CHALLENGING BIAS IN BIG DATA USER FOR AI AND MACHINE LEARNING

Algorithmic Bias Toolkit

Administrators Guideline

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Overview

This document comprises, for the "Algorithmic Bias" course (EQF6), a description of course components, the digital outcomes, the templates to be completed and the quantification of the work developed by the partners responsible for each Competence Unit.

The course has a **blended learning** methodology, being composed by:

- 5 synchronous sessions (preferably face-to-face)
- eLearning asynchronous sessions

Besides the interactive materials for the eLearning sessions, it includes a toolkit for support of the trainer.

The first version of all materials will be developed in English, being then later translated to Spanish, Romanian, Danish and Finnish.

The course includes **5 Competence Units**:

CU1 - AI Ethics, a Practical Approach (developed by VAMK)

CU2 - AI Privacy and Convenience (developed by UA)

CU3 - Algorithms and Their Limitations (developed by UIB)

CU4 - Data Fairness and Bias in AI (developed by UA)

CU5 - Case Studies and Project (developed by VAMK)

It is developed to achieve the **specific objectives** of the work package:

- increase the capacity of HE institutions to provide its students **online learning opportunities** that meet society needs but also are tailored to students learning needs by delivering **b-learning approach with tailor-made OERs** ready to be uploaded in any LMS (.scorm packages).

- increase Tech students **social and ethical competencies**, allowing them to **engage positively, critically, and ethically** with AI/ML technology by providing a **state-of-the-art education programme**, specifically targeting this target group (including serious game for formative assessment, digital online assessment, and other support materials)

- equip **teachers/professors** with **digital and engaging approaches** to effectively teaching the topic (specially in online teaching) by providing a **roadmap to incorporate the course** in their daily activities with tools specifically designed for face-to-face learning.

Principles of distance learning

The methodology adopted for Algorithmic Bias course is hybrid (blended learning), i.e. there are synchronous training sessions (face-to-face or online) and asynchronous training sessions.

1. Motivating the trainee

The role of student motivation in achieving the learning outcomes defined for a course is a topic that has been widely studied in the educational sciences and its importance is undeniable. Trainers have used strategies in face-to-face training to increase trainees' engagement and motivation, such as including practical demonstrations that capture their attention. In online training contexts, teachers and trainers need to innovate to increase or maintain motivation levels. Different strategies can be used, such as including virtual practical demonstrations, inviting interesting people to share their knowledge on a topic in which they are experts, assigning interactive work and group projects, keeping e-learning sessions dynamic or implementing a course forum where trainees can share ideas with each other and with teachers/trainers.

2. Interaction

The learner's interaction with peers, teachers and trainers and with the training materials is significantly different in traditional face-to-face classes and in an e-learning context.

The traditional classroom is always synchronous, which means that trainees interact with trainers, colleagues and training materials in real time. In the traditional classroom, the trainer is the main conduit of information. In e-learning, sessions can be synchronous or asynchronous, allowing learning to take place "outside" the classroom and empowering trainees to manage their own learning experience, at their own pace, in the time and place that suits them. In this context, learners construct their own learning experience (always with the support of the trainer).

Synchronous sessions should be used to answer questions and promote interaction with trainees; it is possible to use interactive tools that appeal to trainees' participation, such as quizzes, polls and chats.

In the context of distance learning, training materials play an important role in the learning experience, so they must be developed with care to ensure the effectiveness and quality of learning. It is therefore important to ensure that the materials are appealing, which, among other things, means that they are not just expository. Aspects related to the interactivity of materials must be taken into account during the design and development phase. Some examples of how interactivity can be incorporated into distance learning materials: quizzes and tests with immediate feedback on performance; simulations and games, quizzes and periodic challenges to encourage trainees' participation and test their knowledge in a playful way, interactive videos that allow them to choose different paths or outcomes based on their decisions, interactive concept maps to help trainees visualise the relationship between concepts and facilitate understanding of the content, interactive screens and animations with links to learn more, artificial intelligence chats, collaborative activities such as group projects to encourage teamwork and the exchange of knowledge between trainees, simulators and

virtual laboratories that allow trainees to carry out experiments and observe results in a safe environment.

It is also important to guarantee the existence of feedback and support mechanisms through the distance learning platform, which should be user-friendly and offer adequate resources for interaction and monitoring of trainees' progress.

Interactivity is key to keeping trainees engaged and promoting a richer, more meaningful learning experience.

3. Different roles

The roles of trainee and trainer are different depending on whether the training is face-to-face or online.

In online training, the learner is at the center of the learning experience and must move from a passive role to an active one. Trainers also have a different role, since in asynchronous online training they are not the conduit of knowledge, but the ones who support the trainees in their learning journey. Thus, in asynchronous online training, the learner becomes the center of the teaching-learning process and needs to be highly self-motivated, organized and responsible for their own learning. The learner must have certain technological skills from the user's point of view.

The roles and responsibilities of a face-to-face trainer and a distance trainer can vary significantly due to the different teaching approaches and the environment in which they work.

The face-to-face trainer interacts personally with the trainees in the classroom, being able to observe their facial expressions, body language and reactions in real time. This way, they can provide immediate feedback during the lesson, clarify doubts when they arise and adapt their approach according to the feedback they receive at the time.

The distance trainer interacts with the trainees via digital platforms and has no face-to-face contact with them. Feedback may not be immediate, depending on the trainer's availability and the communication channels used, which may require more planning. Distance trainers have to adapt content for the online environment, using various digital resources. Trainers are required to have skills related to the use of distance learning platforms and technological resources to facilitate communication and access to content.

To summarise, face-to-face trainers have the advantage of direct and immediate contact with the trainees, adapting easily to the group, while distance trainers have to use technological resources and promote trainee autonomy, interaction and feedback remotely. Both roles have their particularities and challenges and are equally important in promoting the learning experience.

4. Support and communication

In the classroom (face-to-face or synchronous online), teachers and trainers naturally communicate with trainees and have the opportunity to answer any questions they may have and even identify the need for an individual approach. In the asynchronous online environment, this is not the case and it is often difficult to reach trainees outside of training

sessions. That's why it's essential to create communication channels (such as e-mail, direct messages or forums). That way, trainees can also have their questions answered quickly and improve their overall level of engagement.

It is also important to ensure that there are feedback and support mechanisms via the distance learning platform and to offer a list of contacts (for example, emails for trainers, tutors and helpdesk support).

5. Technical resources

This is an essential part of the e-learning experience. If learning materials are important in face-to-face training, they play an even more important role in online training, since in an asynchronous model trainees are left alone to explore the materials in a self-learning endeavor. Therefore, e-learning materials must be pedagogically well-structured and require the cognitive activation of the learner. It is advisable to prepare different types of materials to cover the different learning styles (videos, exercises, interactive modules, concept maps, among others).

The materials must be hosted on an e-learning platform (LMS) that allows the learner's interactions with the materials to be recorded, so that they can be followed up and monitored.

Structure and methodology

Training methodology

If you want to implement the Algorithmic Bias course, you should start by reading the Competence Matrix of Learning Outcomes and pedagogical objectives, available on the project website.

The training is based on a blended learning methodology. The theoretical training will be delivered mostly via e-learning, with four synchronous sessions (face-to-face or online). The course workload totals 84 hours.

COURSE WORKLOAD	
Course components	
Competence Unit 1	14 hours
Competence Unit 2	14 hours
Competence Unit 3	14 hours
Competence Unit 4	14 hours
Competence Unit 5	14 hours
Gamified assessment	1 hour
Synchronous sessions	
Support session 1	3 hours
Support session 2	3 hours
Support session 3	3 hours
Support session 4	3 hours
Support session 5	3 hours
TOTAL	
3 ECTS (28h x 3)	84 hours

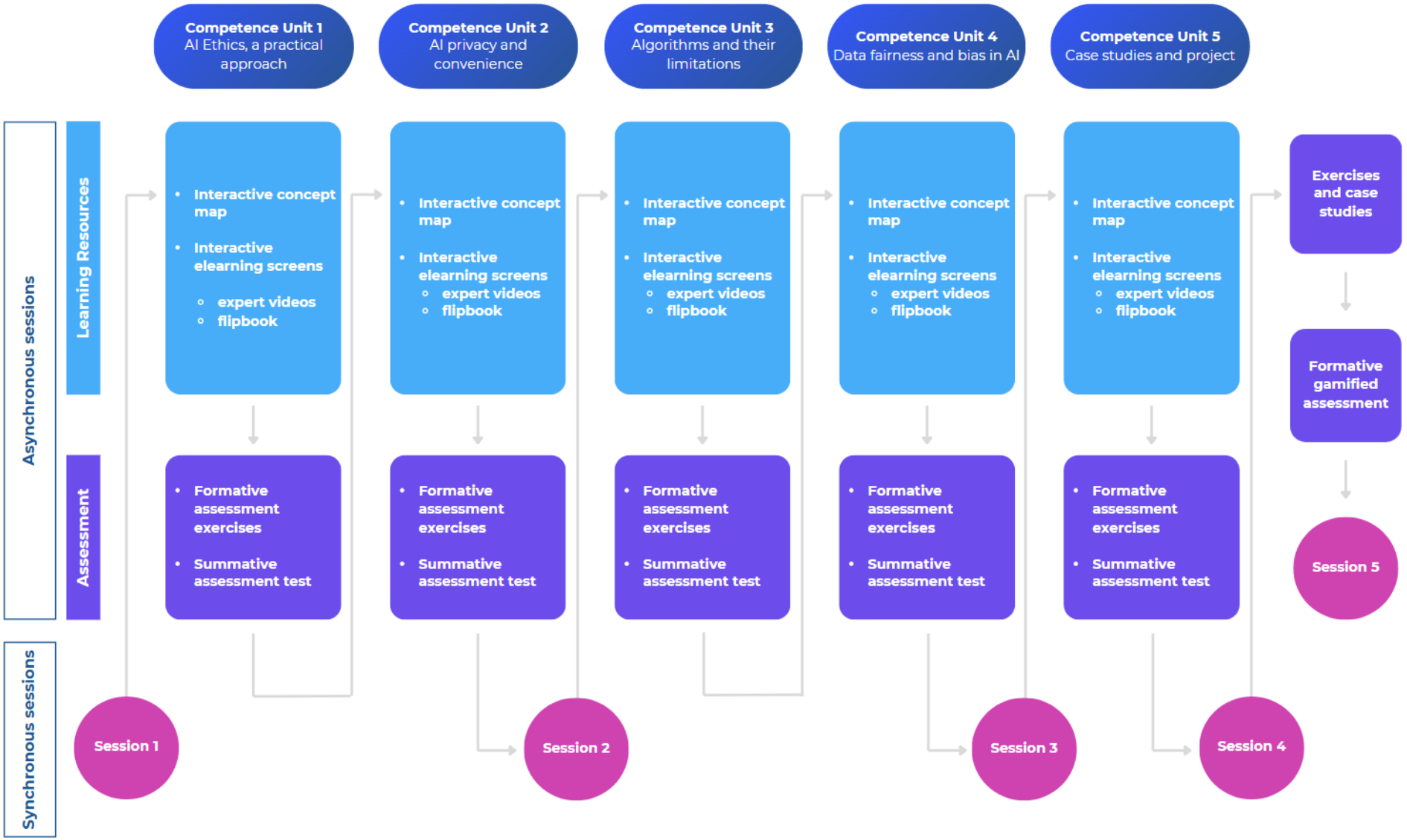
To calculate the ECTS (European Credit Transfer and Accumulation System) credits for the course, the typical standard of 1 ECTS credit representing 28 hours of student workload was used. This includes synchronous and asynchronous sessions, independent study, and assessment activities.

For the 84-hour course, the ECTS credits were calculated as:

84 hours / 28 hours per ECTS = **3 ECTS**

Each training organisation must analyse the proposed methodology, the training materials developed, and decide on a timetable according to its specific circumstances, although a suggestion is provided in this guide.

Course Structure



Course calendar

WEEK 1	WEEK 2	WEEK 3	WEEK 4
Support session 1 Introduction and guidance to initiating the course	Trainees to explore CU1 **ASSESSMENT**	Trainees to explore CU2 **RESOURCES**	Trainees to explore CU2 **ASSESSMENT**
Trainees to explore CU1 **RESOURCES**	**Trainees to deliver assessment of CU1**		**Trainees to deliver assessment of CU2**
	Trainer to gather and evaluate materials		**Trainer to gather and evaluate materials**

WEEK 5	WEEK 6	WEEK 7	WEEK 8
Support session 2 Support to CU1 and CU2 and next steps	Trainees to explore CU3 **ASSESSMENT**	Trainees to explore CU4 **RESOURCES**	Trainees to explore CU4 **ASSESSMENT**
Trainees to explore CU3 **RESOURCES**	**Trainees to deliver assessment of CU3**		**Trainees to deliver assessment of CU4**
	Trainer to gather and evaluate materials		**Trainer to gather and evaluate materials**

WEEK 9	WEEK 10	WEEK 11	WEEK 12
Support session 3 Support to CU3 and CU4 and next steps	Trainees to explore CU5 **ASSESSMENT**	**Support session 4** Support to CU5 and guidance to closure of the project activities	Trainees to develop project activities
Trainees to explore CU5 **RESOURCES**	**Trainees to deliver assessment of CU5**	Trainees to develop project activities	**Support session 5** Presentations of the project activities and conclusion of the course

Competence Units

The course covers 5 Competence Units:

CU1 - AI Ethics, a Practical Approach

CU2 - AI Privacy and Convenience

CU3 - Algorithms and Their Limitations

CU4 - Data Fairness and Bias in AI

CU5 - Case Studies and Project

Learning Resources

The target audience of the course, with EQF level 6, is Higher Education students.

As mentioned above, the course has 5 Competence Units. Each unit is covered in the following course components:

eLearning screens

The interactive eLearning screens are the main component of the course, to be complemented by the other materials. They will be developed by a team of Instructional Designers, Multimedia Developers and Graphical Designers.

This component will be available in .scorm packages to be implemented in a Learning Management System (a platform, such as Moodle, Canvas, Cornerstone, etc.) and in FTP links, to be included in the project website or any other page and openly visualized by any user.

Each CU should have around 20 ppt slides worth of content in the provided template, to be digitally transformed into the interactive eLearning screens, containing an overview of the ideas to be covered in each topic.

The outcome is 5 .scorm packages and/or 5 FTP links (one per each competence unit).

Expert videos

Each competence unit will include 2 short expert videos of around 1 minute each:

- introduction to the CU (overview of the topics covered)

- conclusion of the CU (most important points to retain)

These will be included within the interactive eLearning screens, in the beginning and the end of each unit content. They can also be used as separate video files for dissemination purposes.

The outcome will be 10 mp4 files (two per each competence unit).

Interactive flipbook

The interactive flipbook is an interactive document with pop-ups (text, image or video that shows in a small pop-up window in the document itself), appearing when the user clicks on specific marked keywords, concepts, images, etc. It will have the format of an A4 booklet.

The content of the flipbooks is a more in-depth and extended version of the content of the eLearning screens, with examples and clarifications.

Each interactive flipbook will be included within the eLearning interactive screens, where they will be accessed by a button after the conclusion expert video. They can also be exported as regular pdf's, to be easily shared and downloaded and, additionally, they can be shared as interactive documents by FTP link.

The outcome will be 5 pdf files and/or 5 FTP links (one pdf/link per each competence unit).

Concept maps

Each competence unit includes the development of one interactive concept map, which is a visual overview of the key topics of the content of the unit. The trainees are advised to check the concept map before diving into the eLearning screens. The main goal is that the user understands how the concepts covered in the competence unit are interconnected and/or consequential.

These components will be available in .scorm packages to be implemented in a Learning Management System (a platform, such as Moodle, Canvas, Cornerstone, etc.) and in FTP links, to be included in the project website or any other page and openly visualized by any user.

The outcome will be 5 .scorm packages and/or 5 FTP links (one per each competence unit).

Assessment

Formative assessment exercises

The formative assessment exercises are statements of practical activities which the user will resolve to formatively test their knowledge in the topic. After resolving the exercise, they should forward the solution to the trainer/course tutor. These activities should be completed in the week designated for each competence unit, as it is seen in the calendar.

ISQe will provide a specific template which the partner responsible for each unit should complete with the requested information (description, time for the activity, desired outcome, etc). The final documents will be pdf, to which the users will have access to in the LMS and/or in the project website.

Each partner responsible for each unit should develop at least one formative assessment exercise per competence unit.

The outcome will be at least 5 pdf files (at least one pdf per each competence unit).

Multiple-choice Questions Quizzes

For the purpose of summative assessment, the course will include a multiple-choice question quiz, that will provide the user with a grade in percentage.

When taking the quiz, 10 questions out of the pool of 20 per competence unit will be randomly displayed. The user will have to go through 50 questions (10 from each competence unit) and the minimal rate of success is 60%. The user has 3 attempts to go through the quiz, in each attempt the questions will differ because they will be selected from the available pool.

The multiple-choice quiz can be delivered as scorm package or as a FTP link. When choosing to use the scorm package and implementing in LMS, the grade will be recorded and associated with the user profile. When accessed via FTP link, the user will be able to see their grading, but it won't be recorded.

The outcome is one scorm package and/or one FTP link.

Online formative assessment

A serious game will be developed as an online formative assessment tool. It will be a virtual roulette with 5 regular themes (one per each competence unit) and 1 star theme. The learner will click on the centre of the roulette wheel, which will spin and a question will come up in a random order. The learner has a limited time to give their answer and then receives feedback, whether correct or incorrect. The feedback should be a short clarification on the topic of the question.

The expected total duration of the game is 30 minutes. The game will include at all times a support document which the users will be able to consult – this document will be a compilation of the 5 interactive flipbooks developed for the course.

For each regular theme, the user will have to answer 4 questions. In order to make the questions randomized and differentiated on each round/attempt, the partner responsible for each competence unit should come up with 8 questions per unit.

When the star theme shows up, it means that increased difficulty questions will show. This theme will show the user 1 question dedicated to each competence unit. In order to make the questions randomized and differentiated on each round/attempt, the partner responsible for each competence unit should come up with 2 questions per unit.

In total, the player will have to answer 25 questions (4 of regular difficulty per competence unit + 1 of increased difficulty per competence unit). The partner responsible for each unit should have to complete the provided template with 8 regular difficulty questions and 2 increased difficulty questions per competence unit.

A separate document with more details on the game specifications is provided.

The outcome is a scorm package and/or a FTP file.

Support synchronous sessions

First support session

Duration	Approximately 2 hours and 30 minutes
Calendar	To be held before the start of the elearning activities
Objectives	• Introducing the course • Presentation of the participants • Providing context to the contents to be approached • Presenting the methodology and structure • Delivering a calendar and action plan • Providing access and information about the platform used
Resources	• Ice-breaker activity • Presentation powerpoint about the course contextualization • Presentation powerpoint about the course objectives and methodology • List of users of the platform
Agenda (schedule suggestion)	
9 am – 9.30 am	Introduction of the trainer and the participants and Ice-breaker activity
9.30 am – 10 am	Presentation of the course contextualization
10 am – 10.15 am	Coffee break
10.15 am – 11 am	Presentation of the course objectives and methodology
11 am – 11.15 am	Distribution of platform access
11.15 am – 11.30 am	Q&A

Second support session

Duration	Approximately 3 hours
Calendar	To be held in Week 5, after trainees complete Competence Units 1 and 2.
Objectives	• Clarify and discuss key concepts covered in CU1 (AI Ethics) and CU2 (AI Privacy and Convenience) • Provide feedback on formative assessment exercises related to CU1 and CU2

	• Facilitate peer-to-peer discussion and sharing of experiences or challenges • Outline next steps and guide the transition to CU3
Resources	• Support PPT of CU1 and CU2 • Formative assessment exercises • Discussion prompts or real-case scenarios highlighting AI ethics and privacy challenges • Q&A slide deck or prepared discussion topics to support group dialogue
Agenda (schedule suggestion)	
9 am – 9.30 am	• Welcome and recap: Brief review of CU1 and CU2 highlights • Q&A session: Address common questions or clarifications needed
9.30 am – 10 am	• Group discussion: Share experiences with formative assessment tasks • Problem-solving in small groups: Discuss or brainstorm solutions to any difficulties encountered
10 am – 10.15 am	Coffee Break
10.15 am – 11 am	• Interactive activity: Present a short real-world example or case study on algorithmic bias/AI privacy and invite group analysis • Feedback from trainer/tutor: Provide guidance and confirm understanding
11 am – 11.30 am	• Next steps: Introduce CU3 (Algorithms and Their Limitations) and upcoming project milestones • Q&A and conclusion

Third support session

Duration	Approximately 3 hours
Calendar	To be held in Week 9, after trainees complete Competence Units 3 and 4.
Objectives	• Consolidate understanding of CU3 and CU4 content • Discuss practical implications of algorithmic limitations and data bias • Review formative assessments for CU3 and CU4, clarify any lingering questions • Provide guidance for upcoming tasks or any project work in progress

Resources	• Support PPTs for CU3 and CU4 • Formative assessment exercises • Example case studies demonstrating algorithmic limitations and bias • Brainstorming or collaborative software (if online) to facilitate group activities
Agenda (schedule suggestion)	
9 am – 9.30 am	• Welcome and review: Quick overview of CU3 and CU4 main takeaways • Open Q&A: Address common questions or misunderstandings
9.30 am – 10 am	• Discussion: How do algorithmic limitations manifest in real-world AI systems? • Case study exploration: Present a scenario where biased data leads to unfair outcomes—invite group input
10 am – 10.15 am	Coffee break
10.15 am – 11 am	• Formative assessment feedback: Go through common challenges or errors in CU3 and CU4 exercises • Peer-sharing: Encourage students to exchange strategies or solutions
11 am – 11.30 am	• Looking ahead: Introduce upcoming tasks (CU5 and next project steps) • Q&A and wrap-up

Fourth support session

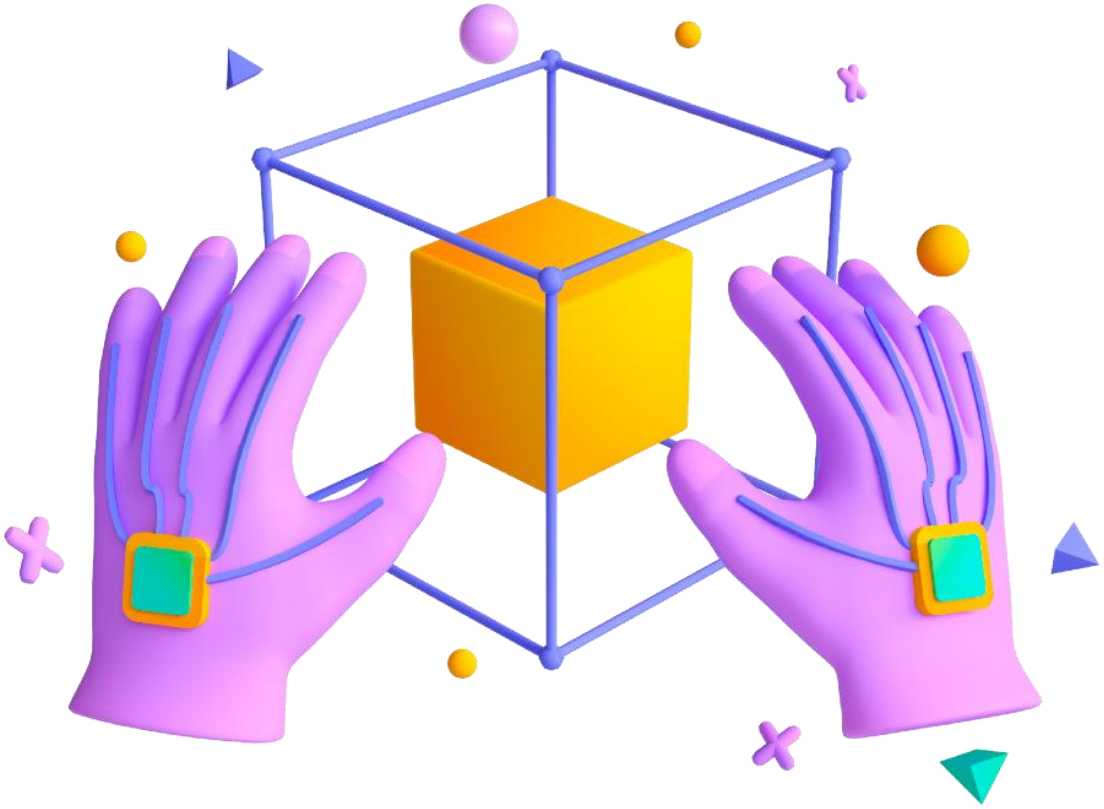
Duration	Approximately 3 hours
Calendar	To be held in Week 11, after trainees complete Competence Unit 5 and need guidance to close project-related activities.
Objectives	• Provide targeted support on CU5's content and project activities • Discuss real-life case studies in depth, ensuring participants can apply theoretical knowledge • Offer feedback on project progress and address any final adjustments • Clarify expectations and deliverables for the project closure
Resources	• CU5 materials and any supplementary case studies • Interim project presentations or draft project reports from trainees

	• Checklists or guidelines for project completion and final submission • Slides or reference documents summarizing key points of the entire course
Agenda (schedule suggestion)	
9 am – 9.30 am	• Recap of CU5: Key lessons learned and thematic highlights • Group sharing: Participants present brief updates on their projects
9.30 am – 10 am	• In-depth case study discussions: Analyze specific real-world scenarios from CU5 • Open floor Q&A: Trainer addresses queries regarding project or course content
10 am – 10.15 am	Coffee break
10.15 am – 11 am	• Project progress feedback: Trainers/tutors provide suggestions or corrections for ongoing group/individual work • Collaborative troubleshooting: Discuss any obstacles in project execution
11 am – 11.30 am	• Planning for closure: Outline final submission process, presentation format, and grading criteria • Next steps & wrap-up

Fifth support session

Duration	Approximately 3 hours
Calendar	To be held in Week 12, at the very end of the course.
Objectives	• Showcase final presentations of project activities • Reflect on course content and personal/professional growth • Provide closing feedback and facilitate a final discussion on the course outcomes • Conduct course closure and final evaluations
Resources	• Presentation equipment or online conferencing tools (if virtual) • Final project reports or demonstrations • Course evaluation forms (online or printed)

	• Certificates or acknowledgments of completion (if applicable)
Agenda (schedule suggestion)	
9 am – 9.30 am	• Welcome and overview: Introduce session objectives and outline the presentation flow • Course recap: Brief summary of all Competence Units and the main takeaways
9.30 am – 10 am	• Project presentations: Trainees (or groups) present their final projects/findings
10 am – 10.15 am	Coffee break
10.15 am – 11 am	• Q&A and feedback: Trainer and peers offer feedback on final projects • Discussion: Lessons learned, real-world applicability, and reflections
11 am – 11.30 am	• Course closure: o Review course objectives and whether they have been achieved o Collect course evaluations o Acknowledge participant achievements o Next steps / future learning opportunities



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