

**RES-SKILL**

**Reskilling coal industry workers for  
the renewables energy sector**

**O3-T3: RES-SKILL Trainer  
handbook**

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## Abbreviations

<b>EU</b>	European Union
<b>RES</b>	Renewable Energy Sector
<b>VET</b>	Vocational Education and Training
<b>WBL</b>	Work-Based Learning
<b>PV</b>	Photovoltaics
<b>HSE</b>	Health, Safety and Environment
<b>EQF</b>	European Qualifications Framework
<b>LU</b>	Learning Unit
<b>FAQ</b>	Frequently Asked Questions

### 1. Summary

This document is deliverable O3-T3 “Trainer Handbook”, as described in the RES-SKILL Application Form. The main precedents of this report are the deliverables O3-T1 “**Developing RES-SKILL learning units**” and O3-T2 “**RES-SKILL training and assessment materials**”. The O3-T2 includes the slide sets components of the learning material, the lecture notes, the training exercises and the case studies.

The main purpose of this report is to provide guidelines for trainers which will help them achieve the training goals. This document includes the trainer’s guidelines on how to use the training material (slides, videos, case studies and exercises) to maximize the learning outcomes achievement, a short methodology and recommendations on how to develop additional material and resources in accordance with RES-SKILL learning outcomes.

The trainer is advised to read carefully the RES-SKILL Curriculum as well as the Training and Assessment materials before continuing with this Handbook:

- The RES-SKILL Curriculum is divided into **4 learning units**.
- Each learning unit addresses several **objectives**.
- Each objective represents the development of selected **competences**.
- Some competences are developed in different units with different objectives.



## 2. Introductory notes

### 2.1 Rationale of RES-SKILL

The decarbonisation of the EU27 is expected to result in the loss of ~76k workers' jobs in coal mines & plants until 2025 (154k until 2030). Partnership countries (GR, DE, AT, RO, BG, PL) will be particularly affected, currently representing 81% of the total EU coal workforce (190k). At the same time, a surge of jobs in the Renewable Energy Sources (RES) sector is already happening and expected to continue and perhaps grow. VET education & the labour market are expected to be challenged by a) the spike of coal workers seeking reemployment in the near future, b) the surge in unfilled positions in RES.

RES-SKILL aims to strengthen VET provision in the energy sector aimed at coal workers for compatible RES sector jobs, to increase their reemployment opportunities & cover at the same time RES sector's skills demand. The project's specific objectives are to:

1. Develop a novel curriculum & tailored training content to facilitate coal workers' reorientation to the RES industry.
2. Support VET providers to integrate the RES-SKILL materials into their VET & WBL offerings.
3. Improve cooperation between VET providers & businesses to provide opportunities that will enable coal workers to transition to the RES sector.

### 2.2 Overview of the RES-SKILL Curriculum

The following table show the breakdown of the four learning units in terms of lessons. Each Learning Unit contains theoretical lectures, practical work and individual assignment parts.



Learning Units	Lessons
<b>PV system installer</b>	Lesson 1 Understanding solar energy and PV systems basics
	Lesson 2 Understanding PV system design and site survey
	Lesson 3 Installation of civil and mechanical components of PV system
<b>Advanced service technician for PV applications</b>	Lesson 1 Installation of electrical PV components
	Lesson 2 Completing system installation, testing and commissioning
	Lesson 3 Electrical maintenance and Troubleshooting on PV systems
	Lesson 4 Service and repairs
<b>Wind turbine and farm technician</b>	Lesson 1 Basics and Background
	Lesson 2 Structure of a wind turbine
	Lesson 3 Power and Calculations
	Lesson 4 Planning
<b>Safety considerations &amp; protocols in the RES industry</b>	Lesson 1 PV Occupational health and safety practice
	Lesson 2 Civil maintenance and Troubleshooting on PV systems
	Lesson 3 Health, Safety and Environment (HSE) in the wind energy industry

### 2.3 Recommended Learner's Background

Target groups of learners include:

- VET providers
- Coal industry workers (primarily low-skilled) that need to up-skill themselves to strengthen employability or job security
- Sector representatives and key players/employers, social partners, and associations of employees and employers
- VET authorities & career guidance bodies (incl. regional development agencies responsible for training initiatives)

Based on the learning outcomes derived from O1, the EQF level of the training material is 4. According to the official description of this level<sup>1</sup>, the learning outcomes should reflect:

<sup>1</sup> <https://europa.eu/europass/en/description-eight-efq-levels>



### **Knowledge**

Factual and theoretical knowledge in broad contexts within a field of work or study

### **Skills**

A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study

### **Responsibility and autonomy**

Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities.

## **2.4 Structure of the Trainer Handbook**

The Trainer Handbook is organized as follows:

- **Section 3** give the detailed lesson plans for each of the lessons of the four Learning Units of RE-SKILL. These plans are helpful for the trainer in order to teach the content in an efficient way and to engage and motivate the participants.
- **Section 4** provides useful recommendations for the trainer in order to organize the course. These include the activities to perform before the course, during the course and after the course.



### 3 Detailed Lesson Plans

These sections give the detailed lesson plans for all Learning Units. The plans aim to provide the trainers with a guidance for a successful teaching experience.

LU1: PV system installer				
<b>Abstract</b>	The Learning Unit 1 is part of the package for upskilling coal workers into the PV industry. Taking into consideration the skill gap identified between coal workers and blue-collar workers in the PV industry, all the essential themes to bridge this gap are covered within each unit but not exhaustively, since this is not possible in a text of this size. Also, it is important to note that the information given here needs to be critically interpreted. While most of the information will be relevant to your location/situation, some may not, or only partially, apply.			
<b>Connection with other LU</b>	This LU is connected with LU2 “Advanced service technician for PV applications” and “Information on health and safety codes” that is given in LU4.			
<b>Structure and additional learning methods of the LU</b>	<b>Topic</b>	<b>Theory</b>	<b>Practice</b>	<b>Additional</b>
	Solar energy and PV systems basics	X		Focus group
	Photovoltaic system design and site survey	X		Expert seminar, focus group
	Installation of civil and mechanical components of PV system	X		Expert seminar, focus group
<b>Additional resources from other courses/videos/tutorials on the topics</b>	<p>How do solar panels work:  <a href="https://www.youtube.com/watch?v=xKxrkht7CpY">https://www.youtube.com/watch?v=xKxrkht7CpY</a></p> <p>Solar System Calculation For Home / Inverter battery solar panel requirement:  <a href="https://www.youtube.com/watch?v=4WAgQ_19B5k">https://www.youtube.com/watch?v=4WAgQ_19B5k</a></p> <p>Solar Photovoltaic Technology Basics</p>			



	<p><a href="https://www.energy.gov/eere/solar/solar-photovoltaic-technology-basics#:~:text=PV%20materials%20and%20devices%20convert,thickness%20of%20four%20human%20hairs.">https://www.energy.gov/eere/solar/solar-photovoltaic-technology-basics#:~:text=PV%20materials%20and%20devices%20convert,thickness%20of%20four%20human%20hairs.</a></p>
<p><b>Questionnaire for initial evaluation of learners' knowledge</b></p>	<p>General questions could be the same for each LU, e.g., Nationality, Sex, Age, Education, Specialisation, Place</p> <p>It is essential to understand what is helpful to investigate and which topics of LU1 as new may be of greater interest.</p> <p>Do you have enough information about solar energy?</p> <p>Are you aware of the components of PV systems?</p> <p>Do you have information about putting in place the mechanical components?</p>
<p><b>Questionnaire at the end of the course for the teaching assessment</b></p>	<p>1) Was the course topic complex for you? Evaluate with a grade from 1 to 5, for which 1 is not difficult at all and 5 means very difficult</p> <p>2) Compared to initial expectations, was the course to your satisfaction? Evaluate with a grade from 1 to 5, for which 1 is not appreciated at all and 5 means very welcome</p> <p>3) Do you think you will be able to use the information and innovations you learned during the course in your current or future work?</p> <p>4) What aspects or topics of the course did you particularly like?</p> <p>4) Are there any suggestions for improving the course in the future (e.g. topic, teaching methods)?</p>
<p><b>Evaluation</b></p>	<p>Oral: discuss the main topics</p> <p>Written: multiple-choice test, open-text questions</p> <p>The FAQ can be used for evaluation.</p>
<p><b>Exercise/Practical activity</b></p>	<p>The O2-T1 and O2-T2 did not specify a practical activity for that LU; however, focus group discussion during lessons for developing a critical and innovative vision about future is recommended. It could be helpful, for example, to simulate the participation or get involved in activities promoted by the European Commission, such as: "Energy communities"</p>





	<p><a href="https://energy.ec.europa.eu/topics/markets-and-consumers/energy-communities_en">https://energy.ec.europa.eu/topics/markets-and-consumers/energy-communities_en</a></p> <p>Furthermore, seminars and interviews with professionals working on the topic for the EU research centre on the territory or other experts linked to the topic are recommended.</p>
<b>Teaching materials and media</b>	White/Blackboard, notepad, laptop, pencil, video equipment, flipchart, visualisation tools for presentation and watching videos
<b>Place or classroom and auxiliary accessories needed for the activities</b>	Classroom; computer; projector; Wi-fi access.

<b>LU2: Advanced service technician for PV applications</b>	
<b>Abstract</b>	<p>This LU is designed to provide a comprehensive overview of photovoltaic (PV) system installation, operation and maintenance. It is divided into 4 lessons which are:</p> <ul style="list-style-type: none"> <li>• Installation of electrical PV components</li> <li>• Completing system installation, testing and commissioning</li> <li>• Electrical maintenance and Troubleshooting on PV systems</li> <li>• Service and repairs</li> </ul> <p>The Learning Unit 2 is part of the package for upskilling coal workers into the PV industry. Taking into consideration the skill gap identified between coal workers and blue-collar workers in the PV industry, all the essential themes to bridge this gap are covered within each unit but not exhaustively, since this is not possible in a text of this size. Also, it is important to note that the information given here needs to be critically</p>



	interpreted. While most of the information will be relevant to your location/situation, some may not, or only partially, apply.			
<b>Connection with other LU</b>	Learning unit 2 which is designed for Advance Service technician for Solar PV is complimentary to learning unit 1 and aims at building on the knowledge of LU1 and going in-depth into the subject matter.			
<b>Structure and additional learning methods of the LU</b>	<b>Topic</b>	<b>Theory</b>	<b>Practice</b>	<b>Additional</b>
	Installation of electrical PV components	X		Expert seminar
	Completing system installation, testing and commissioning	X		Expert seminar
	Operation, maintenance and Troubleshooting on PV systems	X		Expert seminar
	Service and repairs	X		Expert seminar
<b>Additional resources from other courses/videos/tutorials on the topics</b>	PV Electrical Testing: Test Setup <a href="https://www.youtube.com/watch?v=0zGEtBygbMU">https://www.youtube.com/watch?v=0zGEtBygbMU</a>  PV System operations and maintenance fundamentals: <a href="http://www.solarabcs.org/about/publications/reports/operations-maintenance/pdfs/SolarABCs-35-2013.pdf">http://www.solarabcs.org/about/publications/reports/operations-maintenance/pdfs/SolarABCs-35-2013.pdf</a>			
<b>Questionnaire for initial evaluation of learners' knowledge</b>	General questions could be the same for each LU, e.g., Nationality, Sex, Age, Education, Speciliasation, Place  It is essential to understand what is helpful to investigate and which topics of LU2 as new may be of greater interest.  Do you have enough information about carrying on a system installation, identify the steps in testing and commissioning it?  Can you describe the maintenance services and repairs for a PV systems?			



	Are you able to identify faults in a PV system?
<b>Questionnaire at the end of the course for the teaching assessment</b>	<p>1) Was the course topic complex for you? Evaluate with a grade from 1 to 5, for which 1 is not difficult at all and 5 means very difficult</p> <p>2) Compared to initial expectations, was the course to your satisfaction? Evaluate with a grade from 1 to 5, for which 1 is not appreciated at all and 5 means very welcome</p> <p>3) Do you think you will be able to use the information and innovations you learned during the course in your current or future work?</p> <p>4) What aspects or topics of the course did you particularly like?</p> <p>4) Are there any suggestions for improving the course in the future (e.g. topic, teaching methods)?</p>
<b>Evaluation</b>	<p>Oral: discuss the main topics</p> <p>Written: multiple-choice test, open-text questions, practical exercise using the PV Array test report</p>
<b>Exercise/Practical activity</b>	For this LU, case studies are available that can be used for practical exercises. Moreover, it is advised to organise an expert seminar or study visit.
<b>Teaching materials and media</b>	White/Blackboard, notepad, laptop, pencil, video equipment, flipchart, visualisation tools for presentation and watching videos
<b>Place or classroom and auxiliary accessories needed for the activities</b>	Classroom; computer; projector; Wi-fi access.



<b>LU3: Wind turbine and farm technician</b>				
<b>Abstract</b>	This LU focuses on wind energy. It is divided into 7 lessons covering the most common wind energy systems and their characteristics, information on installation of components of an onshore wind plants and important operations and maintenances of wind turbines.			
<b>Connection with other LU</b>	Learning unit 2 is connected with LU4 Lesson 3: "Health, Safety and Environment (HSE) in the wind energy industry"			
<b>Structure and additional learning methods of the LU</b>	<b>Topic</b>	<b>Theory</b>	<b>Practice</b>	<b>Additional</b>
	Basics and Background	X		Expert seminar
	Structure of a wind turbine	X		Expert seminar, study visit
	Power and Calculations	X		Expert seminar, focus group
	Planning	X		Expert seminar
<b>Additional resources from other courses/videos/tutorials on the topics</b>	<p>How do Wind Turbines work?  <a href="https://www.youtube.com/watch?v=qSWm_nprfqE">https://www.youtube.com/watch?v=qSWm_nprfqE</a></p> <p>The next generation monopole foundations for offshore wind turbines:  <a href="https://www.boslan.com/wp-content/uploads/2022/06/BOSLAN_monopile_foundations.pdf">https://www.boslan.com/wp-content/uploads/2022/06/BOSLAN_monopile_foundations.pdf</a></p>			
<b>Questionnaire for initial evaluation of learners' knowledge</b>	General questions could be the same for each LU, e.g., Nationality, Sex, Age, Education, Speciliasation, Place			



	<p>It is essential to understand what is helpful to investigate and which topics of LU3 as new may be of greater interest.</p> <p>Do you have enough information about the components and control systems of the most common wind energy systems?</p> <p>Can you describe the maintenance and operation services for wind turbines?</p> <p>Are you able to apply systematic trouble shooting- and repair techniques in a safely manner?</p>
<p><b>Questionnaire at the end of the course for the teaching assessment</b></p>	<p>1) Was the course topic complex for you? Evaluate with a grade from 1 to 5, for which 1 is not difficult at all and 5 means very difficult</p> <p>2) Compared to initial expectations, was the course to your satisfaction? Evaluate with a grade from 1 to 5, for which 1 is not appreciated at all and 5 means very welcome</p> <p>3) Do you think you will be able to use the information and innovations you learned during the course in your current or future work?</p> <p>4) What aspects or topics of the course did you particularly like?</p> <p>4) Are there any suggestions for improving the course in the future (e.g. topic, teaching methods)?</p>
<p><b>Evaluation</b></p>	<p>Oral: discuss the main topics</p> <p>Written: multiple-choice test, open-text questions.</p>
<p><b>Exercise/Practical activity</b></p>	<p>The excel files that accompany the material can be also used for evaluation.</p> <p>It is highly recommended to show in practice the installments, operation and maintenance as well as the repair techniques to learners so an expert seminar or study visit will add value.</p>
<p><b>Teaching materials and media</b></p>	<p>White/Blackboard, notepad, laptop, pencil, video equipment, flipchart, visualisation tools for presentation and watching videos</p>



<b>Place or classroom and auxiliary accessories needed for the activities</b>	Classroom; computer; projector; Wi-fi access.
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<b>LU4: Safety considerations &amp; protocols in the RES industry</b>				
<b>Abstract</b>	The last Learning Unit has to do with health and safety rules and regulations that should apply in PV and wind energy systems.			
<b>Connection with other LU</b>	This LU is connected with all the previous units.			
<b>Structure and additional learning methods of the LU</b>	<b>Topic</b>	<b>Theory</b>	<b>Practice</b>	<b>Additional</b>
	PV Occupational health and safety practice	X		Expert seminar
	Civil maintenance and Troubleshooting on PV systems	X		Expert seminar
	Health, Safety and Environment (HSE) in the wind energy industry	X		Expert seminar
<b>Additional resources from other courses/videos/tutorials on the topics</b>	<p>Working safely with PV systems:  <a href="https://www.ihsa.ca/pdfs/magazine/volume_18_Issue_2/working-safely-with-pv-systems.pdf">https://www.ihsa.ca/pdfs/magazine/volume_18_Issue_2/working-safely-with-pv-systems.pdf</a></p> <p>Working the wind safely - An induction video for wind energy workers:  <a href="https://www.youtube.com/watch?v=snY8JwyUxTQ">https://www.youtube.com/watch?v=snY8JwyUxTQ</a></p>			
<b>Questionnaire for initial evaluation of learners' knowledge</b>	<p>General questions could be the same for each LU, e.g., Nationality, Sex, Age, Education, Speciliasation, Place</p> <p>It is essential to understand what is helpful to investigate and which topics of LU4 as new may be of greater interest.</p>			

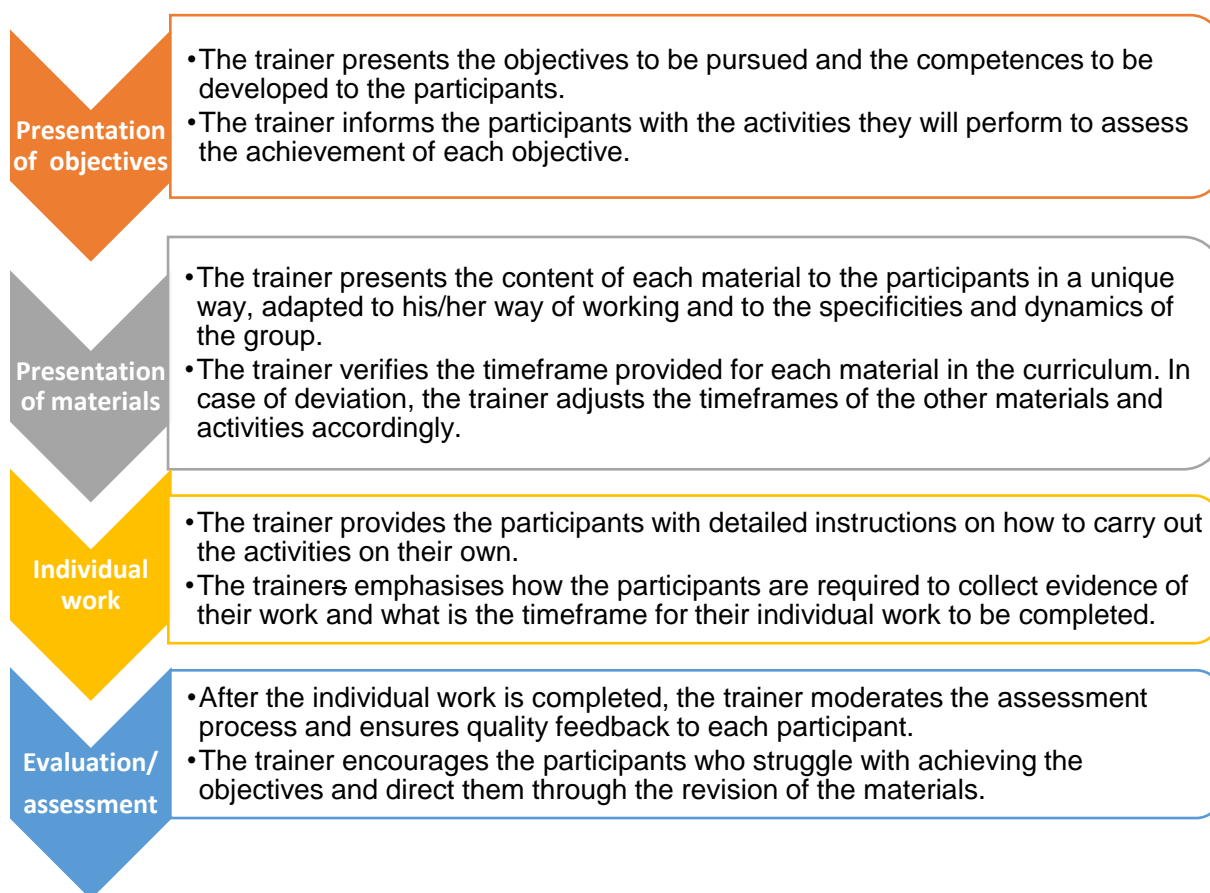


	<p>Do you have enough information about maintenance and troubleshooting on PV systems ?</p> <p>Are you able to follow and apply health and safety rules and regulations while working on PV and wind energy systems?</p>
<b>Questionnaire at the end of the course for the teaching assessment</b>	<p>1) Was the course topic complex for you? Evaluate with a grade from 1 to 5, for which 1 is not difficult at all and 5 means very difficult</p> <p>2) Compared to initial expectations, was the course to your satisfaction? Evaluate with a grade from 1 to 5, for which 1 is not appreciated at all and 5 means very welcome</p> <p>3) Do you think you will be able to use the information and innovations you learned during the course in your current or future work?</p> <p>4) What aspects or topics of the course did you particularly like?</p> <p>4) Are there any suggestions for improving the course in the future (e.g. topic, teaching methods)?</p>
<b>Evaluation</b>	<p>Oral: discuss the main topics</p> <p>Written: multiple-choice test, open-text questions.</p>
<b>Exercise/Practical activity</b>	<p>The O2-T1 and O2-T2 did not specify a practical activity for that LU; however, focus group discussion during lessons for developing a critical and innovative vision about future is recommended.</p>
<b>Teaching materials and media</b>	<p>White/Blackboard, notepad, laptop, pencil, video equipment, flipchart, visualisation tools for presentation and watching videos</p>
<b>Place or classroom and auxiliary accessories needed for the activities</b>	<p>Classroom; computer; projector; Wi-fi access.</p>



## 4 Didactic Recommendations

The steps that should be taken by the trainer so as to link objectives, materials and activities are:



### 4.1 Before the training

Prior to the start of the training course, the trainer obtains the empirical data about the group of participants, which is relevant to determine the elective factors:

1. Number of participants,
2. Age and educational background of the participants,
3. Employers' expectations according to requirements related to workplaces of participants,
4. Hardware and software at disposal of participants:





- a. On the location of the training,
- b. At home.

The trainer introduces the objectives and collects qualitative data from participants **for each learning unit separately**:

1. Prior knowledge,
2. Expectations,
3. Limitations,
4. Reservations and concerns.

Based on the information obtained, the trainer defines **the unit-specific** elective factors for each group.

**Elective factors form**

Group:	
Method of implementation:	
Hardware available:	
Employer:	
Number of participants:	
Age and sex composition:	
Educational structure:	
Specialisation:	
RES sector with the most interest:	
Country of implementation (national regulations, number of coal mines &	



plants, strategy about RES)	
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On the basis of elective factors and group dynamics the trainer makes necessary adjustments to plan for each unit learning content.

When adjusting the time plan, the trainer takes into consideration the time allocated to each unit and the time allocated to performing individual and (self)assessment activities.

**Time planning form**

Learning Unit: \_\_\_\_\_

Time / Duration	Phase	Material/ Activity	Preparation	Trainer's activity	Participants' activity

**4.2 During the training**

The trainer prepares his/her own material preparation and visual support for the presentations (tabular images or electronic slides) and handouts or printed materials (resources for individual work) for the participants.



When preparing the presentation for each material, the trainer needs to take into consideration again the empirical data collected about the group, quality information about individual participants and other elective factors.

Every presented material should be followed by one or more activities to check the following **for each participant**:

1. Understanding of the acquired knowledge,
2. Level of achieving the objectives,
3. Development of competences.

The trainer can assess several materials with one activity and can use the overview of material and activities described in detail in the RES-SKILL Curriculum for support.

The activities should follow the Bloom's Taxonomy<sup>2</sup>:

1. Remember
1. Understand
2. Apply
3. Analyse
4. Evaluate
5. Create

### **4.3 After the training**

The learning process continues after training's end. The trainer should act more like a mentor and support their learners.

A recommendation is to supplement the training with "social learning". Through the exchange of experiences, ideas, successes and lessons learnt, participants will feel more engaged, belonging in a group with the same interest, concerns and transition status. Also, the expert seminars, focus groups and study visits that are recommended can boost the networking and the discussion of opportunities.

Trainees often report being unable to retain key learning points after the training is over or recall these concepts when needed. These challenges inhibit practical application of the knowledge. A refresher course can improve recall. The course should be simple and provide

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<sup>2</sup> <https://bloomstaxonomy.net/>



just crisp and coherent summary of the key learning concepts. The trainer can pair these refresher programs with problem-solving sessions where trainees can help each other by recounting the challenges they have faced while trying to implement the learning and sharing stories of their success or troubleshooting tips.

Reflection is one of the most efficient ways to cement the knowledge, identify gaps in training, and identify the barrier(s) to a strong transfer of learning.

The trainer can send follow-up emails to trainees after about a month to reinforce key learning points.

Another idea is to arrange post-training follow-up sessions to provide supplementary lessons or use these opportunities to let trainees practice their skills or discuss their experiences as they try to apply their knowledge on the job.