
Contract Number: 2018-1-ES01-KA203-050887

Title of Contract: “Online training course on design, of human-centred workplaces”

Acronym: TRAIN4HCWORK

Intellectual Output 1

Curriculum

Prepared by:

Partner	Name	Date
UGA, IBV, IAD, FEES		30-07-2019

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Work Package	W2	Intellectual Output	IO1
Title	Curriculum		
Type of outputs/ products/ results	Report		
Delivery date	Month 6	Dissemination level	<input checked="" type="checkbox"/> Public <input type="checkbox"/> Restricted to other program participants (including Commission services and project reviewers) <input type="checkbox"/> Confidential, only for members of the consortium (including EACEA and Commission services and project reviewers)
Executive Summary			
<p>This document describes the intended structure, content and administrative arrangements for a training programme responding to the specific needs of professionals engaged in TRAIN4HCWORK.</p>			

Table of contents

TABLE OF CONTENTS.....	2
1 INTRODUCTION.....	3
2 LEARNING METHODOLOGY	4
2.1 Course general resources section.....	4
2.2 'Before you begin' section	4
2.3 Course structure	4
2.4 Implementation of the online course.....	7
2.4.1 Access to the online course	7
2.4.2 Didactic units.....	7
2.4.3 Reinforcement activities	8
2.4.4 Self-evaluation tests.....	8
2.4.5 Final examination	8
2.4.6 Duration of the online course	8
2.4.7 Grades	8
2.4.8 Course certificate	9
3 VET CURRICULUM.....	10
3.1 GENERAL STRUCTURE	11
3.2 TOPICS AND OBJECTIVES PER SESSION.....	12
APPENDIX I_ RECOGNITION FRAMEWORK.....	22
APPENDIX II_ REPORT ON TRAINING REQUIREMENTS	59
APPENDIX II-A.....	65
APPENDIX II-B.....	69
APPENDIX II-C.....	73
APPENDIX II-D.....	76
APPENDIX II-E	79
APPENDIX II-F	85

1 INTRODUCTION

This document represents Intellectual Output IO.1- *Curriculum* of work package WP2.- *Definition of the curriculum* of the ERASMUS+ project TRAIN4HCWORK. The objectives of TRAIN4HCWORK are to implement and set the basis for a European dissemination of a new online course focused on the ergonomic design of human-centred workplaces. Training contents should cover some important issues for a human-centred design, integrating knowledge in ergonomics, health and safety at work and productivity.

This report contains information relating the online course that will be developed and implemented in this project. The main resources, online learning methodology and course structure has been proposed. The contents have been organized in different modules and sessions, describing the information that participants will receive in each one, as well as the main objectives of them.

The information included in this document reflects as well the activities performed to extract, gather and analyse the training preferences and specific needs of target users at European Union level.

2 LEARNING METHODOLOGY

2.1 Course general resources section

The participant will find the following general resources for the online course:

- **A bulletin board and news:** where the facilitator reminds participants important dates for the course, and any news of interest.
- **The forum of the online course:** with the participation of the teacher and the facilitator of the course to answer all questions and inquiries from participants.
- **Library:** a collection of resources selected by the teacher of the course.
- **Utilities:** selection of applications and software that may be required for the participant to follow the course (unzip, PDF and documents viewers, etc.).

2.2 'Before you begin' section

This section is designed for participants to review it before starting the online course. Section consists of the following:

- **FAQ:** is a collection of answers to questions most often raised by most participants on the operation of the online platform. This section will be periodically updated as comments and feedback from users is generated.
- **Teaching Guide:** a document specifically developed for each course, which contains all the information needed by the participants to get the most out of their efforts. This section is organized as follows: *introduction, objectives, agenda, timing, methodology, resources, teaching and assessment team.*

2.3 Course structure

The online course is divided into 5 modules. Each module is divided into sessions, which correspond to learning units that will have a duration of 30 minutes to 60 minutes, plus the reinforcement activities and other resources. Each work session starts with a short section in which its main objectives are stated. This section is followed by the corresponding didactic unit and ends with a summary of the key ideas learned during the session. The sessions are presented in audio-visual format and complemented (if necessary) with pdf information.

By the end of each session, a reinforcement activity could be completed by the participant using the online platform. This activity consists of an exercise automatically corrected by the system and the results are reported to both, the participant and the course facilitator.

When the participant has finished all the sessions of the module, he or she must complete the self-evaluation test. The participant must pass the tests corresponding to all the modules before doing the final examination that will be necessary for the participant to get the corresponding qualifications or certificate.

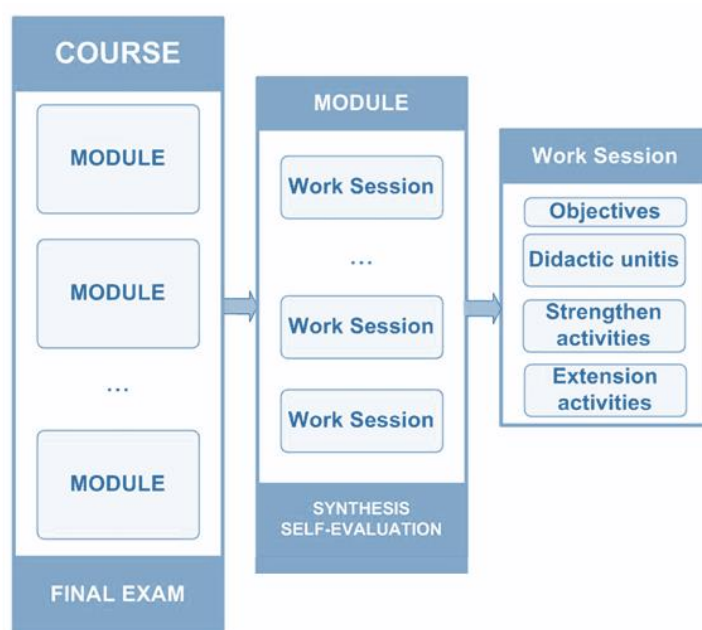


Figure 1.- Online course structure.

The structure of a **working session** will be the following one:

- **To begin:** This is a brief presentation (or summary) to introduce the participant about the main topics of the session. This is normally a plain text with ideas, thoughts, etc. It may also include activities, links or external documents to provoke a participant for reflexion. The previous ideas can also have a specific question, and the answer to this question can be shared with the other participants and provoke a debate into the course forum.
- **Teaching unit:** multimedia material combined with pdf documents (if necessary) containing the main topics to study. It is divided into:
 - **Objectives:** are the learning objectives of the **working sessions**,
 - **Topics:** are the main contents developed by the teacher,
 - **Key ideas:** they are the fundamental concepts emphasized by the teacher to be discussed in the session.
- **Activities:** Each work session includes a series of exercises for the participant to consolidate the knowledge acquired by putting them into practice.

The general structure of each **topic** will include some of the following **pedagogical resources**:

- **Bibliography and references.** Each unit will include both, references and additional bibliography recommended to expand the reading. The online structure of the course will permit that the citing is dynamic and each cite can lead to its reference.
- **Images, illustrations and videos.** All the contents will be widely improved and explained with images, tables, graphs and videos. That will allow to not only explain and expand some

concepts treated in the session, but also to ease the understanding and insert pauses in the process of studying.

- **Insertions.** To reinforce the content, each unit may have specific insertions. The main insertions considered for the course are the following ones:
 - **Concept.** Important concepts or cites.
 - **Examples.**
 - **Remark boxes.** Useful to emphasize or summarize some important concept that you have previously developed.
 - **Enlargement of concepts.** Additional information, that is not strictly necessary, but that can enlarge the knowledge about one particular topic.

All working sessions have the same structure of content, except the last session of each module, the session named "To finish". These sessions can contain the following items:

- **To learn more:** A space to expand knowledge about the topics covered in the module.
- **Glossary:** A space where the participant can study the most important concepts explained during the module.
- **Facts and figures:** quantitative and/or qualitative evidence that can support participants by facilitating the application of concepts and ideas to practical cases, or their transfer across different contexts and domains.
- **The forum of key ideas:** In this forum, the participant may present to the rest of the group the most important aspects learnt during the module in order to summarize them and obtain a list of key ideas.
- **Self-assessment questionnaire:** At the end of a module, the participant could pass an assessment or fulfil a questionnaire to move to the next module. The participant can undertake the assessment as many times as he or she wants. The system will display their successes and mistakes and give information about what content should be reviewed based on their answers. However, this assessment or questionnaire will not be considered as a GO/NOGO evaluation performed to make the other modules available.
- **Multimedia materials:** a collection of multimedia resources showing in graphical way the contents described during the module.

When the participant starts the online course, he or she will obtain help from two external experts:

- **Academic tutors:** They are members of the organizations involved in the creation of the learning contents, and solve academic doubts or questions from participants in the course. In addition, they have a dynamic participation in the different communication channels available for the participants: forum, conversations and electronic mail. Their mission is to create a collaborative learning environment, offering the participants support and orientation.
- **Facilitator:** Acts as a link between the participants and the tutors and technicians of the course. Each partner will appoint a facilitator who will communicate with the participants in the course

in their native language and with IBV in English. The facilitator guides the participants along the development of the course, tracking their advance and providing diverse information (welcome message, instructions, reminders, qualifications, etc.).

After performing the e-learning course, the participant has to pass a final examination in order to obtain the Certificate of Completion of the course.

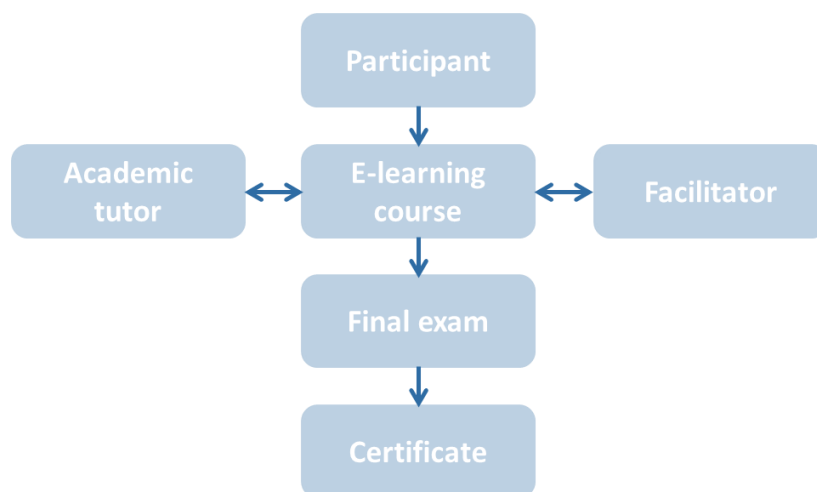


Figure 2.- Overview of the online course with certificate

2.4 Implementation of the online course

2.4.1 Access to the online course

The application will be placed on the telematic platform of the IBV (*Virtual Campus IBV* <https://campus.ibv.org>). In order to access the online course, the user must identify him- or herself introducing the passwords that will be provided after their enrolment in the course. The application will be available on laptop as well as on smartphone.

2.4.2 Didactic units

According to the defined modules and sessions, the didactical material will be compiled and classified. Each session will be developed using Multimedia materials using Moodle as training platform.

The Didactic Units will be developed in audio-visual format, which will include all the topics of each session.

If necessary, the audio-visual content can be reinforced with additional information in pdf format.

The duration of each video will not be higher than 10 minutes, and each session will include two videos of 10 minutes each one as maximum.

The structure of the Didactic Unit will be the following:

- Index
- Learning Objectives
- Topics: Unit 1, Unit 2...
- Key ideas

- Bibliography

To develop videos each partner will use a Power Point presentation template, and will record an individual audio file for each slide.

2.4.3 Reinforcement activities

The different activities included in each work session will be included and programmed within the online application so that they are automatically corrected, and as a result, the correct answers are displayed. These activities consist of several questions in which the participant must complete multiple-choice tests, match images with the corresponding definitions, etc.

2.4.4 Self-evaluation tests

Before starting or finishing or finishing a module, a self-evaluation test will be performed. The self-evaluation tests will be normally questions of 3 or 4 answers, where the user must select the correct one. When finished the test, the application will correct it automatically and will show the mark obtained.

2.4.5 Final examination

After finishing the course, the last step is to take the final examination. It will consist of questions for every module, where the user must select the correct answer. The final examination will be available to the user at any time but time to complete it will be limited. That means that the user will have to study for passing it if he or she wants to complete it before finishing in time.

2.4.6 Duration of the online course

The time needed to complete the entire online course has been estimated in 60 hours (58 hours + 2 hours self-assessment to be completed in a period of 12 weeks). A calendar will be prepared as a help for the users to finish the course on time. Depending on the extension and number of sessions of each module, the calendar will suggest the number of days needed to study them. As explained in the previous section, the final examination will be performed the last day of the course.

2.4.7 Grades

A final mark will be calculated from the results of the final examination, as well as from the self-evaluation tests and reinforcement activities of each module.

The following points summarize the grading system:

- The 60% of the global grade corresponds to the result of the final exam, and the remaining 40% corresponds to the score obtained from the seven modules.
- According to the importance of the different modules, each one has a different weight:
 - Module 1: 8%
 - Module 2: 20%
 - Module 3: 28%
 - Module 4: 16%
 - Module 5: 28%

The mark obtained for each module is calculated as the weighted sum of the marks obtained in the activity and the self-evaluation test (both are graded from 0 to 10). These weights are:

- Reinforcement activities: 50%
- Self-evaluation test: 50%

The results of the exam and self-evaluation tests are graded from 0 to 10. The contribution of each mark to the global grade is calculated by multiplying this by the assigned weight.

2.4.8 Course certificate

After doing all the modules and passing the final exam, the user will get a Certificate of Completion of the course.

The Certificate of Completion will contain a description of the learning outcomes (knowledge, skills and competences) acquired by the participant once he had completed the course.

3 VET curriculum

The TRAIN4HCWORK course proposes a structure organized by areas or disciplines (Anthropometry, Biomechanics, Mental and Environment) being each one divided into 4 levels:

- Definition and concepts
- Influence on the design of the workplace
- Analysis and measurement methods and tools
- Simulation tools

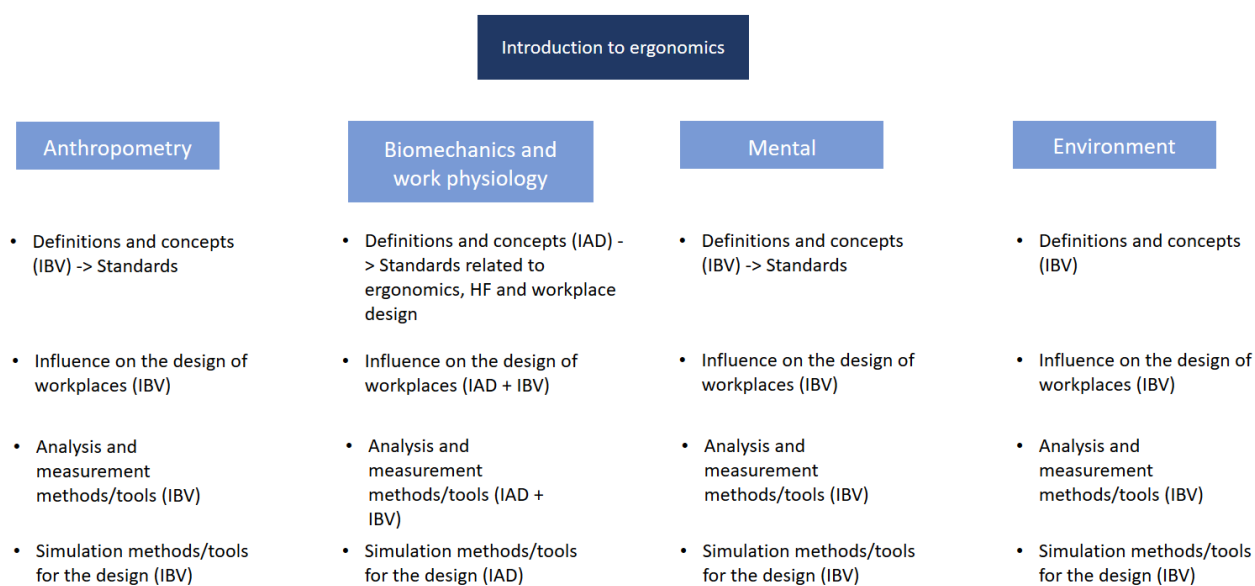


Figure 3. TRAIN4HCWORK course structure.

3.1 GENERAL STRUCTURE:

Module 1: introduction and importance of ergonomics & human factors.

- Session 1: Introduction to ergonomics & human factors.
- Session 2: Importance of ergonomics in work design process (human and economic aspects).

Module 2: Anthropometry.

- Session 1: Definitions and concepts.
- Session 2: Influence on the design of workplaces.
- Session 3: Analysis and measurement methods and tools.
- Session 4: Simulation tools for the design.
- Session 5: Practical example.

Module 3: Biomechanics and work physiology.

- Session 1: Definitions and concepts of analysis of physical workload.
- Session 2: Influence on the design of workplaces (I). Ergonomic criteria. General recommendations.
- Session 3: Influence on the design of workplaces (II). Recommendations related to workload and integration of productivity and human-centred manufacturing.
- Session 4: Analysis and measurement methods and tools (I). Methods and tools for ergonomic analysis & risk assessment related to physical workload on workplaces and production lines (e.g. NIOSH, EAWS; examples of analysis).
- Session 5: Analysis and measurement methods and tools (II). Tools for ergonomic workloads assessment and redesign (e.g. Ergo/IBV).
- Session 6: Practical example.
- Session 7: Simulation methods and tools for the design.

Module 4: Mental workload.

- Session 1: Definitions and concepts.
- Session 2: Influence on the design of workplaces and human reliability.
- Session 3: Measurement methods and simulation tools.
- Session 4: Practical example.

Module 5: Environmental conditions.

- Session 1: Visual comfort (I). Definitions and concepts, and influence on the design of workplaces.
- Session 2: Visual comfort (II). Measurement methods and simulation tools.
- Session 3: Acoustic comfort (I). Definitions and concepts, and influence on the design of workplaces.
- Session 4: Acoustic comfort (II). Measurement methods.
- Session 5: Thermal comfort (I). Definitions and concepts, and influence on the design of workplaces.
- Session 6: Thermal comfort (II). Measurement methods and simulation tools.
- Session 7: Practical example.

25 WORKING SESSIONS + 5 "TO FINISH AND SELF-EVALUATION" SESSION (NOT INCLUDED)

3.2 TOPICS AND OBJECTIVES PER SESSION

MODULE 1: INTRODUCTION AND IMPORTANCE OF ERGONOMICS

Session 1: Introduction to ergonomics & human factors

Topics

In this introductory session, the participant is going to know the concept and objectives of ergonomics. Furthermore, this session addresses the necessity to take into account the ergonomic approach when designing products and jobs.

Objectives

- ✓ *To understand what ergonomics is.*
- ✓ *To know which are the sciences that inspire it.*
- ✓ *To learn the main areas in which ergonomics acts.*

Session 2: Importance of ergonomics in work design process

Topics

This session addresses the importance of the ergonomic approach in the workplace and indicates the consequences of not applying it (musculoskeletal disorders & diseases, accidents, sick leave, absenteeism, errors and production losses, quality failures, etc.)

Objectives

- ✓ *To understand the necessity to take into account ergonomic approach in design.*
- ✓ *To know the statistics and figures of injuries (diseases & disorders), accidents and losses of working days that are associated to poor ergonomics.*

Session 3: To finish and self-evaluation test

MODULE 2: ANTHROPOMETRY

Session 1: definitions and concepts

Topics

In this starting session, the participant is going to know the definition and objective of anthropometry applied to the design of workplaces, what are the main body dimensions related to design of workstations and elements of these.

Objectives

- ✓ *To become familiar with terms and concepts used in anthropometry.*
- ✓ *To learn the main body dimensions related to design of workplaces.*

- ✓ *To recognize the consequences of no consideration of anthropometry in the design.*
- ✓ *To know the international standards related to this topic.*

Session 2: influence on the design of workplaces

Topics

In this session, the participant is going to know the ergonomic criteria to be considered in the design of the workplaces about body dimensions. This session addresses the main strategies to follow in the design of elements of the workplace and the types of relationships that can be established between the dimensions of the workers and the main dimensions of the elements of the workstation. The participant will also learn what the standards say in this regard.

Objectives

- ✓ *To learn the ergonomic criteria and general recommendations about body dimensions based on heights, reaches, spaces and clearances.*
- ✓ *To know the strategies to follow in the anthropometric design.*
- ✓ *To understand the relationships that can be established between the dimensions of the users and these elements.*
- ✓ *To know the anthropometric aspects to be considered about older workers in design.*

Session 3: analysis and measurement methods/tools.

Topics

In this session, the participant is going to know how anthropometric population or individual studies are done, what are the main tools for register anthropometric data, and the standards related. Some anthropometric tools and studies will be presented.

Objectives

- ✓ *To know how anthropometric data are obtained.*
- ✓ *To expose different existing technologies and tools, from manual instruments to 4D scanners.*
- ✓ *To know anthropometric data sources available.*

Session 4: simulation tools for the design

Topics

This session addresses some existing tools related to the anthropometric design of workstations and elements (e.g. RAMSIS, Ergo/IBV).

Objectives

- ✓ *To know some tools that allow integrating the anthropometry in the design, simulating during the first phases of the design how will be the relations between the dimensions of the user and their future position.*

Session 5: practical example

Topics

In this session, the participant is going to know and understand a practical example where design solutions for ergonomic improvement are proposed. The criteria to be used and how to apply them are also explained.

Objectives

- ✓ *To present a design problem.*
- ✓ *To analyse an example of ergonomic design.*
- ✓ *To know solutions proposed for the ergonomic improvement of the workplace.*

Session 6: To finish and self-evaluation test

MODULE 3: BIOMECHANICS AND WORK PHYSIOLOGY

Session 1: definitions and concepts of analysis of physical workload

Topics

In this session, the learner/ user is going to know the main concepts and ergonomic principles related to work system in production and physical workload (working posture, action forces, manual material handling). The learner will also study the international regulation documents, ISO and EC standards related to assessment of physical stress and physiological strain

Objectives

- ✓ *To learn the concept of work system and the elements, that must be considered related to physical work load during the design of production /industrial work systems.*
- ✓ *To learn the main concepts (e.g. stress-strain-concept) and factors that must be considered related to physical work load during the design of workplaces and working tools*
- ✓ *To know the international regulation documents, standards related to the topic.*

Session 2: influence on the design of workplaces (i). ergonomic criteria. general recommendations

Topics

In this session, the participant is going to know the ergonomic criteria to be considered in the design of the workplaces based on body postures, movements and efforts. The participant will also learn what the standards say in this regard.

Objectives

- ✓ *To learn the main work postures, their advantages and disadvantages.*
- ✓ *To study a method to determine the main work posture.*
- ✓ *To know the ergonomic criteria regarding the positions of the different body segments.*

- ✓ *To know ergonomic criteria regarding the movements at the workplace.*
- ✓ *To define the types of effort and general recommendations regarding these in different tasks and elements.*
- ✓ *To present some limit values.*
- ✓ *To define the effort aspects to be considered with older workers in workstation design.*

Session 3: influence on the design of workplaces (ii)

Topics

In this session, the learner/user is going to know and to understand the main biomechanical and physiological factors related to the design of workplaces with mainly physical workload (e.g. action forces, manual material handling, repetitive movements of upper extremities). Management and optimization of physical workload (overload and underload), focus on ergonomic measures and job/task design. The learner will also study the international regulation documents, ISO and EC standards related to analysis /assessment of physical workload

Objectives

- ✓ *To understand the analysis of workload deals with biomechanical factor action forces and ergonomic design measures.*
- ✓ *To understand the analysis of work load deals with manual material handling and ergonomic design measures*
- ✓ *To understand the analysis of work load deals with repetitive movements of upper extremities and ergonomic design measures*
- ✓ *To understand the management of physical work load on working places in production*
- ✓ *To define ergonomic recommendations (technical, organizational) related to physical workload and integration of productivity and human-centered manufacturing*
- ✓ *To define aspects to be considered with gender and older workers in workstation design.*

Session 4: analysis and measurement methods and tools (i)

Topics

This session addresses some existing methods and tools related to the ergonomic assessment of physical workload and redesign of workstations and elements (e.g. AAWS, EAWS).

Objectives

- ✓ *To know how aspects of physical workload (working postures, action forces, manual material handling, repetitive movements of upper extremities) can be assessed by using simple screening tools (e.g. AWSlight) or experts screening tools (e.g. EAWS)*
- ✓ *To know main principles how to apply the expert screening tool*
- ✓ *To know how to integrate the anthropometrical, biomechanical aspects to summarized score of physical workload.*
- ✓ *To know how the results of analysis/ assessment can be used to redesign the workplace, job, task.*
- ✓ *To know advantages and disadvantages some existing screening tools and measurement methods in the practice.*

Session 5: analysis and measurement methods and tools (ii). tools for ergonomic workloads assessment and redesign (e.g. ergo/ibv)

Topics

This session addresses some existing tools and examples related to the ergonomic workload assessment and redesign of workstations and elements (e.g. Ergo/IBV).

Objectives

- ✓ *To know how workload can be assessed and this analysis can be used to redesign the task.*
- ✓ *To present some existing tools.*

Session 6: practical example

Topics

In this session, the participant is going to know and understand a practical example where design solutions for ergonomic improvement are proposed. The criteria to be used and how to apply them are also explained.

Objectives

- ✓ *To present a design problem.*
- ✓ *To analyse an example of ergonomic assessment and design.*
- ✓ *To know solutions proposed for the ergonomic improvement of the workplace.*

Session 7: simulation methods and tools for the design

Topics

This session addresses some existing simulation methods and tools related to testing of design of workstations and elements in the planning phases related to anthropometric, biomechanical and physiological aspects (prototype making) (e.g. IMK-EMA-Tool).

Objectives

- ✓ *To know some simulating tools for human centered design process of workplaces and production lines that allow to perform the ergonomic analysis and design in the planning phase by developing of concepts for work place, work process*

Session 8: To finish and self-evaluation test

MODULE 4: MENTAL WORKLOAD

Session 1: definitions and concepts

Topics

In this session, the participant is going to know the main concepts and ergonomic principles related to cognitive and mental workload. The participant will also learn what the standards say in this regard.

Objectives

- ✓ *To learn some of the main concepts and factors that must be considered related to cognitive load during the design of workplaces.*
- ✓ *To know the international standards related to this topic.*

Session 2: influence on the design of workplaces

Topics

In this session, the participant is going to know and understand the main factors related with the design of workplaces (e.g. management of cognitive and attentional resources, cognitive overload and underload, focus on primary and secondary tasks, etc.). The participant will also learn what the standards say in this regard.

Objectives

- ✓ *To understand the management of cognitive and attentional resources.*
- ✓ *To define the cognitive aspects to be considered with older workers in workstation design.*

Session 3: measurement methods and simulation tools

This session addresses some general methodologies for the assessment of mental workload at workplaces. The participant will also learn some specific techniques for the measurement and registration of mental and emotional load through physiological signals, as well as behaviour.

Objectives

- ✓ *To know some general methodologies for the assessment of mental workload at work.*
- ✓ *To present some techniques to register and monitoring physiological signals related to mental, emotional and behavioural responses.*

Session 4: practical example

Topics

In this session, the participant is going to know a practical example of application of these register techniques to the design of environments.

Objectives

- ✓ *To present a design problem.*
- ✓ *To analyse the example.*
- ✓ *To know solutions proposed for the ergonomic improvement.*

Session 5: To finish and self-evaluation test

MODULE 5: ENVIRONMENTAL CONDITIONS

Session 1: visual comfort (i)

Topics

In this session, the participant is going to know and understand visual comfort concepts, and their influence on the design of workplaces.

Objectives

- ✓ *To introduce the concept of visual ergonomics and the factors that should be considered.*
- ✓ *To indicate the consequences and problems derived from inadequate lighting.*
- ✓ *To raise the importance of colour within visual ergonomics and the psychological effects that colour can have.*
- ✓ *To define the visual aspects to be considered with older workers in workstation design.*

Session 2: visual comfort (ii)

Topics

This session addresses a measurement method and simulation tool.

Objectives

- ✓ *To explain how lighting is measured in a workplace.*
- ✓ *To present a simulation tool for the design of workplaces.*

Session 3: acoustic comfort (i)

Topics

In this session, the participant is going to know and understand acoustic comfort concepts, and their influence on the design of workplaces.

Objectives

- ✓ *To introduce the main concepts of acoustic comfort.*

- ✓ *To indicate the consequences and problems derived from inadequate acoustic work-environment and the negative effects of noise at levels that do not cause loss of hearing (offices).*
- ✓ *To introduce the importance of music in the work environment.*
- ✓ *To define the acoustic conditions to be considered with older workers in workstation design.*

Session 4: acoustic comfort (ii)

Topics

This session addresses measurement methods.

Objectives

- ✓ *To explain how noise is measured in a workplace.*
- ✓ *To develop acoustic comfort assessment methods.*

Session 5: thermal comfort (i)

Topics

In this session, the participant is going to know and understand thermal comfort concepts, and their influence on the design of workplaces and products.

Objectives

- ✓ *To introduce the main concepts of thermal comfort.*
- ✓ *To know the factors that influence in thermal comfort.*
- ✓ *To indicate the consequences and problems derived from inadequate thermal work-environment.*
- ✓ *To introduce the main recommendations to achieve thermal comfort, as well as preventive control measures to establish exposures to cold or hot environments.*

Session 6: thermal comfort (ii)

Topics

This session addresses a measurement method and simulation tool.

Objectives

- ✓ *To explain the main methods and techniques to assess thermal comfort.*
- ✓ *To present a simulation tool for the design (e.g. environmental chamber).*

Session 7: practical example

Topics

In this session, the participant is going to know a practical example of application of these methods and register techniques to the design.

Objectives

- ✓ *To present a design problem.*
- ✓ *To analyse the example.*
- ✓ *To know solutions proposed for the ergonomic improvement.*

Session 8: To finish and self-evaluation test

Appendix

APPENDIX I

RECOGNITION FRAMEWORK

1 Introduction

This report establishes the recognition framework that will be established as non-formal training provided by the different partners with exploitation capabilities.

The new course proposes a structure organized into areas or disciplines (Anthropometry, Biomechanics, Mental and Environmental load), containing each one of them information about definition and concepts, influence on the design of the workplace, analysis and measurement methods and tools and finally, simulation tools.

The present document describes for each module, the main structure and the contents that participants will receive. In the same way, the main learning outcomes (knowledge, skills, competences and contents) of each session are detailed.

60-hour curriculum for Train4HCWork course

INTRODUCTION

Course aim	<p>Human centered manufacturing is one of the research and innovation priorities of the European Factories of the Future Research Association (EFFRA). The workplaces of the future will give much more importance to human knowledge, skills and cultural background, in particular through life-long learning and training. Human-centered workplaces not only remain essential in the pursuit of reduced occupational and work-related diseases and injuries, and absenteeism, but they will also become increasingly critical to ensure the flexibility, agility, and competitiveness that will be imposed on future manufacturing operations. The continuous intensification of interactions between technology and human operators raises complex safety and efficiency problems that, to a great extent remain unsuitably addressed. This is partly due to their highly context specific characteristics, which challenge many standard and well-established approaches. In this context, the cooperation between ergonomics practice and expertise, and all other relevant inputs to the design of work systems becomes increasingly critical.</p> <p>Train4HCWork will develop, implement and set the basis for a European dissemination of a new online course focused on the design of human-centered workplaces that will contribute to address such challenges. The main objective of the Train4Work project is to strengthen the knowledge and skills of targeted professionals in the design of human-centered workplaces.</p>
Total amount of teaching hours	60 hours (modules + final examination)
Modules	<p>Module 1. INTRODUCTION AND IMPORTANCE OF EGONOMICS AND HUMAN FACTORS (4 hours)</p> <p>Module 2. ANTHROPOMETRY (12 hours)</p> <p>Module 3. BIOMECHANICS AND WORK PHYSIOLOGY (16 hours)</p> <p>Module 4. MENTAL WORKLOAD (10 hours)</p> <p>Module 5. ENVIRONMENTAL CONDITIONS (16 hours)</p>
Target group definitions	<ul style="list-style-type: none"> – Engineers responsible for workplaces, process and production design – Engineers responsible for machinery, working equipment and tools design

	<ul style="list-style-type: none"> – Health and safety managers – Consultants who provide services related to these issues to industry – Human resources professionals (recruitment and job assignment of workers)
Prerequisites for participation	<p>Basic knowledge in:</p> <ul style="list-style-type: none"> – Computing and internet. – Knowledge of English, Spanish, German or French language
Academic tutors profiles	Depending on modules and/or sessions
Pedagogical resources	<p>The general structure of each module will include some of the following pedagogical resources:</p> <ul style="list-style-type: none"> – Bibliography and references. Each unit will include both, references and additional bibliography recommended to expand the reading. The online structure of the course will permit that the citing is dynamic and each cite can lead to its reference. – Images, illustrations and videos. All the contents will be widely improved and explained with images, tables, graphs and videos. That will allow to not only explain and expand some concepts treated in the session, but also to ease the understanding and insert pauses in the process of studying. – Insertions. To reinforce the content, each unit may have specific insertions. The main insertions considered for the course are the following ones: <ul style="list-style-type: none"> • Concept. Important concepts or cites. • Examples. • Remark boxes. Useful to emphasize or summarize some important concept that you have previously developed. – Enlargement of concepts. Additional information, that is not strictly necessary, but that can enlarge the knowledge about one particular topic.
The procedure of assessment and examination	<p>The procedure is divided into two components:</p> <ul style="list-style-type: none"> – Self-evaluation tests. Before starting or finishing a module, a self-evaluation test will be performed. The self-evaluation tests will be normally questions of 3 or 4 answers, where the user must select the correct one. When finished the test, the application will correct it automatically and will show the mark obtained.

	<ul style="list-style-type: none">– Final examination. After finishing the course, the last step is to take the final examination. It will consist of questions for every module, where the user must select the correct answer. The final examination will be available to the user at any time but time to complete it will be limited. That means that the user will have to study for passing it if he or she wants to complete it before finishing in time.
Technical infrastructure	The application will be placed on the telematic platform of the IBV (<i>Virtual Campus IBV</i> https://campus.ibv.org).

MODULE 1: INTRODUCTION AND IMPORTANCE OF ERGONOMICS.

Module description	<p>In this introductory module, the participant is going to know the concept and objectives of ergonomics. Furthermore, this module will address:</p> <ul style="list-style-type: none">– The necessity to take into account the ergonomic approach when designing products and jobs.– The importance of the ergonomic approach in the workplace and the consequences of not applying it (musculoskeletal disorders & diseases, sick-leave, absenteeism, errors and production losses, etc.)
Total amount of teaching hours	4 hours
Sessions	<p>Session 1: Introduction to ergonomics & human factors (2 hours).</p> <p>Session 2: Importance of ergonomics in work design process (human and economic aspects) (1 hour).</p> <p>Session 3: To finish and self-evaluation test (1 hour).</p>
Academic tutors profiles	Academic tutors have general knowledge of ergonomics, musculoskeletal problems and occupational risk in several industrial sectors.

Session 1: Introduction to ergonomics & human factors.

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Knows what ergonomics is – Differences the disciplines and sciences that inspire ergonomics. – Recognizes the main areas of application of ergonomics 	<p>The participant:</p> <ul style="list-style-type: none"> – Can express the concept of ergonomics and the main sciences that inspire it. – Controls the objectives of ergonomics. – Can identify the fields of application of ergonomics to design of workplaces 		<p>Concept, objectives of ergonomics, different approaches, sciences and main areas of application of ergonomics.</p>



Session 2: Importance of ergonomics in work design process.

Total amount of teaching hours	1 hour			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Knows the importance of work-related musculoskeletal disorders and can describe the main types of these disorders – Has knowledge of the main statistics and figures of injuries and losses of working days associated to lack of ergonomics 	<p>The participant:</p> <ul style="list-style-type: none"> – Can understand and recognize the main musculoskeletal disorders in function of the body zone affected – Realizes the main problems identified in ergonomics studies made to date – Understands the importance of ergonomics at work 	<p>The participant:</p> <ul style="list-style-type: none"> – Can appreciate which are the problems related to the lack of ergonomics in a workplace context – Can collaborate in the initial diagnosis of the work related causes (risk factors) of the main disorders 	<p>Importance of the ergonomic approach in the workplace design and consequences of not applying it (musculoskeletal disorders & diseases, sick leave, absenteeism, errors and production losses, etc.)</p>

MODULE 2: ANTHROPOMETRY.

Module description	<p>In this module, the participant is going to know:</p> <ul style="list-style-type: none"> – The definition and objective of anthropometry applied to the design of workplaces, what are the main body dimensions related to design of workstations and elements of these. – The ergonomic criteria to be considered in the design of the workplaces about body dimensions. – How anthropometric population or individual studies are done, what are the main tools for register anthropometric data, and the standards related. – Some existing tools related to the anthropometric design of workstations and elements (e.g. RAMSIS, Ergo/IBV). – How to apply solutions for ergonomic improvement.
Total amount of teaching hours	12 hours
Sessions	<p>Session 1: Definitions and concept (1.5 hours)</p> <p>Session 2: Influence on the design of workplaces (2 hours)</p> <p>Session 3: Analysis and measurement methods/tools (2.5 hours)</p> <p>Session 4: Simulation tools for the design (3 hours)</p> <p>Session 5: Practical example (2 hours)</p> <p>Session 6: To finish and self-evaluation test (1 hour)</p>
Academic tutors profiles	Academic tutors have detailed theoretical and practical knowledge of anthropometry; design based on anthropometric criteria, as well as in manage of measurement and simulation methods and tools.

Session 1: Definitions and concepts

Total amount of teaching hours	1.5 hour			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Becomes familiar with terms and concepts used in anthropometry. – Learns the main body dimensions related to design of workplaces. – Knows the international standards related to this topic. 	<p>The participant:</p> <ul style="list-style-type: none"> – Can express and debate about the importance of anthropometry at work – Is able to identify the main body dimensions related to design of workplaces and the importance of these for the adaptation to the worker 	<p>The participant:</p> <ul style="list-style-type: none"> – Can appreciate and recognize some of the main consequences due to a workstation is not adapted to the worker – Can propose what body dimensions must to be take into account in the design of some elements of the workstation 	<p>Definition and objective of anthropometry applied to the design of workplaces, terms and concepts used in anthropometry, main body dimensions related to design of workstations and elements of these, international standards.</p>

Session 2: Influence on the design of workplaces

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant</p> <ul style="list-style-type: none"> – Knows the ergonomic criteria to be considered in the design of the workplaces about body dimensions. – Can explain the main strategies to follow in the design of elements of the workplace – Identifies the types of relationships that can be established between the dimensions of workers and the workstation. – Understands anthropometric aspects to be considered about older workers in design. 	<p>The participant:</p> <ul style="list-style-type: none"> – Can manage ergonomic criteria about body dimensions – Can apply the strategies in the anthropometric design of workplaces. – Can formulate the main relationships that can be established between the dimensions of workers and the main dimensions of the elements of the workstation. 	<p>The participant:</p> <ul style="list-style-type: none"> – Can appreciate and share with colleagues how a workplace should be modified according to the anthropometry international standards 	<p>Ergonomic criteria to consider in the design of workplaces about body dimensions, main strategies to follow in the design of elements of the workplace, types of relationships between the dimensions of the workers and the main dimensions of the elements of the workstation, international standards, anthropometric aspects to be considered about older workers in design.</p>

Session 3: Analysis and measurement methods/tools

Total amount of teaching hours	2.5 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant</p> <ul style="list-style-type: none"> – Knows how anthropometric data are obtained. – Exposes different existing technologies and tools, from manual instruments to 4D scanners. – Can localize different anthropometric data sources available. 	<p>The participant:</p> <ul style="list-style-type: none"> – Difference some of existing measurement methods and tools to register body dimensions – Can use some anthropometric data source available. – Can collect some basic measurements manually 	<p>The participant:</p> <ul style="list-style-type: none"> – Can investigate the existing anthropometric data sources available 	<p>Anthropometric studies, main tools for register anthropometric data (from manual instruments to 4D scanners), international standards.</p>

Session 4: Simulation tools for the design

Total amount of teaching hours	3 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Knows some tools that allow integrating the anthropometry in the design of workstations. 	<p>The participant:</p> <ul style="list-style-type: none"> – Can formulate the future design of the workstation taking into account existing tools for the simulation, during the first phases of the design how will be the relations between the dimensions of the user and their future position. 	<p>The participant:</p> <ul style="list-style-type: none"> – Can assess the need to use this type of tools and collaborate in their definition. 	<p>Tools for the anthropometric design of workstations and their elements: module of design of the Ergo/IBV® and software RAMSIS.</p>

Session 5: Practical example

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Is able to identify and analyse a design problem – Understand the criteria applied for the resolution – Knows the solutions proposed for the ergonomic improvement of the workplace or elements 	<p>The participant:</p> <ul style="list-style-type: none"> – Is able to investigate a design problem – Is able to solve the type of design problem presented – Is able to produce ergonomic improvements/solutions to solve this type of problem. 	<p>The participant:</p> <ul style="list-style-type: none"> – Can cooperate in the identification and resolution of design problem related with the lack of anthropometric criteria. 	<p>Practical example of a design: presentation of the problem, anthropometric criteria applied, and final solution proposed.</p>

MODULE 3: BIOMECHANICS AND WORK PHYSIOLOGY.

Module description	<p>In this module, the participant is going to know:</p> <ul style="list-style-type: none"> – The main concepts and ergonomic principles related to work system in production and physical workload (working posture, action forces, manual material handling) – The ergonomic criteria to be considered in the design of the workplaces based on body postures, movements and efforts – The main biomechanical and physiological factors related to the design of workplaces with mainly physical workload (e.g. action forces, manual material handling, and repetitive movements of upper extremities). Management and optimization of physical workload (overload and underload), focus on ergonomic measures and job/task design – The existing methods and tools related to the ergonomic assessment of physical workload and redesign of workstations and elements (e.g. AAWS, EAWS)
Total amount of teaching hours	16 hours
Sessions	<p>Session 1: Definitions and concepts of analysis of physical workload. (2 hours)</p> <p>Session 2: Influence on the design of workplaces (I). Ergonomic criteria. General recommendations. (1.5 hour)</p> <p>Session 3: Influence on the design of workplaces (II). Recommendations related to workload and integration of productivity and human-centred manufacturing. (2 hours)</p> <p>Session 4: Analysis and measurement methods and tools (I). Methods and tools for ergonomic workloads analysis & risk assessment related to physical workload on workplaces and production lines (e.g. NIOSH, EAWS; examples of analysis). (2.5 hours)</p> <p>Session 5: Analysis and measurement methods and tools (II). Tools for ergonomic workloads assessment and redesign (e.g. Ergo/IBV). (2.5 hours)</p> <p>Session 6: Practical example (2 hours)</p> <p>Session 7: Simulation methods and tools for the design. (2.5 hours)</p> <p>Session 8: To finish and self-evaluation test (1 hour).</p>
Academic tutors profiles	<p>Academic tutors possess detailed theoretical and practical knowledge of ergonomics, biomechanics and methods of postural analysis at work. Especially important is that they have a wide experience in the use and development of methods and tools for ergonomic workload assessment a redesign, as well as they have fluency and experience in the design of equipment and workstations.</p>

Session 1: Definitions and concepts of analysis of physical workload

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Learns the concept of work system and the elements, that must be considered related to physical work load during the design of production /industrial work systems. – Learns the main concepts (e.g. stress-strain-concept) and factors that must be considered related to physical work load during the design of workplaces and working tools – Knows the international regulation documents, standards related to the topic. 	<p>The participant:</p> <ul style="list-style-type: none"> – Can explain the concept of work system – Can explain the main concept (stress-strain concept) 	<p>The participant:</p> <ul style="list-style-type: none"> – Can assess the need to use the system approach and collaborate in their definition and elements; – Can assess the need to use the stress-strain concept for assessment of work loads 	<p>The work system complex: definition, framework (processes and activities, participants, information, technologies, product/services, customers, environment, infrastructure and strategies)</p> <p>Strain stress concept: definition</p> <p>Fundamental ergonomic principles: neutral postures, work in the comfort zone, allow for movement, reduce excessive force, reduce excessive motions, minimize contact stress, reduce vibration, adequate lighting</p>

Session 2: Influence on the design of workplaces (I). Ergonomic criteria. General recommendations.

Total amount of teaching hours	1.5 hour			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Knows ergonomic criteria that influences in the design of the workplaces based on body postures, movements and efforts. – Learns the main work postures and a method to determine the main work posture. – Knows the ergonomic criteria regarding the positions of the different body segments – Knows ergonomic criteria regarding the movements at the workplace – Defines the types of effort, general 	<p>The participant:</p> <ul style="list-style-type: none"> – Can explain and manage the ergonomic criteria based on body postures, movements and efforts to the design of a workplace. 	<p>The participant:</p> <ul style="list-style-type: none"> – Can appreciate and share with colleagues how a workplace should be modified according to the ergonomic criteria. 	<p>Ergonomic criteria and general recommendations to be considered in the design of the workplaces based on body postures (main body postures and body segments positions), movements and efforts (types and limits); international standards; aspects to be considered with older workers in workstation design.</p>



	<p>recommendations and some limit values</p> <ul style="list-style-type: none"> – Defines the effort aspects to be considered with older workers in workstation design. 			
--	--	--	--	--

Session 3: Influence on the design of workplaces (II).

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Understands the analysis of workload dealing with biomechanical factor action forces and ergonomic design measures. – Understands the analysis of work load dealing with manual material handling and ergonomic design measures – Understands the analysis of work load deals with repetitive movements of upper extremities and ergonomic design measures – Understands the management of physical 	<p>The participant:</p> <ul style="list-style-type: none"> – Can explain which factors are important to take into account to analyse manual material handling – Can explain which factors are important to take into account to analyse repetitive movement (repetitiveness, amplitude and duration and speed of movement) – Can present ergonomic recommendations and international regulation standards. 	<p>The participant:</p> <ul style="list-style-type: none"> – Can estimate on which articulation forces are applied and their consequences – Can assess the need to analyse the manual material handling and collaborate of their definition and elements 	<p>Limiting values regarding repetitiveness and amplitude of movements according to body segments (neck, shoulders, arms, forearms, wrists, back...)</p> <p>Factors to determine workload dealing with manual material handling (load, distance, joint position)</p> <p>Limiting values regarding manual material handling</p> <p>Analysis of biomechanical workload</p> <p>Effects of age/gender and experience on risk of injuries</p>

	<p>work load on working places in production</p> <ul style="list-style-type: none">– Defines ergonomic recommendations (technical, organizational) related to physical workload and integration of productivity and human-centered manufacturing– Defines aspects to be considered with gender and older workers in workstation design.			<p>International regulation document: ISO and EC standards</p>
--	--	--	--	--

Session 4: Analysis and measurement methods and tools (I).

Total amount of teaching hours	2.5 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Knows how aspects of physical workload (working postures, action forces, manual material handling, repetitive movements of upper extremities) can be assessed by using simple screening tools (e.g. AWSlight) or experts screening tools (e.g. EAWS) – Knows main principles how to apply the expert screening tool – Knows how to integrate the anthropometrical, biomechanical aspects to 	<p>The participant:</p> <ul style="list-style-type: none"> – Can use different screening tools to assess physical workload 	<p>The participant:</p> <ul style="list-style-type: none"> – Use the appropriate screening tools according to the context – Is able to interpret the results of the screening tools and able to give advice 	<p>The screening tools of physical workload</p> <ul style="list-style-type: none"> - AWS light - EAWS



	<p>summarized score of physical workload.</p> <ul style="list-style-type: none">– Knows how the results of analysis/ assessment can be used to redesign the workplace, job, task.			
--	---	--	--	--



Session 5: Analysis and measurement methods and tools (II).

Total amount of teaching hours	2.5 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	The participant: <ul style="list-style-type: none"> – Knows how different types of physical workload can be identified and assessed – Understands how this assessment can be used to redesign the task 	The participant: <ul style="list-style-type: none"> – Can use different tools to redesign workstations and elements 	The participant: <ul style="list-style-type: none"> – Can assess the need to use this type of tools and collaborate in their definition according to the context. 	Tools for the workload identification, assessment, and redesign of tasks: software Ergo/IBV®.

Session 6: Practical examples.

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Is able to classify an ergonomic problem related to physical work load – Can identify the main risk factors related with this problem – Can interpret the results of the ergonomic evaluation and the improvement proposals 	<p>The participant:</p> <ul style="list-style-type: none"> – Is able to investigate an ergonomic problem related with biomechanics – Is able to debate about the workload type presented in the example – Can propose ergonomic improvements or solutions to solve this type of problem 	<p>The participant:</p> <ul style="list-style-type: none"> – Can cooperate in the identification and resolution of practical problems related with the lack of biomechanics criteria. 	<p>Practical example of an ergonomic assessment and redesign of a task: presentation of the problem, identification of the risk factors, workload assessment (by means Ergo/IBV® tool), ergonomic criteria applied and final solution proposed.</p>

Session 7: Simulation methods and tools for the design.

Total amount of teaching hours	2.5 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	The participant: <ul style="list-style-type: none"> – Knows some simulating tools for human centred design process of workplaces and production lines 	The participant: <ul style="list-style-type: none"> – Uses different simulating tools for human centred design process of workplaces and production lines 	The participant: <ul style="list-style-type: none"> – Is able to use the appropriate simulating tool for human centered design process of workplaces and production lines 	Simulating tools for human centred design process of workplaces and production lines



MODULE 4: MENTAL WORKLOAD.

Module description	<p>In this module, the participant is going to know:</p> <ul style="list-style-type: none"> – The main concepts and ergonomic principles related to cognitive and mental workload – The main factors related with the design of workplaces (e.g. management of cognitive and attentional resources, cognitive overload and underload, focus on primary and secondary tasks, etc.) – Some general methodologies for the assessment of mental workload at workplaces
Total amount of teaching hours	10 hours
Sessions	<p>Session 1: Definitions and concepts (2 hours).</p> <p>Session 2: Influence on the design of workplaces (2 hours).</p> <p>Session 3: Measurement methods and simulation tools (2.5 hours).</p> <p>Session 4: Practical example (2.5 hours).</p> <p>Session 5: To finish and self-evaluation test (1 hour).</p>
Academic tutors profiles	Academic tutors have general knowledge of mental and cognitive ergonomics in different applications. Especially important is that they have experience in the monitoring and register of mental processes with different tools applied to the design.

Session 1: Definition and concepts.

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Learns some of the main concepts and factors that must be considered related to cognitive load during the design of workplaces and tasks. – Knows the international standards related to this topic. 	<p>The participant:</p> <ul style="list-style-type: none"> – Can apply some of the ergonomic principles presented. – Can use international standards related to this topic. 	<p>The participant:</p> <ul style="list-style-type: none"> – Is able to contemplate the ergonomic principles related to cognitive and mental load to the design of tasks. 	<p>Main concepts and ergonomic principles related to cognitive and mental load, international standards related to this topic.</p>



Session 2: Influence on the design of workplaces

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Understands the management of cognitive and attentional resources – Defines cognitive aspects to be considered with older worker 	<p>The participant:</p> <ul style="list-style-type: none"> – Can explain how to manage cognitive workload – Can apply the cognitive aspects to be considered with older workers in workstation design 	<p>The participant:</p> <ul style="list-style-type: none"> – Can appreciate and share with colleagues how cognitive and mental workload should be modified according to the ergonomic criteria. 	<p>Main factors related with the design of workplaces (e.g. management of cognitive and attentional resources, cognitive overload and underload, focus on primary and secondary tasks, etc.), international standards, and cognitive aspects to be considered with older workers.</p>

Session 3: Measurement methods and simulation tools

Total amount of teaching hours	2.5 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Knows some general methodologies for the assessment of mental workload at work – Knows some techniques to register and monitoring physiological signals related to mental, emotional, and behavioural responses. 	<p>The participant:</p> <ul style="list-style-type: none"> – Can present some general methodologies for the assessment of mental workload at work – Can present some techniques to register or monitor physiological signal related to mental responses – Is able to interpret the results of the technique 	<p>The participant:</p> <ul style="list-style-type: none"> – Appreciate the utility and field of application of these methodologies and techniques. 	<p>General methodologies for the assessment of mental workload at workplaces, specific techniques for the measurement and registration of mental and emotional load through physiological signals.</p>

Session 4: Practical examples.

Total amount of teaching hours	2.5 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Presents and analyse a design problem related with the lack of cognitive criteria – Knows the ergonomics assessment 	<p>The participant:</p> <ul style="list-style-type: none"> – Is able to investigate an ergonomic problem related with cognitive and mental workload – Can propose a methodology or technique for the registration 	<p>The participant:</p> <ul style="list-style-type: none"> – Can cooperate in the identification and resolution of practical problems related with the lack of cognitive ergonomic criteria. 	<p>Practical example of an ergonomic assessment and redesign of a task: presentation of the problem, assessment, ergonomic criteria applied and conclusions.</p>

MODULE 5: ENVIRONMENTAL CONDITIONS.

Module description	<p>In this module, the participant is going to know:</p> <ul style="list-style-type: none"> – The visual comfort concepts, their influence on the design of workplaces and the appropriate measurement tools – Acoustic comfort concepts, their influence on the design of workplaces and the appropriate measurement tools – Thermal comfort concepts, their influence on the design of workplaces and the appropriate measurement tools
Total amount of teaching hours	16 hours
Sessions	<p>Session 1: Visual comfort (I). Definitions and concepts, and influence on the design of workplaces (2 hours).</p> <p>Session 2: Visual comfort (II). Measurement methods and simulation tools (2 hours).</p> <p>Session 3: Acoustic comfort (I). Definitions and concepts, and influence on the design of workplaces (2 hours).</p> <p>Session 4: Acoustic comfort (II). Measurement methods (2 hours).</p> <p>Session 5: Thermal comfort (I). Definitions and concepts, and influence on the design of workplaces (2 hours).</p> <p>Session 6: Thermal comfort (II). Measurement methods and simulation tools (2 hours).</p> <p>Session 7: Practical example (3 hours).</p> <p>Session 8: To finish and self-evaluation test (1 hour).</p>
Academic tutors profiles	Academic tutors have detailed theoretical and practical knowledge of environmental ergonomics (visual, acoustic and thermal comfort). Especially important is that they have experience in the use of methods and tools of assessment of the environmental conditions.

Session 1: Visual comfort (I).

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Knows the concept of visual ergonomics and the factor that should be considered – Knows the consequences and problems derived from inadequate lighting – Knows visual aspects to be considered with older workers 	<p>The participant:</p> <ul style="list-style-type: none"> – Can indicate the consequences and problems derived from inadequate lighting – Can raise the importance of colour within visual ergonomics and their psychological effects – Can define the visual aspects to be considered with older workers 	<p>The participant:</p> <ul style="list-style-type: none"> – Is able to organize a workspace to enhance visual comfort of the worker 	<p>Main visual comfort concepts and influence on the design of workplaces, factors to be considered, the importance of colour and psychological effects that colour can have, visual aspects to be considered with older workers in workstation design.</p>

Session 2: Visual comfort (II).

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Knows tools to measure lighting in a workplace context – Knows simulation tools for the design of workplaces 	<p>The participant:</p> <ul style="list-style-type: none"> – Can explain how lighting is measured in a workplace – Can present a simulation tool for the design of workplaces – Use the appropriate lighting measurement tool according to the context 	<p>The participant:</p> <ul style="list-style-type: none"> – is able to interpret the results of the lighting tools and able to give advice 	<p>Measurements methods to assess visual comfort at work; and simulation tool to design.</p>

Session 3: Acoustic comfort (I).

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Knows the concept of acoustic ergonomics and the factor that should be considered – Knows the consequences and problems derived from noise – Knows acoustic conditions to be considered with older workers 	<p>The participant:</p> <ul style="list-style-type: none"> – Can indicate the consequences and problems derived from inadequate work acoustic – Can explain the importance of music at work – Can define the acoustic conditions to be considered with older workers 	<p>The participant:</p> <ul style="list-style-type: none"> – Is able to organize a workspace to enhance acoustic comfort of the worker 	<p>Main acoustic comfort concepts, consequences and problems derived from inadequate acoustic work-environment, factors to be considered, importance of music and effects that can have, acoustic aspects to be considered with older workers in workstation design.</p>

Session 4: Acoustic comfort (II).

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	The participant: <ul style="list-style-type: none"> – Knows tools to measure acoustic comfort in a workplace context – Explains how noise is measured in a workplace 	The participant: <ul style="list-style-type: none"> – Uses the appropriate acoustic measurement tool according to the context 	The participant: <ul style="list-style-type: none"> – Is able to interpret the results of the acoustic measurement tool and able to give advice 	Measurements methods to assess acoustic comfort at work.

Session 5: Thermal comfort (I).

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Knows the concept of thermal comfort and the factor that should be considered – Knows the consequences and problems derived from inadequate thermal work environment 	<p>The participant:</p> <ul style="list-style-type: none"> – Can indicate the consequences and problems derived from inadequate thermal work environment – Can present the main recommendations to achieve thermal comfort, as well as preventive control measures to establish exposures to cold or hot environments 	<p>The participant:</p> <ul style="list-style-type: none"> – Is able to organize a workspace to enhance thermal comfort of the worker 	<p>Thermal comfort concepts, factors that influence in thermal comfort, consequences and problems derived from inadequate thermal work-environment, recommendations and preventive control measures.</p>

Session 6: Thermal comfort (II).

Total amount of teaching hours	2 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	The participant: <ul style="list-style-type: none"> – Knows tools to measure thermal comfort in a workplace context – Can explain how thermal comfort is measured in a workplace – Can present a simulation tool for the design (e.g. environmental chambers) 	The participant: <ul style="list-style-type: none"> – Uses the appropriate thermal measurement tool according to the context – 	The participant: <ul style="list-style-type: none"> – Is able to interpret the results of the thermal measurement tool and able to give advice 	Measurements methods to assess thermal comfort at work; and simulation tools to design

Session 7: Practical examples.

Total amount of teaching hours	3 hours			
Description of learning outcomes	Knowledge	Skills	Competence	Content
	<p>The participant:</p> <ul style="list-style-type: none"> – Presents a design problem related with environmental conditions – Knows the ergonomics assessment 	<p>The participant:</p> <ul style="list-style-type: none"> – Is able to investigate an ergonomic problem related with environmental conditions – Can propose a methodology or technique for the registration – Is able to propose ergonomic improvements/solutions 	<p>The participant:</p> <ul style="list-style-type: none"> – Can cooperate in the identification and resolution of practical problems related with the lack of environmental ergonomic criteria. 	<p>Practical example of an ergonomic assessment: presentation of the problem, assessment, ergonomic criteria applied and conclusions.</p>

APPENDIX II

REPORT ON TRAINING REQUIREMENTS

1 Introduction

This document represents the deliverable *D2.1.- Report on training requirements* of work package *WP2.- Definition of the curriculum* of the European project **TRAIN4HCWORK**. This project aims to generate a new **online course focused on the design of human-centred workplaces** to strengthen the knowledge and skills of targeted professionals, mainly engineers responsible for the design of working environments, processes and organization, design and ergonomic verification of machinery, and health and safety professionals.

The information included in this document reflects the activities performed, with the objectives of extracting, gathering and analysing the training preferences and needs of target users. User-centred methodologies have been used in this task to assure representativeness of the whole collective of final users, prioritize the preferences and provide the new course with high innovation component. The main objective of this study is to establish the requirements for the curriculum, in order to suit the specific needs of professionals at European Union level.

2 Materials and methods

The methodological process followed to obtain the training needs of professionals involved in the design of human-centred workplaces has been divided into two stages: a qualitative one, followed by a quantitative stage (*Figure 4*).



Figure 4.- Stages in the methodological process.

In the first phase, generic information has been gathered by discussing directly with professionals of this sector. A set of three Focus Groups has been done for this purpose. In each one of them, different topics were addressed. The output of this first phase has been an overview of the main problems of professionals, as well as their training needs relating this topic, which has been used in order to define a survey with specific questions at phase II.

The survey has been implemented on www.surveymonkey.com, a specific survey platform that allows online answer the questions and analyse the results in a relatively easy way. The survey has been distributed by FEES through its professional network in order to have a high number of respondents. The information of the survey has been statistically analysed, obtaining representative results and making possible to interpret them in an easy way.

2.1 Qualitative research/methodology

Qualitative research/methodology is a research method used primarily in the social sciences, based on theoretical principles such as phenomenology, hermeneutics, social interaction using data collection methods that are not quantitative, in order to explore the social relations and describe reality as experienced by individuals. Qualitative research requires a deep understanding of human behaviour and the reasons that govern it.

As the qualitative research is the observation of small-sized population groups, it is also based on small samples.

2.1.1 Focus group

The focus group is a way of qualitative research in which a group of people discuss about their perceptions, opinions, beliefs and attitudes towards a product, service, concept or idea. A moderator asks questions and the participants are free to answer and talk with other group members.

The guide of the focus groups performed in this project can be seen in APPENDIX II-A.

2.2 Quantitative research/methodology

Qualitative research intends to explain the reasons for the different elements of such behaviour. In other words, it investigates why and how they make a decision, whereas the quantitative research aims to answer such as what, where, when and how much/many.

2.2.1 Survey

Survey methodology studies the sampling of individual units from a population and the associated survey data collection techniques, such as questionnaire construction and methods for improving the number and accuracy of responses to surveys.

In comparison to the qualitative methodology, in the quantitative one using techniques such as survey it is possible to involve a higher sample of the population, making possible to obtain much more representative information and statistical data.

The guide of the survey performed in this project can be seen in APPENDIX II-E.

3 RESULTS

3.1 Qualitative results

IBV, IAD and UGA were in charge of conducting the three discussion groups (one per partner), each one of them focused on a different topic. IBV was focused on the training requirements about the application of human-centred knowledge to the design of workplaces, work equipment and tools and on the design requirements included in related standards; IAD dealt with the training requirements related to the integration of productivity and human-centred manufacturing and; UGA mainly covered the methodological part (structure of the course, length, evaluation method...).

The outputs of these sessions can be found in:

- APPENDIX II-B.: Results of the focus group conducted by IBV.
- APPENDIX II-C: Results of the focus group conducted by IAD
- APPENDIX II-D: Results of the focus group conducted by UGA.

The main result was the design of a questionnaire that was translated into five languages: English, French, Spanish, Dutch and Serbian as well. The English version can be found in APPENDIX II-E.

3.2 Quantitative results

FEES was the partner in charge of distributing the online survey to project targeted professionals (through their networks of associates/contacts) under the premise of guaranteeing the fulfilment of at least 100 surveys. The APPENDIX II-F collects the results of the online survey and includes the data treatment carried out by FEES. The following information is presented:

- Analysis of the sample.
- Analysis of the respondent's profile.
- Analysis of respondent's background and professional experience.
- Statistical analysis of the answers of each question, covering both, training needs and course features.

4 Conclusions

The information obtained from the focus groups, together with the results of the online survey answered by more than 100 potential users, have been used to define the features of the course and the training needs.

Regarding the course features, **sessions of 30 minutes to one hour** will be accessible through an online platform via computer or other electronic devices. The contents will be provided in pdf format and access to additional contents and self-evaluation systems will be included as well.

With respect to the training needs, the interest expressed by the respondents and the length limitation of the course, **60 hours**, have been taken into account to finally define the list of contents. In that way, the most interesting topics according to potential users are included in the course.

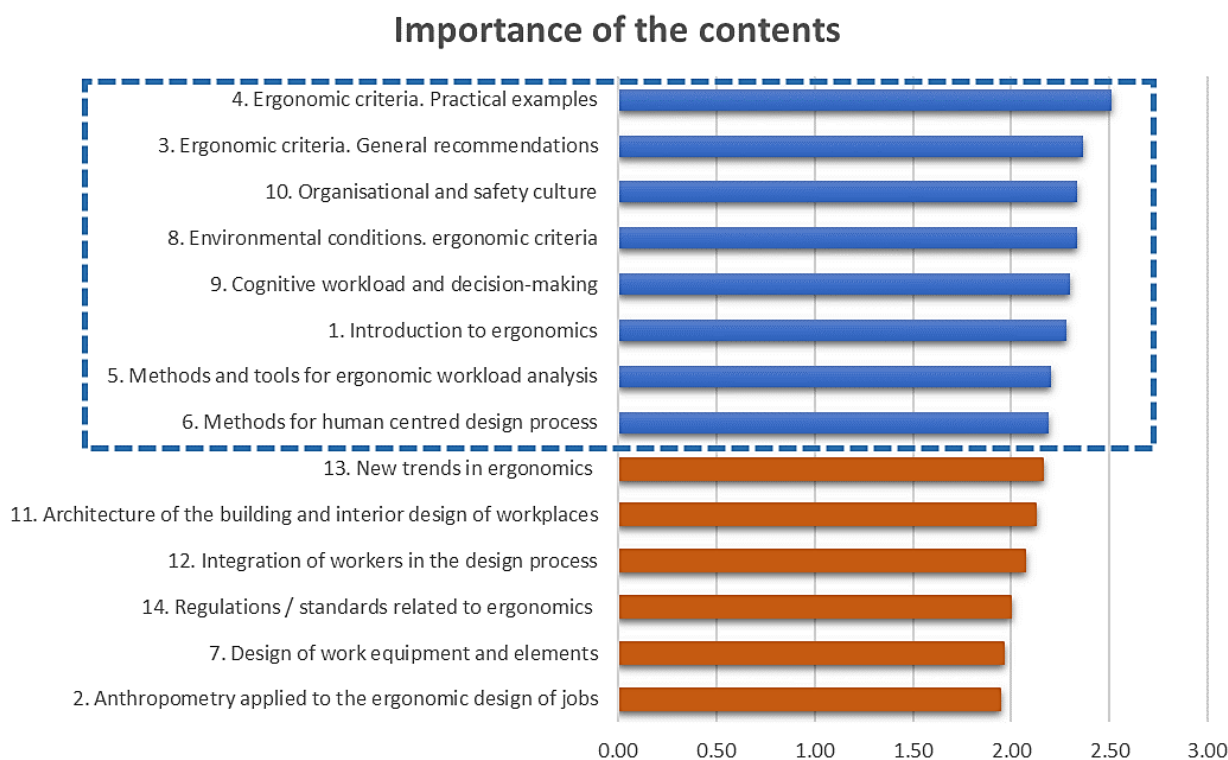


Figure 5.- Importance of contents.

In general terms, it can be observed that the areas of interest can be classified into three main groups:

- **General and traditional ergonomics:** including basic concepts of ergonomics and anthropometry as well as ergonomics related to biomechanics (contents 1, 2, 3, 4, 5 and 6). It should be pointed out that some of the modules proposed contain essential information to understand the rest of them. This is the case of *1.-Introduction to ergonomics* and *2.-Anthropometry applied to the ergonomic design of jobs*. Therefore, although respondents showed lower interest in the anthropometric aspects, it has been decided not to exclude them from the course.

-
- **Cognitive aspects:** including concepts related to cognitive workload and decision-making as well as methods and tools for ergonomic workload analysis (content 9).
 - **External factors:** including environmental and organizational aspects (contents 8 and 10).

This is going to be used as the starting point for the development of the VET Curriculum of the course.

APPENDIX II-A

Planning of the focus group

1 Technique

Focus group for obtaining information concerning the training needs of professionals in charge of the design and practical implementation of human centred workplaces in the European factories of the future.

2 Project

This activity is developed in the framework of the European Project TRAIN4HCWORK.

The aim is to detect the training needs of professionals involved in the design and practical implementation of human centred workplaces in the European factories of the future

3 Objective of the session

The following general objectives have been established:

- To characterize the current knowledge and background of target professionals.
- To identify the knowledge areas required by professionals to be included in the online course.
- To determine the aspects related to the format and design of the courses (length, availability, structure, accreditation, teachers...).
- To assess the interest in this kind of training.

4 Participants profile

In each one of the three Focus Groups (Valencia (Spain), Darmstadt (Germany) and Grenoble (France)), about **7 participants** will be enrolled.

The profile of the participants will be among the following ones:

- **Main profile** (if possible between 3 and 5 participants):
 - Engineers (professionals/participants in the last year) responsible for the design of workplaces, working environments processes and production
- **Secondary profile** (between 1 and 4 participants, depending on their availability and the number of participants of the 'main profile'):
 - Engineers (professionals/participants in the last year) responsible for the design of machinery, working equipment and tools
 - Consultants who provide services related to these issues

- Health and safety managers
- Human resources professionals, responsible for the recruitment and job assignment of workers.

5 Human resources

- **Moderator of the session:** in charge of leading the session, assuring that all planned issues are analyzed and that the objectives are accomplished. The moderator will control time assuring that all members participate in a relaxed environment.
- **Observer:** expert providing support to the moderator without participating in the session. He can ask the moderator about dealing with a specific or remaining issue.
- **About 7 participants:** Every participant must respect the opinion and comments of the other members of the focus group.

6 Material resources

- Meeting room
- Blackboard and material
- Record card for observations
- Digital recorder
- Soft drinks and coffees
- Writing material for attendants

7 Development of the session

The session should last approximately **one hour and a half**. The following structure is recommended for the session:

- **Initial presentation.** Presentation of participants and objectives of the session [10 min].
- **Analysis of current knowledge, background and training courses received (if any),** relating the design of human centred workplaces [20 min].
- **Analysis of the knowledge areas** required by the target professionals (application of human-centred knowledge to the design of workplaces, work equipment and tools, the integration of productivity and human-centred manufacturing workplaces) [30 min].
- **Preferences regarding training course format.** Requirements needed for a suitable material concerning training [15 min].
- **Conclusions** [10 min].
- **Farewell and gratitude** [5 min].

8 Topics to discuss about

- **Initial presentation**

Presentation of participants and objectives of the session [10 min]

- Each participant will introduce him- or herself commenting: name, work, specialty, workplace, years of experience...

- **Analysis of current knowledge, background and training courses received (if any)**, relating the design of human centred workplaces [20 min]

- Which is the current training of the professionals in charge of the design of workplaces?
- Has the target professionals any specific training relating the design and practical implementation of human centred workplaces?
- Do you think that current knowledge of the professionals in the design of human-centred workplaces is appropriate (define strengths and weaknesses).

- **Analysis of the knowledge areas** required by the target professionals. Each group will be mainly focused on a specific knowledge area [30 min]

For this part of the session, each partner organizing a focus group should define a specific set of questions to get information about the topic/knowledge area that is being covered.

- **FG1 (IBV):** it will be mainly focused on the training requirements about the application of human-centred knowledge to the design of workplaces, work equipment and tools and on the design requirements included in related standards.
- **FG2 (IAD):** it will be mainly focused on the training requirements related to the integration of productivity and human-centred manufacturing.
- **FG3 (UGA):** it will be focused in the methodological part (structure of the course, length, evaluation method...). It will also provide additional information about the topics covered in FG1 and FG2 (*to do that, IBV and IAD will send UGA the main questions addressed in their focus groups, i.e., general questions about the knowledge and interest in a set of contents*).

- **Preferences regarding training course format.** Requirements needed for a suitable material concerning training [15 min]

This topic will be mainly covered by UGA (*IBV and IAD will provide additional information by asking in their focus groups general questions about the course format*).

- Length of the courses.
- Suitable schedule.
- What are the advantages and inconveniences that you associate to an E-learning course?

- Which complementary documentation (apart from the contents) do you consider valuable?
- Which method to evaluate the accomplishment of the course do you consider most adequate?
 - Training should be theoretical or practical?
 - Who should organize and give the training?
 - Which qualifications should be provided and who should give them?
- **Conclusions** [10 min]
 - Review of the contents and confirmation of results.
 - Review the contents of sections 3 and 4, validating the priority proposed:
 - Contents of the courses.
 - Length and timetable.
 - Type of training.
- **Farewell and gratitude** [5 min]

9 Deliverable

Focus groups in the mother tongue of each group of users (French, German, Spanish, English...), processing finally a report in **English**.

The report of each focus group will contain:

- Script followed during the session (questions asked, procedure followed...)
- Material generated during the session (observations, notes taken, photos ...)
- Results and conclusions of the focus group
- Just for IBV and IAD: proposal of a *Curriculum* (list of theoretical contents that might be included in the course. This list of contents will be the basis for elaborating the online survey).

The report sent by each partner (IBV, IAD, UGA) will be attached as an Annex in the Deliverable *D.2.1 Report on training requirements*.

APPENDIX II-B

IBV Focus Group

1 Objective of the session

Organize a focus group to obtain information about the training needs of professionals responsible for the design and implementation of workplaces centered on the person (user) in the European factories of the future.

2 Organization

On Thursday 13th a focus group was held in the IBV facilities. In that session, 7 people representing all the considered profiles participated. Among the participants, the following profiles were covered:

- Responsible for prevention
- Industrial designer (participant and professionals)
- Industrial machinery designer
- Architecture (factories building)
- Industrial engineer

The session lasted approximately one hour and a half.



Figure 6. Focus group held in IBV.

3 Main results

As a result of the analysis of current knowledge, background and training courses received by the focus group users, it has been detected that there is a need for training and that current knowledge is insufficient with academic training.

The participants believe that there is a need for training in this matter both in university careers and in a complementary master's education.

As a result of the analysis of knowledge areas required by the target professionals apart from the typical topics related to the physical dimensions and design of the static workplaces (anthropometrics, biomechanics, design of tools, machines) the following areas of interest were mentioned:

- An introductory unit that serves as an awareness of the importance of designing work taking into account the needs of workers, where large data on sick leave is included.
- Architecture of the building and interior design of workplaces.
- Ergonomics according to the profile of the worker, including people with functional diversity.
- Integration of workers in the design process. Methodologies and techniques to participate in the design. Co-creation.
- Existing tools for the design.
- New trends in ergonomics and technologies that help the worker

Other topics, which are not the subject of this course and would be the subject of other courses, have been mentioned (safety, accessibility).

3.1 Analysis of current knowledge, background and training courses

- There is no specific training in the subject of interest in university careers (industrial, etc.).
- The participants believe that current knowledge is insufficient with academic training.
- Profiles of interest: industrial engineering (organization), industrial design...
- Information on the topic only in risk prevention courses, where just the most serious safety problems are emphasized.
- The participants believe that there is a need for training in this matter both, in university careers and in a complementary training: master, online courses...

3.2 Analysis of the knowledge areas required by professionals / target participants

3.2.1 Topics that they consider should include the course (spontaneous)

- Architecture of the building and interior design of the workplace
- Introductory module that serves as an awareness of the importance of a workplace design that takes into account the needs of workers. In this module, big data (statistics) can be used as an

awareness. For example, *“after one year there are X work absences related to the job”*. (messages that impact)

- Ergonomics according to worker profile
- Accessibility
- Ergonomics for all, including people with functional diversity.
- Design of the workplace with the workers; consider them from the beginning of the design process. Methodology and techniques to allow workers to participate in the design of workplace (example: Lego serious play).
- Safety
- Technology: to help the worker to carry out their tasks
- Design tools for a workplace: range of existing design tools
- Trends in ergonomics: active ergonomics.

3.2.2 Topics that the course should include (suggested)

Knowledge applicable to the ergonomic design of workplaces that they are interested in acquire:

- Body dimensions applicable to the design (Anthropometry)
- Postures, movements and efforts (Biomechanics)
- Heights, reaches and workspaces
- Standards in ergonomics
- Integration of Ergonomics in the design process of workplaces / products; elements (phases and tools)
- Others:
 - Organization and management of work.
 - Loads in displacement.

3.2.3 Areas of application of the ergonomic design that would interest them (equipment and work elements)

- Hand tools.
- Machines.
- Controls and indicators.
- Trolleys.
- Boxes and containers.

- Office (tables, chairs, etc.)
- Others:
 - Buildings
 - Structure
 - Environmental noise

3.2.4 Preferences regarding training course format

Regarding the structure of the course (methodological part), it was highlighted the need to:

- Include real success cases.
- Include a large number of practical cases.
- Include videos and activities. Make the course as visual as possible.

APPENDIX II-C

UGA Focus Group

1 Objectives

Preferences regarding training course format (no discussion about the theoretical contents of the course)

2 Organization

Three successive focus groups have been undertaken to obtain feedback from engineers (professionals/participants in the last year) on their preferences regarding training course format.

Focus group 1

- 03-12-2018, 17-19h
- 6 participants : Master participants in Movement-Ergonomics-Handicap who had followed online courses in Anatomy and Biomechanics at Univ. Grenoble Alpes, France)

Focus group 2

- 06-12-2018, 18-20h
- 8 participants: ergonomics and design consultants, human resources managers

Focus group 3

- 12-12-2018, 18-20h
- 7 participants: HSE (health, safety and environment) engineer, human resources managers

3 Main results

The focus group participants assigned importance to the following 5 points:

3.1 Duration of the online course

- The desired, feasible and realistic duration of the entire online course: 40 hours.

Discussion between participants has pointed out that the duration of university courses related to the design of human centered workplaces is usually between 30 and 50 hours

3.2 Sequencing of the online course

- The sequencing of the online course (in terms of number and duration of the teaching modules) should be considered on the basis of each participant's 'profile'.
- Discussions have revealed an important distinction between professionals and participants' expectations and concerns: (1) for professionals for whom the time is running out, the training module should not exceed 10-20 minutes; whereas (2) participants are agreed to follow training modules lasting 45 minutes.

- Participants also suggested clearly mentioning before starting a module the time needed to complete it.

3.3 Access to the online course

- The access of the training modules should be available on different supports (laptop, smartphone, digital tablet)
- All the content on the site should be made accessible to people with disabilities, including visual impairments.
- All the content on the site should be made accessible in different languages.
- Professionals would prefer whether the access to the online course was not time limited and available offline. They pointed out their difficulties to be available at a given date or at a given day over weeks.
- Participants also preferred this approach, although the majority of their actual online courses are provided with a calendar which helps them to finish the course on time.

3.4 Didactic materials

- Contents relative to the design of human centered workplaces should alternate between theoretical and practical contents.
- To the greatest extend as possible, theoretical contents should be illustrated by images, videos with a narrative voice off and the possibility to read subtitles.
- To engage participants, contents should create active learning experience in a highly engaging and realistic environment in order to enable the application of the human centered design workplaces knowledge. Participants pointed out that the approach in the design of workplace is complex and strongly associated with the context. For this reason, the active learning experience should take into consideration technical standards (EN or ISO standards) and the point of view of various professionals (i.e., health and safety managers, middle and top managers, human resources managers and employees).
- Participants also asked for the didactic materials used in the online courses should ideally be integrated with their corresponding subject areas. In other words, even if the topic of human centered design workplaces seems particularly relevant to be addressed in online courses, professionals will not the online courses if the content is not specifically related to their field of activity.
- The content should be updated regularly, as often as necessary, according to the latest technical standards or law standards and also according to the latest scientific literature.
- The content should be 'approved' by a competent authority or a third party.
- The platform supporting the online course should offer the learners the possibility (1) to download and print a PDF file or a document which contains a summary of the content presented in the module, and (2) to have access to a "learn more" module which leads the learner to specific or scientific content to develop their knowledge.
- The focus group participants assigned great importance to the possibility to have access to (1) the FAQ (Frequently Asked Questions), (2) online multiple choice or true/false quizzes (200 questions/responses), and (3) discussion forum

3.5 Validation of the training modules

- All training modules should be available at the beginning of the online course.

Indeed, participants expressed their disagreement with the necessity to validate a training module before starting the next module. If a self-evaluation test before finishing a module should be performed, results of this evaluation should not be considered as a pre-requisite (GO/NOGO) to make another module available.

- The self-evaluation related to theory contents should involve 20 questions with 3 or 4 answers.

Participants will appreciate if the potential answers would be provided using virtual contents rather than only written text. Participants suggested that the application has to correct immediately the answers and show the mark obtained. Participants also suggested that, in case of a wrong answer, the application should be able to automatically direct the learner to the content related to the error.

- The self-evaluation related to practical content should assess knowledge as well as know-how.

APPENDIX II-D

IAD Focus Group

1 Objective of the workshop

- To characterize the current knowledge and background of target professionals.
- To identify the knowledge areas required by professionals to be included in the online course
- To determine the aspects related to the format and design of the courses (length, availability, structure, accreditation, teachers...).

2 Organization

Date and participants:

- 2018/12/13 from 14.30 till 16.15h
- 6 participants: ergonomists, ergonomic design consultants, safety engineer

3 Main results

3.1 Characterization the current knowledge and background

To characterize the current knowledge and background of target professionals. At the beginning of the workshop, we collected and structured the current knowledge findings related to human centred design of work places and tools of all participants. Structure (Figure 7) includes 3 groups: methods, content, tools.

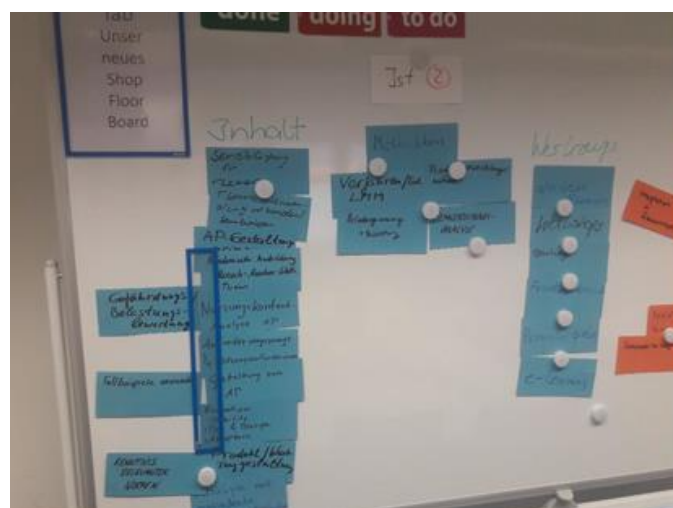


Figure 7.- Structure of the knowledge.

3.2 Identification of the knowledge areas

In second step, we identified the knowledge areas required by professionals to be included in the online course; competences related to following aspects are necessary:

- Standards (CE /ISO /) related to human centered design processes
- Methodology for human centered design process of workplaces and work tools
- Projective ergonomics vs. corrective ergonomics
- Methodology: economic aspects...
- Experiences: Good praxis Examples vs. "bad" solutions related to work places /tools

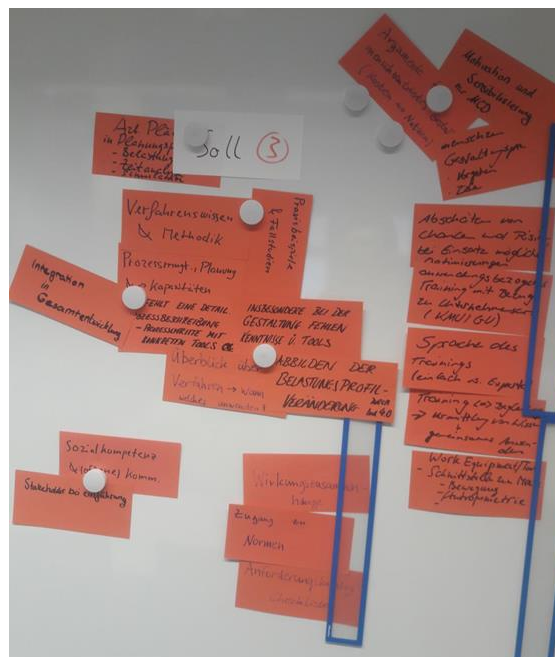


Figure 8.- Identification of knowledge areas.

3.3 Preferences regarding training course format

Length of the course:

- It depends on whether a sensitization or an application-related training or method course should take place
- Sensitization: 1h – half day
- Application-related training or method course: 1-2 full days (max. 15 participants)

Advantages of e-learning:

- Appropriate for factual knowledge
- It is possible to integrate test questions. Thus, it is possible for each individual to see whether it has understood the mediated content

- Participants can learn in their own pace
- Possibility to integrate small case studies
- Less staff costs for the instructor
- e-learning is suitable to support trainings

Disadvantages of e-learning:

- No possibility for questions
- No natural interaction (especially not suitable for people that learn by “hearing”)
- No communication with people that have the same understanding problem
- E-learning is not suitable for content that needs to be interpreted

3.4 Complementary documentation

- Documentation of developed results (pictures of slides, flip charts, cards...)
- Expectations and objectives of the training
- Lessons learned
- A short conclusion of the training

3.5 Theoretical or practical?

- Every training should contain both
- To what extend completely depends on the background of participants

APPENDIX II-E

Questionnaire

Dear respondent,

This activity is part of the European **project Erasmus TRAIN4HCWORK** (2018-1-ES01-KA203-0508879). The objective of this questionnaire is to identify the training needs of different professionals dealing with human-centred workplaces. This will enable a specific and suitable training course to be developed.

We invite you to complete the following questionnaire, keeping in mind the perspective of a NON-SPECIALIST in ergonomics and human factor (E & HF). As the interactions between human operators and technology intensify, we seek to better understand what level of E & HF knowledge and practice are important for those involved in the design of such interactions.

Thank you
Team project
TRAIN4HCWORK
www.train4work.eu

I. PERSONAL DATA

1. Indicate your gender:

☐ Male

☐ Female

2. Enter your age:

☐ Less than 25

☐ 25 - 35 years

☐ 36 - 45 years

☐ 46 - 55 years

☐ 56 - 65 years

☐ More than 65 years

II. BACKGROUND AND PROFESSIONAL EXPERIENCE

3. Indicate your professional profile:

- ☐ Engineer responsible for the design of machinery, work equipment and tools.
- ☐ Engineer responsible for the design of jobs, processes and production
- ☐ Consultant that provides services related to these topics
- ☐ Health and safety manager
- ☐ HR staff
- ☐ Participant
- ☐ Other speciality. Specify:

4. Indicate the years of experience: years

5. Indicate the sector of your company:

- ☐ Agriculture, forestry and fishing
- ☐ Manufacturing, mining, quarrying and other industry
- ☐ Construction
- ☐ Wholesale and retail trade, transportation and storage, accommodation and food service activities
- ☐ Information and communication
- ☐ Professional, scientific, technical, administration and support service activities
- ☐ Public administration, defence, education, human health and social work activities
- ☐ Other services. Specify:

6. Indicate the size of your company:

- ☐ Micro-company (max 10 workers)
- ☐ Small company (11-49 workers)
- ☐ Medium-sized company (50-250 workers)
- ☐ Large company (> 250 workers)

7. Currently, considering your professional needs your training in the **design of human-centred workplaces** is:

☐ Very suitable

☐ Suitable

☐ Unsuitable

☐ Not at all suitable

8. ¿ Have you received any training related to the **design of human-centred workplaces** in the last two years?

☐ Yes

☐ No

9. ¿Which training?

III. TRAINING NEEDS

10. What would be your motivation to take a training course related to the **design of human-centred workplaces**? (Select at least 2 motivations that you consider most important to you).

☐ Increase my general knowledge in this field

☐ Retrain professionally through new technologies

☐ Improve my professional status and competitiveness

☐ Reduce sick-leave and absenteeism

☐ Improve the well-being of workers

☐ Improve quality, safety and efficiency of processes in my organisation

☐ Increase flexibility, agility and competitiveness

☐ Better serve my clients

☐ Other (please specify):

11. Regarding the training contents of the course mentioned below, please specify in each case the level of importance for your work:

* The importance of this field in my work is... (1=SMALL, 2=MEDIUM, 3=ESSENTIAL)

* I would take training in this field... (1=YES, 2=MAYBE, 3= NO)

	The importance of this field in my work is...
1. INTRODUCTION TO ERGONOMICS. Definition and importance of its application to the design of workplaces (awareness)	
2. ANTHROPOMETRY APPLIED TO THE ERGONOMIC DESIGN OF JOBS. Basic definitions and main body dimensions, interpretation and management of anthropometric data, estimation methods of anthropometric dimensions and criteria for the application of anthropometry to design.	
3. ERGONOMIC CRITERIA. GENERAL RECOMMENDATIONS. The design considering the corporal dimensions, postures, movements and corporal efforts.	
4. ERGONOMIC CRITERIA. PRACTICAL EXAMPLES. References on what criteria to use and how to apply them	
5. METHODS AND TOOLS for ergonomic workloads analysis & risk assessment related to workplaces and production lines (e.g. NIOSH, EAWS; examples of analysis)	
6. METHODS for human centered design process of workplaces and production lines during planning phase (incl. using simulation e.g. IMK-EMA-Tool)	
7. DESIGN OF WORK EQUIPMENT AND ELEMENTS. Design of controls, indicators and manual tools. Ergonomic criteria for machinery. Design of carts/trolleys and containers.	
8. ENVIRONMENTAL CONDITIONS. ERGONOMIC CRITERIA. Environmental ergonomics, lighting, thermal comfort, noise, acoustic comfort. Visual ergonomics, chromatic environment.	
9. COGNITIVE WORKLOAD AND DECISION-MAKING Management of cognitive and attentional resources, cognitive overload and underload, focus on primary and secondary tasks	
10. ORGANISATIONAL AND SAFETY CULTURE Managing behavioural aspects, human reliability within production and decision-making processes	
11. ARCHITECTURE OF THE BUILDING AND INTERIOR DESIGN OF WORKPLACES. Layout of work areas, transport routes, aisles and corridors, surface of transport routes, stairs and ramps.	
12. INTEGRATION OF WORKERS IN THE DESIGN PROCESS. Methodologies and techniques to participate in the design. Co-	

creation. Existing tools (softwares) for the design. (Example: Lego serious play).	
13. NEW TRENDS IN ERGONOMICS AND TECHNOLOGIES THAT HELP THE WORKER. Active ergonomics, emotional ergonomics. Exoskeletons, robots, cobots, sensors, drones, automation, etc.	
14. REGULATIONS / STANDARDS RELATED TO ERGONOMICS (DESIGN OF WORKPLACES)	
15. Other. Please specify:	

IV. COURSE FEATURES

For answering the following questions, keep in mind that the course is divided into different modules and each module into different sessions.

12. How much time will you have to devote to a training/study session?

- ☐ Less 30 min
- ☐ Between 30 min and 1 hour
- ☐ More than 1 hour

13. The course must be available on

- ☐ Laptop
- ☐ Smartphone
- ☐ Digital tablet
- ☐ Other. Please specify:

14. Regarding the training contents of the course previously mentioned, please specify in each case the level of importance for you to have access to:

* The importance to have access to... (1=SMALL, 2=MEDIUM, 3=ESSENTIAL)

	The importance to have access to
1. A PDF FILE OR A DOCUMENT which contains a summary of the content presented in the module	
2. A "LEARN MORE" MODULE which leads the learner to specific or scientific content to develop their knowledge	
3. FREQUENTLY ASKED QUESTIONS (FAQ)	

APPENDIX II-F

Questionnaire Results

1 Introduction

The questionnaire was initially produced in four different languages (English, German, French and Spanish) and later in the process, an additional version in Serbian was produced by a member of FEES team. A sample of 107 respondents was achieved with the following distribution among the five versions of the questionnaire:

- English: 41 respondents
- German: 5 respondents
- Serbian: 22 respondents
- French: 31 respondents
- Spanish: 8 respondents

Although the initial project target of 100 was achieved, this is regarded as a very small sample and below expectations, as it is estimated that questionnaire dissemination has **reached more than 5.000 relevant** entities across Europe, namely engineering, human factors & ergonomics and industry sector associations, in addition to several hundreds of individual organisations. This low adherence may be partly attributed to the yet relatively low maturity of project's dissemination activities. Data analysis had to be carried out at this stage, so as to maintain adherence to project work plan. The questionnaire was nevertheless kept available online, aiming to benefit from any possible late respondents emanating from the wide dissemination that was developed. While a review of data analysis may be carried out at a later stage, this will not affect the statistical outcome and the data trends that are present here, as sample size already ensures a normal distribution of data.

2 Questionnaire data trends

In line with the low level of response that was achieved, when considering the size of the universe of potential respondents that was reached, a considerable number of non-respondents was registered in large majority of questions. On average, a rate of 25% of non-respondents was obtained, while some questions registered as much as 36% of non-respondents. While this may raise additional difficulties for more in-depth statistical analysis, it does not compromise the normal distribution of data. The main trends of questionnaire data are given in the following sections. These sections follow the same structure as the questionnaire.

2.1 Personal data

Two thirds of the sample are male respondents, which may be regarded as a consequence of a yet higher prevalence of male practitioners in the domains of engineering that are estimated to compose that large majority of the sample. Half of the sample is aged between 35 and 55 years old, which suggests that respondents have some level of professional maturity. Nearly 10% of respondents have over 65 years old which is in line with the aging population trend that is currently registered in Europe.

2.2 Background and professional experience

2.2.1 Occupational profile

As previously observed, engineering disciplines prevails in the sample. 38% of respondents have an engineering background, 15% are directly related to health & safety, and 37% stated other types of backgrounds, amongst which a considerable part is engineering related.

Approximately 40% of the sample stated having **20 years or more of professional experience**, which confirms a considerably degree of maturity. Despite this trend, as shown in **Erro! A origem da referência não foi encontrada.**, experience is widely distributed, with only an outstanding higher concentration around the 15 years.

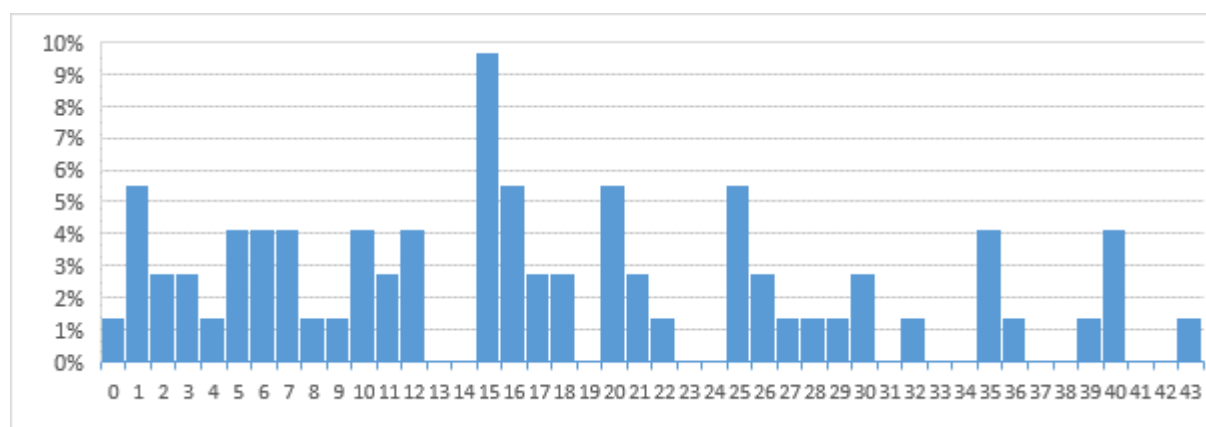


Figure 9: Years of professional experience.

2.2.2 Organizations

The questionnaire sample represents a wide range of sectors, of which manufacturing industry and support services (i.e. consultancy) are the most representative ones. Nearly half of the respondents are with large organisations, which may reflect the relation between human-centred design related issues and the availability of resources in organisations, in particular their investment capacity. Nevertheless, an important interest on these issues appears to exist on smaller organisations, as 38% of respondents are with companies with less than 50 employees.

2.2.3 Training in human-centered aspects

65% of respondents consider themselves as having a suitable or very suitable training in this domain. However, this should be pondered against the fact that only 15% of respondents stated that they had relevant training within the last two years, and the majority of the training mentioned are of short duration and of relatively narrow scope (i.e. conference attending or tool-based and workplace training). Master programmes and update training are also mentioned.

2.3 Training needs

2.3.1 Motivating factors

Data on training needs seems to underline a wide range of priorities. While some 60% of respondents identified the need to increase general knowledge, almost half also considered of equal importance of updating through new technologies. This suggests that the majority of respondents consider of equal importance maintaining general knowledge and the need to update in specific and applied aspects. This somehow contrasts with the fact that only 15% of respondents stated having train during the last

two years. The prevalence of increasing general knowledge in this field as the highest motivation for seeking training also contrasts with the fact that 65% of respondents considered having suitable or very suitable training. Improving well-being, quality, safety and efficiency also stand out as important motivators for seeking training. **Erro! A origem da referência não foi encontrada.** provides an overview of motivating factors.

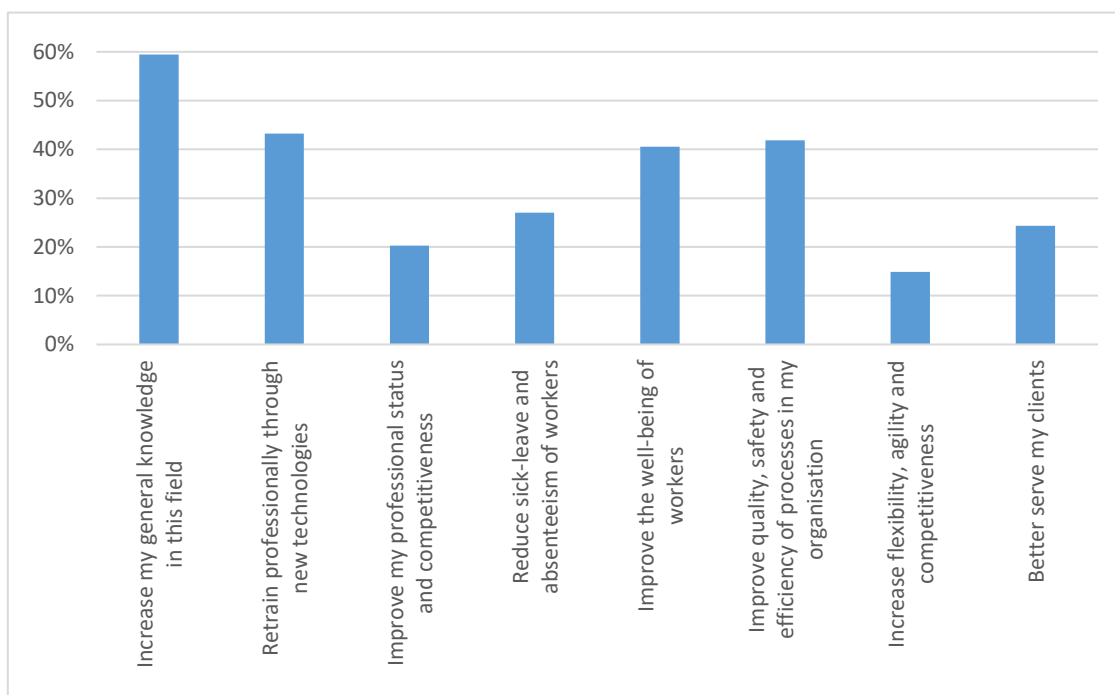


Figure 10: Motivations for taking training related to human-centred design.

2.3.2 Importance of different training contents

As illustrated in Figure 11**Erro! A origem da referência não foi encontrada.**, the majority of respondents considered **all the topics as having a medium importance or as being essential**. Only the items relating to the design of equipment and the integration of workers in the design process stand out by the fact that 20 respondents (27%) considered them as having a low importance. Keeping in mind the focus of the project on human-centred design, this may indicate that more in-depth analysis may be needed regarding the understanding that stakeholders may have on such issues.

The search for guidance and criteria to support ergonomics practice is regarded as the most essential topic. Ergonomic criteria in terms of general recommendations and of environmental conditions, as well as the use of practical examples as guidance, were considered as essential contents by the majority of respondents (54%, 51% and 64% respectively). A respondent commented that guidance based on real context best practices were the most important content. The fact that organisational and safety culture aspects were also considered as essential by a similar percentage of respondents (53%) highlights the growing perception regarding the critical role of human factors in dealing with complex work contexts.

The content to be considered as essential by the lowest percentage of respondents were anthropometry aspects (22%). This could be regarded as a consequence of the continuous evolution

of work towards a growing cognitive nature in detriment of a more physical one. However, this item was also notably regarded as having a medium importance by the majority of respondents (55%), which suggests that concerns in this domain persist, perhaps related to the working postures that are maintain for long periods of time within contexts such as control rooms and other desktop related work that increasingly dominates human activities.

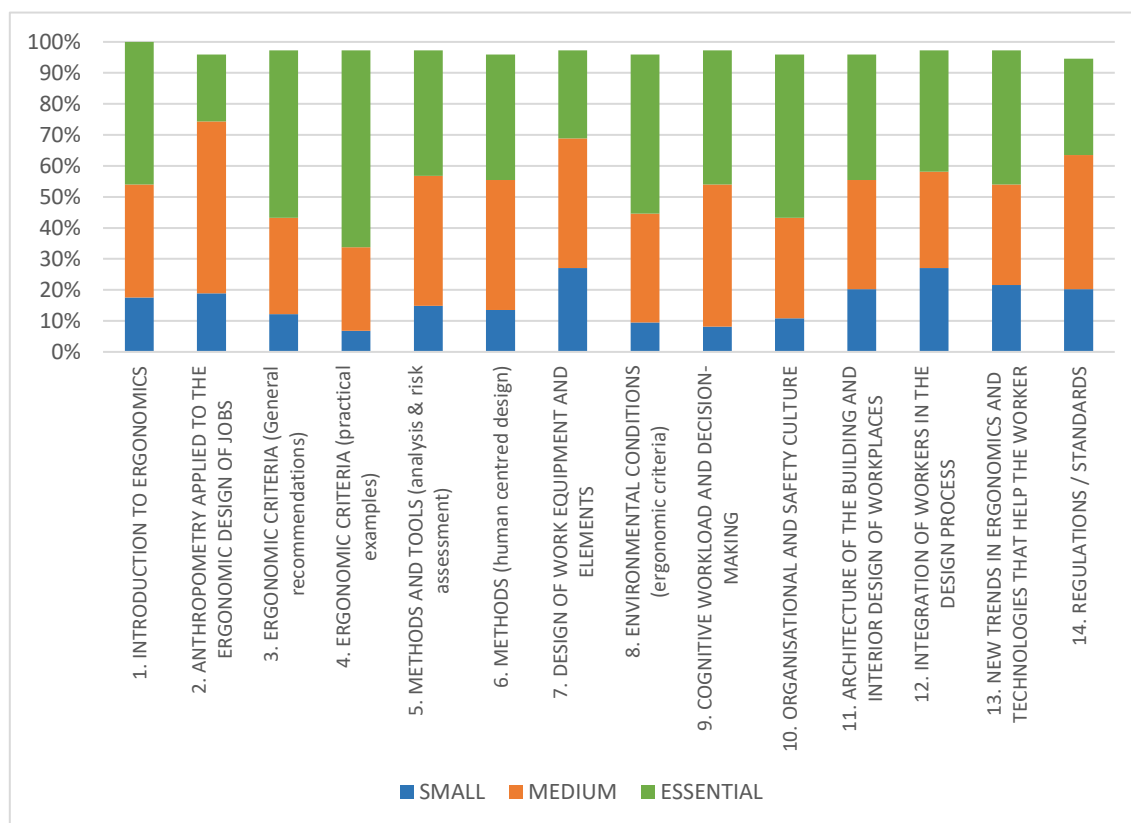


Figure 11: Level of importance of training by topics.

2.4 Course features

Regarding the duration of training sessions, respondents clearly point to 30 minutes to 1 hour. In terms of the available technology supports, the computer based (i.e. laptop) was also clearly regarded as the most relevant one, although other smaller devices such as smartphones and tablets were also considered as having some importance.

Figure 12 **Erro! A origem da referência não foi encontrada.** illustrates degree of importance that was attributed to different types of resources. **Access to formal documentation** (in PDF format) was regarded as the most essential one (62% of respondents considered it as essential). Offering guidance on how to access additional contents and information (“learn more”) was also considered by the majority of respondents (57%) as an essential resource.

When considering additional resources, namely obtaining explanatory support and means for self-assessment, data trends show a less clear trend. In particular, discussion forums were simultaneously considered as having a low and medium importance, and as essential by approximately the same number of respondents. Regarding self-assessment resources, while 84% of respondents were

favourable to having means of testing their proficiency at the start of each training module, having access to multiple choice and quizzes was considered by the majority of respondents as only having a medium importance.

In general, respondents considered more advantageous to have **immediate access to all training modules**, as opposed to any form of partial access, as progress is made throughout the course structure. In particular, the low acceptance that was accorded to carrying out a “GO/NO GO” test before progressing contrasts with the high importance given to a pre-module self-evaluation. Under additional notes, a respondent added that assessment resources should only be made available if anonymous response can be ensured. A respondent also added that universal access and some form of certification should be pursued.

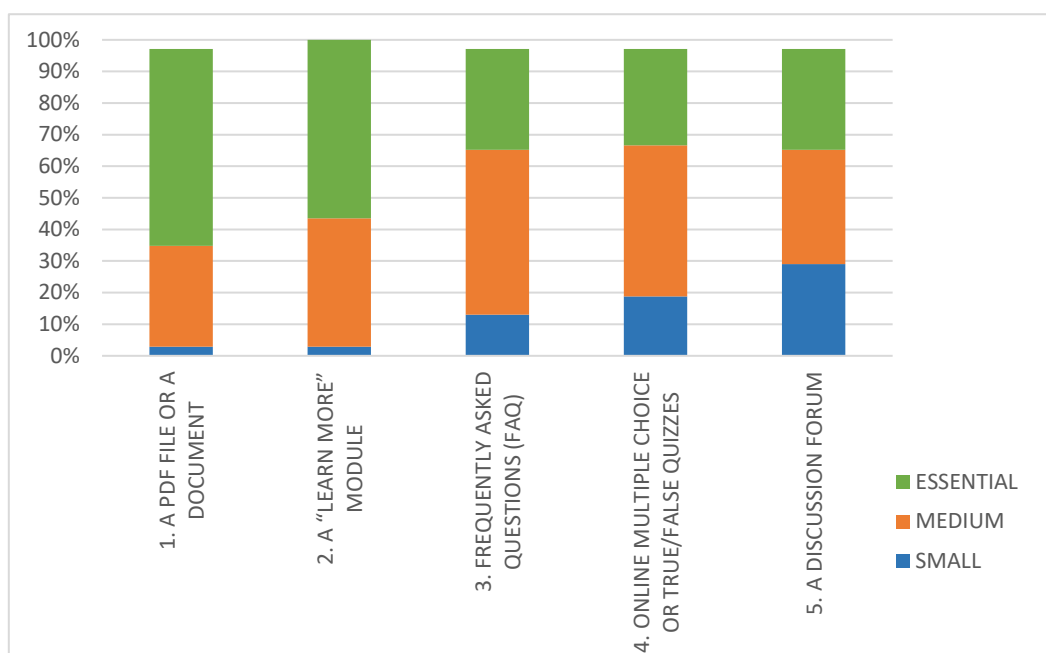


Figure 12: Level of importance of training resources

3 Final note and the pursuit of TRAIN4HCWORK objectives

Overall, questionnaire data **shows similar trends as those extracted from the various focus groups previously carried out**. This is perceptible, namely through value attributed to the different types of contents and resources. Nevertheless, the differences in terms of background between the questionnaire sample and the focus groups participants should be kept in mind.

Online questionnaires are often low reliability methods for the data collection. The rate of response that was achieved and the rate of non-respondents in all questions were well below expectations and can be taken as indicators of potential data reliability issues. When confronting the fact that few respondents undertook training within the last two years with the need for general human factors knowledge and training that was expressed, it can be considered that either respondents were unclear on the meaning of the questions or have too little understanding relating to the domain of human factors and ergonomics. Project team may balance this with focus group data and further ahead, through a more thorough validation of course contents and structure.