning should be related to the purposes and needs of learners. The development and application of ICT skills should be integrated with other subjects, workplace activities and wider interests.
- Personalization: each learner should be offered an individual programme with opportunities for progression.
- Active learning: active learning methods should be used to maintain motivation by ensuring that skills are applied in real and relevant contexts.
- Collaborative learning: encouraging collaborative learning whenever possible.

### 3.5 On-line training principles

Online training such as e-learning has been developed to provide cost-effective and improved learning experiences beyond those available in classrooms. It is about the delivery of all activities of education such as instructing, teaching and learning through various electronic media [10]. The appropriate instructional design, including the

selection of appropriate theories and principles, is very important to the success of e-learning.

The theory of constructivism has been widely used in e-learning environments [9]. Elements of constructivism such as the design of learning activities (collaboration, cooperation, multiple perspectives, real-world examples, scaffolding, self-reflection, multiple representations of ideas, and social negotiation), the learning assessment (instructor assessment, collaborative assessment, and self-assessment), and the role of the instructor (coaching, guiding, mentoring, acknowledging, providing feedback, and assessing student learning) have been included in the development of e-learning models.

The following pedagogic principles [11] have been suggested to be followed for successful e-learning provision:

- Match to the curriculum: there must be clear objectives, relevance to content covered, appropriateness of students' activities.
- Inclusion: inclusive practices should be seen in terms of different types and range of achievement, physical disabilities, different social and ethnic groups and gender.
- Learner engagement: learners should be engaged and motivated, activities should have a worthwhile educational aim, not just to occupy the learners, be enjoyable, not to produce adverse emotional reactions, improving the learning atmosphere.
- Effective learning: promoting personalized learning, learner autonomy; encouraging metacognitive thinking and collaboration, providing authentic learning exhibiting multiple perspectives on a topic.
- Provision of formative and summative assessment for the purposes of improving and grade learners.
- Coherence, consistency and transparency: objectives, content, activities, and assessment should match to each other. It should be clear to the user what to expect.
- Ease of use: being open and accessible, intuitive and not requiring guidance on use, providing appropriate guidance to learners of teachers.

### **3.6 WBL definitions and principles**

Work-based learning is one of the fundamental aspects of vocational training, since it is linked directly to the mission of vocational training and help learners to acquire knowledge, skills and competences which are very important in working life [13]. Generally speaking, work-based learning is a form of experiential learning [14] and

implies two characteristics, namely learning in a work context and learning through practice. It can be further understood as the model of learning through work, for work and at work [16]. It is often used in academic context as the educational strategy that combines traditional forms of education with work experiences, where theoretical and technical skills can be combined and applied. WBL is usually applied in school-based and vocational, educational and training programmes to develop basic work habits, occupational identity and specific occupational competences [14]. Through WBL the learners not only acquire specific skills and competences, but also enhance their ability to develop meta-competence and learning to learn skills [16].

The three main models of work-based learning are apprenticeships, on-the-job training periods in companies, as well as WBL integrated into a school-based programme.

**Apprenticeships**, known as “dual system” are often defined as “systematic long-term training alternative periods at the workplace and in an educational institution or training center” [13]. Learners spend a significant time in companies acquiring general and work-related knowledge and skills and often key competences [13].

The model of **on-the-job training** typically covers internships, work placements, traineeships or in-company training, which are incorporated as compulsory or optional elements of VET programmes leading to formal qualifications [13].

The third model is **WBL that is integrated into a school-based programme**, mainly through on-site labs, workshops, simulations or real business/industry project assignments. The aim of this model is to create real-life work environments, establish cooperation with companies and develop entrepreneurship competences [13].

Across Europe terminology and definition regarding WBL are still varying, and many countries combine the aforementioned three general models.

WBL benefits all parties involved. The following table summarizes these benefits, under the scope of providing WBL for the up-skilling of employees [13, 14, 15].

Learner	<ul style="list-style-type: none"> <li>– Development of deep professional expertise</li> <li>– Build hard skills, soft skills, as well as other competences and behaviours</li> <li>– Development of carrier managements skills</li> <li>– Career improvements</li> <li>– Improve self-confidence, socialization and motivation</li> <li>– Fostering entrepreneurial skills</li> </ul>
Employers	<ul style="list-style-type: none"> <li>– Address skills gaps through tailor-made training</li> <li>– Improve productivity, innovation and performance</li> </ul>

	<ul style="list-style-type: none"> <li>– Positive effects on staff development</li> <li>– Enhanced corporate image</li> <li>– Staff retention and work satisfaction</li> <li>– Recruitment impact</li> </ul>
VET	<ul style="list-style-type: none"> <li>– Improved attractiveness of VET programmes</li> <li>– Better quality of VET programmes and learning outcomes</li> <li>– Enhancement of relevance and responsiveness of VET</li> <li>– Positive effect on teaching staff competences and development</li> <li>– Better cooperation between VET and businesses</li> </ul>
Society	<ul style="list-style-type: none"> <li>– Skilled labour force that corresponds better to the labour markets' needs</li> <li>– Cost-sharing of VET between the state and the employers</li> <li>– Contribution to innovation and creativity</li> <li>– Strengthening of social inclusion and improvement of equal opportunities</li> <li>– Increased employability</li> </ul>

The following pedagogical and organizational options should be taken into account for successful work-based learning [14, 16]:

- There are many practices that may increase the extent to which work is learnt, such as: encouraging people to reflect on their experience; guidance provided by other workers and/or experts; mentoring; demonstration and practice; simulation; task rotation and task variety; project work; provision of problems to be solved.
- The extent to which employees–learners perceive their job to be meaningful, as well as the sense of progress and accomplishment within a WBL context, influences the learning process.
- The role of employers is crucial since they must devote some of the staff time to planning the learning process, assessment and review, supervision and training.
- The role of supervisors is crucial for the implementation of WBL. They should realize that developing the knowledge, skills and expertise of workers is part of their normal job tasks; and this role must be cultivated as part of the organizational culture. Mutual respect and a collaborative attitude are also crucial.
- Constructive feedback from supervisors, trainers, mentors, co-workers, and support are very important in the learning process.

- Supervisors or in-company trainers should be trained, in order to be able to help and interact with and manage the trainees under their supervision. They should have the required pedagogical and personal skills to support WBL.
- The complexity of the job influences the learning process and potential.
- The allocation of work is also important in stimulating learning; the learning process is affected by the way the tasks are allocated and work is organized. The opportunity to learn at work depends on the daily scheduling of normal work tasks and the production cycle. If such an opportunity is not offered, extra arrangements should be made between the enterprises and the training organizations.
- Encouraging progress and recognizing it stimulates the learning process. The working environment must also be organized in a way so as to encourage learners to take responsibilities and resolve problems by themselves.
- In small and medium-sized enterprises it is difficult to promote and improve the quality of WBL. In these cases the support or assistance of external expertise is valuable; such support could be coaching and training for in-company supervisors or the development of competency lists and learning guides. This expertise could be provided by VET practitioners.
- Practical methods of translating experience into learning could be a key challenge for improving the quality of WBL.

## **4 Recommended training methodology for face to face training**

### **4.1 Recommended training methods and techniques**

In accordance with the theoretical training methodology background presented before, the training methods and techniques recommended for the SEnDIng training courses are selected with respect to content and duration of the face to face training and the desired learning outcomes.

More specific, the training methods [1]:

1. Promote experiential, collaborative, active, transformational and self-directed learning.
2. Address all perception channels (visual, auditory and kinaesthetic) and cater for different learning styles, when used in combination.

3. Are differentiated according to the learning activity type: a) *Exploitation activities* reveal existing representations, experience and knowledge, provide reflection and critical thinking, and lead to the realization of training or reconstruction needs. b) *Presentation of information* provides new material for the construction of new schemes, knowledge, attitudes and skills in harmony with the desired learning outcomes. c) *Application in practice* leads to the acquisition and consolidation of new skills, competences and experiences.

The trainer, while determining the frequency and the extent to which each teaching technique will be used, has to take into account the unique characteristics of each learner group and the learning styles of the learners involved. Training techniques can be added or omitted according to the needs.

The training techniques per learning activity recommended for the module of soft (or transversal) skills are presented in the following table. The underlined ones are proposed for the purposes of SEnDIng training. Their use is not obligatory; it depends on the needs of the learners and the choices of the trainers:

<b>Exploration</b>	<b>Presentation of information</b>	<b>Application in practice</b>
Representation exercises <u>Memory activation</u> <u>Questions</u> <u>Reflection</u> <u>Brainstorming</u> <u>Self-observation</u> <u>Group activities</u> <u>Group discussion</u> Self-assessment theory/paper critiquing	<u>Lecture</u> Demonstration Use of multimedia Flipped learning <u>Support with handbooks or other material</u> Interview/lecture from expert Self-study Learning platform <u>Group discussion</u>	<u>Brainstorming</u> <u>Role-play</u> Simulation <u>Exercises</u> <u>Case study</u> Experimenting <u>Working in teams</u> <u>Teambuilding and groups activities</u> Presentation by learner Peer learning Workshops Moral dilemma exercises <u>Self-assessment</u> <u>Reflection</u> Individual coaching session <u>Action plan</u> Concept writing

## 5 Recommended training methodology for on-line ICT training

### 5.1 Recommended training methods and techniques

In accordance with the theoretical training methodology background presented before, the training methods and techniques recommended for the delivery of SEnDIng online training are the following:

- **Self-paced online training.** Self-paced online training has many advantages. It is highly flexible, which makes participation to the training easy. This is critical, as the main beneficiaries of SEnDIng training are ICT professionals who are likely to have strict work obligations, so flexibility is key for them. Furthermore, self-paced online training can also improve learning retention, as the learners often retain content better when they have time to absorb concepts between lessons. Additional benefits exist, after the completion of the course, as it continues to be a great reference tool when questions will arise during WBL or on the job.
- **Asynchronous online training** to promote learner autonomy. Asynchronous events are time-independent, so each learner is able to participate in the online training according to his/her program. A self-paced course is an example of asynchronous Learning because online learning can take place at any time.
- **Learner-centred content.** Learner-centred content presents many benefits. It provides self-reflection opportunities, as the learners want to know, how information relates to and benefits them directly, enables personalization and responds to individuals' needs. So, the online Open Educational Resources should be relevant and specific to learner's needs and responsibilities in professional life.
- **Personalization** to promote effective learning. Self-study courses should be customizable to reflect learner's interests and needs. In addition, learners should be able to build their own customized learning path, as when you allow your learners to choose what they want to learn, they feel valued.

## 6 Recommended training methodology for WBL

### 6.1 Forms of WBL adopted by SENDING

For the purposes of SEnDIng training the model of WBL that is going to be adopted is the "On the job training" (OJT) and more specifically in-company training or in other words learning at work, which means acquiring knowledge, skills and competences by doing a job and by reflecting on the experience.

OJT is the process of helping people to learn in planned ways at the workplace [17]; it is an approach of training based on regular work and aims at the development of skills,

knowledge and competences that are needed in a specific job or work settings. OJT is tailored to the requirements of the workplace; it may be structured or unstructured [20].

In SEnDIng, structured OJT is going to be employed. Structured training implies the use of standardized training materials, processes, trained trainers and performance checklists [20], ensuring consistency and accountability. There is no one right way to implement a structured OJT but some characteristics should be reflected such as management support, trainers support process, checklists, OJT training materials, training of trainers and reporting [20].

The training activities which will result in learning through the model of OJT in the frame of SEnDIng will be planned and be both general and specific such as [17]:

- planned activities resulting in guiding what an employee-learner has to do and learn (e.g. special assignments and/or job rotation that increase general knowledge of certain operational areas),
- carefully structured approaches, such as using specific software to train learners and develop skilled workers.

Useful learning activities that might be carried out on the spot will also be exploited as good opportunities for learning.

OJT embodies many advantages for both trainees-employees and employers. Learning by executing work tasks in real workplace enables employees to develop specific professional expertise, transversal skills and improve their confidence in an easy way for them. For employers, OJT is a flexible cost-effective training method, that can be easily adjusted to the needs of their company and contribute to competitive advantages, improvement of quality, greater productivity, transfer of training, development of desired attitudes and rapid results.

## 6.2 Recommended training methods and techniques

The phases of the implementation of OJT in the frame of SEnDIng are [18, 19]:

- a) Information and agreement between all the partners involved (enterprise, training provider and employee/trainee) regarding the detailed description of OJT, and preparation of the training. At this stage:
  - The training provider has to prepare a detailed task description; a checklist of the tasks that need to be trained; administration information such as lesson plans and schedule; adjustment of all the aforementioned in collaboration with the enterprises. All this information will be enclosed into a training guide.

- The training provider has also to prepare a core OJT training material based on the learning outcomes.
- Each company involved will go through the aforementioned OJT plan and material and suggest any adaptations, inform the trainees-employees and the rest of the staff about the training, and assign a supervisor. The supervisors will be the ones responsible for the day to day implementation of OJT, and prepare the relevant climate as well as establish the priorities that will enable the smooth and effective implementation of OJT.
- Each company will select in-company trainers based on their professional and personal skills as well as their desire to train.

b) Implementation and evaluation of training. At this stage:

- The companies through the supervisors will involve the trainees according to the task description and break the procedure down into steps.
- The in-company trainers, based on the training guide tasks and training material, will implement the training, explaining to the employees-trainees what they are required to do and why, let them perform the required tasks autonomously, give them time to replicate tasks, observe carefully without interfering if it is not necessary, provide constructive feedback and guide them to adjust their performance. They will also adapt or provide additional training material if needed.
- Training providers of the consortium will provide support to the trainers and individual coaching.
- Each trainee has to comply with the training and evaluation rules and respect the tasks assigned, as well as to cooperate with the in-company trainer.
- The supervisors and in-company trainers have to perform the tasks assigned to them and report progress, as well as to communicate with the training organization.

There are many techniques [17] that have been proposed to be used in training at workplaces such as:

- **Basic techniques:** relatively simple techniques, such as giving feedback about performance, consultation, modelling, supervision, observation, learning by doing, demonstration.

- **Meta-techniques:** making use of the basic techniques and further involving one-to-one relationships between the trainer and the learner such as mentoring, coaching, counselling, peer training, job instruction training.
- **Organized activities** such as job rotation, quality circles, case studies.
- **Media-based techniques,** such as computer-assisted learning, e-learning, reading.
- **Other techniques,** such as action learning, briefings, consultants, delegation, find-out-yourself, meetings, unplanned opportunities.

The following techniques are proposed for the purposes of WBL in the frame of SEnDIng training courses:

### **Case Study**

This behavioural technique focuses on problem analysis and solving and requires the active involvement of trainees. Trainees are given a description of a situation and are asked to come to decision or solve a problem. This can be done in small groups or individually. Trainers need to provide the ideal solution and be open to assess and discuss solutions proposed by trainees. This technique is particularly useful if the cases reflect real work situations and daily concerns. By this way, trainees can learn how to analyse and solve problems on an actual base. Moreover, the trainees learn the importance of accepting the opinions of others. Case studies will be developed by the involved project partners and be adopted by in-company trainers, according to the companies and the trainees' needs.

### **Supervision**

The main objective of supervision [18], as used in SEnDIng training courses, is to assist trainees in developing the professional skills and competences described by the learning outcomes. Trainees are guided in developing their competences, role awareness, and effective working methods, according to their developmental level. An essential element of supervision is to teach task and problem analysis. Through this process, trainees gain the necessary motivation, autonomy and self-awareness to successfully move to the next level of professional development. Supervision provided by SEnDIng will have the following characteristics: a) establishes clear performance objectives and promotes quality standards, b) focuses on problem-solving and monitoring performance objectives, c) enables trainees to continuously improve their own performance, d) provides feedback and recommendations, e) motivates and empowers, f) encourages participatory decision making. Effective supervision leads to higher-quality services, enhanced productivity, as well as to employees with a wider range of skills and increased ability to function with

autonomy. In SEnDIng, supervision can play a significant role in the professional development of trainees, not only in terms of technical skills but also in developing transversal skills. Supervision will be held both individually and in groups of trainees.

### **Coaching**

Coaching focuses on the individual's needs and accomplishments providing encouraging feedback and suggestions to improve performance [19]. It is a collaborative solution-focused, results-orientated and systematic process in which the trainer facilitates the enhancement of work performance, self-directed learning and personal growth of the trainee [18]. According to a comparative review [18] coaching appears to be effective during formative education, encouraging motivation and developing skills related to reflection and critical thinking. Coaching will be used in SEnDIng to assist trainees to develop technical and transversal skills. Trainers will work directly with the trainees in individual sessions on regular basis. In line with the desired learning outcomes and according to the trainees' individual needs the trainers will agree with the trainees on a set of tangible and well-defined goals according to the acquisition of skills.

The in-company trainers will determine the frequency and the extent of OJT training techniques, taking into account the unique characteristics of each learner or learner group, the learning styles of the learners involved and the enterprises' needs. Training techniques can be added or omitted according to the needs. Trainers could also use more techniques, such as basic techniques, meta-techniques, organized activities, media-based techniques or other techniques.

There are also some additional elements that could strengthen the trainees' support [19]

- One-to-one feedback sessions
- Individual consultations
- Group discussions, managed on a regular basis
- Consultation in informal settings, e.g. lunch
- Coaching and mentoring in combination with self-managed learning

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