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SKILLING, UPSKILLING, RESKILLING
IN THE FUTURE AIR TRANSPORT

# D4.2 VET Training Results Report

*(March, 2023)*

*(Partner Responsible: QSR)*

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# SKILLING, UPSKILLING, RESKILLING IN THE FUTURE AIR TRANSPORT

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## *List of Acronyms*

| Acronyms List | |
|---|---|
| AI | Artificial Intelligence |
| AR | Augmented Reality |
| ATC | Air Traffic Control |
| ATCO | Air Traffic Control Officer |
| F2F | Face-to-face |
| HMI | Human Machine Interface |
| ICT | Information and Communications Technology |
| LMS | Learning Management System |
| M | Mean |
| ML | Machine Learning |
| N/A | Not applicable |
| NASA-TLX | NASA Task Load Index |
| PISA | Programme for International Student Assessment |
| RPAS | Remotely Piloted Aircraft Systems |
| S.D. | Standard Deviation |
| SA | Situational Awareness |
| SAGAT | Situation Awareness Global Assessment Technique |
| SART | Situation Awareness Rating Technique |
| SM | Specific Module |
| TM | Transversal Module |
| VET | Vocational Education Training |
| VR | Virtual Reality |
| WP | Work Packages |

## *Executive Summary*

In the present document, the main results obtained through the VET Training Assessment Tools will be presented and analysed. These Assessment Tools were developed within the scope of Work Package 4 (WP4) which aimed to design a set of methodologies and tools for assessing targeted users in three distinct moments (before, during and after training). The development of the Assessment Tools analysed can also be found in Deliverable 4.1 (VET Training: Assessment Portfolio).

# 1 Project Overview

The skill-UP project aims to define the knowledge, skills and competencies required by the current and future workforce of the air transport industry so that the educational and training programmes can be better aligned to the requirements of different occupational profiles. Specifically, the project looks at four occupational profiles: air traffic controllers, pilots, airport operators and drone operators.

Also, the project seeks to develop initial and continuing VET training programmes based on suitable and innovative teaching and training methodologies and study pathways to aid in the skilling, upskilling and reskilling of the future workforce of the air transport sector. The skills and knowledge required by the future workforce will change, mainly because of an increase in digitization, automation and advancement in artificial intelligence. New competencies will become essential, amongst which are: the ability to work with data to perform descriptive diagnostics, and predictive and prescriptive tasks; increased ICT knowledge, including multimodal interaction with advanced HMIs, automation and robotics; and teamwork and communication skills, in scenarios where the team would be composed of both humans and advanced automation. The skill-UP project aims to identify such new required competencies and address the training needs required to address the current gaps in skills and knowledge.

## 1.1. Purpose and structure of the document

The present deliverable aims to report the main results obtained through the implementation of the assessment tools developed in the scope of WP4 and implemented during the skill-UP pilot sessions (WP3). Therefore, the deliverable is divided into 4 main areas:

- **Section 2 – skill-UP Grading System** – the skill-UP grading system developed and presented in deliverable 4.1 is summarized and presented again to contextualize the reader.
- **Section 3** – **skill-UP Pilot Sessions Implementation Overview** – a table with an overview of the skill-UP pilot sessions implementation is presented with the number of participants that completed the exercises in each evaluation moment (before training, during training and at the end of the training).
- **Section 4 – VET Training Assessment Results Report**
    - **Section 4.1 – Transversal Prognostic Assessment Tools** – presents the results obtained through the implementation of the 3 transversal prognostic assessment scales regarding motivation, expectation, and computer attitudes of participants.
    - **Section 4.2 - Training Modules Assessment Tools** – presents the results obtained through the implementation of all assessment tools, divided by each training module developed.
    - **Section 4.3 – Transversal Post-training Assessment Tools** – presents the results obtained through the implementation of the transversal post-training assessment tools regarding the satisfaction and experience of participants.
- **Section 5 – Conclusion and next steps** – a conclusion to all of the assessment tools results reported previously is presented and points for improvement of the skill-UP training modules are made.

# 2 Skill-UP Grading System

Within the scope of WP4, a grading system was developed for skill-UP. A grading system is a predefined system that is used to assess individuals' educational performance. It aims to provide feedback to trainees, teachers/trainers, employers, institutions, and other active agents.

The development of a grading system ensures consistency and fairness in the learning assessment, this will allow the scores and proficiency levels to be based on the same learning standards across trainers, curricula, and training.

Therefore, to assess skill-UP's training achievements in a consistent way across all trainees, trainers, training modules and partners, the following grading system was developed (Table 1).

**Table 1 - skill-UP Grading System Overview**

| skill-UP Grading System | | | | |
|---|---|---|---|---|
| **Structure** | | | | |
| **Training Assessment Tools for Entry Level** | Transversal Prognostic Assessment Scales | | | NA |
| | Self-Assessment Questionnaire | | | |
| | Problem-based Activities | | | |
| **Training Assessment Tools for Participants' Progression** | Summative Assessment | | Multi-choice Test | 30% |
| | | | Case Study | 40% |
| | Formative Assessment | Progress Assessment | Glossary | 10% |
| | | | Progress Activity 2 | 4% |
| | | | Progress Activity 3 | 4% |
| | | Participation Assessment | Concept Map | 8% |
| | | | Participation Activity 2 | 2% |
| | | | Participation Activity 3 | 2% |
| **Training Assessment Tools for Post-Training** | Satisfaction and Experience Questionnaire (Kirkpatrick Level 1) | | | NA |
| | Focus Group (Kirkpatrick Level 1) | | | |
| | Problem-based activities (Kirkpatrick Level 2) | | | |
| | Behaviour Questionnaire (Kirkpatrick Level 3) | | | |

The previous table presents the assessment structure, which is divided into three parts, each one corresponding to the work package tasks. Therefore:

- ***Training Assessment tools for Entry Level*** – task 4.1 – assessment of prior knowledge and skills before training.
- ***Training Assessment Tools for Participants' Progression*** – task 4.2 – assessment of progress and performance during training and at the end of the training.
- **Training Assessment Tools for Participants' Knowledge and Skill Retention Following Training** – task 4.3 – assessment of skills and knowledge retention 3 months after training.

Lastly, Table 2 below presents the three levels of the skill-UP's grading system. A rubric is a scoring tool that identifies the various criteria relevant to an assignment or learning outcome, and then explicitly states the possible levels of achievement along a continuum. Therefore, the skill-UP's grading system will have three levels (*developing, competent* and *exemplary*) which the trainees will achieve according to their final score (Table 2).

The skill-UP's grading system and respective rubrics will be used to score and communicate to the trainees about their performance during the training (***Training Assessment Tools for Participants' Progression).***

Therefore, the trainees' results from Training Assessment tools for Entry Level and Training Assessment Tools for Participants' Knowledge and Skill Retention Following Training will not have an influence and impact on the level obtained.

**Table 2 - skill-UP grading system final levels**

| Grading System Levels | |
|---|---|
| 0% - 49% | Developing |
| 50% - 79% | Competent |
| 80% - 100% | Exemplary |



All of the assessment tools and their respective development and evaluation criteria (if applicable) are presented in Deliverable 4.1 (D4.1. VET Training Assessment Portfolio, skill-UP Project Deliverable).

# 3 Skill-UP Pilot Sessions Implementation Overview

The different pilot sessions consider the implementation of all 8 specific and transversal skill-UP training modules. These pilot sessions occurred between July 2022 and December 2022. The following table (Table 3) presents an overview of all training modules developed with the starting and ending date, the number of registered participants and the number of participants that completed the courses, as well as other relevant information. However, Deliverable 3.3 presents the pilot sessions implementation from a trainers' perspective (Skill-UP Project, 2023. D3.3. VET Training design and implementation of the training modules)

**Table 3 - Pilot Sessions and Assessments Implementation Overview**

| Participant Profile | Training course | From | To | Modality | Number of participants that registered | Participants that completed the assessment tools of T4.1 | Participants that completed the assessment tools of T4.2 | Participants that completed the assessment tools of T4.3 |
|---|---|---|---|---|---|---|---|---|
| Transversal Profiles | "Houston, we have a problem": Problem Solving & Decision-making | 21/11 | 12/12 | Online (Synchronous; Asynchronous) | 4 | 4 | 1 | 1 |
| Transversal Profiles | Artificial Intelligence and Machine Learning for Aviation Applications | 17/10 | 04/12 | Online (Asynchronous) | 8 | 9 | 6 | 6 |
| Transversal Profiles | Deepening of Situational Awareness | 25/10 | 12/12 | Online (Synchronous; Asynchronous) | 10 | 11 | 5[1] | 5 |
| Transversal Profiles | Strengthening the Psychological Capital | 01/11 | 29/11 | Online (Synchronous; Asynchronous) | 45 | 24 | 24 | 24 |
| Airport operators | Change Management for Automation and Emerging Technologies in Airport Operations | 16/01 | 16/03 | Online (Synchronous; Asynchronous) | 9 | 8 | 9 | 8 |
| Air Traffic Controllers | How to cope with Stress and Change to fit in Future Roles | 29/09 | 29/09 | f2f | 11 | 12 | 8 | 8 |
| Pilots | Learning and Practice of Aircraft Procedures | 04/07 | 4/10 | f2f | 10 | 10 | 10 | 10 |
| RPAS operators | Managing My Self: towards a Safer Life | 21/11 | 12/12 | Online (Synchronous; Asynchronous) | 6 | 5 | 1 | 1 |

[1] Of all assessment tools developed for T4.2, only one assessment (i.e., multiple-choice test) was implemented in the "*Deepening of Situational Awareness*" training module due to issues on the Knowledge Centre Platform. This is discussed again in section 4.2.3.

# 4 skill-UP VET Training Results Report

Due to the diversity of the competencies addressed, the occupational competencies, and the content included in the skill-UP pilot sessions, the partners had autonomy in both the development of their training modules and their assessment tools. They received general orientation and guidelines for the assessments, but the final set of assessments was diverse and customized to what each considered more relevant.

This section will be divided into the following 3 main subsections:

- Results of the ***Transversal Assessment Scales***, 3 scales to assess motivation, expectations, and computer attitudes that were developed and implemented in all training modules.
- Results of the ***Training Modules Assessment Tools***, specific assessment tools for each training module. Assessment tools were developed to be implemented at three different moments (entry-level, during training, and post-training). This section will be divided into 8 subsections, corresponding to the **8 skill-UP training modules**.
- Results of the ***Transversal Post-training Assessment Tools***, these assessment tools included all the tools developed and implemented in all training modules equally (i.e., a satisfaction questionnaire, a focus group and a behavioural change questionnaire).

## 4.1 Transversal Prognostic Assessment Scales

To analyse and report the results of the skill-UP pilot sessions from a transversal and equal starting point, 3 scales were implemented for all participants before starting the training modules aiming to assess intraindividual differences by training module.

The three scales were the following:

- **Motivation Assessment Scale**: The assessment of trainees' general motivation for learning, training, and skills development.
- **Expectations Assessment Scale**: The assessment of trainee's professional and personal expectations regarding skill-UP training modules.
- **Computer Attitudes Assessment Scale**: The assessment of trainees' experience, comfort and satisfaction with online learning and training.



Finally, the results of the prognostic assessment tools are presented below. However, before analysis, it's important to notice that this assessment had 34 responses from the total of 69 registered participants, which translates to 49,3% total adherence with a disproportion among training modules (i.e., some training modules having more participants than others). It's important to have this in mind when analysing the results because the disproportion among training modules and the low adherence of participants can affect the results presented.

### *4.1.1 Motivation Assessment*

Motivation in a training environment is defined as "the degree to which the learner is willing to make efforts to improve his or her performance of training and work" (Lim et al., 2007) or the "special desire of participants to learn the contents of the training program" (Noe & Schmitt, 1986).

Furthermore, Colquitt and colleagues (2000) stated that the more trainees are motivated, and the trainer can keep motivating them, the better the trainees' reactions, consequently increasing the possibility of everybody taking positive outcomes from the training sessions (Reuteler, 2017).

Moreover, training motivation was assessed at the entry-level to have an overview of the trainees' motivation to learn and develop their skills. The scale used to assess training motivation is presented and explained in skill-UP Deliverable 4.1 (Skill-UP Project, 2022. D4.1 VET Training Assessment Portfolio).

Finally, the results obtained regarding the trainees' training motivation are presented below. Regarding the overall trainees' motivation (*M* = 4.46*; SD* = 0.77*; N* = 34), on a 5-point Likert scale more than half of the answers were on the positive side of the scale, as seen in the image below (Figure 1). This can mean that more than half of the trainees (95%) were motivated for the pilot sessions and, therefore, motivated for training. This motivation for training can have an impact on training effectiveness (Noe & Schmitt, 1986).

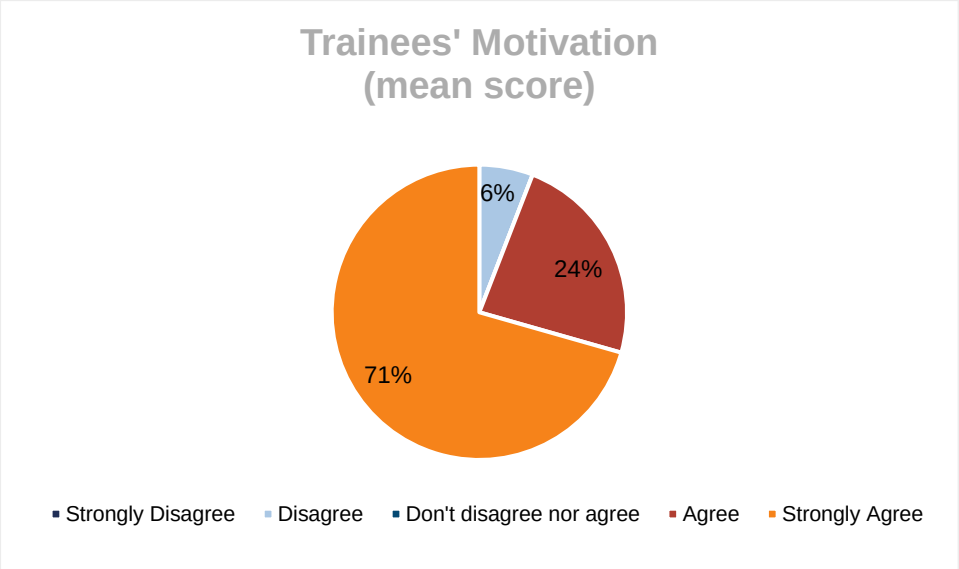


**Figure 1 - Trainees' Motivation for training**

Furthermore, it was possible to analyse the trainees' motivation across training modules, as it's seen in the image below (Figure 2). In the image, it's possible to see that the trainees seemed more motivated in the fourth specific training module "Managing myself: Towards a safer life", however all of the training modules had a different number of participants, as can be seen in Figure 2, which can impact the mean scores obtained. Moreover, some participants didn't state in which training module they participated. These are represented, in the figure, with the acronym "N/A" (not applicable).



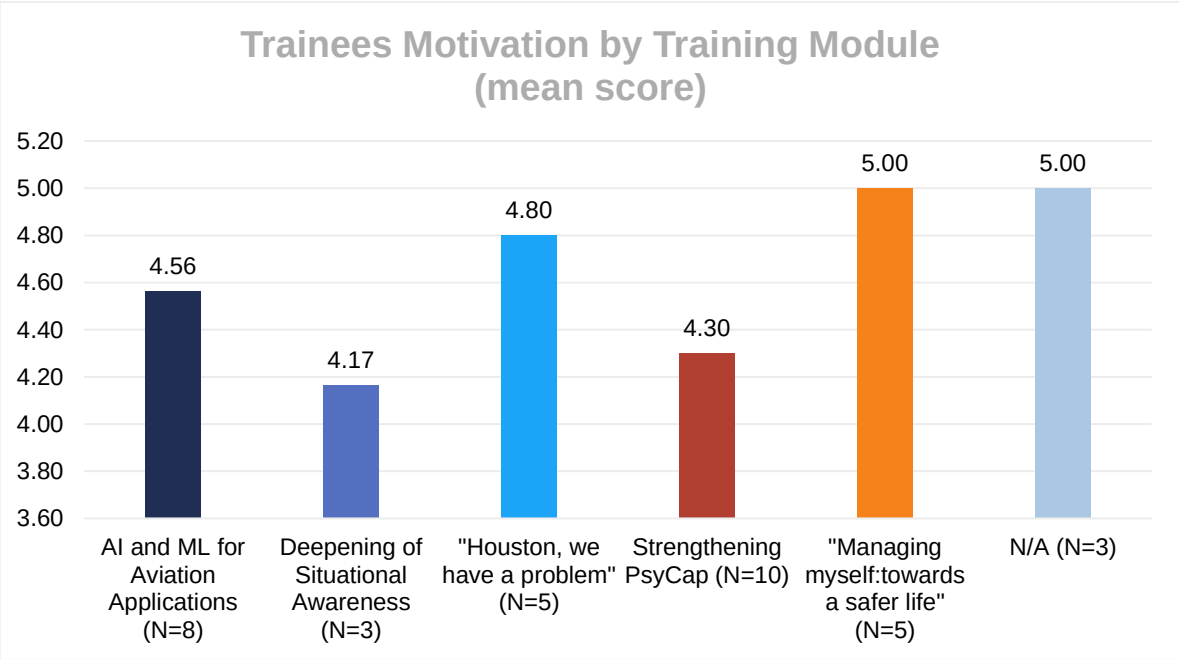


**Figure 2 - Trainees' motivation by training module**

### *4.1.2 Computer Attitudes Assessment*

Attitudes are “affective, conative and cognitive components” (Stiller & Bachmaier, 2017). Therefore, the attitudes that trainees have towards computers may influence their performance and experience during the pilot sessions.

Stiller and Bachmaier (2017) state that computer attitudes can influence the learners’ decision to drop out of online training since negative computer attitudes can create an extraneous load associated with, for example, intrusive thoughts about the computer malfunctioning or not being able to attend a class because of not understanding the online platform.

Since most of the training modules implemented as well as all materials of skill-UP were implemented online (i.e., via the Knowledge Centre Platform or Google Forms), it was important to consider the trainees’ attitudes regarding computers. The scale used to assess trainees’ computer attitudes is presented and explained in skill-UP Deliverable 4.1(Skill-UP Project, 2022. D4.1 VET Training Assessment Portfolio).

Finally, the results obtained regarding the trainees’ computer attitudes are presented below. Regarding the overall trainees’ computer attitudes ($M$ = 4.32; $SD$ = 0.72; $N$ = 34), on a 5-point Likert scale most of the answers (94%) were on the positive side of the scale, as seen in the image below (Figure 3). This can mean that almost all of the trainees were at least comfortable with computers and technology and, therefore, had positive attitudes regarding these.

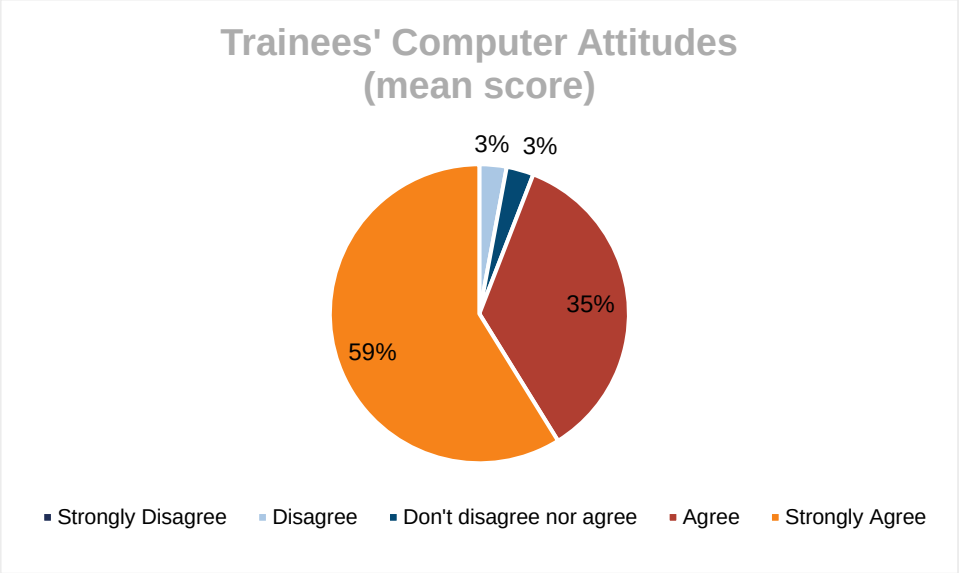


**Figure 3 - Trainees' computer attitudes**

Furthermore, it was possible to analyse the trainees’ computer attitudes across training modules, as it’s seen in the image below (Figure 4). In the image, it’s possible to see that the trainees that were registered in the fourth specific training module “Managing myself: Towards a safer life” seemed to have more positive attitudes regarding computers. Moreover, some participants didn’t state in which training module they participated (represented as “N/A”).

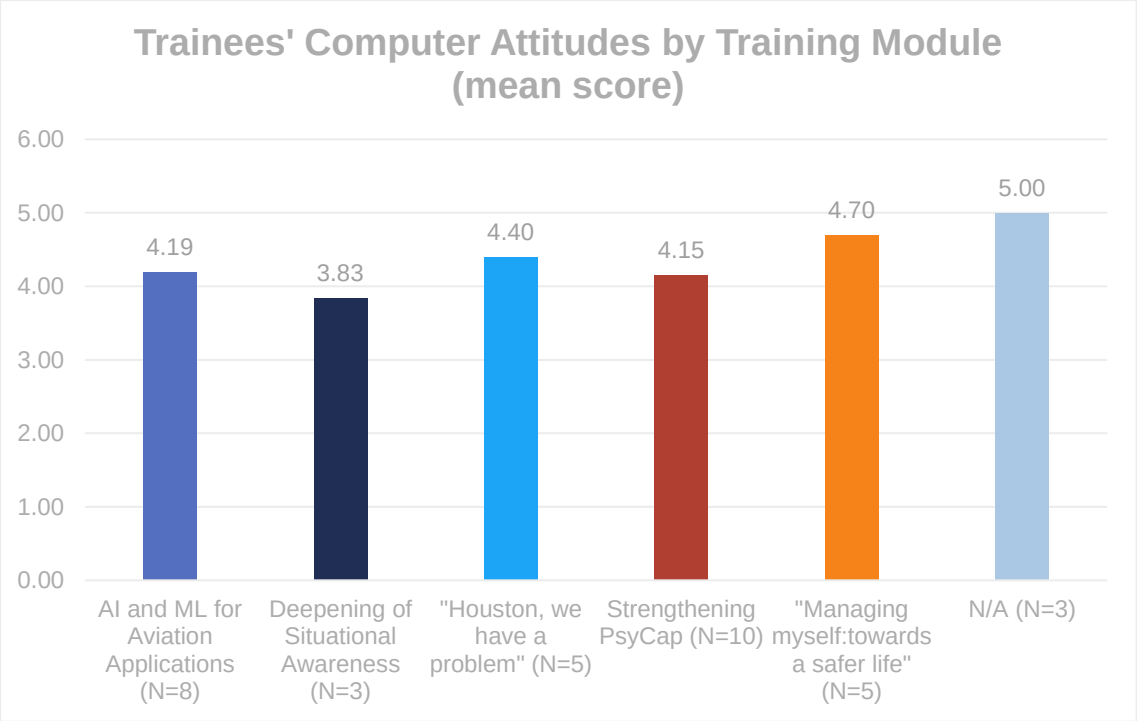


**Figure 4 - Trainees' computer attitudes by training module**

### *4.1.3 Expectations Assessment*

Chimote (2010) developed a study based on the evaluation of a training program as the expectation and experience of the trainees to understand whether the training program had been successful. The author also states that the feedback and opinions of employees undergoing training constitute a good source to determine the training's effectiveness.



The trainees' expectations were assessed before the pilot sessions and their experience was assessed after the pilot sessions. In section 4.3.1 (Training Experience), a comparison is made between the experience and expectations of trainees as a way to contribute to determining if the skill-UP training program was successful and effective. The scale used to assess trainees' expectations is presented and explained in skill-UP Deliverable 4.1 (Skill-UP Project, 2022. D4.1 VET Training Assessment Portfolio).

Finally, the results obtained regarding the trainees' expectations are presented below. Regarding the overall expectations of trainees ($M$ = 4.28; $SD$ = 0.68; $N$ = 34), on a 5-point Likert scale most of the answers (91%) were on the positive side of the scale, as seen in the image below (Figure 5). This can mean that almost all of the trainees had positive expectations for the training program.

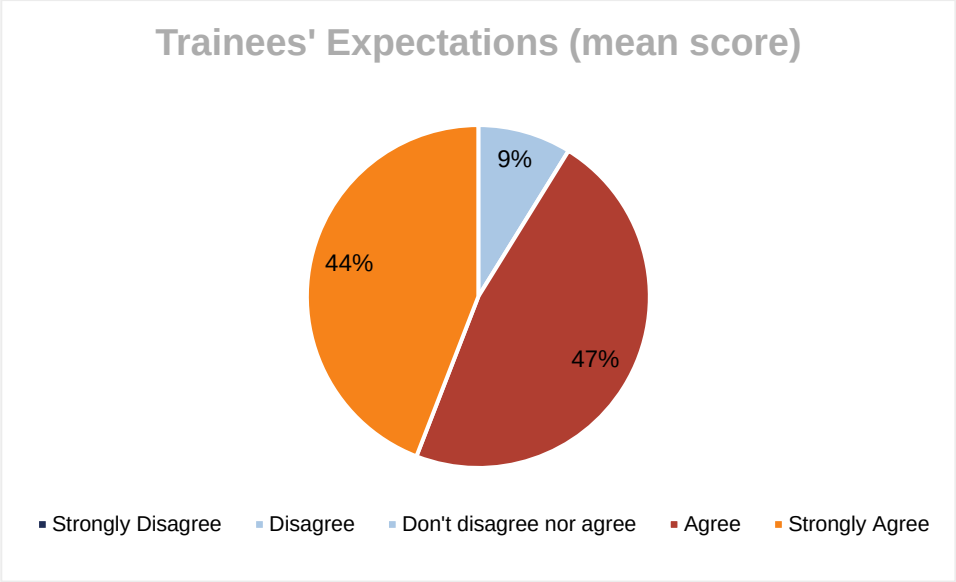


**Figure 5 - Trainees' Expectations**

Furthermore, it was possible to analyse the trainees' expectations across training modules, as it's seen in the image below (Figure 6). In the image, it's possible to see that the trainees that were registered in the fourth specific training module "Managing myself: Towards a safer life" had more positive expectations for the training module. Lastly, some participants didn't state in which training module they participated (represented as "N/A" in the figure).

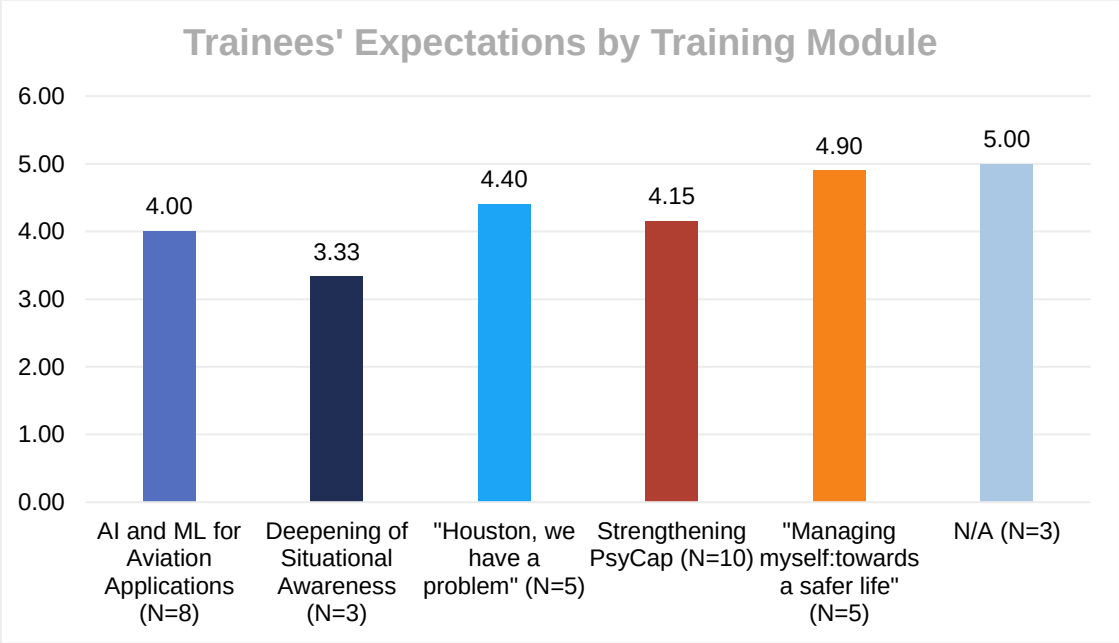


**Figure 6 - Trainees' Expectations by training module**

## 4.2 Training Modules Assessment Tools

### *4.2.1 Training Module TM #01 ("Houston, we have a problem!": Problem-solving & Decision-making)*

#### *4.2.1.1 Training Assessment tools for entry-level*

##### **4.2.1.1.1 Self-assessment questionnaire**

In this assessment, participants were asked six questions that were designed to allow them to assess their own experience regarding problem-solving and decision-making. Four responses were received for this assessment.

Participants were asked to select from 1 (strongly disagree) to 6 (strongly agree) the degree to which they agreed with the statements presented, to measure their behaviour regarding problem-solving and decision-making.

The first question asked participants to mark the statements that best described their behaviour when faced with a problem (*M* = 3.3; *S.D.* = 1.5, N = 4). Half of the participants disagreed with the statement and the other half agreed, meaning that when a problem arises, they have some ability to respond to it, however, they are more impulsive and not very thoughtful about their course of action (Figure 7).

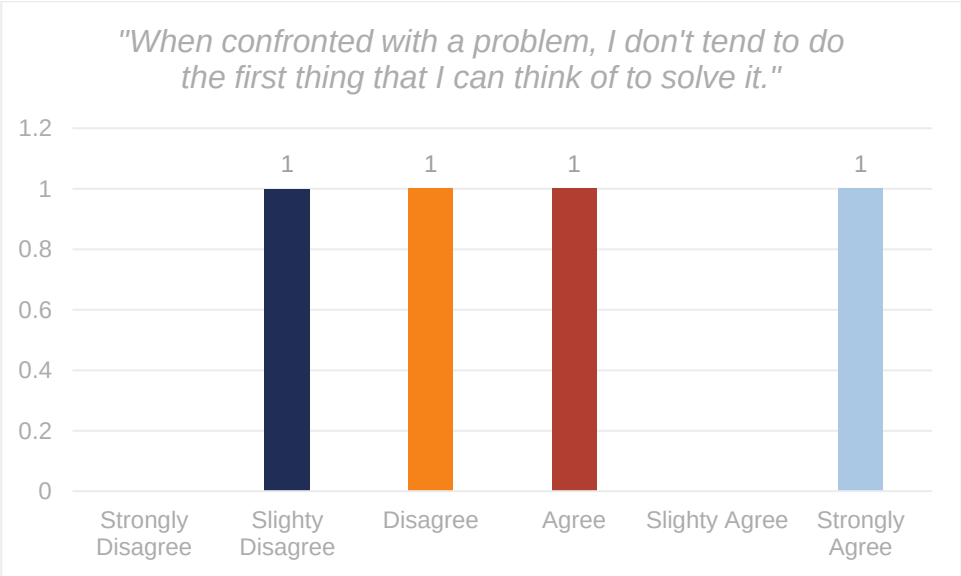


**Figure 7 - Responses to the first item**

To the item "*When I become aware of a problem, one of the first things I do is to find out exactly what the problem is*", all participants responded that they agreed or strongly agreed (*M* = 5.5; *S.D.* = 0.5; *N* = 4), which shows a certain degree of reflection regarding the problem (Figure 8).

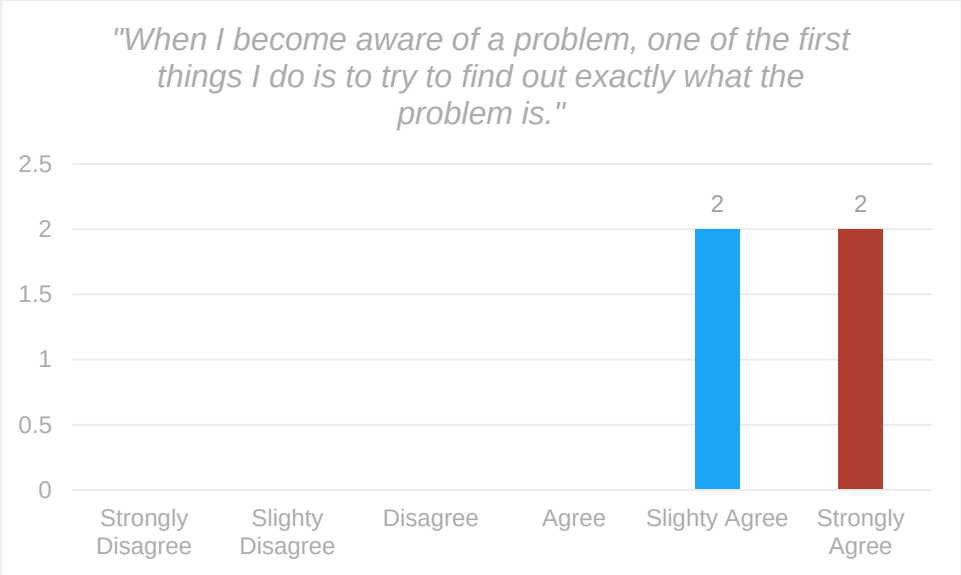


**Figure 8 - Responses to the second item**

Regarding the third statement, all participants responded that they are confident in their ability to solve problems (*M* = 4.8; *S.D.* = 0.4; *N* = 4) as can be seen in Figure 9.

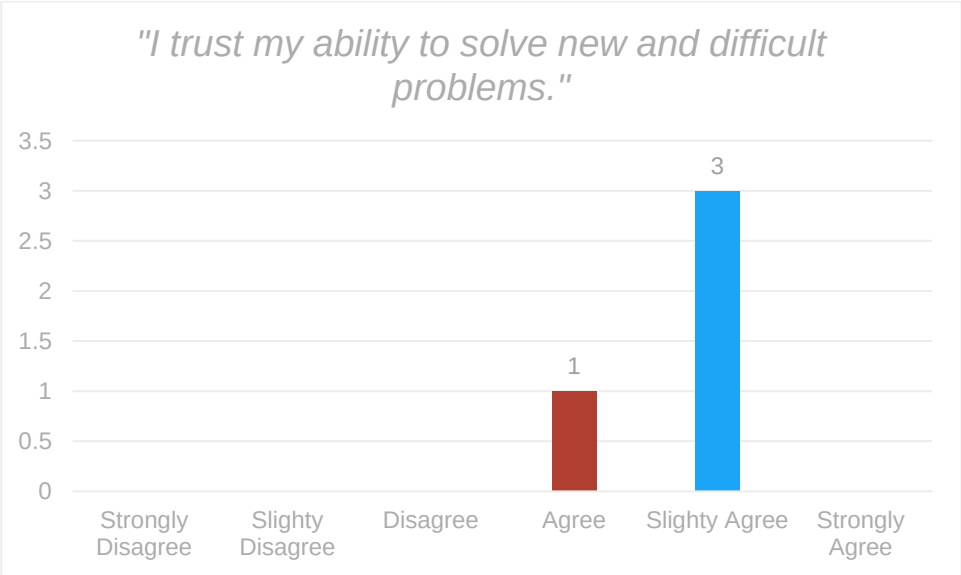


**Figure 9 - Responses to the third item**

For the fourth statement, two participants said that when they are faced with a problem, they try to develop strategies to help gather information to define the problem, and two participants said that they do not usually develop strategies to help define the problem (*M* = 3.5; *S.D.* = 1.5; *N* = 4), as it can be seen in Figure 10. For the last two participants, their answers can indicate avoidance behaviour.

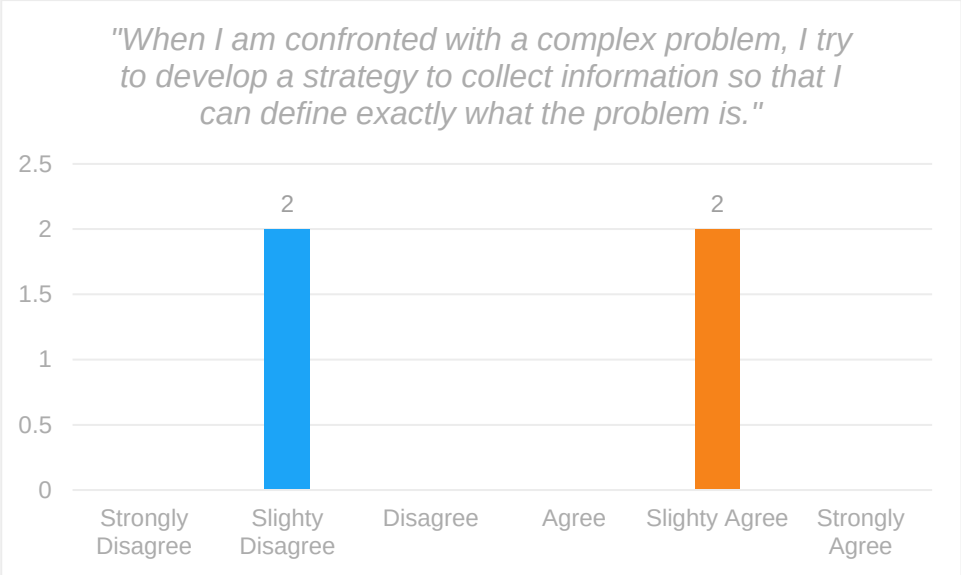


**Figure 10 - Responses to the fourth item**

Regarding the fifth item, as can be seen in the figure below (Figure 11), all participants responded that when solving a problem, they compare the results with what they think should have happened, to understand more easily where the error is and act on it (*M* = 4.8; *S.D.* = 0.4; *N* = 4).

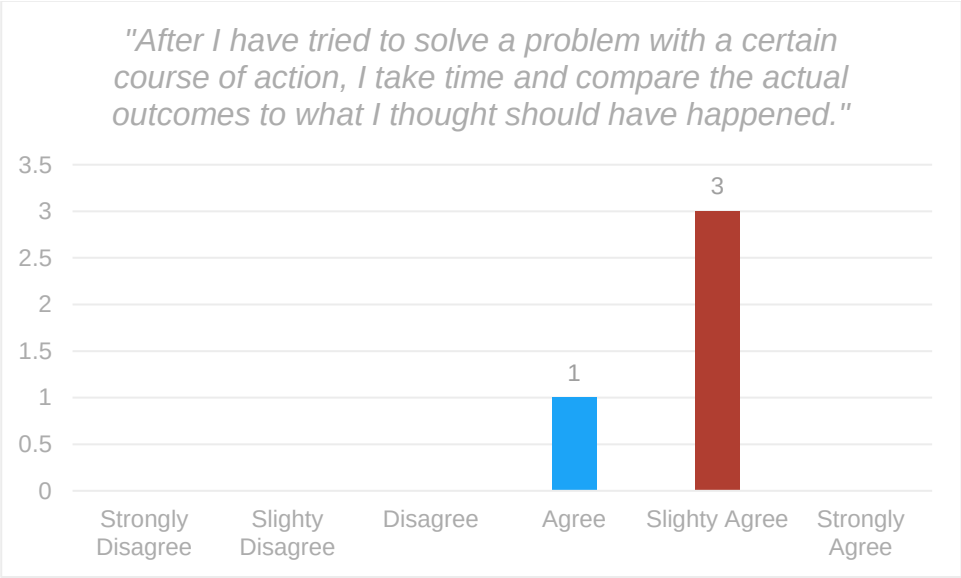


**Figure 11 - Responses to the fifth item**

Finally, Figure 12 presents the responses to the sixth statement, in which all participants responded that before they try to solve a problem, they set a time so that they can decide what to do next (*M* = 5.3; *S.D.* = 0.4; *N* = 4).

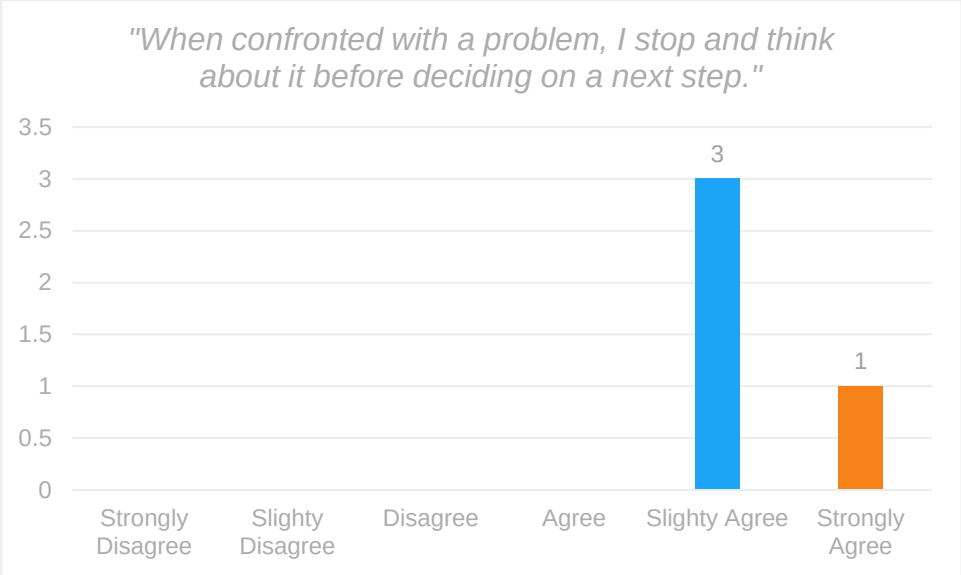


**Figure 12 - Responses to the sixth item**

In general, the participants demonstrate with their answers that they are more thoughtful and confident people when it comes to problem-solving and that they try to do more in-depth planning before making decisions.

#### 4.2.1.1.2 Short activities

In this exercise, a set of fake scenarios, developed by Bruine de Bruin and colleagues (2007), were implemented. The items were developed by the authors using the framing effect to understand whether participants' decisions were influenced by the way information was presented. Equivalent information can be more or less attractive depending on the features that are highlighted (Bruine de Bruin et al., 2007).



McElroy and Seta (2003) found fewer framing errors among people with a more analytical/systematic processing style, suggesting that more systematic thinkers could better see through irrelevant differences between normatively equivalent problem framings.

In addition, the items offered choices with a safe and risky option in the context of income tax (participants decide between saving 600 animals or risking saving 800, with a 25% probability that they will all die), social norm recognition, which measures how participants evaluate peer social norms (participants judge whether it is "sometimes OK" to engage in undesirable behaviour - stealing in certain circumstances), consistency in risk perception, which assesses the ability to follow the rules of probability (getting into a car accident while driving versus being accident-free) and resistance to Sunk Costs measures, that refers to the ability to ignore prior investments when making decisions (order some food options and, after a few bites, stop eating because you feel full; Bruine de Bruin et al., 2007).

This set of questions shows that lower decision-making abilities could lead to more difficult life experiences, while the stress of bad outcomes could undermine the quality of people's decisions. When analysing the participants' answers to the above-mentioned items, it was possible to see that their answers depend on the way the questions were asked, as expected.

In the question "*Imagine that recent evidence has shown that a pesticide is threatening the lives of 1,200 endangered animals*", two response options were suggested: (A) 600 animals will certainly be saved; (B) 75% chance that 800 animals will be saved and a 25% chance that no animals will be saved. For this question all participants choose option A (saving 600 animals), opting for a less risky decision.

Moreover, when the options were presented in another format: (A) 600 animals will be lost for sure; (B) there is a 75% chance that 400 animals will be lost and a 25% chance that 1,200 animals will be lost, half of the participants chose the riskier decision.

However, for the other two items, the participants don't present the same pattern of answers, as previously. When asked "*What is the probability* ***that you will get into a car accident*** *while driving during the next year?*", on a 0% to 100% scale, half of the participants answered 5%, another participant answered 65%, and the last participant stated that it depends on several factors.

When the structure of the question is changed to "*What is the probability* ***that your driving will be accident-free*** *during the next year?*" the same participants answered 95%, one participant answered 35%, and the last still answered that it depends on several factors. This shows that even though the structure was changed the participants used the same logical thinking and decision-making to answer the remaining percentage of the first answer.

Furthermore, the items "*Do you think is sometimes ok to steal under certain circumstances?*" and "*Out of 100 people your age, how many would say it is sometimes ok to steal under certain circumstances*?" were not presented in the same way and most participants answered that it was not appropriate to steal under any circumstances to both, within the recognition of social norms.

#### *4.2.1.2 Training Assessment tools for participants' progression*

##### **4.2.1.2.1 Summative Assessment**

4.2.1.2.1.1 Multiple-choice test

The multiple-choice test included 20 questions with one right answer. This quiz could only be taken once by each participant, with no time restriction. However, only one participant took the test and received a 95% score.

4.2.1.2.1.2 Case Study

The case study asked the participants to consider a fictitious scenario in which a flight with a new drone would be tested, however, some setbacks are presented. The two case study questions were based on the participant's perspectives on how they could solve the problem, given the content covered in the training. The figure below (Figure 13) presents the case study implemented.

CASE STUDY – "HOUSTON, WE HAVE A PROBLEM": PROBLEM-SOLVING AND DECISION-MAKING

With this case study you will be able to apply, detail and assert the newly learned strategies on problem-solving and decision-making.

Keep reading this case study to be introduced to a hypothetical situation in and answer the questions presented.

FRAMING AND SCENARIO

Imagine that you have a YouTube channel which has grown considerably, thanks to the high-quality footage that you record with your drone in your free time.

This time, you want to do a test flight on your new drone that is have equipped with solar panels, a 5G module for live stream downlink of video and telemetry and a backup radio frequency link with a max range of 7km.

You study the flight plan quite thoroughly, to make sure the drone will: i) fly high enough to avoid obstacles; ii) fly close to roads where you can follow the drone and regain control of it mid flight if needed; iii) avoid restricted airspace areas and populated locations on the ground.

Since it is solar drone, equipped with a battery that should last for 2 hours of flight time without the solar recharge, you plan the flight for a sunny day, and head out to the countryside, which is manly rural for the test flight. The drone weighs about 4kg.

You bring a colleague with you to drive the car, while you pay attention to the drone's telemetry and establish visual contact when in proximity

CONSIDERATIONS

You have tested the drone in a local park, close to where you live, for several flight hours, for three days. Here you tested the flight control, the endurance and the 5G communications. All of the tests were concluded successfully.
You have only tested the drone in nominal conditions, in an area you are familiar with. You have not tested the 5G connection in the countryside and forgot to consider that 5G is common around urban areas where you live.
You updated the ground station software to update the return for landing "home" point to your position. This means, should the drone lose connection, it will fly to your last known location.
The weather forecast for the day (May 25th) is clear sky, with stratus clouds, and low intensity wind.
You had little sleep due to the considerable amount of work and anxiety you were feeling.

LESSON 2 – "What is my problem? Time to solve it"

When arriving to the take-off location, at 9am, you find:
- The day is not so clear at the time being, with forecast indicating clear sky after 11am ;
- It is breezy (and your drone flies at 10m/s)
- You test 5G connection and it works fine

You have a problem: you feel tired, and notice the weather is not as planned. However, you had already publicized your test on social media and planned to have a live stream during the flight for update and your followers are waiting for you. **Solve this problem by applying what you have learned regarding problem-solving.**

LESSON 3 – "I have made a decision. Or maybe not?"; "I have 99 problems, and 100 ways to decide"

You decided to proceed with the flight after waiting for 1h30. The weather improved, although not perfect. After take-off, you test everything to assess that it is working – and it is, you go ahead with the test. About 35km from launch point you notice degradation on 5G signal and lose connection to the drone. Since the link was jittery, you do not know if the UAV was receiving your updated position. Since the path you are taking is somewhat circular, if the UAV flies back directly it will overfly a high town area, meaning low ground clearance. Now you regret your decision to fly and are faced with a big problem at hand. **Decide what you will do by applying what you've learned regarding decision-making.**

**Figure 13 - Case study**

The case study was completed by 1 person, and the participant addressed the case study and each of the questions asked in the case study description very well. The participant's answers demonstrated a good understanding of the main content taught in the training, with a score of 90%.



#### 4.2.1.2.2 Formative Assessment

##### 4.2.1.2.2.1 Glossary

The glossary was completed by one of the participants. The participant inserted most of the key points of each lesson in some detail, which suggests that he has read the supporting documents, using them as a help for the definitions of the concepts. In addition, he has done additional research to define some concepts. The participant scored 100% on this exercise. The figure below (Figure 14) shows the completed glossary of the participant.

| SKILL-UP GLOSSARY | |
|---|---|
| CONCEPT | DEFINITION |
| System 2 | System 2 is also known as the explicit system, the rule-based system, the rational system, or the analytic system, as it performs the more slow and sequential thinking (Wikipedia) |
| IDEA | 4 Step Model for Problem Solving that involves Identification, Definition, Execution and Assessment (Lectures) |
| DIET | Model to assist in collecting relevant information that involves Definition, Integration, Exploration and Test (Lectures) |
| Problem solving | Thinking process that leads to a solution, answer or conclusion (Lectures) |
| Decision making | Thinking process that involves a choice between options, leading to a decision (Lectures) |
| Estimation Bias | A distortion effect that influences our decisions, such as Overconfidence bias, Prudency bias and Memory bias (Lectures) |
| Status Quo Bias | The status quo bias results from the desire to protect our ego from damage (Lectures) |
| Confirmation Bias | This is the tendency to look for information which supports our idea or perspective and at the same time avoid information which contradicts it (Lectures) |
| 5 Why's | Define the problem and ask why this and that (Lectures) |
| Fishbone Diagram | This technique also called "cause and effect" and will make you think about all the possible causes and factors within that could cause your problem (Lectures) |
| Mind Map | Visual thinking to bring problems to life by building out the connections and visualizing the relations that make up the problem (Lectures) |
| Brainstorming | Brainstorming is a group creativity technique by which efforts are made to find a conclusion for a specific problem by gathering a list of ideas (Wikipedia) |
| BrainSwarming | In a BrainSwarming graphic the goal growths in a downward direction for sub goals more refined. The resources interact with one another and growth in upward direction (Lectures) |
| SWOT Analysis | Is a strategic planning and strategic management technique used to help a person or organization identify Strengths, Weaknesses, Opportunities, and Threats (Wikipedia) |
| Weighted Decision Matrix | Comparing multiple different options measured by critical factos that are weighted by importance (Lectures) |



**Figure 14 - Glossary completed**

#### 4.2.1.2.2.2 One-question quiz

The exercise is intended to help participants understand and review what they learned in the last training session lesson. As with the previous exercises, only one participant answered this question, scoring 100%.

#### 4.2.1.2.2.3 One minute essay

This activity is designed to assist participants in understanding and reviewing what they learnt in the last training session lesson. As with the other tasks, only one participant answered this question, scoring 100%.

#### 4.2.1.2.2.4 Concept map

The concept map aims to relate the main concept of this training module with other concepts, strategies, models, etc. This exercise was completed by one of the participants with a score of 100%. The figure below presents the concept map completed by the participant (Figure 15).

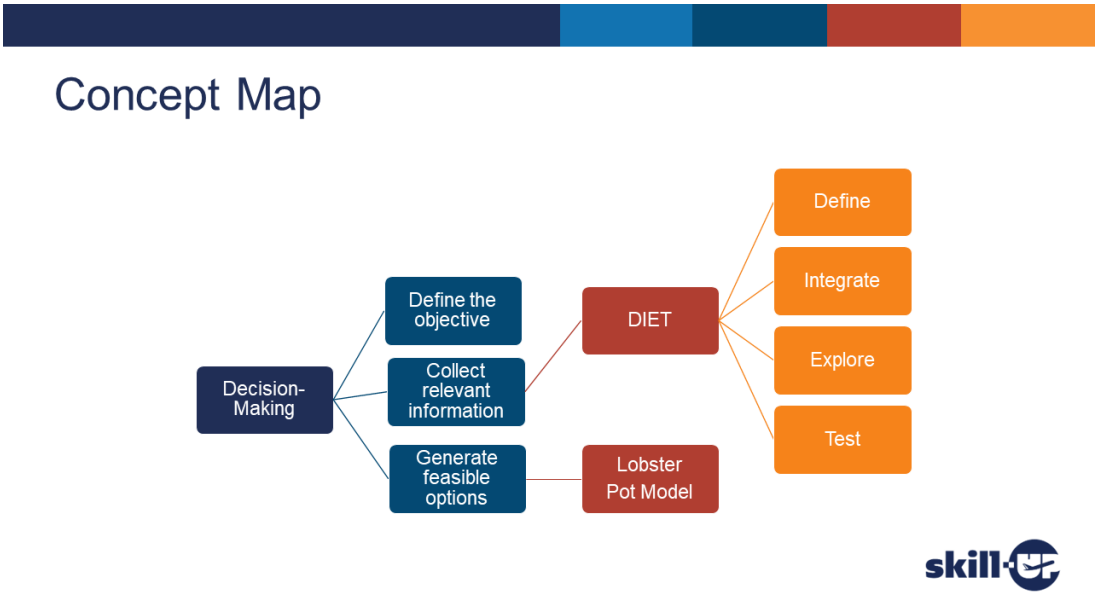


**Figure 15 - Concept Map completed**

4.2.1.2.2.5 Misconception Check

The following exercise presents the participant with the following statement: "*Problem-solving and decision-making are the same skill with different names*". The goal is for the participant to read the statement carefully and give his or her opinion, explaining his or her point of view. Only one participant completed this exercise, scoring 100%.

4.2.1.2.2.6 One-sentence Summary



This task is meant to help participants comprehend and review what they learned in the last training session lesson. As with the other tasks, only one participant answered this question, scoring 100%.

### *4.2.1.3 Training Assessment Tools for Participants' Knowledge and Skill Retention Following Training*

#### 4.2.1.3.1 Focus Group

The communication and invitation to participate in the focus groups were done via e-mail to all participants registered in the training module. However, only one participant responded and participated in the activity. Therefore, the focus group was conducted in Portuguese and in an interview-like setting (i.e., one-on-one conversation). The focus group was held on the 21st of February online (via Zoom) and was based on a Miro dashboard prepared by QSR for all training modules.

The following sections focus on the three parts of the focus group session: training review, training experience and training application. Furthermore, since the participant of the focus group for this training module was the same participant for the focus group of the other QSR's training module «*Managing myself: towards a safer life": Workload Management and Stress Management*», it was stated by the participant that it was easier to analyse and comment both training modules together. Therefore, all the following inputs refer to both training modules.

*Training review*

- **Strengths**

The following are the key strengths that were identified by the participant:

- The course content was well-prepared and structured.
- Interesting contents.
- Methods and techniques were useful and innovative.
- Accessible exercises and well-designed.

- **Weaknesses**

- The low number of participants made the synchronous moments less productive.
- The exercises could be closer to reality.
- The online platform was of low quality.
- Platform issues when watching the videos.
- The platform didn't allow for the PowerPoint download.

- **What could have been done differently?**

- Having a backup plan for low adherence to the training module.
- Help students with the exercises with answers more concrete and specific.
- Contact the participants to watch the video lessons before the synchronous moment.
- Create a session to explain to the students how to navigate the training program/platform and the exercises.

*Training experience*

Table 4 presents what participants loved and what could be improved concerning the trainer, video lessons, support materials and self-study materials.



**Table 4 - Training experience overview**

| | What I loved | What could be improved |
|---|---|---|
| Trainer | • Comprehensive interaction<br>• Patience<br>• A good approach to the contents and concepts<br>• Clear language | • Not being able to fill the gaps that students may have<br>• Better preparation of the information/knowledge to transfer to students |
| Video Lessons | • Clear usage of the English language<br>• Concepts are clear and easy to understand | • The platform not allowing students to move forward or backwards in the videos.<br>• Not being able to speed up the video. |
| Support materials | • The slides help to keep up with the videos | n/a |
| Self-study materials (supplementary books, articles, videos) | n/a | n/a |

- **Work-life/Social Life**
  - It has been helpful for their professional life and social life.
  - Was able to implement some methods and techniques of problem-solving/decision-making and workload and stress management.

#### 4.2.1.3.2 Problem-based activities

This exercise is similar to the prognostic assessment exercise in that the goal is to determine whether, following the training and taking into account the topics covered, the participants would reply differently to the questions presented in this exercise. As a result, the participants would be presented with a series of fictitious scenarios and asked to reply to the questions posed to them.

In this exercise, the participant answered the same question as in the previous one. This is possible because there was very little time between the first and last exercises, as well as the fact that they were identical. This less positive point may have been avoided if we had completed different tasks that required the same responses. The only participant who answered this exercise scored 100%.

### *4.2.1.4 Summary and final note*

The training module was well thought out, designed, and delivered. However, the learning platform has detracted from the participants' experience. Since this training module had only one participant that completed the course, the time remaining from the synchronous lessons could have been used to help the participant become familiar with the platform so that it would be easier to use and navigate. The synchronous moments could also have been used to help the participant perform the various exercises for the training. This was stated by the participant in the focus group when he/she suggested that the trainers developed a “plan B” for the possibility of low adherence in future training modules.

The overall module could also be improved by incorporating more dynamic videos with examples more applicable to aviation professionals. Some references that trainers consider important for a better learning experience could also be added to the study materials, and questions that incorporate information from these sources could be developed, in addition to the content of the PowerPoint presentations.

Overall, the participant was satisfied with the training module (and the trainers) and felt that their learning experience will benefit them in their professional and personal lives.

## *4.2.2 Training Module TM #02 (Artificial Intelligence and Machine Learning for Aviation Application)*

### *4.2.2.1 Training Assessment tools for participants’ entry-level*

#### 4.2.2.1.1 Self-assessment questionnaire

In this assessment, the participants were asked five questions that were designed to allow them to assess their knowledge, experience, and opinions concerning AI and computer programming. Nine responses were received for this assessment.

The first question asked the participants to tick statements which best described their knowledge and experience with AI and ML. As can be observed from Figure 16, the majority of the participants had a basic understanding of AI/ML but did not use the technology daily.

When asked whether they had ever written a computer program, 100% of the respondents answered ‘yes’. This was not surprising given that most of the participants had a technical background.

In the third question, the participants were asked to list three existing or potential applications of AI in aviation. The answers provided included: automated take-off; collision avoidance; crew scheduling; automated airport vehicles; route planning; and system monitoring.

The last two questions asked the participants for their opinion on the importance of trustworthy AI and the need for human oversight of AI systems. Their responses are shown in Figure 17 and Figure

18. From Figure 17 it can be observed that the majority of the participants believe in the importance of trustworthy AI. Similarly, from Figure 18 it can be observed that the majority of the participants agree that humans will always be required to oversee AI systems.

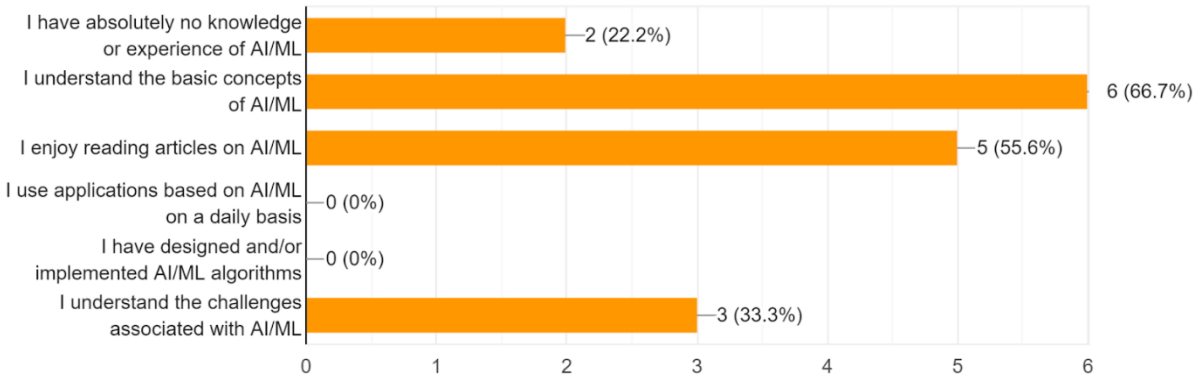


**Figure 16 - Prior knowledge and experience with AI and ML**

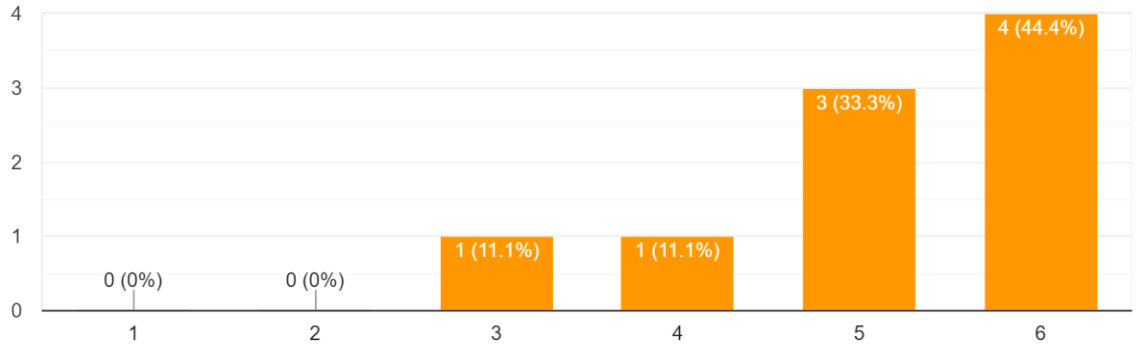


**Figure 17 - Responses to the question "How much do you agree with the following statement? One of the key challenges to the introduction of AI in aviation is trustworthiness."**

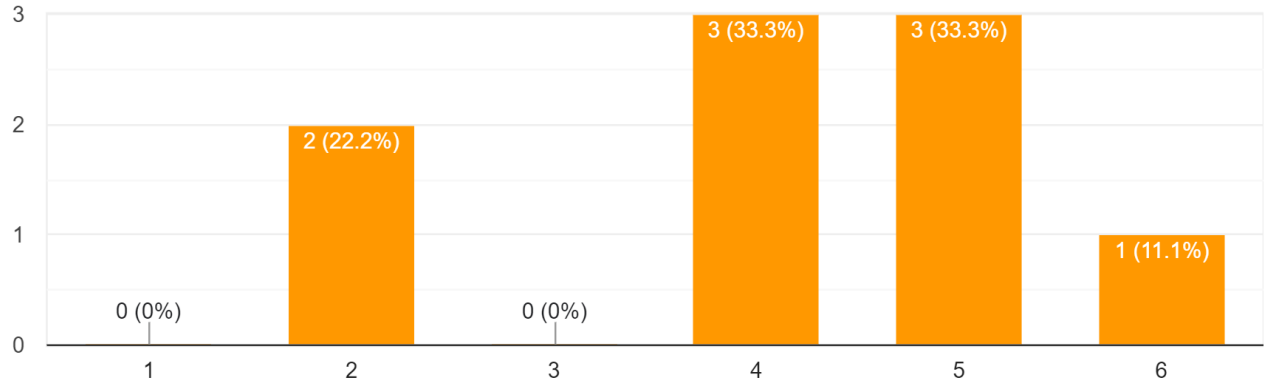


**Figure 18 - Responses to the question "How much do you agree with the following statement? AI systems will always require human oversight."**

#### 4.2.2.1.2 Performance-based activities

This assessment consisted of three questions to assess the participants' level of competence in AI and ML. In each question, the participants described an application and were asked to identify the key AI/ML capabilities – associated with that application – from a list of AI/ML capabilities. The number of capabilities was provided as a hint for each question. The answers provided by the participants – together with the correct responses (highlighted in green) – are shown in Figure 19, Figure 20 and Figure 21.

Out of 9 participants, 4 answered the first question correctly; 6 answered the second question correctly; and 4 answered the third question correctly. In most cases, the participants selected at least one correct AI/ML capability for each application. The average score of this assessment was 1.56 (out of 3).

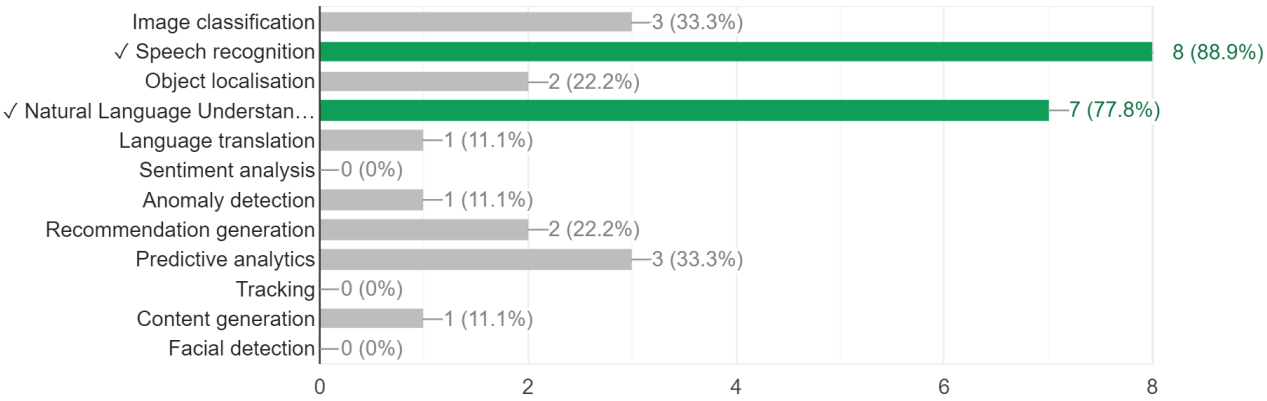


**Figure 19 - Key AI/ML capabilities which are used in the following application: an application which allows the user to get a weather update on his smartphone by means of a voice command**

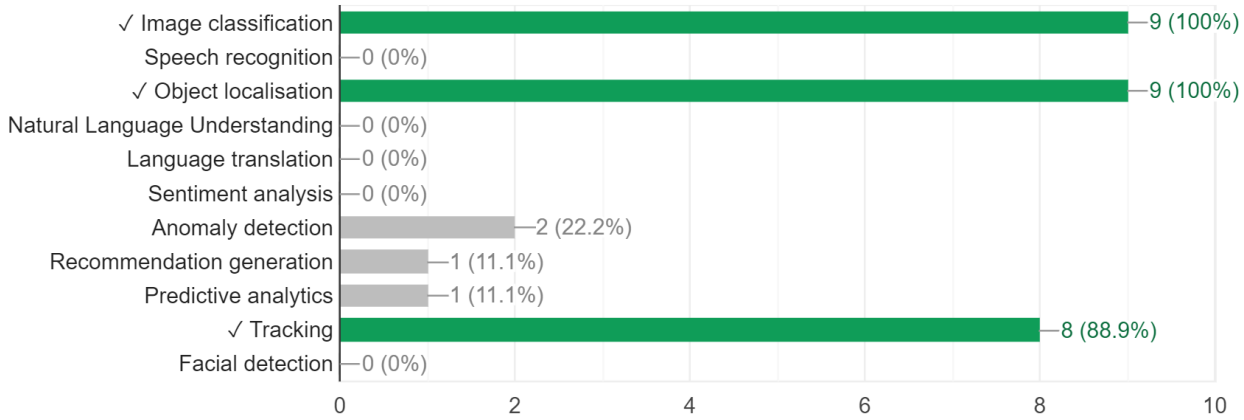


**Figure 20 - Key AI/ML capabilities which are used in the following application: an application which can detect and track cars in surveillance footage**

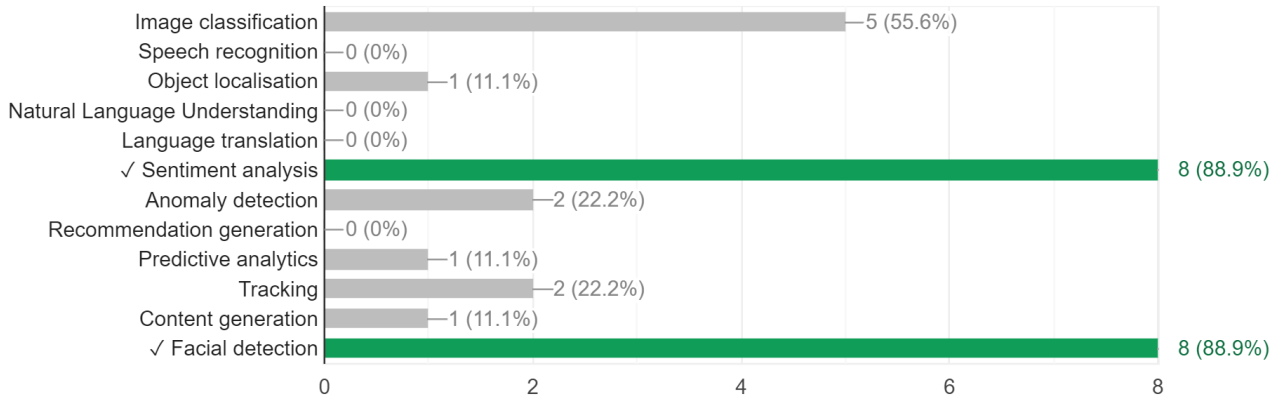


**Figure 21 - - Key AI/ML capabilities which are used in the following application: an application which can determine the emotional state of a person on the basis of his/her facial expressions**

### *4.2.2.2 Training Assessment tools for participants' progression*

#### 4.2.2.2.1 Summative Assessment

##### 4.2.2.2.1.1 Multiple-choice test

The multiple-choice test consisted of 20 questions, each with one correct answer. Each participant could only complete this questionnaire once, and no time limit was imposed. The test was completed by 6 of the participants[2]. The average score for this test was 16 (out of a maximum possible score of 20), with scores ranging from 14 to 18 (i.e., 70-90%) as shown in Figure 22. Thus, it can be stated that, in general, the participants did very well on this test.

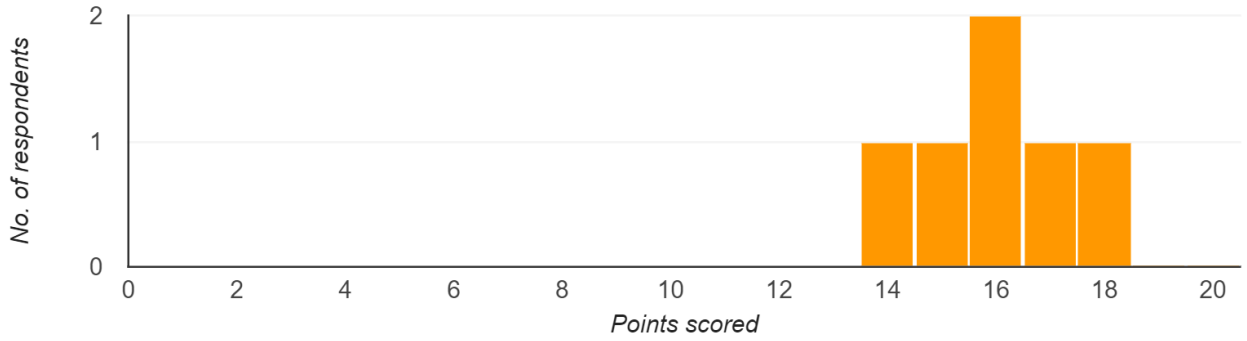


**Figure 22 - Distribution of multiple-choice test scores**



##### 4.2.2.2.1.2 Case Study

The case study requested the participants to consider a fictitious scenario where an airline would like to invest in an AI-based system to improve the quality of pilot training and to help it transition to Evidence-Based Training.

The case study was completed by 2 of the participants. Both of them tackled the case study quite well and addressed each of the questions asked in the case study description. The participants' answers demonstrated a good understanding of key AI concepts, techniques, challenges and applications. The participants scored an average of 80% on the case study.

[2] Note: Although 9 participants completed the self-assessment questionnaire and performance-based activities, 6 participants eventually completed the course.

#### 4.2.2.2.2 Formative Assessment

##### 4.2.2.2.2.1 Glossary

The glossary was completed by one of the participants. Some of the concepts which were described in the participant's submission included: narrow AI; black box AI; Reinforcement Learning; pilot condition monitoring; simple linear regression; explainable AI; and Artificial Neural Networks. The participant scored 90% on this exercise.

##### 4.2.2.2.2.2 Drag and Drop

The drag-and-drop exercise was completed by 6 participants, with each participant obtaining full marks. Figure 23 shows the answer provided by one of the participants.

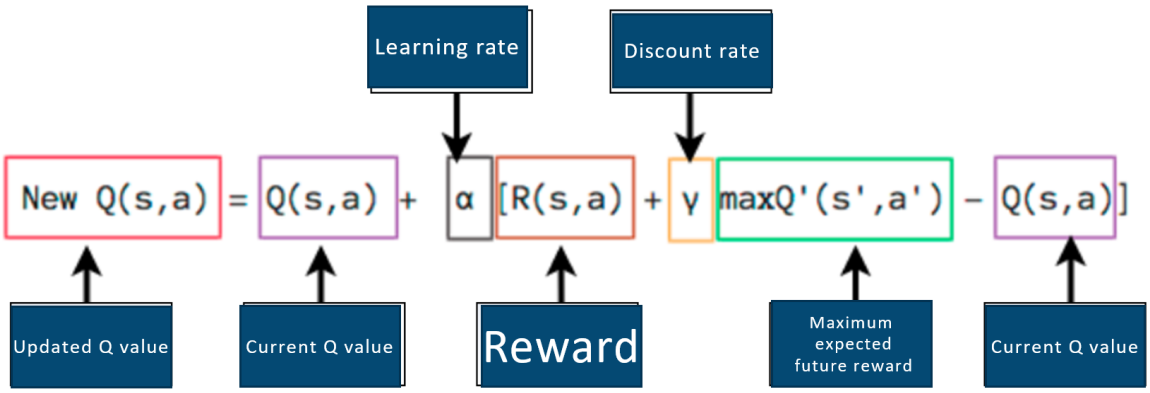


**Figure 23 - Response provided by one of the participants**



##### 4.2.2.2.2.3 Discussion Forum

This online discussion focused on the practical applications of AI and ML in aviation. The participants were asked to search, identify a real-world use case of AI/ML in aviation, and explain how AI/ML is being applied in this use case. The discussion was open from Lesson 5 until the end of the training module (around 3 weeks).

Two participants took part in this discussion and interacted with each other and with the instructor. One of the reasons for the low participation was the fact that the online learning platform was not user-friendly and had several technical issues. Another reason was the lack of time available due to the participants' busy work schedules. Extracts from the online discussion are shown in Figure 24 and Figure 25.

JEA jeadarmanin@gmail.com
Newbie

3 months ago #2

Let me open the discussion on use of AI/ML in Aviation.

Apart from a seamless passenger journey, the aviation industry also targets to have a seamless baggage journey. AI and ML is being used to create Intelligent baggage solutions. One Company providing this service is BagsID. Their technology uses rapid computer vision and artificial intelligence to recognise bags in a system that will significantly streamline the baggage journey. The system has a read rate of 99.1%, which translates to a cheaper price per bag than barcode. The system uses Computer vision and deep learning algorithms recognise patterns in baggage flows and time. Images are captured by cameras at strategic touch points. The core technology of BagsID is centered around the ability to identify, validate, match, extract and store data from baggage.

Sources: https://www.bagsid.com/product/our-solution; https://www.bagsid.com/

Thank Reply Reply with Quote Multi-Quote

JAS jason.gauci@um.edu.mt
Newbie Topic Starter

3 months ago #3

Jean, that is a very interesting application which I was not aware of! The use of computer vision in this case complements the use of other baggage labeling technologies (such as RFID) and offers several advantages.

+1 Reply Reply with Quote Multi-Quote

**Figure 24 - Extract from the online discussion on applications of AI/ML in aviation**

KRI [redacted].aero
Newbie

2 months ago #5

Very interesting [redacted] I did not know about this application either. I have gone quite in detail in my academic life into the provision of value to the traveller and an utopia of the seamless journey is a strategic goal of many service providers today. I am sure that this technology could not only contribute to better value with less time/lost baggage, but also increase cost effectivness - contributing to operator profitability.

Thank Reply Reply with Quote Multi-Quote

KRI [redacted].aero
Newbie

2 months ago #6

My contribution to this discussion is an application in the field of flight crew training. I found this paper:

https://www.researchgate.net/publication/352933885_Artificial_Intelligence_in_Pilot_Training_and_Education_-Towards_a_Machine_Learning_Aided_Instructor_Assistant_for_Flight_Simulators

which conceptualises a framework for a Machine Learning concepts to be applied in the field of flight crew training, with a view of improving pilot training, pilot performance in the flight deck, and ultimately levels of safety.

Within the simulator environment, maybe even with the use of biometrics, a massive amount of data (which could be classified as Big Data) is being generated, which could be analysed and correlated to gain inference on flight crew competences and instructor performance, amongst other dependent variables. Machine learning could be used to idenfy patterns, objective performance evaluations, and community/industry trends. It could also be used to predict competence behaviours when flight crew are faced with different (single and/or multiple) environmental and operational conditions. @[redacted] ... good topic for a PhD

Thank Reply Reply with Quote Multi-Quote

**Figure 25 - Extract from the online discussion on applications of AI/ML in aviation**

4.2.2.2.2.4 Concept map

The concept map exercise was completed by one of the participants with a score of 80%. The concept map submitted by this participant is shown in Figure 26 and shows that the participant has a fair understanding of key AI/ML concepts.

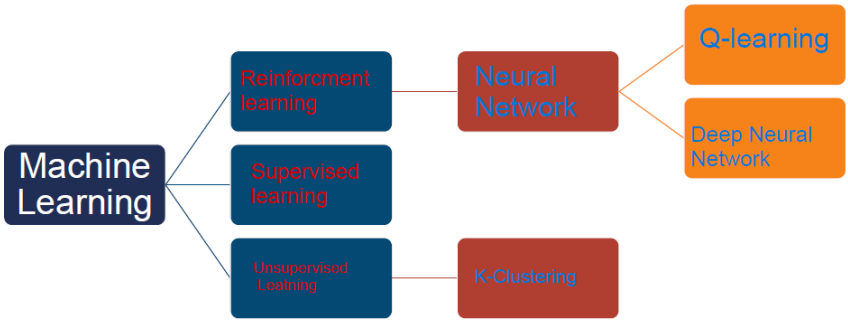


**Figure 26 - Concept map submitted by one of the participants**

4.2.2.2.2.5 Discussion Forum

This discussion was intended to allow the participants to introduce themselves to each other and the instructor at the beginning of the training module. The participants were invited to share their professional and personal background – including any interesting facts – and to briefly state the reason(s) why they decided to do this training module.

Five participants took part in this discussion. The discussion was very cordial and served as an icebreaker. For instance, one of the participants revealed that he is an aviation enthusiast, has just started working at an airport, and is passionate about cooking and trekking. Another participant shared his passion for aviation and described his experience in flight crew training administration and flight operations quality management. Yet another participant shared the fact that he is working towards his PPL license and is interested to learn how AI impacts aviation.



4.2.2.2.2.6 Discussion Forum

The topic of this discussion was trustworthy AI. The participants were expected to explain why it is important for AI to be explainable and unbiased, and to provide a practical example to support their answer. Unfortunately, no participants took part in this discussion and the reasons were very similar to those described in Section 3.2.1.3.

#### 4.2.2.2.3 Average scores

The average score of the participants for each type of assessment in the training module is provided in Table 5. Note that the average score of an assessment was found by dividing the total score of the participants who completed the assessment by the number of participants who completed the assessment. This was done because not all of the participants completed/submitted all of the assessments. No average score was found for the discussion 'Towards trustworthy AI' because there was no participation in that discussion. Each average score is expressed as a percentage between 0 and the corresponding grade allocation.

Table 5 - Summary of scores for the training module 'AI and ML for Aviation Applications

| Type of assessment | | | Grade allocation | Average score |
|---|---|---|---|---|
| Summative Assessment | | Multi-choice test | 30% | 24% |
| | | Case Study | 40% | 32% |
| Formative Assessment | Progress Assessment | Glossary | 10% | 10% |
| | | Drag-and-drop | 4% | 4% |
| | | Discussion – Applications of AI/ML in aviation | 4% | 3% |
| | Participation Assessment | Concept Map | 8% | 6.4% |
| | | Discussion – Introduce yourself | 2% | 2% |
| | | Discussion – Towards trustworthy AI | 2% | - |
| **Total** | | | **100%** | **81.4%** |

#### *4.2.2.3 Training Assessment Tools for Participants' Knowledge and Skill Retention Following Training*

##### 4.2.2.3.1 Focus Group

Due to the availability of the participants, two focus group sessions were carried out: one with three participants and another with two participants. Both focus groups were carried out online (via Zoom) and were based on a Miro dashboard prepared by QSR for all the training modules. Each focus group was approximately an hour long. A screen capture of the participants of the first focus group session is shown in Figure 12. The following sections focus on the three parts of each focus group session: training review, training experience, and training application.



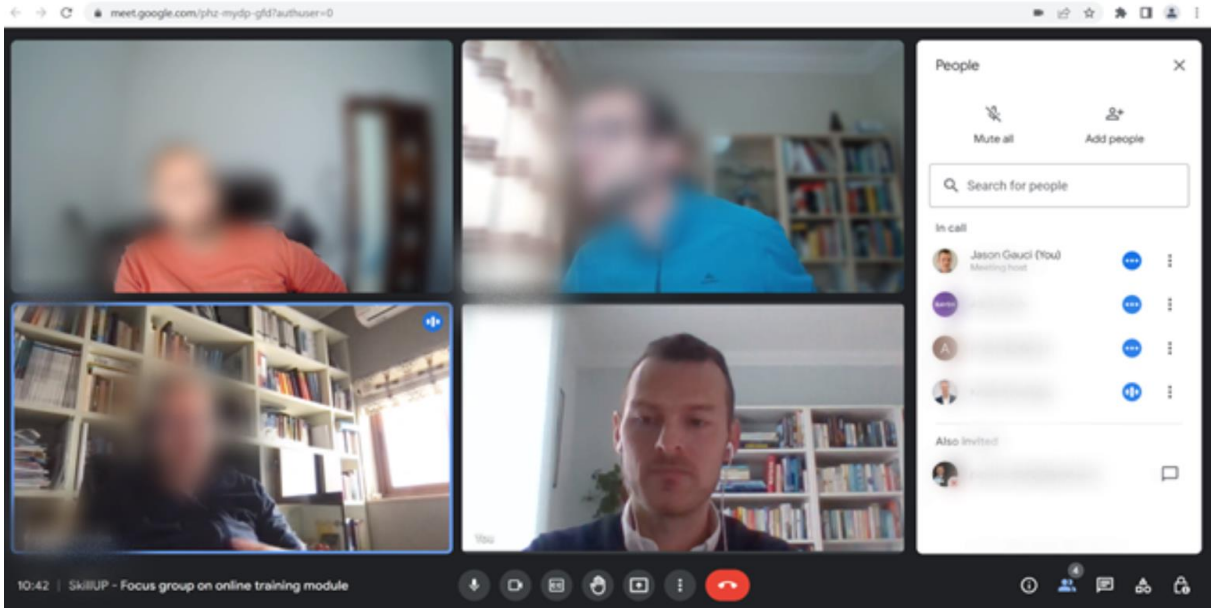


Figure 27 - Screenshot of the first focus group session

*Training review*

- **Strengths**

The following are the key strengths that were identified by the participants:

- Overall concept
- The course content was well-prepared and presented.
- The course script is well-written and rehearsed.
- Clear, paced videos.
- Examples
- Course outline
- Although limited, graphics were adequate.

- **Weaknesses**

The following are the key weaknesses that were identified by the participants:

- Learning Management System (LMS) does not monitor progress.
- Low interactivity/immersion in the LMS
- Video lessons are too long.
- Issues were experienced when watching the video lessons.
- Weak social learning environment
- Some mathematical concepts needed more detail.
- The content was sometimes too academic and could be more applicable to aviation.
- LMS is more Italian-oriented and certain features were difficult to access.
- Assignments were easy.
- Video lesson transcripts were not available, reducing accessibility.

- **What could have been done differently?**

The following are some of the suggestions which were put forward by the participants:

- Video lessons could be split into small videos.
- Choose a better LMS with a better user interface (e.g., Udemy)
- Create a micro-learning environment.
- Insert stock footage and animated graphics.
- Increase the level of interactivity.
- The video quality can be improved.
- Include more hands-on applications of AI.
- Advanced lessons could be created to allow participants with the right background to delve deeper into a certain topic/concept.

*Training experience*

Table 6 highlights what the participants loved and what could be improved concerning the video lessons, support materials, and self-study materials.

**Table 6 - Training experience overview**

| | What I loved | What could be improved? |
|---|---|---|
| Video Lessons | • Lessons were structured and it was easy to pause the videos and review them.<br>• Good content and real-world examples<br>• Good review of concepts | • The videos could be made available offline so as not to have to log on to the LMS every time.<br>• More (and shorter) videos<br>• Graphics could be more visually appealing.<br>• Introduction of a Virtual Reality-based environment |
| Support materials<br>(Discussion forums, assessments, LMS, didactic plan, slides) | • The lesson plan was clear. Notifications (announcements) from the trainer about deadlines helped to keep me in check.<br>• The didactic plan and course outline<br>• The assignments were interesting and relevant | • More interaction from the participants<br>• A synchronous session/tutorial could be organised halfway through the training module.<br>• The didactic plan could be integrated with the course/LMS rather than being a separate document.<br>• Assignment submission needs to be improved |
| Self-study materials<br>(Supplementary books, articles, videos) | • With what I learnt, I could easily browse online and learn more.<br>• Good choice of articles and support materials | • The amount of material could be reduced because there was quite a lot of material to go through |



*Training application*

- **Work-life**

The participants identified the following ways in which the training module will be useful to them in their professional life:

- Increased awareness of AI/ML concepts and the growing influence of AI on the aviation industry.
- Better knowledge of the way forward in the aviation industry.
- Better ability to identify new applications of AI/ML such as predictive analytics of an airline's On-Time Performance, or predictive analytics of flight crew training performance.
- Better ability – and increased confidence – to learn more about AI and to further their studies in this field.

- **Social life**

The participants identified the following ways in which the training module will be useful to them in their social life:

- Better ability to hold a conversation about the subject and to raise awareness.
- A better understanding of how smartphone apps use AI and ML.

#### 4.2.2.3.2 Problem-based activities

For this assessment, the participants repeated the performance-based activities described in Section 4.2.2.1.2. The answers provided by the participants – together with the correct responses (highlighted in green) – are shown in Figure 28, Figure 29 and Figure 30. Out of 6 participants, 5 answered the first question correctly; 4 answered the second question correctly; and 5 answered the third question correctly. In most cases, the participants selected at least one correct AI/ML capability for each application. The average score obtained in this assessment was 2.33 (out of 3). This means that there was an increase in the average score when compared to the average score (1.56) obtained when carrying out the same assessment at the beginning of training.

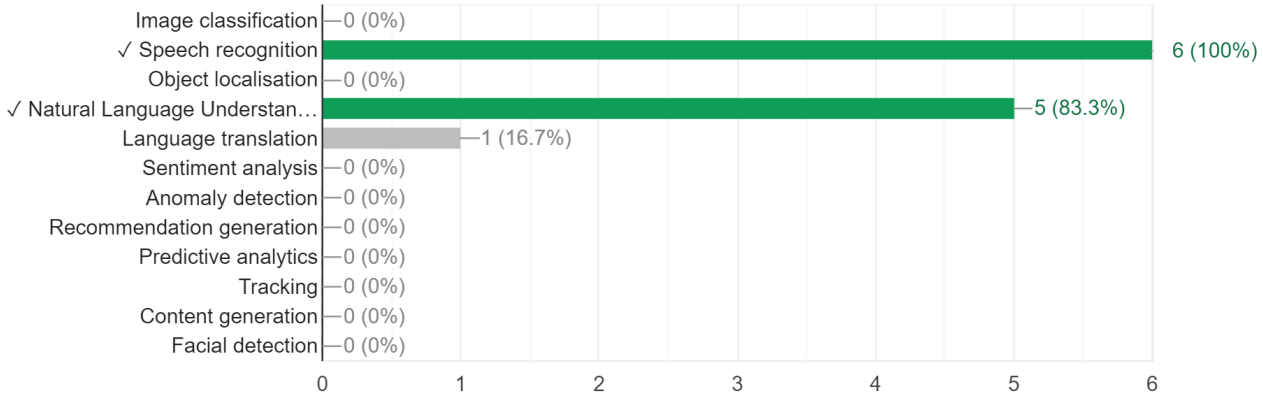


**Figure 28 - Key AI/ML capabilities which are used in the following application: an application which allows the user to get a weather update on his smartphone by means of a voice command**



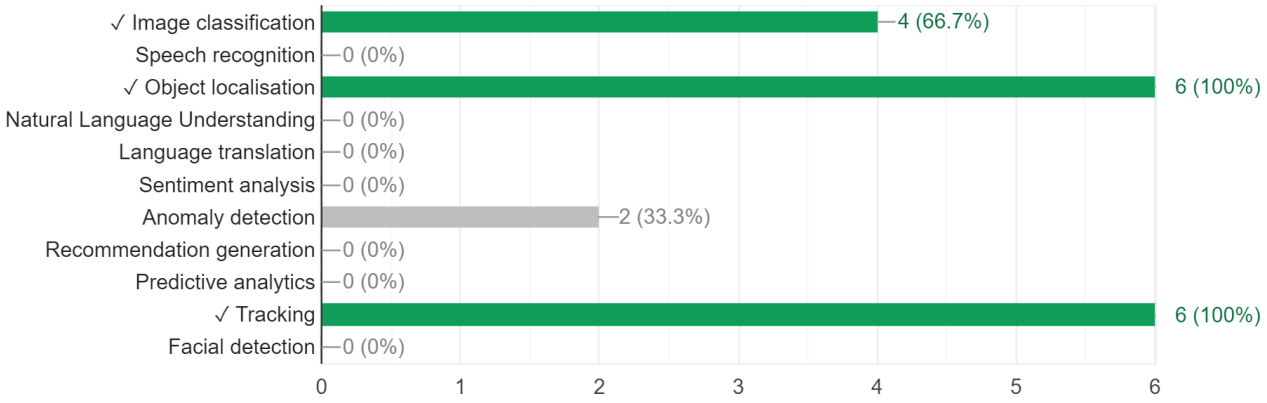


**Figure 29 - Key AI/ML capabilities which are used in the following application: an application which can detect and track cars in surveillance footage**

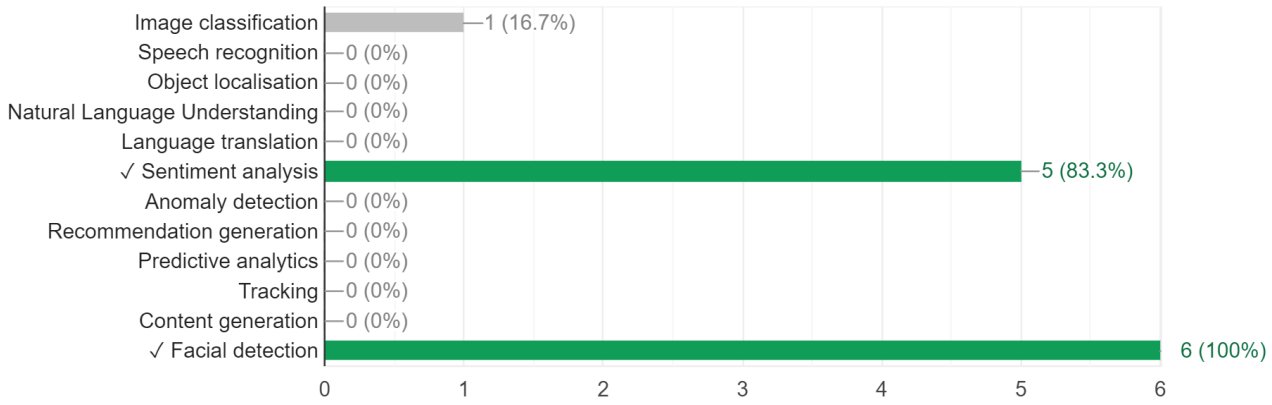


**Figure 30 - Key AI/ML capabilities which are used in the following application: an application which can determine the emotional state of a person on the basis of his/her facial expressions**

#### *4.2.2.4 Summary and final note*

Here are some overall reflections and recommendations based on all of the results presented in this report:

- The training module – particularly the content and script of the video lessons – is well-thought-out and designed. However, unfortunately, the online learning platform (LMS) detracted from the online learning experience of the participants.
- Apart from changing the LMS, the module can be improved by incorporating shorter videos, video transcripts, better graphics, and animations, and by making the content less academic and more applicable to aviation professionals. In addition, given that the module is completely asynchronous, it may be beneficial to include a synchronous session (tutorial) halfway through the module to better connect with the trainees.
- The participants did not interact in the discussion forum as much as expected, and most of them did not complete all of the assessments. This was due to multiple reasons, including the difficulty of using the LMS, and the participants' busy work/life schedules. Nevertheless, all of the participants managed to watch all of the video lessons and did very well on the assignments which they submitted. Furthermore, as observed from the results of the final test and the problem-based activities, the participants managed to gain and retain knowledge of AI and ML.

Overall, the participants were satisfied with the training module (and with the trainer) and felt that their learning experience will benefit them in their professional and personal lives. Furthermore, the participants were happy to recommend the training module to other people.

### *4.2.3 Training Module TM #03 (Deepening of Situation Awareness)*

Eleven participants were recruited and tested for the "Deepening of Situation Awareness" training module at ENAC.

#### *4.2.3.1 Training assessment tools for participants' entry level*

##### **4.2.3.1.1 Self-Assessment questionnaire**

An assessment questionnaire was derived from the SART, the "Situation Awareness Rating Scale", which is used for the subjective assessment of one's situation awareness. This scale has been developed by Taylor (1990) and is one of the best-known and thoroughly tested subjective techniques to assess situation awareness. The scale is originally composed of ten items. We adapted the scale and removed the non-relevant items, as participants had to recall several complex situations and not only one. Four items were selected and aimed at assessing attentional supply and understanding of the situation: arousal, spare mental capacity, concentration and

understanding of the situation. Each item was assessed through a 6-point Likert scale, with answers ranging from 1 – strongly disagree – to 6 – strongly agree.

Six participants answered the questionnaire. The self-assessment scores of the participants varied from 3,75 to 5, with a **mean score of 4,25/6**. This means that when they were confronted with complex situations, they self-rated themselves as having a relatively good situation awareness. This is not surprising as all the participants of this training module were instructors in their domain. The analysis of their answers to each question revealed that:

1. They self-assessed themselves as rather alert and ready for the situation (all answers varied from 4 to 6);
2. They felt they had rather limited spare capacity to deal with this complex situation (all answers varied from 2 to 4);
3. They felt highly concentrated on the situation (all answers varied from 5 to 6);

Except for one participant (answer: 2) all had a moderate understanding of the situation (all other answers varied from 4 to 5).

##### 4.2.3.1.2 Performance-based activities

The entry-level of the participants regarding the Situation Awareness topic was relatively low. Indeed, eight participants felt not able to answer any questions. Only three participants completed the five questions of the entry-level questionnaire. Their scores varied from 2 to 3 with a **mean score of 2.3/5**. The analysis of their answers to each question revealed that:

1. All of them recognized correctly the three keywords associated with the levels of situation awareness in Endsley's definition.
2. There was confusion regarding the SA assessment tools. Some of them selected tools used for assessing workload (like NASA-TLX or PISA) and one answer was only partially correct (SAGAT was recognized while SART was not);
3. Concerning the "top-down" processing, two answers were wrong ("bottom-up" was chosen) and one was partially correct ("goal-driven" was not ticked);
4. All of them answered correctly concerning the usefulness of expert eye movements for improving novices' visual scanning.
5. Only one participant answered correctly to the question asking to recognize examples of metacognition. Two of them selected the correct answers but also answers corresponding to procedural knowledge.



Globally, most participants lacked knowledge of each topic covered by the training module. However, some participants had some previous knowledge about Endsley's model and about the benefits of showing expert eye movements for improving visual scanning.

### *4.2.3.2 Training assessment tools for participants' progression*

#### 4.2.3.2.1 Multiple-choice test

Participants answered both a multiple-choice questionnaire with 20 questions. Among the eleven participants, only five answered the questionnaire. Their scores were globally high, ranging from 13 to 18, with a **mean score of 16.8/20**, which is **84.0%** of correct answers on average. The item analysis revealed that more than half of the items (11) were correctly answered by all participants. For five items, only one participant chose the wrong option. Four items were wrongly answered by more than one participant:

- Item 9 - about the relationship between situation awareness and performance (3 errors).
- Item 11 - about the SAGAT technique (4 errors).
- Item 13 - about the model of comprehension (2 errors).
- Item 16 - about metacognitive processes (2 errors).

#### 4.2.3.2.2 Other assessments

Exercises and assessment tools were designed to help trainees check their understanding of the main topics addressed and to assess their progress during the training module implementation. However, participants did not get the opportunity to get access to these exercises due to technical

issues with the Knowledge Centre Platform. Unfortunately, these technical issues have not been solved in the time frame of the planned pilot sessions which led to the impossibility of implementing these assessments for this training module.

#### *4.2.3.3 Training Assessment Tools for Participants' Knowledge and Skill Retention Following Training*

##### 4.2.3.3.1 Focus group

Several sessions of focus groups were organised to adapt to the participants' planning constraints. The results presented here represent the synthesis of the feedback collected among the eleven participants of the ENAC pilot sessions.

Several strengths were highlighted by the participants: the relevance of the topic (especially for pilots and air traffic controllers), the achievement of the main objective that is having a better representation of the concept of situation awareness, the usefulness of the examples provided in the situation awareness self-assessment grid presented at the end of the training module and the flexibility offered by the asynchronous material (they could watch the video lessons whenever they wanted).

However, several weaknesses have also been pointed out. Most of them were concerned with the format of the video lessons and the difficulties to remain concentrated and involved in listening actively to the discourse while following the slides. One comment also concerned the content of the lesson which was considered to be too "academic", which means more suited for scholars. Suggestions have been made:

- Provide more examples and be more practical (also focus more on results than on the method of research studies);
- Make the video lessons interactive and add guidance in the slides with graphs;
- Allow listening to the video lessons in the native language and/or add subtitles to the video lessons;
- Shorten the video lessons;
- Add a summary sheet at the end of each lesson;
- Provide a glossary for key terms and the web links to the cited research studies;
- Add an example of a crash in aviation illustrating the concepts seen in the lesson for each target population of the project.

Concerning the trainer, participants appreciated the pace of speaking but also noticed that the intonation was too weak at the end of the sentences.

Concerning the video lessons, they liked the citations of research studies about situation awareness, some video chaptering and the possibility of pausing the video. However, as already mentioned in the general comments, they highlighted the need to shorten the video lessons, add examples, render the videos more interactive (as with H5P, i.e., Html 5 Package, systems), put less emphasis on research author names, can add markers during the video (chapters), make it easier to find a specific moment (video thumbnail) and integrate exercises in the video.

The participants could not give any feedback concerning the exit ticket exercises at the end of each lesson as they were not available to them. They pointed out that the ergonomics of the platform could be optimised. For instance, they highlighted that registration and access to courses and lessons required too many steps.

Concerning the self-study materials, they confessed that it would have been too time-consuming to read all the cited references. If possible, they suggested adding links to the books or articles cited or adding enriched material complementary to the slides.

At the end of the focus group, the participants explained how this training module could be useful for them:

- Helpful for debriefings with trainees regarding their situation awareness, especially with the use of the grid, and also helpful to help trainees with self-debriefing (after adapting the grid to each one's operational context);
- Step by step better representation of one's own situation awareness;
- Learning to better know oneself;

- Learning new elements that could be integrated into CRM training;
- Could be useful when systems change, even for experts;
- Could be applied to driving or more generally to the management of overload in everyday life.

##### 4.2.3.3.2 Problem-based activities

Concerning the final problem-based activities, five participants completed them. Scores ranged from 1 to 5, with a **mean score of 3.0/5**.

The comparison of the outcomes of the entry-level and final-level questionnaires revealed a slight improvement. However, these results should be taken cautiously, given the small sample of participants who completed these questionnaires. Indeed, out of eleven participants, only three of them for the entry level and five of them for the final level fully completed the exercise.

#### *4.2.3.4 Summary and final note*

The mean average score was only composed of the summative assessment based on the multiple-choice test (given the technical issues with the platform). On average participants had an average grade of **84%**, which highlights fair retention and understanding of the knowledge delivered in the training module. The most frequent errors concerned the name of situation awareness measurement techniques and theoretical relationships of situation awareness with other concepts (performance, comprehension).

The qualitative feedback of the participants was very informative. Globally, the topic of “situation awareness” was rated as relevant and interesting. However, several areas for improvement were pointed out, especially about the form of the training module. In particular, participants suggested that video lessons could be more interactive, with the integration of exercises directly in the video lesson, asking for answers from the participants and providing immediate feedback.

### *4.2.4 Training Module TM #04 (Strengthening Psychological Capital [PsyCap])*



#### *4.2.4.1 Training Assessment tools for participants’ entry-level*

##### 4.2.4.1.1 Self-assessment questionnaire

The exercise developed in this part aimed to assess the prior knowledge and competencies in the main subject of this training module. Four items of Psychological Capital Questionnaire (PCQ) developed by Luthans et al. (2007) used in the current prior knowledge assessment. In order to assess prior knowledge, this short questionnaire asked participants their hope, self-efficacy, resilience and optimism in organizational context. A set of statements were presented to the participants, and they had to choose the degree to which they agreed with each statement, on a scale from 1 (strongly disagree) to 6 (strongly agree). The figure below (Figure 31) presents the answers of the participants across the scale in each statement presented.

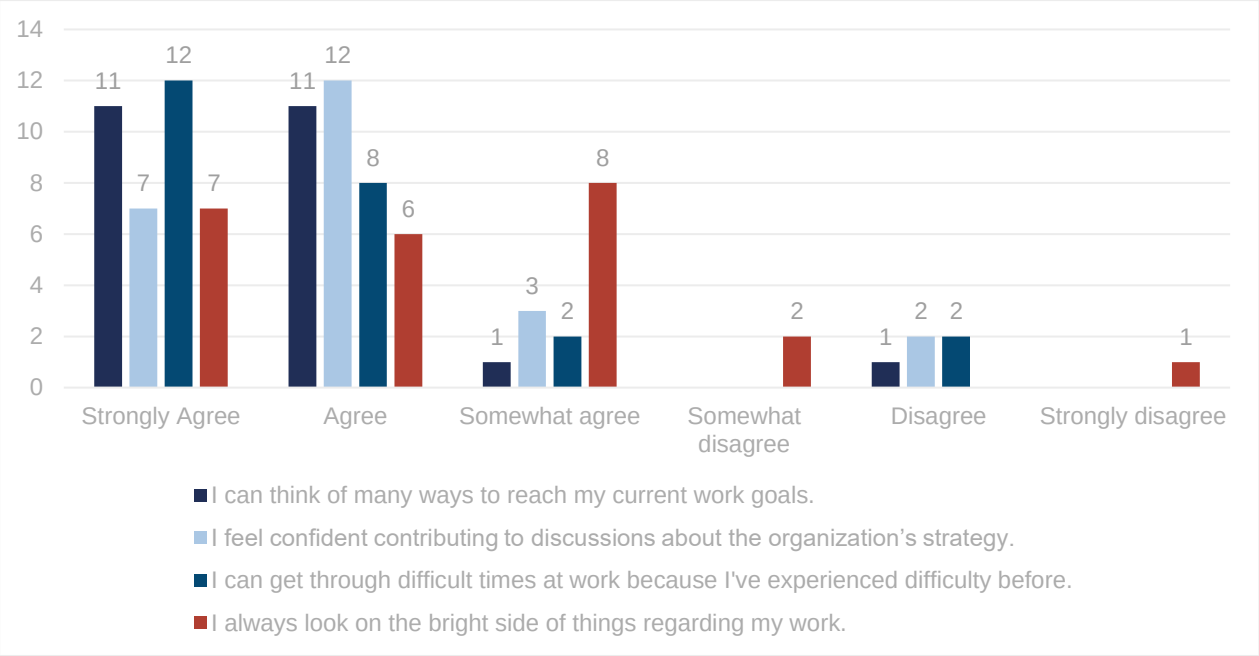


**Figure 31 - Training Assessment Tools for Entry Level: Self-Assessment Questionnaire**

#### 4.2.4.1.2 Performance-based activities

Psychological Capital (PsyCap) is comprised of four resources that act in a synergistic way. It is the powerful combination of our hope, self-efficacy, resilience, and optimism. PsyCap can be developed, trained and strengthened, but can also be managed and assessed.

If properly developed, PsyCap can help you grow personally and lead to a more fruitful and satisfying work life. Just as you can go to the gym to get physically fit, you can train PsyCap to get mentally fit.

In this exercise a set of statements were presented to participants, and they answered the questions asked. The answers related to the first phase explained the participants' self-efficacy, the second phase explained their optimism, the third phase explained their hope, and the fourth phase explained their resilience. The following figure shows an example of how PsyCap resources can work together (Figure 32).

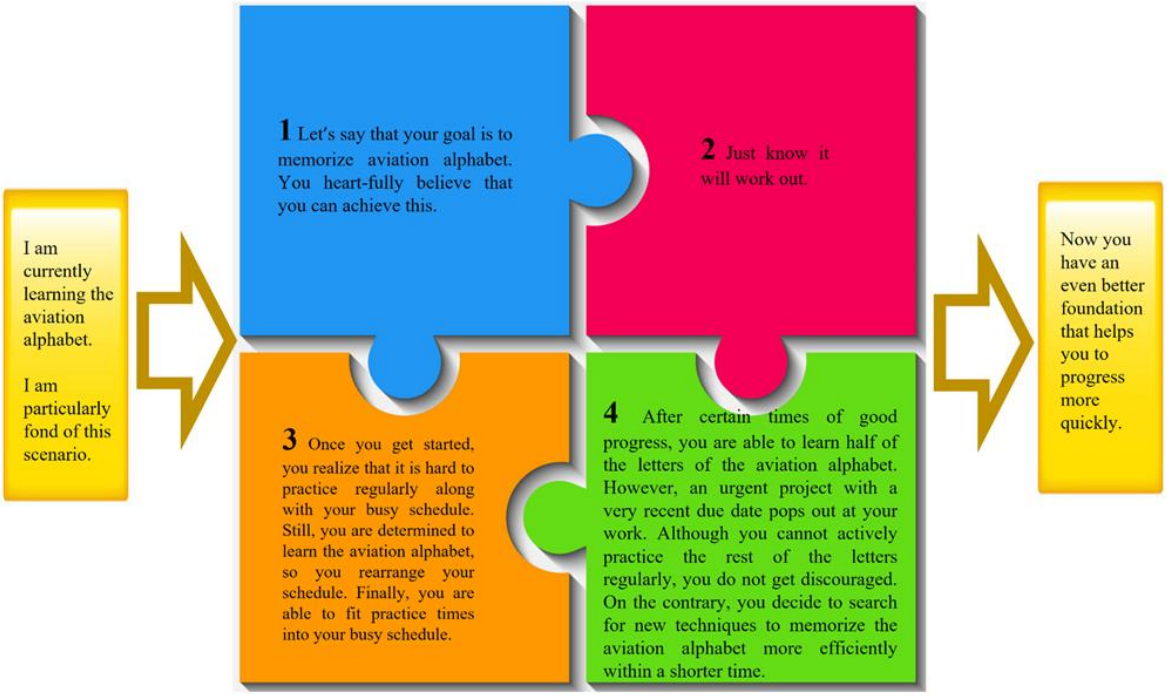


**Figure 32 - Training Assessment Tools for Entry Level: Problem-based Activity**

The first question asked, "*What does first phase explain you as human behaviour*?". Answers to this question showed that participants generally thought "*if anyone wants to achieve something, he/she needs to believe in himself/herself first of all*".

Second question asked as "*What does second phase explain you as human behaviour*?". Answers to this question showed that participants agreed on learning something just because it will work for them in aviation. One of the participants stated the following "u*sing what I have learned in my job can persuade me to learn*" and another participant explained "*self-confidence is the biggest motivation*".



The third question asked, "*What does third phase explain you as human behaviour*?". Answers to this question showed that the participants thought it is important to make sacrifices and create time for the things you want. Some of the answers given here are "*no matter how hard I work, I can take time to learn*", "*determined and able to learn, despite being challenged in terms of time and intensity*", "*even in busiest times I can find time for my goals*", "*no matter how busy I am, I can make adjustments to my schedule to because we have time to learn everything*" and "*if I want to learn something in daily life, I make a part of my life*".

The fourth question asked, "*What does fourth phase explain you as human behaviour?*". Answers to this question showed that participants generally have the same views. Some of the answers given here are "*behaviours that we consider negative create new perspectives for us*", "*if the current conditions don't allow me to do something I have to do, then I change these conditions to be able to fulfil my responsibilities*", "*if I want to learn something, I try all kinds of methods to make it happen and I finally succeed*", "*if we really want to learn something, we can do it*", "*although every obstacle on the way not give up and find a solution*".

Answers generally showed that hope, self-efficacy, resilience, and optimism of participants intertwined and were confused with each other. For example, participants explained their Self-efficacy in Optimism section, their Resilience in the Hope section and Hope or Optimism thoughts in the Resilience dimension.

It is important at the end of this training module to correct their understanding on these phases by gaining the right knowledge on how to manage and strengthen dimensions of psychological capital (PsyCap).

### *4.2.4.1 Training Assessment tools for participants' progression*

#### 4.2.4.1.1 Summative Assessment

4.2.4.1.1.1 Multiple-choice test

The learning exercise developed in this part as summative assessment aimed to assess the knowledge participants gain from the training module. A multiple-choice test was developed and required the participants to reflect on their learning from the training module and answer questions with a specific goal. The participants are asked to answer the questions by following the necessary steps.

In the context of multiple-choice test conducted at the end of the training module, it can be seen in the figure (Figure 33) that participants have generally given the right answers to the questions. Their answers showed they were confused in some questions. It can be said that participants have gained awareness on psychological capital (PsyCap).

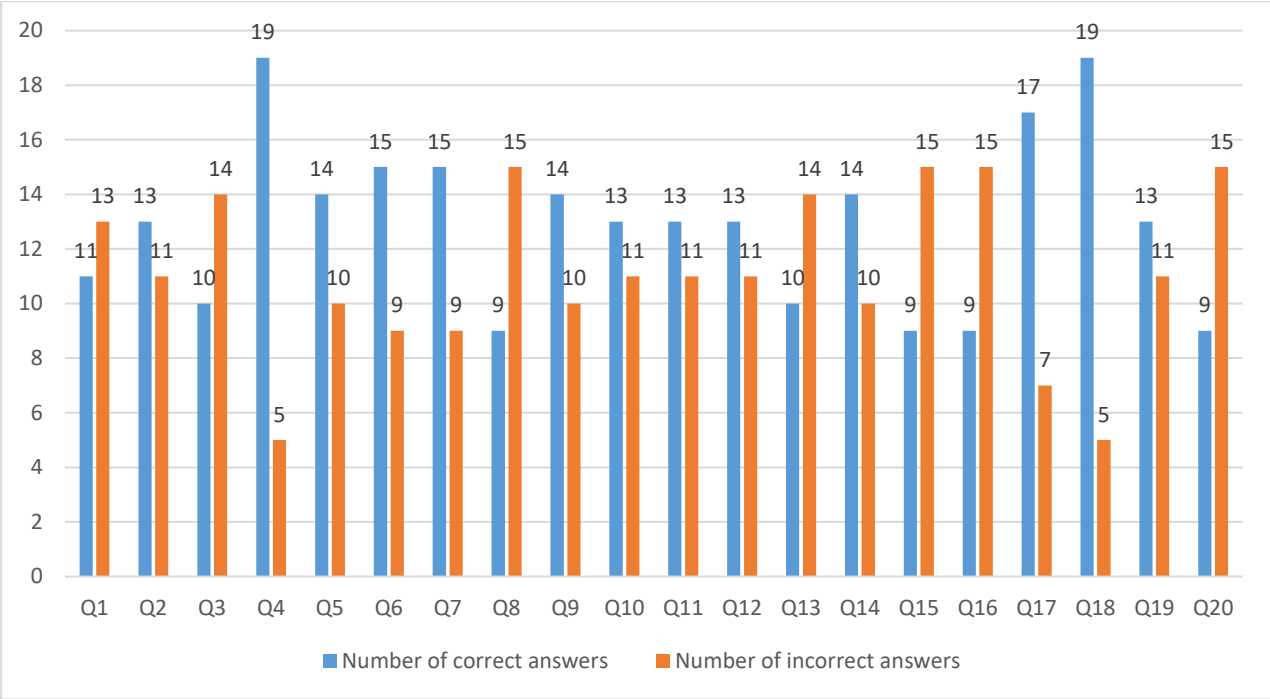


**Figure 33 - Summative Assessment: Multiple-choice Test**

4.2.4.1.1.2 Case study

The Case Study developed (Figure 34) required the trainees to reflect on their learning from the training module and formulate a plan of action to solve/address the issue they encounter in the case presented to them. The participants were asked to answer the specific questions in the context of the problems faced in the related case by following the necessary steps.

CASE STUDY – "MIRACLE ON THE HUDSON"
STRENGTHENING PSYCHOLOGICAL CAPITAL (PsyCap)

With this case study you will be able to apply, detail and assert the newly learned strategies on strengthening psychological capital.

Keep reading this case study and answer the questions presented.

FRAMING AND SCENARIO

On January 15, 2009, US Airways Flight 1549, an Airbus A320, took off from LaGuardia Airport with 150 passengers and 5 crew members, bound for Charlotte, NC. Three minutes into the flight, it struck a flock of Canada geese and lost power in both engines. Air controllers tried to divert the US Airways plane back to LaGuardia or a nearby airport in New Jersey. Captain Chesley "Sully" Sullenberger decided he could not safely land the plane in either of the airports, instructed passengers to "brace for impact," and glided the plane into the Hudson River.

As water got in the drifting plane, the passengers walked out of the doors to stand on the wings or the partially submerged slides. A few swam away from the plane fearing an explosion. The temperature was 21 degrees Fahrenheit. Soon New York Waterway commuter ferries, police boats, fireboats, tugboats and Coast Guard craft converged on the scene to join the rescue effort.

All passengers and crew members were picked up and sent for treatment in hospitals in Manhattan and New Jersey for exposure to the brutal cold. A few people suffered serious injuries.

CONSIDERATIONS

Imagine that you were a crew member in this flight and think on this dramatic event.

Define your role in this potential tragedy and keep in mind the significant challenges.

QUESTIONS

1. How do you feel?
2. What can you control in this situation?
3. What might be your role in this this event?
4. Which psychological resources do you need?
5. What do you need to manage your abilities in such a situation?
6. Describe this water landing and quick rescue in terms of components of PsyCap taking consideration your role in the event.

References

https://www.pagecentertraining.psu.edu/public-relations-ethics/ethics-in-crisis-management/lesson-2-access-to-information-during-a-crisis/case-study-tbd/
https://www.characterandleadership.com/wp-content/uploads/2015/06/RoleModelsTextbookExampleChapterChesleySullenberger.pdf

Figure 34 - Summative Assessment: Case Study

In the context of case study, participants thought there was a depressed and stressful situation. They explained that it was necessary to control the crisis and the stress by following safety instructions. They imagined themselves in different roles and they stated that they need self-efficacy, hope, optimism and resilience. They explained that they need all components of Psychological Capital to manage their abilities in such a situation. They believed that it is necessary to pay more attention to such issues when selecting personnel. This case shows the importance and effects of this training module once more.

#### 4.2.4.1.2 Formative Assessment

##### 4.2.4.1.2.1 Glossary

The learning exercise developed (Figure 35) in this part as formative progress assessment aimed to assess the participants' comprehension of the key concepts in the training module. A Glossary required the participants to reflect their learning from the training module and explain or define complex and/or crucial concepts/expressions in terms of the list of terms presented to them. The participants were asked to explain or define the specific terms by following the necessary steps.

| SKILL-UP GLOSSARY | |
|---|---|
| **CONCEPT** | **DEFINITION** |
| *Organizational Behavior* | |
| *Positive Psychology* | |
| *Positive Organizational Behavior* | |
| *Psychological Capital* | |
| *Hope* | |
| *Self-efficacy* | |
| *Resilience* | |
| *Optimism* | |

**Figure 35 - Formative Progress Assessment: Glossary**

In the context of glossary, participants defined the terms they have learned from the lessons of this training module. They have generally given the right definitions of the related concepts.

##### 4.2.4.1.2.2 Drag and drop



The learning exercise developed in this part as formative progress assessment aimed to enhance participants to sort, group, match, or place information they have learned from the lessons. A Drag and Drop exercise required the participants to drag a piece of text (e.g., a word or a phrase) or an image and drop it at the corresponding place.

In the context of drag and drop exercises, participants generally matched the right information they have learned from the related lessons. These exercises conducted for the second (Figure 36), third (Figure 37), fourth (Figure 38) and fifth (Figure 39) lessons. It was observed that participants dropped the right information (e.g., a word, a phrase or a piece of text) into corresponding place.

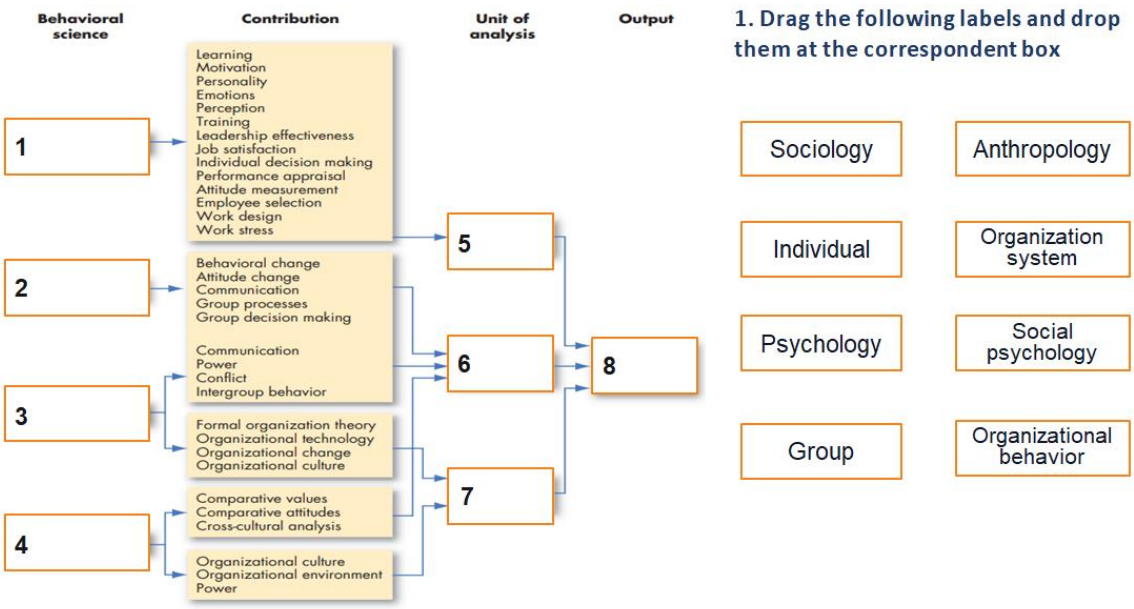


Figure 36 - Formative Progress Assessment: Drag and Drop (Lesson 2)

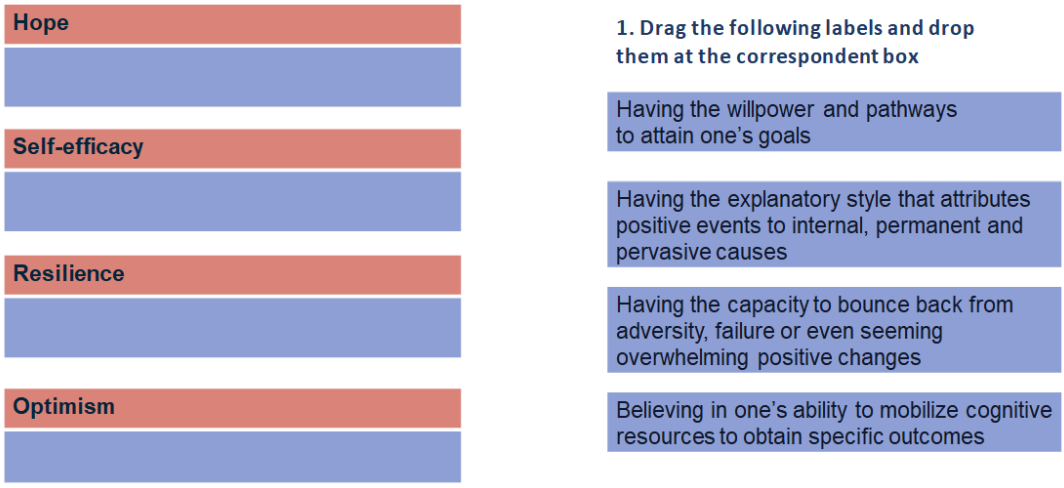


Figure 37 - Formative Progress Assessment: Drag and Drop (Lesson 3)

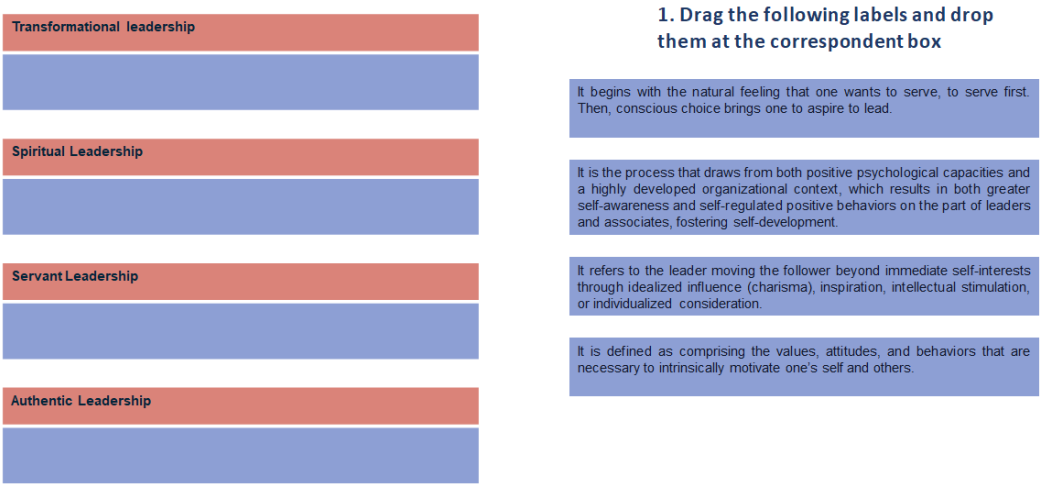


**Figure 38 - Formative Progress Assessment: Drag and Drop (Lesson 4)**

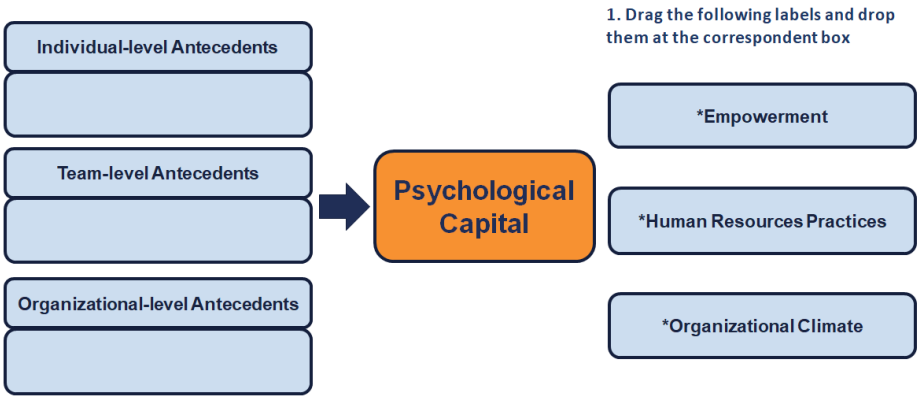


**Figure 39 - Formative Progress Assessment: Drag and Drop (Lesson 5)**

#### 4.2.4.1.2.3 One-question quiz

The learning exercise developed in this part as formative progress assessment aimed to assess the knowledge participants gained from the lessons of the training module. Participants were asked to reflect on their learning from the lesson and make personal connections with their lives. The one-question quiz developed required the participants to answer a single question with a specific goal in a short time.

In the context of one-question quiz exercises, more than half of the participants have given the right answer for each single question for the related lesson. This exercise was conducted for the fifth, seventh and last lesson (Figure 40). It was observed that participants have reflected their learnings.

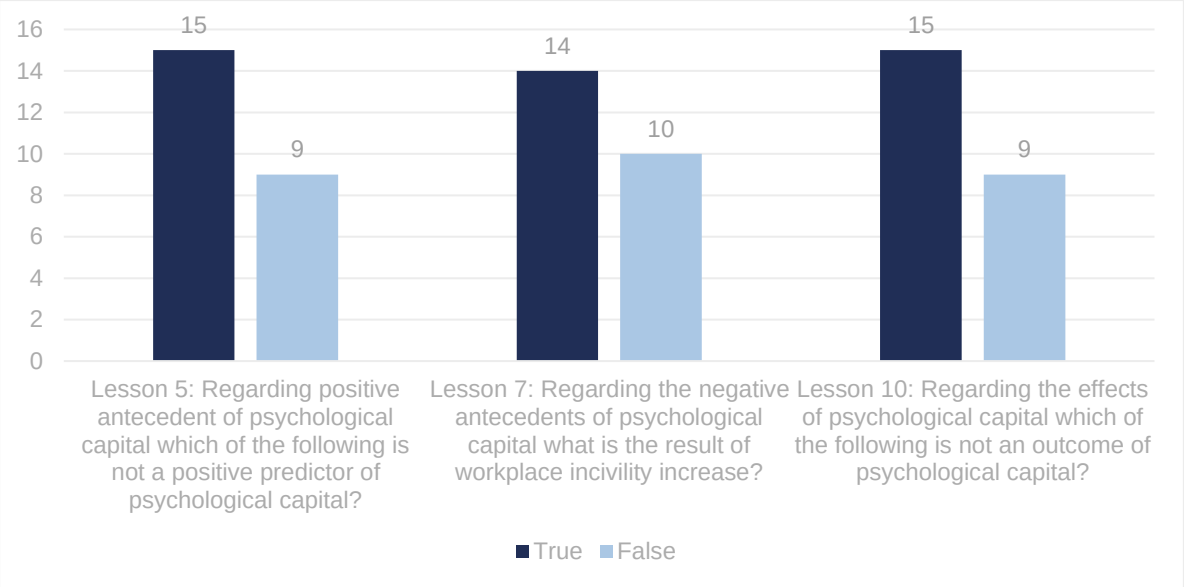


**Figure 40 - Formative Progress Assessment: One-Question Quiz**

#### 4.2.4.1.2.4 Concept Map

The learning exercise developed in this part as formative participation assessment aims to help participants to understand and review the connections between different concepts that they've learned throughout this training module. The concept map developed (Figure 41) required the participants to form relationships between the main topic (psychological capital) and other supporting details and fill the concepts they thought at the corresponding place.

It was observed that all the participants reflected their thoughts on the topic of psychological capital. For the left part of the concept map, participants specified the concepts of organizational behaviour, positive psychology, positive organizational behaviour. It has been explained to the participants in the lessons that psychological capital is an outgrowth of positive organizational behaviour. Additionally, some of the participants specified the antecedents of PsyCap for the left part. For the right part of the concept map, participants specified the dimensions of PsyCap as hope, self-efficacy, resilience, and optimism.

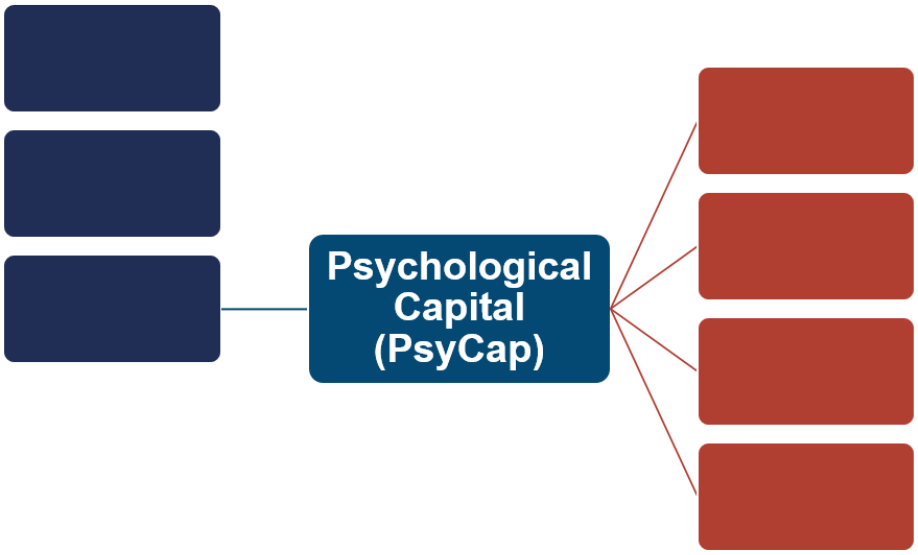


**Figure 41 - Formative Participation Assessment: Concept Map**

4.2.4.1.2.5 One-sentence summary

The learning exercise developed in this part as formative participation assessment enhances participants to show their learning level and reflect their knowledge on the lesson before moving forward to the next lesson. This exercise required the participants to sum up their learning from each lesson they have taken in one sentence.

Lesson one was related to pre-training assessment in this training module. In the context of the answers for lesson two, participants emphasized that they have learned the concepts of organization, organizational behaviour and positive psychology, the reasons that lead people to positive behaviours and the importance of teamwork.

For lesson three, participants explained that they have gain the knowledge of the concept of psychological capital, its importance, and dimensions (hope, self-efficacy, resilience, optimism), and how psychological capital leads people to positive behaviours.

For lesson four, participants emphasized that they have learned the concepts of leader and leadership, the importance of leadership for the organization, leadership theories, the concept of positive leadership approach and different types of leadership.

For lesson five and six, participants have gained awareness of what the positive antecedents of psychological capital are and how these antecedents affect employee behaviour in the organization.

For lesson seven and eight, participants said that they have gained knowledge of what the negative antecedents of psychological capital are, how these negative antecedents affect employee behaviour in the organization and how they can be prevented.

For lesson nine, participants generally stated that business life is not always positive, but people can face these difficulties with their positive capital, and as long as their motivation is high, the quality and efficiency of the work will be high.

For lesson ten, participants have explained that psychological capital has positive effects on the performance of both the individual and the organization, it keeps individuals away from negative organizational behaviours, and they increase their awareness of how it can make individuals happy both in their business life and in their social life.

#### 4.2.4.1.3 Average scores

According to the skill-UP Grading System, the average score of the participants for each type of assessment in the training module was evaluated. The average score of an assessment was found by dividing the total score of the participants who completed the assessment with right answers by the number of participants who complete the assessment. In this training module, all of the participants completed the exercises and some of them were given the full right answers as explained for each exercise above. Average scores of this training module can also be examined in Table 7.

**Table 7 - Average Scores of the Training Module Strengthening Psychological Capital (PsyCap)**

| skill-UP Grading System | | | | |
|---|---|---|---|---|
| **Type of Assessment** | | | **Grade allocation** | **Average score** |
| Summative Assessment | | Multi-choice Test | 30% | %23 |
| | | Case Study | 40% | %34 |
| Formative Assessment | Progress Assessment | Glossary | 10% | %10 |
| | | Progress Activity 2 | 4% | %4 |
| | | Progress Activity 3 | 4% | %3 |
| | Participation Assessment | Concept Map | 8% | %7 |
| | | Participation Activity 2 | 2% | 2% |
| | | Participation Activity 3 | 2% | 2% |
| | | **Total** | **100%** | **87%** |

### *4.2.4.1 Training Assessment Tools for Participants' Knowledge and Skill Retention Following Training*

#### 4.2.4.1.1 Focus Group

In the context of the focus group section, the training module was discussed with the participants and all the views gathered in the focus group can be summarized below.

Overall, the training module was successful. If efficiently provided and organized, online education/training has lots of advantages for organizations, lecturers and trainees.

The participants were very interested in the training module, and they found it exciting and helpful. Being able to point out the needs of the staff in aviation industry was the key point at increasing participants' attention to different training topics.

Before starting the training, getting ready at all points (especially education platform) is the key point to show better corporate image to stakeholders.

It is believed that behaving in an institutional manner gives trust to participants in their online learning process at online education. If participants understand that they are taking the true knowledge in a well-organized system, they feel more interested in the lessons and will benefit from the training. According to discussions with participants, having assessment exercises after the lessons helps the participants being more curious about the future lessons and contents.

Tutors and their academic knowledge are also a key point in online training, explaining the purpose and benefits of the training is necessary to increase the attention and interest of the participants. Finally, participants also considered that it's necessary to take advantage of the online education/training in today's competitive world.

#### 4.2.4.1.2 Problem-based activities

Additionally, in the context of post-training assessment, participants knowledge on dimensions of PsyCap was measured through a problem-based activity. The activity used the same exercise that was implemented at the pre-training assessment (Figure 42), with the goal of making a comparison between the two moments. Answers showed that participants have explained their self-efficacy opinions in the first phase, optimism opinions in the second phase, hope opinions in the third phase and resilience opinions in the fourth phase. Thus, it can be said that participants clearly gained the knowledge on hope, self-efficacy, resilience, and optimism as dimensions of PsyCap.

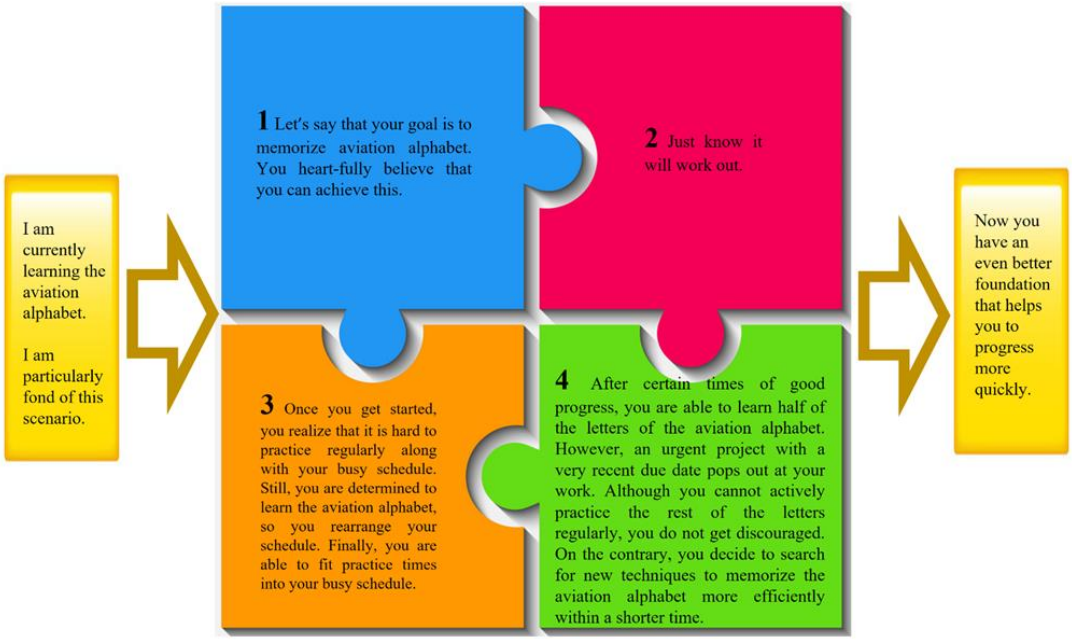


**Figure 42 - Training Assessment Tools for Entry Level: Problem-based Activity**

### *4.2.4.2 Summary and final note*

Based on the results of the whole assessment processes some reflections and recommendations can be presented as in the following key points:

- This training module was a well-designed training module to enhance "self-management and continuous development" competence identified as non-technical/behavioural skills needed in aviation (for pilots, air traffic controllers, drone operators, and airport operators).
- A well-organized system is the key point in online education as it is the linkage with participants. This training module used advantages of "Distance-Online Education".
- The participants were very interested in the training module, and they found it exciting and helpful.
- Pre-training, progressive training and post-training assessments of the training module made the concepts of the lessons well-understood. Having assessment exercises after the lessons arises curiosity on participants about the future lessons.
- Before starting the training, getting ready at all points (especially education platform) is the key point to show better corporate image to stakeholders. It is believed that to behave in an

institutional manner gives trust to participants in their online learning process at online education.

- Twenty-four participants were recruited and tested PsyCap training module and they were satisfied from the training, also stating that their awareness on PsyCap increased with the help of this training and that they have gained the knowledge on how to strengthen their PsyCap.

## *4.2.5 Training Module SM #01 (Change Management for Automation and Emerging Technologies)*

### *4.2.5.1 Training Assessment tools for participants' entry-level*

#### 4.2.5.1.1 Self-assessment questionnaire

Eight participants answered the self-assessment questionnaire. On a scale from 1 (never) to 6 (frequently) participants were asked to state the degree of frequency to each question. The figure below (Figure 43) represents the answers of the participants to all of the statements posed.


**Figure 43 - Self- Assessment Questionnaire**

To the question "*I am afraid of change*", 5 people answered sometimes, 2 people rarely, 1 often. The second question *"I have positive feelings about change*." 5 people answered rarely and 3 people answered sometimes.

The third question stated "*I believe change will make my job harder*" to which 4 participants answered fairly often, 3 participants rarely and 1 participant sometimes. The fourth question stated, "*I believe the change will benefit the organization*" and 5 people answered sometimes and 3 people answered often. "*I look for ways to prevent change from happening*", to this statement half of the participants answered sometimes and 2 people answered rarely and never.

To the sixth statement, "*I personally believe that I will benefit from the change*", most participants answered rarely. "Change stresses me out." In the question, three answers were given often and rarely, while 2 people gave the answer sometimes. In the last question, "*I think making change is a negative thing*", 5 people gave the answer rarely, 2 people gave the answer sometimes, and 1 person gave the answer often.

##### 4.2.5.1.2 Performance-based activities

In this assessment exercise, participants were asked questions about change management and technological developments. In the end was possible to understand the level of how well participants knew and followed these concepts in their work environment. Change management, change resistance, innovation and adaptation difference, technological developments in airports are emphasized. Most participants are familiar with most of these concepts. At some points, it was observed that they needed new information.

### *4.2.5.2 Training Assessment tools for participants' progression*

#### 4.2.5.2.1 Summative Assessment

4.2.5.2.1.1 Multiple-choice test

The multiple-choice test prepared for this module consisted of 20 questions, each with a correct answer (Figure 44).

1. ---------- encompasses all activities aimed at helping an organization successfully accept and adopt new technologies and new ways to serve its customers.
a. Technology management
b. Change resistance
**c. Change management**
d. Human resources management

2.
I. Globalisation of economies
II. Increased competition
III. Development of Internet and web based Technologies

Which of the above are external environmental factors that force businesses to change?
a. Only I
b. I ve II
c. II ve III
**d. I, II ve III**

3. Which of the following is associated with the transactional level of intentional change in businesses?
a. Strategy
b. Culture
**c. Job fit**
d. Leadership

4. Intentional change has been considered at two levels: Firstly, ----------(fundamental level, which includes mission, strategy, culture, leadership, and external environment, focusing on the big picture); and secondly, ---------- (transitional level that includes structure, systems, management practices, motivation, job fit, work unit climate and so on, which focuses on how things get done on a regular basis).
Which of the following correctly fills in the blanks in the above expression?
**a. transformational / transactional**
b. strategic / operational
c. functional / operational
d. institutional / departmental

5. Which of the following options is a correct classification of the change organizations are going through?
a. Simple and progressive / difficult and instantaneous
b. Structural / superficially
c. Strategic / operational
**d. Continuous and incremental / discontinuous and radical**

6. For employee, what could be the consequences of not being able to adapt to change?
a. Job satisfaction
**b. Immediate loss of employment**
c. More opportunities for promotion
d. Higher job security in the long term

7. Which of the following is one of the internal factors of change which exert pressure on the organization to change?
a. Changing customer needs and preferences
b. Economic factors
c. Political factors
**d. Technological changes**

8. Which of the following is one of the opportunity effects of the IT change factor on organizations?
**a. Real-time information**
b. Misuse of IT/ICT
c. Hacking
d. Information leak

9. Which of the following best describes the concept of "Airport 4.0"?
a. Manual and analogic processes at airports
b. Implementation of self-service processes at airports thanks to automation
c. Digitalisation to optimise flow monitoring and processing at airports
**d. Focus on connectivity and realtime information by connecting all stakeholders in one fully integrated digital**

10.
I. Check-in
II. Boarding
III. Baggage Handling

Which of the above airport processes are areas where technological change has been experienced?
a. Only I
b. I ve II
c. II ve III
**d. I, II ve III**

11. Which of the following is one of the contributing factor to resistance coming from an employee?
a. Knowing the reason for the change
**b. Feeling loss of control**
c. Feeling confident about change
d. Support of management to the employees

12. Which of the following methods reduce the resistance to change where people lack information or have inaccurate information and analysis of the situation?
**a. Education and communication**
b. Participation and involvement
c. Facilitation and support
d. Negotiation and agreement

13. Which of the following is the MOST important element in change management?
a. Machines
**b. Human**
c. Technology
d. System

14. Which of the following is the MOST important reason why employees fear change?
a. Possibility of change to reduce work performance
b. Examples of unsuccessful change in other organizations
c. Not being adequately informed about the change by the managers
**d. Their new position and their level of satisfaction there**

15. Which of the following is NOT one of the human resources components that will directly affect the change process?
a. Culture
b. Organisation
**c. Salaries**
d. System

16. Which of the following is the MOST important factor in change management?
a. Coordination
**b. Planning**
c. Communication
d. Solution

17.
I. Define your goals
II. Execute the plan
III. Start building your plan
IV. Assemble a team
V. Reinforce change

Which of the following is the correct order of the change planning steps given above?
a. I, IV, V, III, II
b. IV, III, I, II, V
c. III, II, I, IV, V
**d. I, IV, III, II, V**

18. Which of the following is NOT one of the meanings of change management for employers?
**a) Satisfaction**
b) Improving
c) Efficiency
d) Profit

19. Which of the following is the MOST important reason for the failure of change management in an organisation?
a) Insufficient staff
b) Resistance to change
**c) Lack of communication**
d) Size of the organization

20. What is the change that occurs when change is inevitable and has to adapt to the environment?
**a. Reactive change**
b. Interactive change
c. Micro change
d. Macro change



**Figure 44 - Multiple choices test**

Each participant answered the test once and 9 participants completed the assessment. The average score of the test was 81.11, with the median value being 85. The scores of the participants ranged from 60 to 90. One participant got 60 points, one participant got 65, two participants got 80, one participant got 85 and four participants got 90 (Figure 45).

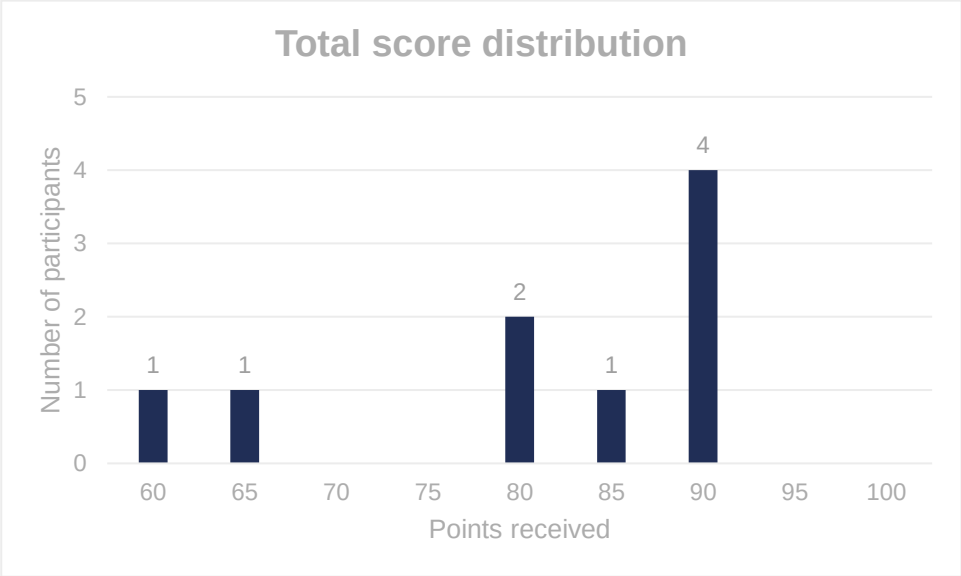


**Figure 45 - Multiple choice test scores**

In this test, the 5th and 16th questions were the questions with more incorrect answers (Figure 46). The 1st, 2nd, 7th, 10th, 12th, 13th, and 18th questions were answered correctly by everyone.



| Soru | Doğru yanıtlar |
|---|---|
| 5. Which of the following options is a correct classification of the change organizations are going through? | 3 / 9 |
| 16. Which of the following is the MOST important factor in change management? | 4 / 9 |

**Figure 46 - Frequently incorrectly answered questions**

#### 4.2.5.2.1.2 Case study

The case study developed (Figure 47) aimed to help participants think about how to deal with the situation under changing operating conditions and producing solutions. 6 of the participants completed the case study process. They answered the questions in the case study. The answers they gave were close to the situations they had faced themselves. They successfully passed this evaluation phase.


CASE STUDY –CHANGE MANAGEMENT FOR AUTOMATION AND EMERGING TECHNOLOGIES

With this case study you will be able to apply, detail and assert the newly learned strategies on stress and change management.

Keep reading this case study to be introduced to a hypothetical situation in your workplace and answer the questions presented.

1. FRAMING AND SCENARIO

You work in a different department.

Meteorological conditions are very bad and flights are canceled or delayed.

Since other employees cannot come due to weather conditions, they assign you to the passenger services department instead of the department you work for.

Airport employees do not know when flights will return to normal. Since the airport is very crowded, passengers want to follow all the processes online.

Many passengers have problems with their luggage due to changes in flights.

You need to know all the check-in types related to all these problems of the passengers and you need to help the passengers in all these processes.

2. CONSIDERATIONS

Weather conditions are very variable.The experienced employee in the department cannot come to work due to the snowstorm. You are on your own and have communication problems. You need to solve all these problems as soon as possible.

3. QUESTIONS

1. How will you adapt to this change?
2. Do you have the individual skills for this change?What can you influence?
3. How would you perform for this change?
4. How do you plan for this change?
5. Are you worried about this change?

**Figure 47 - Case Study**

### 4.2.5.2.2 Formative Assessment

#### 4.2.5.2.2.1 Glossary

The Glossary was an evaluation exercise done by most participants. Some participants participated answered the assessment with a few words and some participants with 10-15 words. However, while 60 words could be written, this number was limited to 20 words. Airport, airside area, anxiety, ATM, boarding, check-in, GPS, IATA, Landside area, PAPI, runway, VR were the most defined words.

#### 4.2.5.2.2.2 One-question quiz

The one question quiz study was one of the assessments that most participants did, like the multiple-choice test. During the training was understood that the participants preferred to mark a ready option more than to write one. In this exercise, questions were prepared for the first six lessons and the eighth lesson. All participants gave the correct answer for the 1st and 2nd lessons (Figure 48 and Figure 49).

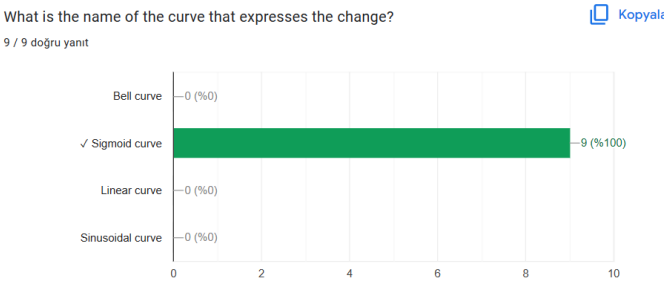


**Figure 48 - One-Question Quiz_Lesson1**

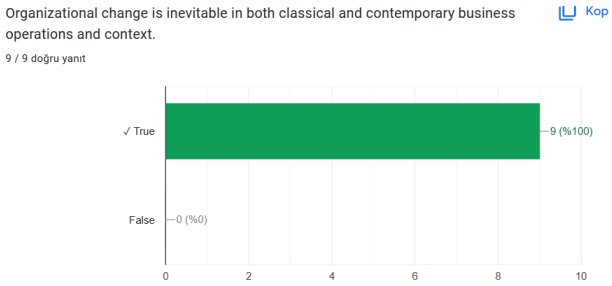


**Figure 49 - One-Question Quiz_Lesson2**

For the 3rd lesson, all the participants did the exercise, but 1 participant gave an incorrect answer (Figure 50).

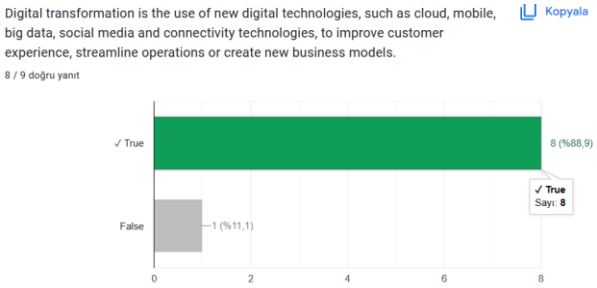


**Figure 50 - One-Question Quiz_Lesson3**

Again, as in the 1st and 2nd lessons, all the participants gave the correct answer for the 4th and 5th lessons (Figure 51 and Figure 52).

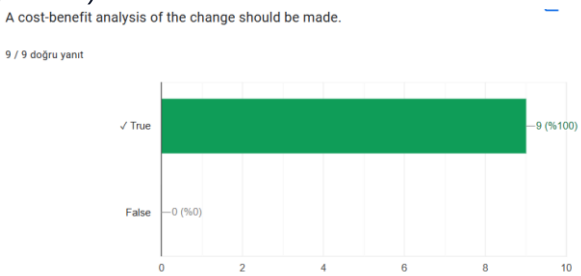


**Figure 51 - One-Question Quiz_Lesson 4**

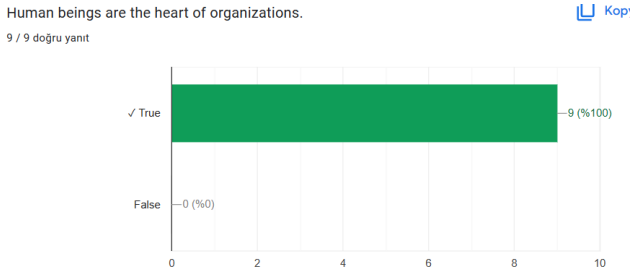


**Figure 52 - One-Question Quiz_Lesson 5**

The most incorrectly answered question of this exercise was for lesson 6. All participants answered the question. However, 3 participants chose group factors and 1 participant marked organizational factors (Figure 53).

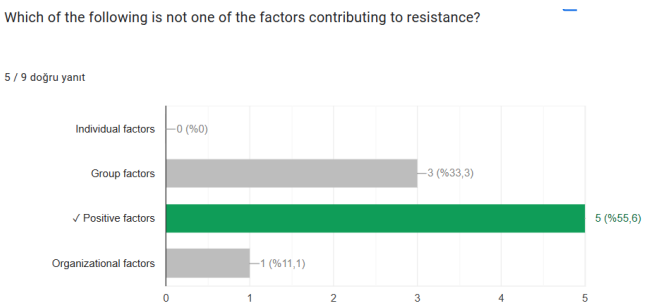


**Figure 53 - One-Question Quiz_Lesson 6**



The last question of this section, which was prepared for the 8th lesson, was answered correctly by all the participants (Figure 54).

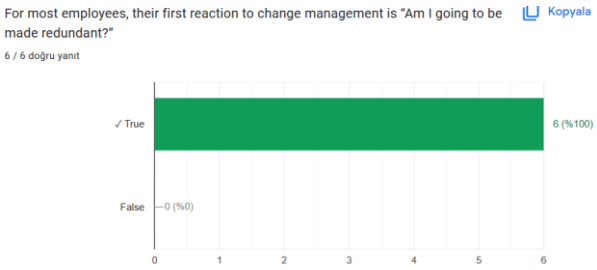


**Figure 54 - One-Question Quiz_Lesson 8**

#### 4.2.5.2.2.3 One minute essay

A different number of participants participated in each of the questions in the one-minute essay. The maximum participation in this entire exercise was 6 people. Most participants could not meet the 80-100-word recommendation outlined in the exercise. They gave shorter answers with fewer word counts. Except for the 1st and 8th lesson, the questions were answered for the other 7 lessons. 3 people answered the question prepared for the second lesson (Figure 55).

Why is change management important to an organization?

3 yanıt

Change management develops employees. It contributes to the development of the company. It increases competitiveness.

Change management forces employees to improve themselves. Technology is followed through change management.

Change management facilitates the cultural changes necessary for the organization to improve its business processes and meet the needs of a dynamic market.

**Figure 55 - One-minute essay for Lesson 2**

4 people participated in the question prepared for the third lesson. Responses were more like explaining the situation in short terms rather than giving definitions (Figure 56).

How would you define Airport 4.0 Technologies?

4 yanıt

airport digitization, smart devices

Airport 4.0 Technologies is IoT, AI, machine learning and data analytics.

Digitalisation to optimise flow monitoring and processing.

Airport 4.0 consists of eight applications, including: smart check-in, self-boarding, internal navigation, biometric services, RFID baggage tags.

**Figure 56 - One-minute essay for Lesson 3**

For lesson 4, two participants answered the question by giving short answers (Figure 57).



How would you define change planning?

2 yanıt

A change planning is an outline that serves as the roadmap.

Workflow, process.

**Figure 57 - One-minute essay for Lesson 4**

Only one participant received a response for the 5th lesson (Figure 58).

What is your opinion of human factor in change management?

1 yanıt

People resist change. Because change is difficult for people.

**Figure 58 - One-minute essay for Lesson 5**

The question prepared for lesson 6 was one of the questions answered by the most people in this exercise (Figure 59). Since an answer in the form of making a list is expected, it is thought to be a question that the participants answered more.

List the external and internal driving forces of change in organizations.

5 yanıt

- competition, technological progress, social changes, hacking, economy, politics,
- politics, competitors, economy, customers
- Internal drivers may include mission, people, and profit goals. External drivers include markets, competition, taxes, regulations, technology, and customer needs
- technology, customer preferences, regulations, competitor moves, or supplier and sourcing instability.
- Political, economic, societal, technical, environmental, and legal aspects are examples of external .Principles, managerial techniques, human resources, technology, physical resources, and organizational structure are examples of internal .

**Figure 59 - One-minute essay for Lesson 6**

Answers were received from 2 participants for the 7th question (Figure 60).

What are cyber security threats?

2 yanıt

- Malware attack, social engineering attacks, software supply chain attacks, password attacks.
- Malware, phishing, identity-based attacks, code injection attacks, supply chain attacks, insider threats.

**Figure 60 - One-minute essay for Lesson 7**



The 9th question was the least answered question. 6 out of 9 participants answered question b. The answers were longer and more descriptive than the other questions (Figure 61).

What is self-service bag drop?

6 yanıt

- Self-service bag drop service allows you to check in your checked baggage at the airport yourself.
- The self-service bag drop service conveniently frees passengers from queuing in line at the airport and allows a swift means to drop off baggage without the airline staff's assistance.
- Self Bag Drop (SBD) is a self-service whereby passengers can check their baggage directly.
- Make use of the possibility of handing your baggage in the evening before your flight.
- This means that you hand your suitcase by an automatic counter where you scan your bags and sending it out on the luggage carousel.
- The self-bag drop system allows passengers to check their bags directly without working with an agent.

**Figure 61 - One-minute essay for Lesson 9**

#### 4.2.5.2.2.4 Concept Map

Only three people completed the concept map exercise. When looking at each of the participants in the maps they created, there is not a whole map that includes all the concepts.

#### 4.2.5.2.2.5 Misconception check

Not all participants responded to the Misconception check exercise, as in the one-minute essay exercise. In this exercise, which is prepared for each lesson, between 1 and 4 answers were provided. Explaining whether they agree with the given statement or not has been an exercise that the trainees hesitate to answer. For the 1st lesson, 3 participants responded. Their explanations were short (Figure 62).

«There is always change and it is necessary to keep up with the change. The Sinusoidal Curve explains this. Do you agree or disagree with this sentence, explain your choice. »

3 yanıt

From time to time, change adapts. Sometimes there is resistance to change.

I agree with the sentence. The only constant is change itself.

Change doesn't always happen. Change is adjusted over time. I agree with the sentence.

**Figure 62 - Misconception check for Lesson 1**

For the 2nd lesson, 3 participants answered again with short statements again (Figure 63).

«Organizational change does not require individual change. Do you agree or disagree with this sentence, explain your choice? »

Remember: Between 80-100 words.

3 yanıt

For organizational change, everyone needs to change. I don't agree with the sentence.

I do not agree. Everything starts with individual change.

I do not agree.

**Figure 63 - Misconception check for Lesson 2**

Only 1 participant responded for the 3rd lesson (Figure 64).

«Technological changes in the environment are the only one driving force of organizational change. Do you agree or disagree with this sentence, explain your ideas. »

1 yanıt

Technology is not the only driving force for change. Different things can also be the driving force for change. Economic reasons, such as crisis situations.

**Figure 64 - Misconception check for Lesson 3**

The question prepared for lesson 4 is one of the most answered exercises (Figure 65). Participants wrote their answers to the question with longer expressions. Lesson 5 was not answered by any participant.

«Change planning always consists of five steps".
Do you agree or disagree with this sentence, explain your choice. »

4 yanıt

Prepare the Organization for Change, Craft a Vision and Plan for Change, Implement the Changes, Embed Changes Within Company Culture and Practices.

Denial. Realisation. Resistance. Letting Go. Searching. Understanding the Meaning of Change. Change Acceptance.

Identify the Reasons for change & create urgency. Form a Powerful coalition & Build the guiding team. Develop a Vision & Strategy for Change. Communicate the Vision and Strategy. Empower Actions & Remove Barriers. Create Quick Wins & Celebrate Achievements. Secure Successes, Accelerate & Build on the Change. Make Change Stick & Anchor Change in the Corporate Culture.

Unfreezing, Moving, Refreezing

**Figure 65 - Misconception check for Lesson 4**

The 6th lesson was the most answered question like the 4th lesson. However, the answers given were also short (Figure 66).



«The nature of resistance is always negative. Do you agree or disagree with this sentence, explain your choice. »

4 yanıt

Resistance is often negative.

The nature of resistance is death, I agree.

I agree.

Everyone resists change, in which case the resistance is negative.

**Figure 66 - Misconception check for Lesson 6**

Only 1 participant responded for the 7th lesson (Figure 67).

«The changing nature of business brings with it competition. It is necessary to be competitive to keep up with change. Do you agree or disagree with this sentence, explain your choice. »

1 yanıt

The changing world creates even more competitive environments in aviation. That's why we need to be more competitive.

**Figure 67 - Misconception check for Lesson 7**

In lesson 8, two participants answered the questions (Figure 68), while in lesson 9, 3 participants answered the question (Figure 69).

«The change must be made unannounced.
Do you agree or disagree with this sentence, explain your choice.»

2 yanıt

I do not agree. Changes should always be known to those who will be exposed to the changes. It is easier to adapt if known.

Changes must be notified. I disagree with the lack of news. Change enables development.

**Figure 68 - Misconception check for Lesson 8**

«Innovation and adaptation are the same concepts. Do you agree or disagree with this sentence, explain your choice? »

3 yanıt

Innovation and adaptation are not the same concepts.

Although these two terms are used interchangeably, they are different.

Adaptation and innovation are almost the same concepts.

**Figure 69 - Misconception check for Lesson 9**



### *4.2.5.3 Training Assessment Tools for Participants' Knowledge and Skill Retention Following Training*

#### 4.2.5.3.1 Focus Group

During the training, the focus group interview was conducted online. Participants were generally satisfied with the training module. They stated that the topic title was chosen correctly due to the changes, crises and extraordinary situations in the aviation industry. However, they emphasized that synchronous lessons will not always be attended, and perhaps the whole module should be made asynchronously. There have been some criticisms within the education platform. They also stated that the exercises should be simple with multiple-choice or true/false options and that this could increase participation.

#### 4.2.5.3.2 Problem-based activities

With this exercise, the participants were asked to evaluate their opinions on how to approach the problem. In addition, the participants were asked to determine the risks together while making a risk assessment.

In the problem-based activities, participants were given an activity about passenger flow at the airport. In this event, it was measured how much information the participants had about both incoming and outgoing passenger processes in the airport. In addition, in this assessment exercise, the airport operators' assessments were taken on how to deal with an earthquake in the region and when the airport was affected by this process. In this study, it was discussed how the process should be managed and how the risk assessment should be done when there is a problem with the airport infrastructure systems and therefore a power cut that affects all check-in and other operations.

Participants successfully drew the figure related to passenger flow processes. Correct suggestions were made regarding the management of the process in case of infrastructure problems and therefore power cuts. In the risk assessment, they determined the risks with a predictive approach since they had not encountered such an event before.

Identified risks include the possibility of delay of the flight due to the inability to check-in on time, the possibility of missing the connecting flight of the passenger due to the inability to check-in on time, the risks related to irregular passengers due to mistakes in customs and passport procedures, the possibility of all incoming flights diverting, and the possibility of cancelling the flights of the departing planes. The evaluations were written by the participants. In this exercise with eight participants, the participants got a satisfactory result in the assessment of adequate/unsatisfactory from this exercise.

Compared with the results obtained from the problem-based activities done before the training started it was possible to understand that participants were more comfortable in dealing with the situation presented and that they were able to suggest possible risks and possible management processes to deal with infrastructure problems.

#### *4.2.5.4 Summary and final note*

Some changes can be made to the content for this training module. Again, some changes are required regarding the exercises as part of the training platform. More visual and audio materials can be used on the training platform. The entire module can be prepared with the asynchronous option for airport operators. some exercises can be corrected. Exercises that the student can answer without getting bored can be prepared. E-mails were sent to the participants about their participation in the classes, but some participants showed a little less effort in this regard, and the asynchronous lessons were watched in the focus group lessons, and feedback was received by sending them via e-mail in the exercises. In general, they carried out the training successfully. They were also satisfied with the subject choice.

### *4.2.6 Training Module SM #02 (How to Cope with Stress and Change to Fit in Future Roles)*



On the 29th of September, Deep Blue's trainers held the specific training module pilot for Air Traffic Controllers "How to cope with stress and change to fit future roles" in the first Italian Remote Digital Tower within Brindisi airport facilities (Figure 70). 12 participants attended the pilot, but only 8 of them answered the questionnaires described below. Inside Deliverable 3.3 a more detailed description of the pilot sample can be found (Skill-UP Project, 2023. D3.3. VET Training design and implementation of the training modules).


**Figure 70 - Implementation of training module "How to cope with Stress and Change to Fit in Future Roles"**

### *4.2.6.1 Training Assessment tools for participants' entry-level*



#### 4.2.6.1.1 Self-assessment questionnaire

Before starting the training activities, the trainers administered the Self-Assessment questionnaire (namely the "Prior Knowledge Questionnaire" during the delivery activities) to the participants. These questions aimed to assess the abilities to perceive and recognize stressors and stress arousal in the participants' everyday life, without correct or wrong answers. All the answers were given on a 6-step Likert scale, considering "1 - Definitely disagree"; "2 - Disagree"; "3 - Partially Disagree"; "4 - Partially agree"; "5 - Agree"; "6 - Definitely Agree" to avoid the "neutral" option.

Some of the main results collected can be synthesised as follows:

- 50% of participants stated that, when feeling stressed, they partially agree about asking for help from someone (colleagues, friends, family); 33.3% answered they partially disagree; 16.7% answered they disagree.
- 33% of participants stated that they partially disagree or agree about their ability to recognise stressful situations from their mood swings, while just 16.7% stated they partially agree or definitely agree.
- 50% of participants felt they can control important things in their lives, while 33% partially disagreed about that and 16.7% partially agreed.
- 50% of the participants stated also they partially agree on recognising a stressful situation from their behavioural changes, while 33.3% stated they partially disagree, and just 16.7% agree.
- 66.7% of the participants felt they can manage effectively difficult situations when they have to face them; just 16.7% stated they partially agreed or disagreed about their ability to face difficult situations.
- 50% of the participants stated they partially disagree with being able to think lucidly after a period of high workload; 33.3% stated they partially agree on that, while just 16.7% agreed.

- Finally, 66.6% of the participants stated that they agree or fully agree with the statement "I use relaxation techniques, hobbies and sports to relieve stress and relax", and just 33.3% partially disagreed or disagreed.

#### 4.2.6.1.2 Performance-based activities

To assess the progress of the participants in understanding and recognising the stress and stressors related to change, after the first half of the course on "How to cope with stress and change to fit future roles…", the participants were asked to perform an exercise mapping their potential and real stressors from today and from the future, identifying their available resources to cope with the elicited stress, and the people they could ask for help to. The trainers provided the trainees with paper support (Figure 71), but the exercise was performed orally. The translated labels are:

- Current operative stressors (*Stressori operativi attuali*)
- Future operative stressors (*Stressori operativi futuri)*
- Resources available (*Risorse a disposizione*)
- Who could help you to acquire the resources you need? (*Chi ti può aiutare nell'acquisire le risorse di cui hai bisogno?*)

| Stressori operativi attuali | Stressori operativi futuri |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| Risorse a disposizione | |
| | |
| | |
| | |
| | |
| | |
| Chi ti può aiutare nell'acquisire le risorse di cui hai bisogno? | |
| | |
| | |
| | |

**Figure 71 - Paper support for stressors exercises**

### *4.2.6.2 Training Assessment tools for participants' progression*

#### 4.2.6.2.1 Summative Assessment

4.2.6.2.1.1 Multiple-choice test

To assess the knowledge retained after the full day of training, a post-assessment multiple-choice quiz was administered to the participants. The post-assessment quiz was composed of 14 questions. 8 responses were collected.

Globally, just one question resulted in being critical, having more wrong answers than correct ones. In fact, to the question "When is a long-term strategy particularly effective in coping with stress?", the answer "When all the causes of stress can be reduced" received 50% of votes.

The correct answer was "all the previous answers", comprising also the 2 items "When the causes of stress can be changed" and "When the causes of stress can be deleted". 5 questions out of 14 received the 100% of correct answers.

The complete list of questions is shown in Figure 72, while an example is provided in Figure 73.

1. How would you define stress?
- a feeling of pressure and worry due to external factors
- a strong reaction that includes a change in feelings
- it's a reaction to a new situation
- **when a person perceives that demands exceed the personal and social resources s/he is able to mobilise**

2. What are the elements that make stress management so subjective in your opinion?
- **Because we might have different innate dispositions (constitution personality), life experiences and different resources**
- Money always makes the difference
- Sleep routine
- All the answers above

3. What in the list it is not a stress sign?
- Behavioural & cognitive changes
- Mood swings
- Health issues
- **Allergies**

4. What is not a healthy habit when facing a stressful situation?
- Physical activities (walking, sports)
- Time with friends and family
- To care more about what you eat choosing more vegetable, fruit instead of sweets and processed foods
- **To eat sweets and candy as comfort food**

5. What is it correct to place in the "control zone"?
- The weather, traffic
- To create a friendly environment at work
- **To find time for healthy habits**
- None of the answers above

6. What is it correct to place in the "zone of influence"?
- The weather, traffic
- **To create a friendly environment at work**
- To find time for healthy habits
- None of the answers above

7. What are the characteristics of a **strong external locus** of control?
- The feeling that everything depends on you
- **Not using the personal resources and often feeling hopeless**
- Changing the situation to reach personal goal
- None of the answers above

9. "Anything that activates a stress reaction, causing the release of stress hormones" is the definition of:
- Resources
- Adrenaline
- Cortisol
- **Stressors**

10. In the N.U.T.S. acronymous, the T stands for:
- **Threat to the ego**
- Time pressure
- Tensions
- Tips

11. Which of the following sentence is false?
- Stressors are highly subjective
- **Our stress management depends only on our personality**
- The resources we need to face stress can be acquired
- Social bonds are a strong resource in stress management

12. When a long-term coping strategy is particularly efficient?
- When the causes of stress might be changed
- When the causes of stress might be reduced
- When the causes of stress might be eliminated
- **All the answers above**

13. Complete the sentence: "____are effective when the cause of stress cannot or is not desired to be changed at the moment"
- Social bonds
- Resources
- **Short term coping strategies**
- Friends

14. "evaluating one's own performance expectation, changing one's attitude when situation can't be changed, re-evaluate expectations of the others" is the definition of:
- **A cognitive strategy to manage stress**
- A stressors strategy
- Pleasant strategy
- None of the answers above

15. L.o.C. stands for:
- Latitude of control
- Locus of calm
- **Locus of control**
- Lack of control

16. What is called the "stress hormone"
- **Cortisol**
- Serotonin
- Dopamine
- Oxytocin

**Figure 72 - Multiple-choice test questions**

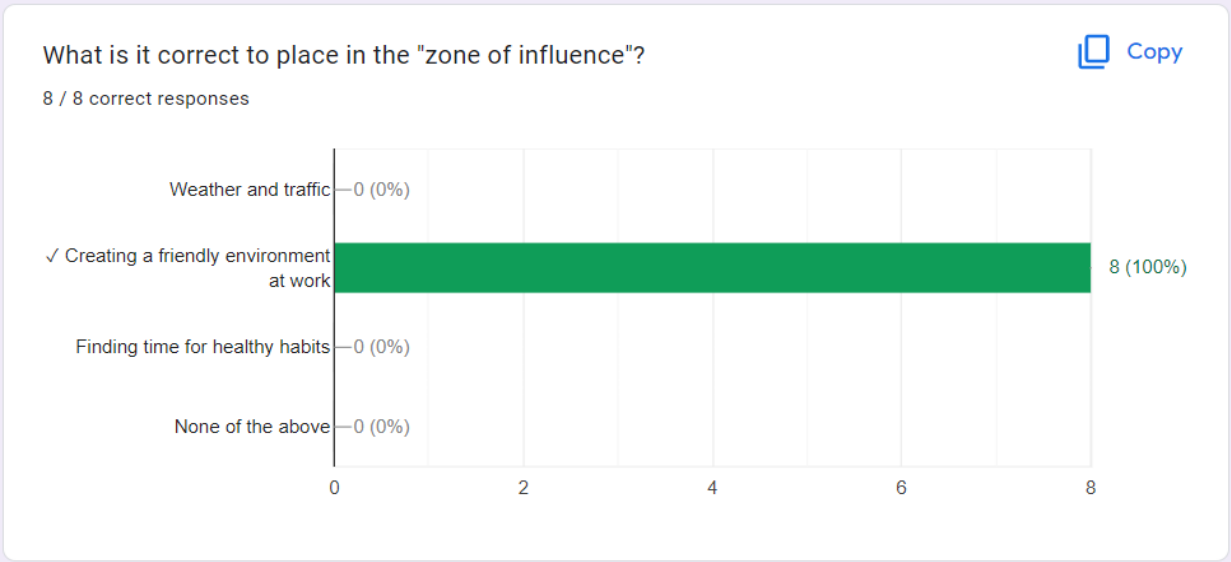


**Figure 73 - Question with the most correct answers**

#### 4.2.6.2.1.2 Case study

The Case Study exercise was performed after the training module dedicated to coping strategies, splitting up the participants into 3 groups. An example of the template prepared for the case study is shown in the figure below (Figure 74).


CASE STUDY – STRESS AND CHANGE MANAGEMENT

With this case study you will be able to apply, detail and assert the newly learned strategies on stress and change management.

Keep reading this case study to be introduced to a hypothetical situation in your workplace and answer the questions presented.

1. FRAMING AND SCENARIO

It's Friday afternoon and your boss calls you in her/his office and tells you that big changes are coming.

Your company, involved in the testing, inspection, and certification based in Italy, is going to be merged with a German one with a different business in cyber security.

You have always worked in your territory, traveling once a while for business trips and almost always coming back home to your spouse every evening.

You enjoy consulting different organizations; customers and colleagues define you as an expert in your sector.

You have built your expertise in 15 years of experience in your field, and recurrent training sessions; since 2018 you are the official tutor for the junior consultants.

2. CONSIDERATIONS

Your boss just informed you that your job will change in the medium term, she wants to implement the Italian business with the German one and she requires you to be in charge of the team that will develop the strategy and the new business.

This new task will require you to drop the tutorship and to travel a lot in Germany, for sure in the next six months.

3. QUESTIONS

1. How do you feel?
2. What can you control in this situation?
3. What can you influence?
4. What do you need/decide to accept?
5. What are the resources you might need to better deal with this change?
6. Who can support you in this process? and how?

**Figure 74 - Case study**

Each group was provided with an ad-hoc case study dealing with managing a personal change of career and improved responsibilities. For a live assessment, the trainers used the web tool Mentimeter. An example of the question presented is shown in Figure 75.


**Figure 75 - Answers to the question "How do you feel know?" playing the role of the main character of the case study**

Then, the participants were asked to roleplay the case study, diving into the role of the main actor of the case study. In particular, they were asked to write anonymously how they felt about the scenario if they were the main actor, applying at the same time the 3 circles of control (as per the Drag and Drop exercise). Finally, they were asked to express what kind of resources and coping strategies they could use to cope with the stress elicited by the situation described in the case study, and who they could ask for help, to overcome the difficulties.

#### 4.2.6.2.2 Formative Assessment

##### 4.2.6.2.2.1 Glossary

The glossary exercise for the module “How to cope with stress and change to fit future roles” was initially thought to be performed in the blended delivery of the training but was adapted to the in-person delivery of the course. Therefore, during the course, we developed the exercise differently than the initial version. It was then structured as an exercise in which the participants should choose at the end of the training day the most important definitions in their opinion and write them down. The participants had to assess different stressors, from personal and professional life, considering the 3 circles of control, influence, and concern. The goal of the exercise was to generate a deeper understanding of what kind of stressors people can control, influence or just be concerned with, mapping the sense of agency that can be applied to different stressors to reduce and effectively manage the stress.

##### 4.2.6.2.2.2 Drag and drop

The Drag and Drop exercise for the module “How to cope with stress and change to fit future roles” was initially thought to be presented in the blended delivery of the training but was adapted to the in-person delivery of the course. The participants performed this exercise as a group exercise, trying to match several stressors with the three circles of stress management.

##### 4.2.6.2.2.3 One-minute essay

The one-minute essay exercise was performed in an oral way as a group exercise, due to the nature of the in-presence pilot. During the training pilot, the trainers asked the participants to sum up the main contents they dealt with for each module delivered, to evaluate their understanding and therefore proceed with the following topic.



##### 4.2.6.2.2.4 Concept Map

At the end of the training day, participants were divided into 3 groups to design their concept map of the module. The concept maps presented in Figure 76, Figure 77 and Figure 78, were then discussed in plenary, solving eventual final doubts and refining the less clear concepts for the group.

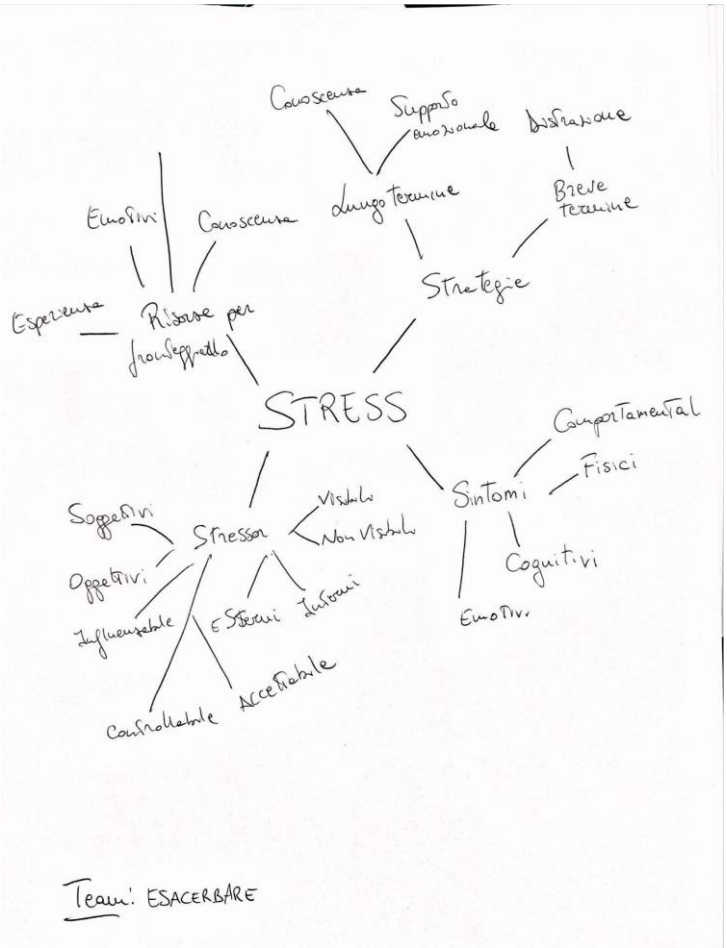


Figure 76 - Group 1 Concept Map

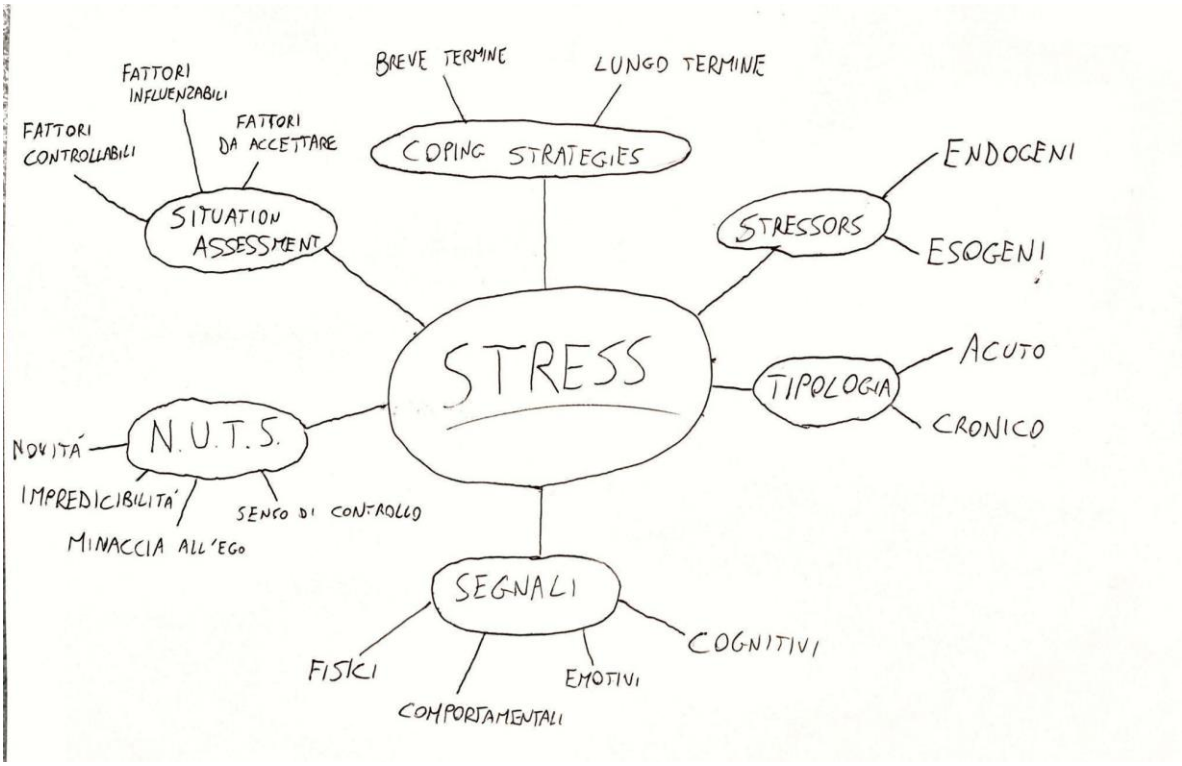


Figure 77 - Group 2 Concept Map

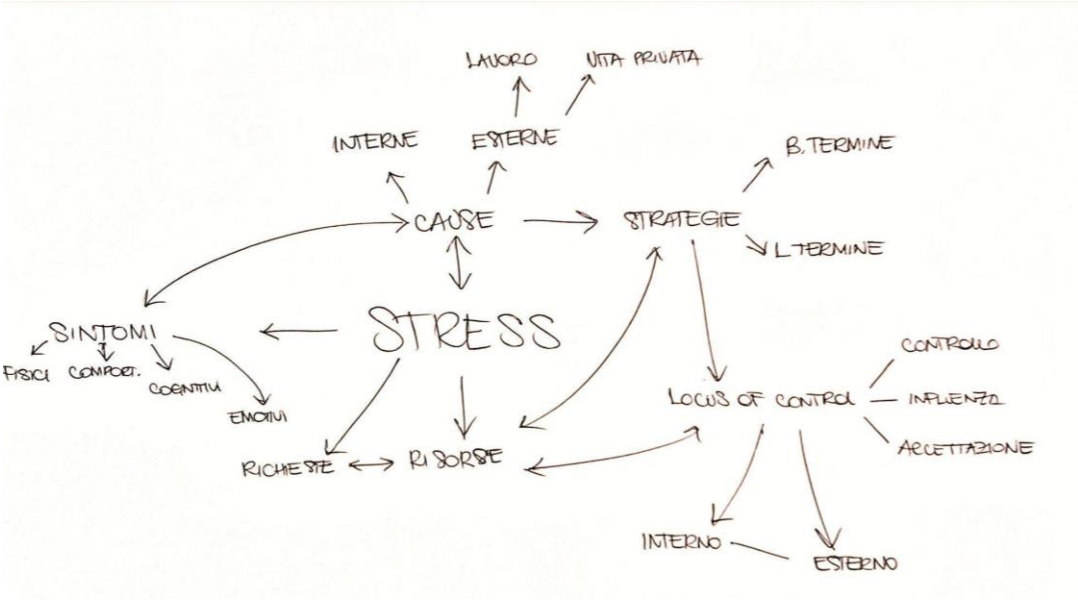


Figure 78 - Group 3 Concept Map

#### 4.2.6.2.2.5 One-sentence summary

At the end of the training day, the participants were asked to perform the One Sentence Summary exercise. Especially, they were asked to write what came to their mind with the word “stress” on the web tool Mentimeter. The answers reported these contents:

- A specific colleague
- Tiredness
- Tasks and schedules
- Discomfort coming from external sources
- Out-of-control situations

- External or internal factors influencing the behaviour.
- Climate
- Anxiety, worry.
- Something or someone negative
- An external factor influences the own well-being.

#### *4.2.6.3 Training Assessment Tools for Participants' Knowledge and Skill Retention Following Training*

##### 4.2.6.3.1 Focus Group

Since the training was delivered in presence, the trainers did not use Miro to assess the satisfaction of the trainees, having the focus group discussion in presence instead.

Overall, the trainees were satisfied with the training course, but they had some negative comments as well. The negative feedbacks were all about their expectations since the participants thought the training module would have been more focused on the new technologies to be introduced, and not on how to cope with the stress elicited by the change process within the organisation. This comment was already taken into account by the trainers: in the development of the blended training course, there is a module on change management that would have addressed these topics, which could not be delivered in the pilot due to time management reasons. The main goal of the change management module was to introduce some tools and know-how to manage stressful situations related to change and the introduction of new disruptive technologies in everyday work.

All the remaining feedbacks were positive, including comments on how the contents of the training were useful to be applied in their everyday life as well. Table 7 presents the trainees' inputs from the focus group.

**Table 8- Focus group inputs overview**

| What went well | What could be improved/suggestions |
|---|---|
| The sample was carefully selected representing ATCOs from different types of airports | Extend the duration of the course (2 days) |
| The activities of the course were designed to actively engage participants during the training, and this allowed to keep the attention high | Include case studies or practical activities more related to the ATC domain |
| | No direct connection with the digital remote tower… |
| The management of time allowed the trainers to decide whether to focus more on the questions asked by the participants, or on going on delivering when some topics needed more attention from the participants | Organise a training session focused on change management / Deepen the change management topic |
| | Scenario exercises were partially functional since it was interpreted differently from what thought in the preparation step |
| Hosting a social dinner, the day before the delivery allowed the trainers and the participants to share some preliminary thoughts on the agenda and the topics they would have dealt with, helping the trainers to assess some attitudes towards the stress elicited by the workplace as well | The participants felt they had to deal with too many questionnaires |
| | No available Wi-Fi connection inside the training delivery place |

#### 4.2.6.3.2 Problem-based activities

The comparison of the outcomes of the entry-level and post-assessment questionnaires did not show any noticeable improvement, probably because the pilot was held in a single-day face-to-face modality and not spread over 4 weeks as initially planned.

### *4.2.6.4 Summary and final note*

The trainers have not been able to deepen some topics and concepts that then resulted in being important for the participants, such as the dynamics of change management. This topic was just introduced, while the training pilot focused more on the stress management part.

The qualitative feedback revealed some important information. Despite some mostly negative feedback focused more on the absence of the change management part, which can still be retrieved inside the skill-UP knowledge centre, positive feedback focused on the usefulness of the training methodology, which elicited in the participants' introspective thoughts regarding their stressors and how they usually coped with stress. In particular, stress is an all-encompassing construct, characterising both private and working life, and which can reflect the stressors of one on the other. Therefore, the trainers found the feedback important concerning how the training module was useful not only for gaining greater self-awareness in the work sphere but also within the private sphere.

## *4.2.7 Training Module SM #03 (Learning and Practice of New Aircraft Procedures)*

Ten participants were recruited and tested in the “Learning and practice of new aircraft procedures” training module at ENAC. During this training module, they had to learn a new procedure composed of 22 items.

### 4.2.7.1 Training assessment tools for participants’ entry level

#### 4.2.7.1.1 Self-Assessment questionnaire

Four questions were asked of the participants to assess their prior experience in flying and learning procedures. Most of the participants had a piloting licence (among the 13 participants, 9 had an aircraft piloting licence, one had a glider flight instructor licence and 3 had no piloting licence). Most of them also had prior experience with flight simulators (5 of them had spent 1 or 2 hours in a simulator of a commercial aviation aircraft (Boeing or Airbus), 3 of them had between 50 and 100 hours of a flight simulator on a personal computer (FlightSim) and 1 of them had spent 50 hours in a simulator of a general aviation aircraft). Most of them (8 of them) also already had to learn at least one procedure. Finally, most of them (8 of them) had only a little or no experience with the A320 cockpit.



#### 4.2.7.1.2 Performance-based activities

This specific training module aimed at learning a fictitious procedure to mimic the learning of an unknown procedure. Therefore, it was not relevant to assess an entry-level knowledge of the to-be-learnt procedure before the beginning of the training. However, as the procedure concerned an A320 cockpit, we decided to assess the level of knowledge of the participants about the A320 cockpit in general. The participants had to annotate an A320 scheme with as many items as they could. The number of correct items was counted with a maximum of 20. The mean score of the participants was **9.4/20** with a score ranging from 1 to 16 and a standard deviation of 5,4. This means that the knowledge of the A320 cockpit was low on average, but with large interindividual differences among participants.

### *4.2.7.2 Training assessment tools for participants’ progression*

Participants were instructed first to learn the procedure (i.e., the sequence of actions to perform) and second to practice the procedure until they were able to perform the procedure without any error and they felt confident in performing the procedure in an A320 simulator the day following the learning of the procedure.

The mean number of errors committed at the end of the training was **0.6** (with a standard deviation of 0.7) with the Virtual Reality device, which is a sign of a high level of knowledge of the procedure and a high commitment of the participants.

#### *4.2.7.3 Training assessment tools for participants' knowledge and skill retention following training (T4.3)*

##### 4.2.7.3.1 Quantitative feedback

At the end of the learning session, all participants answered a follow-up questionnaire about their subjective assessment of the learning. They had to rate their confidence in their capacity to execute the procedure in the simulator (1= "minimal confidence", 10= "maximal confidence") and their perception of the difficulty of the learning (1= "really very easy", 7= "really very difficult"). Finally, to assess their motivation, they completed a 7- item questionnaire of intrinsic motivation (seven items of the 8-item questionnaire of Isen and Reeve, 2005). We computed a global motivation score based on the sum of the score on these seven items.

The participants' mean self-rated confidence score was **8.2/10**, with scores ranging from 7 to 9 and a standard deviation of 0.7. Thus, their level of confidence in their capacity to execute the procedure correctly was quite high.

Their mean perception of difficulty score was **2.9/7**, with scores ranging from 2 to 5 and a standard deviation of 1.0. Therefore, they felt the training was not very difficult.

Their mean global motivation was rated at **6.7/7**, with scores ranging from 6 to 7 and a standard deviation of 0.3. This indicated a very high level of motivation.

##### 4.2.7.3.2 Qualitative feedback

At the end of the training phase, each participant was asked to provide qualitative feedback about the training device. Globally, participants liked learning through a virtual reality device. However, most of them highlighted a too-high sensitivity of the interactions within the virtual reality device, which led to false errors during the execution of the procedure.



##### 4.2.7.3.3 Problem-based activities

The day following the learning phase, they had to perform the procedure on a real A320 cockpit simulator at ENAC, which constituted the delayed retention test. They had to perform the procedure two times, successively, with no guidance from the experimenters concerning the steps to perform. The first run was intended to familiarize them with the A320 cockpit, and the experimenters helped participants to manipulate the controls when needed. On the contrary, during the second run, experimenters did not give any information on anything. Thus, only the second run was used to assess the retention of the procedure.

The mean number of errors committed by the participants during the second run was **0.9**, ranging from 1 to 3, with a standard deviation of 1.0. This means the number of errors is quite low, compared to the 22 items composing the procedure. However, two participants committed 3 errors. It could be noticed that these two participants also had the lowest level of confidence at the end of the training (only these 2 participants self-rated their confidence level at 7/10, and all other participants self-rated their level of confidence at 8 or 9).

#### *4.2.7.4 Summary and final note*

Globally, participants were able to learn to perform correctly the newly learnt procedure. They rated the virtual reality learning experience as fun and amusing. They appreciated the experience and were motivated by the feedback provided at the end of each run of the procedure. Indeed, the execution time and the number of errors were provided in the virtual reality device at the end of each sequence of actions.

The participants' level of confidence was rather high at the end of the learning phase. However, during the restitution phase, they committed some errors. Maybe more than one learning session with the virtual reality device would have been necessary to consolidate the learning.

Concerning the ways of improvement, a consensus has emerged that the device was too much sensitive, inducing false errors. One can imagine that this could become frustrating for the learners in the long run.

## 4.2.8 Training Module SM #04 (“Managing Myself: Towards a safer life”: Workload Management & Stress Management)

### 4.2.8.1 Training Assessment tools for entry-level

#### 4.2.8.1.1 Self-assessment questionnaire

These questions are designed to assess participants' prior knowledge and skills in the main subject of the training module. These 5 questions will be asked before the training starts, have no correct or incorrect answers, and will not contribute to the evaluation and grading of this training module.

Participants were asked to select from 1 (strongly disagree) to 6 (strongly agree) the degree to which they agreed with the statements presented, to measure their behaviour regarding stress management.

To the first item ("*If my responsibilities and tasks change, I can accept it and welcome the opportunities that it will give me*") all the participants responded positively, with only one putting that he agreed (*M* = 4.8.; *S.D.* = 0.7*; N* = 5), as it can be seen in the figure below (Figure 79). This shows that everyone has some openness to change and can adapt to it, with some finding it easier than others.

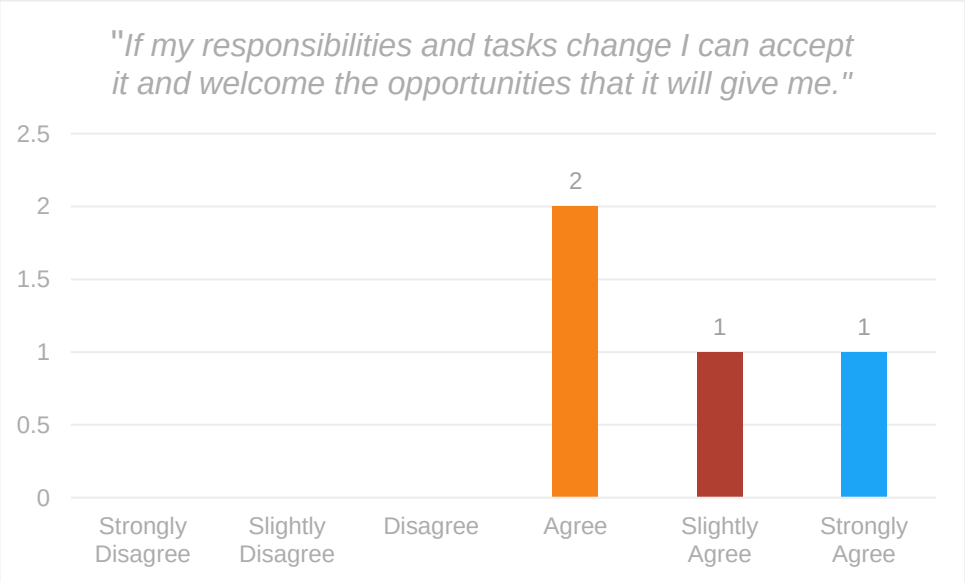


**Figure 79 - Responses to the item “If my responsibilities and tasks change, I can accept it and welcome the opportunities that it will give me”**

Most responses to the second item ("*Stressful situations are easy for me to deal with*") indicate that the participants can handle stressful situations with some pressure (*M* = 4.4.; *S.D.* = 0.8*; N* = 5), with only one participant disagreeing with the statement, as it can be seen in Figure 80.

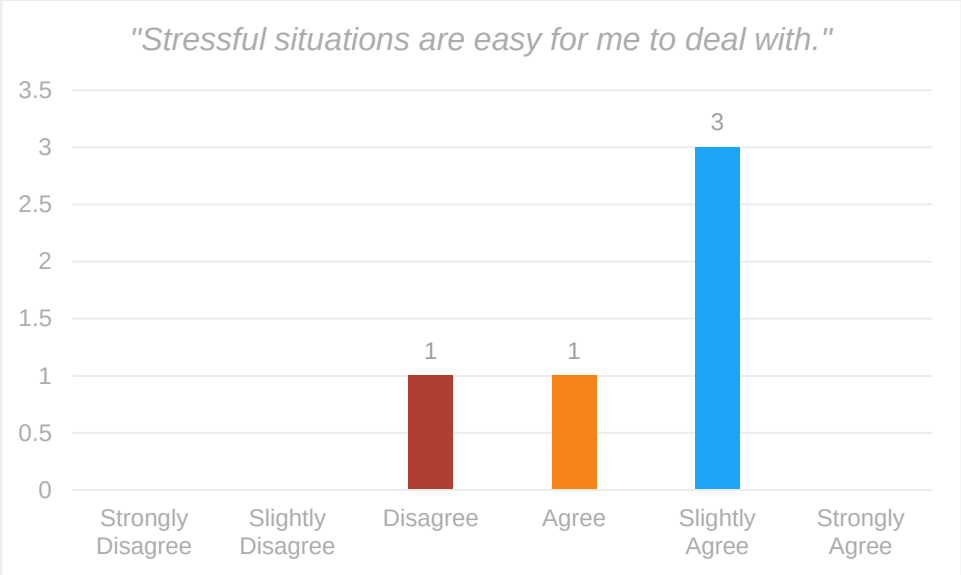


**Figure 80 - Responses to the item "Stressful situations are easy for me to deal with."**

To the third statement ("*I know how to relax when I feel too much pressure*") most participants replied that they can relax when in stressful situations (*M* = 3.8.; *S.D.* = 0.7*; N* = 5), which means that in overly stressful situations, they can abstract themselves from the problem, thus opening the way for them to focus on solving it (Figure 81).

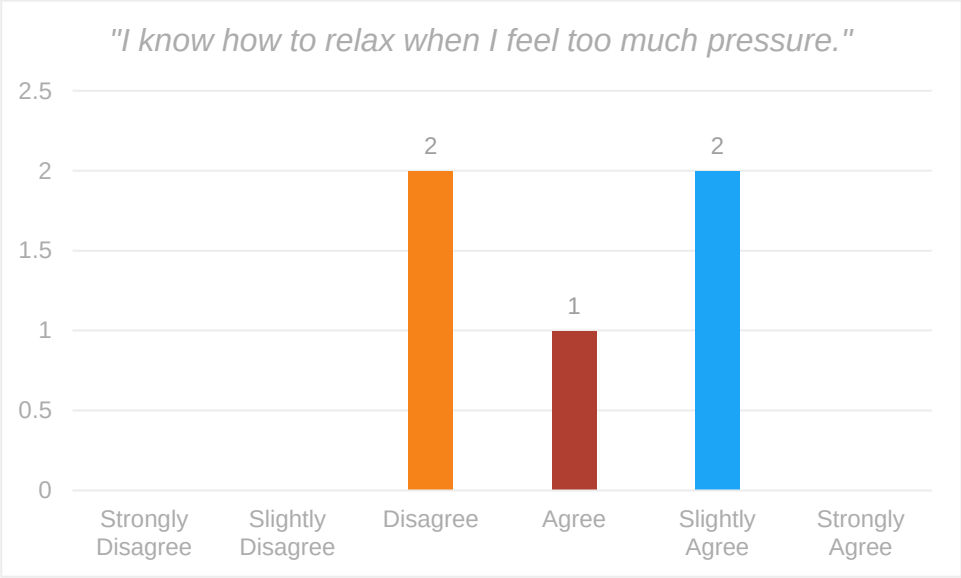


**Figure 81 - Responses to the item "I know how to relax when I feel too much pressure."**

To the fourth question ("*If a project that I worked on fails, I will learn from the experience and move on*"; *M* = 4.2; *S.D.* = 1.0*; N* = 5) only one participant answered that he strongly agreed, and three agreed. However, one participant stated that they disagree with the statement, which can indicate that he/she had little ability to put the issue aside and move on. This shows that in general, it is difficult for them to accept a failure and not think about it for some time (Figure 82).

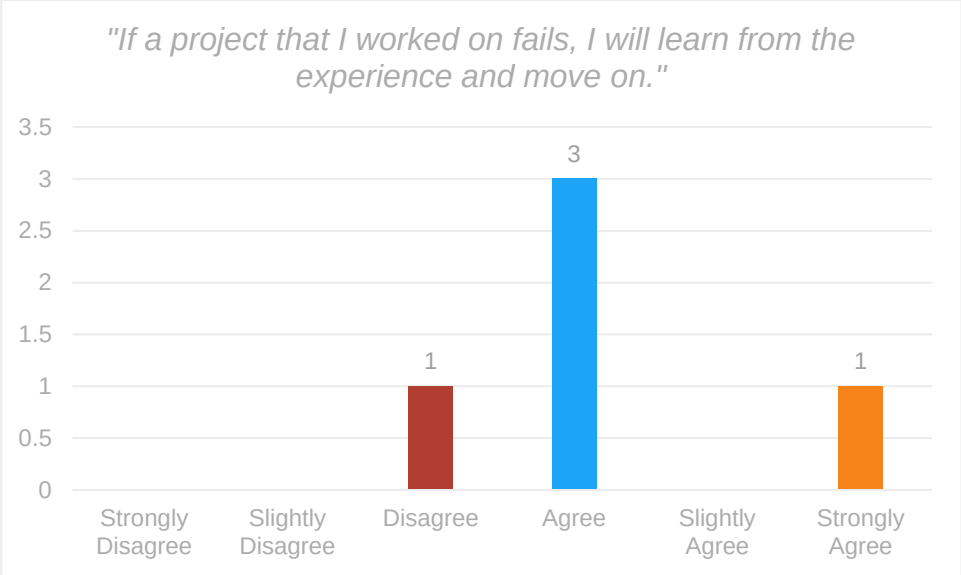


**Figure 82 - Responses to the item "If a project that I worked on fails, I will learn from the experience and move on."**

Finally, to the last item ("*When I finish my workday I can relax and get a good night's sleep*") only one participant responded that he disagreed, with most having the ability to finish the workday and abstract from it at home (*M* = 4.2; *S.D.* = 1.3*; N* = 5), as it can be seen in Figure 83.


**Figure 83 - Responses to the item When I finish my workday I can relax and get a good night's sleep."**

Overall, the participants have a good ability to adapt to change and can handle stressful situations with ease. This allows us to assume that they're able to calm down when these types of situations occur and focus on solving the problem. In addition, most of the participants find it easy to take their minds off their work problems when they are at home.

When it comes to projects that go wrong, the participants' responses indicate that they might have some difficulty understanding what went wrong and then putting it aside.

The ability to adapt to change and deal with stressful situations are essential skills in today's world of work. Thus, it is important to be aware of how easy (or not) it is to face these scenarios so that, when they arise, we can act to shape our behaviour and improve our response capacity.

#### 4.2.8.1.2 Short activities

In this exercise, the participants will be presented with a series of fake scenarios and asked to answer the questions posed. Four participants answered these questions.

The first question relates to the experience of someone who has just gone through a stressful situation at work and has spoken to her friend about it. Everyone has gone through what this person has just gone through. The goal of this question would be for the participants to recall a stressful situation and describe it, explaining how they felt and how they dealt with the stress.

Some situations can be stressful for us and we must know how to deal with them in the best way possible so that we can solve any problems that may arise. All four responses suggest that it is important, when we find ourselves in these kinds of situations, to stop and calm down and think about what we can do to resolve the issue.

The second question reports a stressful work situation, and participants are asked to explain how they would proceed if it happened to them.

The answers to this question are in line with the content presented in the training. All participants mentioned that it is important to prioritize the most urgent and important tasks and to think of effective strategies that can help Martha get the work done on time, such as writing a to-do list and working at the time of day when she feels most productive.

### *4.2.8.2 Training Assessment tools for participants' progression*

#### 4.2.8.2.1 Summative Assessment

##### 4.2.8.2.1.1 Multiple-choice test

The multiple-choice test included 20 questions with one right answer. This quiz has only been taken by one participant, and there was no time restriction. The test was completed by one individual, who received a 90%.

##### 4.2.8.2.1.2 Case Study



The case study allowed participants to explore a fake scenario of drone flight under new conditions, however, several drawbacks were provided. The three case study questions were based on the participant's perception of how they could tackle the situation given the training information. The figure below (Figure 84) presents the case study implemented.

CASE STUDY - MANAGING MYSELF: TOWARDS A SAFER LIFE

With this case study you will be able to apply, detail and assert the newly learned strategies on managing time and stress.

So, do you remember Marco? He represents the Upskilling group of people (Personas) who already have some experience in flying small and light UAVs in the Open category and has now started to fly heavy UAVs, for a new contractor. You will fit his shoes for the current exercise – link to Marco's bio here.

FRAMING AND SCENARIO

Imagine that you started to work for a new company, that specializes in wet lease drone services, e.g., building and bridge inspection, delivery of goods, field and crop monitoring and photogrammetry.

Your new company is expanding its services rapidly, and has opted to hire open category remote pilots and train them in-house, according to the existing standards.

Despite having several hundreds of flight hours on small and light UAVs for aerial photography and video, you have never flown heavy lift "drones" and fixed wing UAVs.

After finishing your instruction on two new UAVs – 1 heavy multi-rotor and 1 fixed wing – you were immediately sent into the field, for your first assignment: inspecting a highway bridge. Needless to say that you have no operational experience in these UAVs yet.

This bridge is 600m long and stands 80m above its foundations in a valley; next to it lies a conglomerate of houses and warehouses which are served by Digital TV and 4G antennas located in the vicinity.

The previous inspection, carried 6 months ago, detected considerable wear on the Northern 6th pillar – the one closer to the conglomerate – probably due excess humidity and wind gusts.

CONSIDERATIONS

You have no operational experience on the heavy lift multi-copter UAV. The experienced pilot that was supposed to go with you to the field fell sick and was not able to join you – still you have to get the job done, because the agenda is very tight for rescheduling at the company.

Wind turbulence is very high at this location, due to:
- predominant winds that come from the North;
- thermal effects;
- local boundary layer turbulence induced by the conglomerate;
- Effect of the wind on the bridge itself.

There is a high density of radio frequency transmitters, that have much higher power than your UAV;

Iron and metallic alloys on the bridge can pose significant challenges on the datalink with the UAV.

LESSON 2 – "How to manage my work"

You will have to plan the inspection, including:
- Preparing and testing the UAV, including spares;
- Assessing the area remotely (e.g., photos, maps, satellite images);
- Assessing weather conditions;
- Performing a risk assessment on the operation;
- Managing Airspace requests and radio frequencies;
- Performing an assessment on the RF spectrum;

You will have a considerable body of work to execute, in only 2 days. How do you manage your work?

LESSON 3 – "Feeling stressed"

Your stress levels increase considerably after you lose datalink with the UAV for 10 minutes after take-off. You are now more than 5 minutes without any control over the UAV. The UAV is at a height of 70m, 400m away from you – while you can see the drone, it looks too small for controlling in using visual line of sight. Suddenly you realize that you took-off without resetting the return to land home point, which was still at the company's HQ. State and elaborate which steps would you take to cope with the stress you're feeling.



**Figure 84 - Case Study implemented**

The case study was performed by one individual, who examined the case study and each of the issues posed in the case study description thoroughly. With a score of 100%, the participant's responses exhibited good knowledge of the major topic given in the program.

#### 4.2.8.2.2 Formative Assessment

##### 4.2.8.2.2.1 Glossary

The glossary was completed by one of the participants. has inserted most of the key points of each lesson in some detail, which suggests that he has read the supporting documents, using them as a help for the definitions of the concepts. In addition, he has done additional research to define some concepts. The participant scored 100% on this exercise. Figure 85 presents the glossary completed by the participant.

GLOSSARY - AI AND ML FOR AVIATION APPLICATIONS

The Skill-UP Glossary aims to be a tool when you want to review some concepts, models, strategies, etc. that you've learned during training.

For this Glossary you're asked to define two to three concepts for each lesson in this training module.

| SKILL-UP GLOSSARY | |
|---|---|
| **CONCEPT** | **DEFINITION** |
| *Example: Stress* | *The result of tension caused by overwhelming situations, situations that will create psychosomatic reactions or psychological disturbances.* |
| ABC | Strategy to cope with stress that involves Awareness to the cause, Balance on how much we can cope with and Control over negative effects of stress |
| 4 A's | Strategy to cope with stress that involves Avoid unnecessary stress, Alter the situation, Adapt by reformulating expectations and attitudes, and Accept what cannot be changed |
| Workload Management | Techniques to manage the workload to be more productive, by considering What, Why and How |
| Eisenhower Matrix | Technique to help set priorities by distinguishing what is important from what is urgent |
| Positive routine | Include routines in our daily lives that allow us to relax and challenge us to conquer, by setting positive thinking and taking care of our sleep, nutrition and exercise |
| Productivity | Refers to our income during a certain period of time |
| Performance | Unlike productivity, it is associated with more permanente attributes |

**Figure 85 - Glossary completed**

#### 4.2.8.2.2.2 One-question quiz

The activity is meant to assist participants in understanding and reinforcing what they learnt during the previous training session lesson. Similar to the other tasks, only one participant answered this question, scoring 100%.

#### 4.2.8.2.2.3 One minute essay

This activity is designed to assist participants in understanding and reviewing what they learnt in the last training session lesson. As with the other tasks, only one participant answered this question, scoring 100%.

#### 4.2.8.2.2.4 Concept map

The concept map's goal is to connect the core concept of this training module to other concepts, methods, models, and so on. One of the participants finished this exercise with a perfect score. The figure below (Figure 86) presents the concept map completed by the participant.

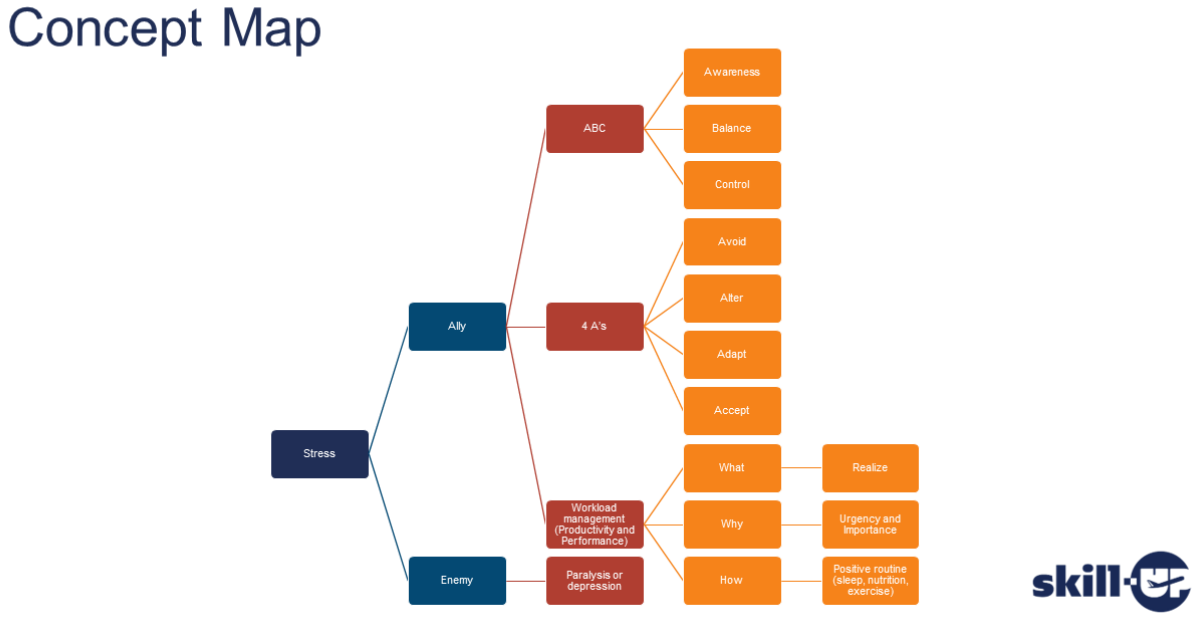


**Figure 86 - Concept Map completed**

4.2.8.2.2.5 Misconception Check

The sentence "*Stress is pervasive, and there's nothing we can do about it*" is presented to the participants during the exercise. The goal is for participants to thoroughly read the statement and share their opinion, explaining why. Only one person finished this activity and received a perfect score.



4.2.8.2.2.6 One-sentence Summary

This task is meant to help participants comprehend and review what they learned in the last training session lesson. As with the other tasks, only one participant answered this question, scoring 100%.

### *4.2.8.3 Training Assessment Tools for Participants' Knowledge and Skill Retention Following Training*

#### 4.2.8.3.1 Focus Group

The focus group for the training module "*Managing myself: towards a safer life*" was conducted with only one participant. Furthermore, since the participant of the focus group for this training module was the same participant for the focus group of the other QSR's training module "Houston, we have a problem: Problem-solving and decision-making", it was stated by the participant that it was easier to analyse and comment both training modules together. Therefore, all of the inputs stated by the participant refer to both training modules and can be consulted in section 4.2.1.3.1 (Focus Group)

#### 4.2.8.3.2 Problem-based activities

This exercise is similar to the prognostic assessment exercise in that the goal is to determine whether, following the training and taking into account the topics covered, the participants would reply differently to the questions presented in this exercise. As a result, the participants would be presented with a series of fictitious scenarios and asked to reply to the questions posed to them.

In this exercise, the participant answered the same question as in the previous one. This could have happened because there was very little time between the first and last exercises, as well as the fact that they were identical. This less positive point may have been avoided if the different tasks developed were equal and required the same type of answers but were not identical. The only participant who answered this exercise scored 100%.

#### 4.2.8.4 Summary and final note

The training module is well thought out and produced, particularly the substance and script of the video sessions. However, the learning platform has severely detracted from the participants' experience. Some of the synchronous time could have been used to help the participant become more familiar with the platform.

Furthermore, the module might be improved by integrating more dynamic videos with examples and exercises more relevant and closer to the aviation professionals' reality. Certain bibliographic references that trainers believe are crucial for a better learning experience might be incorporated into the study materials, and questions that incorporate knowledge from these sources could be developed in addition to the content of the PowerPoint presentations.

Overall, the participant was pleased with the training module and believed that their learning experience will assist them in both their professional and personal life.

## 4.3 Transversal Post-training Assessment Tool

The **Transversal Post-Training Assessment** aimed to complement the *focus groups* implemented at the end of each training module. This tool was developed and implemented to assess the trainees' level of satisfaction with the training program and the learning experience factors involved in the pilot sessions.

For this, an individual questionnaire with a 5-point Likert scale, from 1 ("totally disagree") to 5 ("totally agree") was developed and implemented. The full questionnaire was published in Deliverable 4.1 (Skill-UP Project, 2022. D4.1 VET Training Assessment Portfolio).

Furthermore, the analysis of the data collected with individual questionnaires was divided into 3 sections:

1. **Training Experience** – to assess the trainees' training experience. As mentioned above (Section 4.1.3 – Expectations Assessment), the expectations of the trainees were assessed through 6 statements regarding the training program that they would be doing. These 6 questions were later implemented again to assess the real experience of the trainees. Furthermore, a comparison is done between the data collected for the expectations and experience of the trainees (Chimote, 2010).
2. **Trainer Satisfaction** – To assess the trainees' satisfaction with the trainer(s) that implemented and delivered the training module.
3. **Overall experience** – to assess the trainees' overall experience during the skill-UP pilot sessions.

In the following sections, the data collected from the individual questionnaire is analysed and reported, according to the three abovementioned sections.

### 4.3.1 Training Experience

As mentioned above, previous authors have analysed the expectation and experiences of the trainees to understand whether a training program had been successful (Chimote, 2010).

The trainees' experiences were assessed after the pilot sessions. Regarding the overall experience of trainees ($M$ = 3.89; $SD$ = 0.74; $N$ = 20), on a 5-point Likert scale most of the answers (80%) were on the positive side of the scale, as seen in the image below (Figure 87). This can mean that almost all the trainees had positive expectations for the training program.

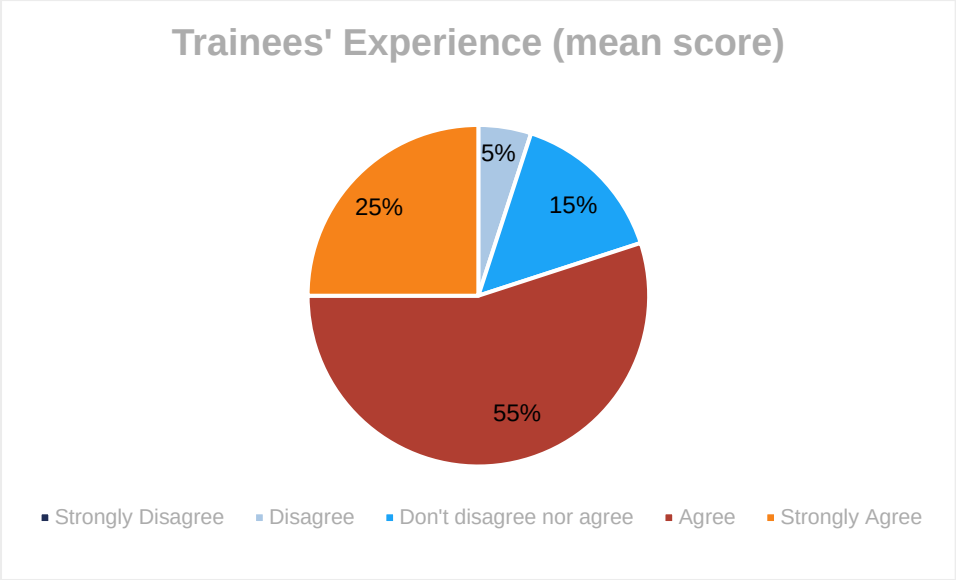


**Figure 87 - Trainees' Experience**

Furthermore, it was possible to analyse the trainees' experience across training modules, as it's seen in the image below Figure 88. In the image it's possible to see that the first transversal training module "Houston, we have a problem!" and the fourth specific training module "Managing myself: towards a safer life" have a higher mean score, however, these training modules only have one trainee response. On the other side, the second specific training module "How to cope with stress and change to fit in future roles" had 8 responses and a mean score of 3.9/5.



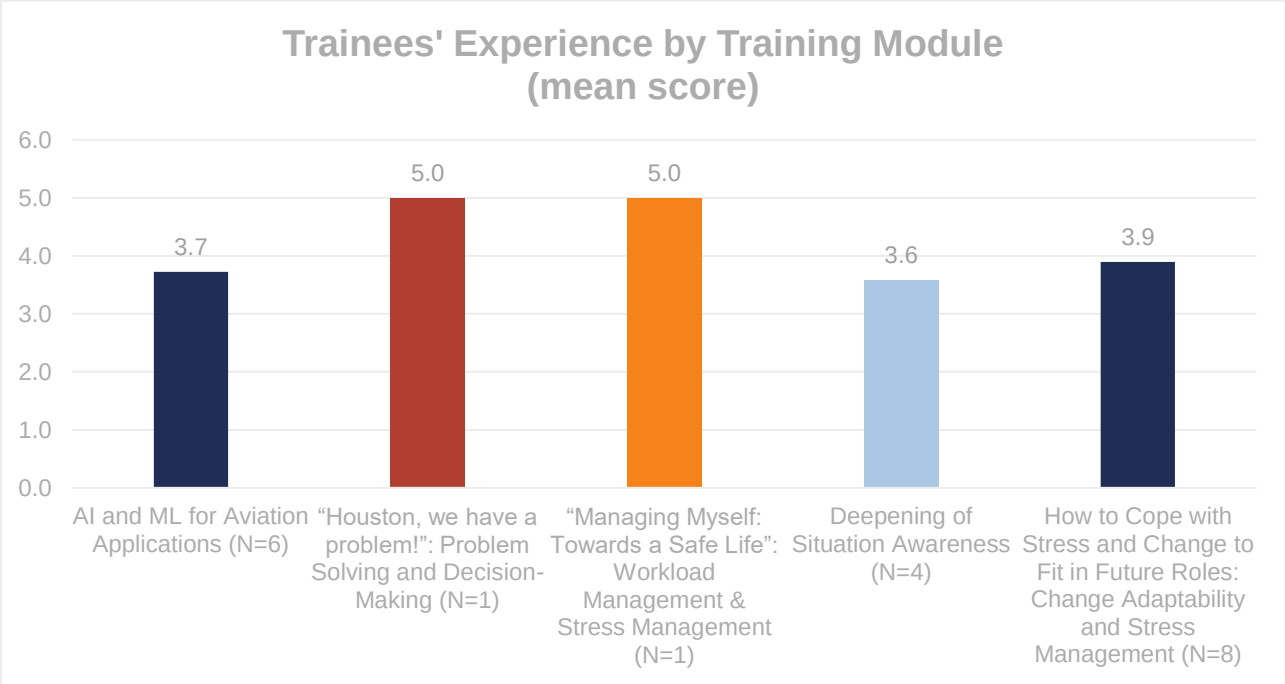


**Figure 88 - Trainees' Experience by training module**

Comparing the trainees' expectations (pre-training) and experience (post-training), it seems that the trainees had more positive expectations for the training module than their experience (Figure 89) since there was a decrease in the positive side of the scale.

Even though there were a higher percentage of "agree" answers, it's important to note that there was a decrease in "strongly agree" answers, and an increase in "don't disagree nor agree" answers and in "disagree" answers. To consider that trainees had a more positive experience than their expectations it would be necessary to have an increase in both "agree" and "strongly agree" answers and a decrease or no changes in the percentage of answers on the negative and neutral sides of the scale.

However, it's necessary to note that the experience assessment had only 14 responses, compared with the 26 responses on the expectations assessment. This missing answers in the experience assessment can have an impact on the comparison between the two moments.

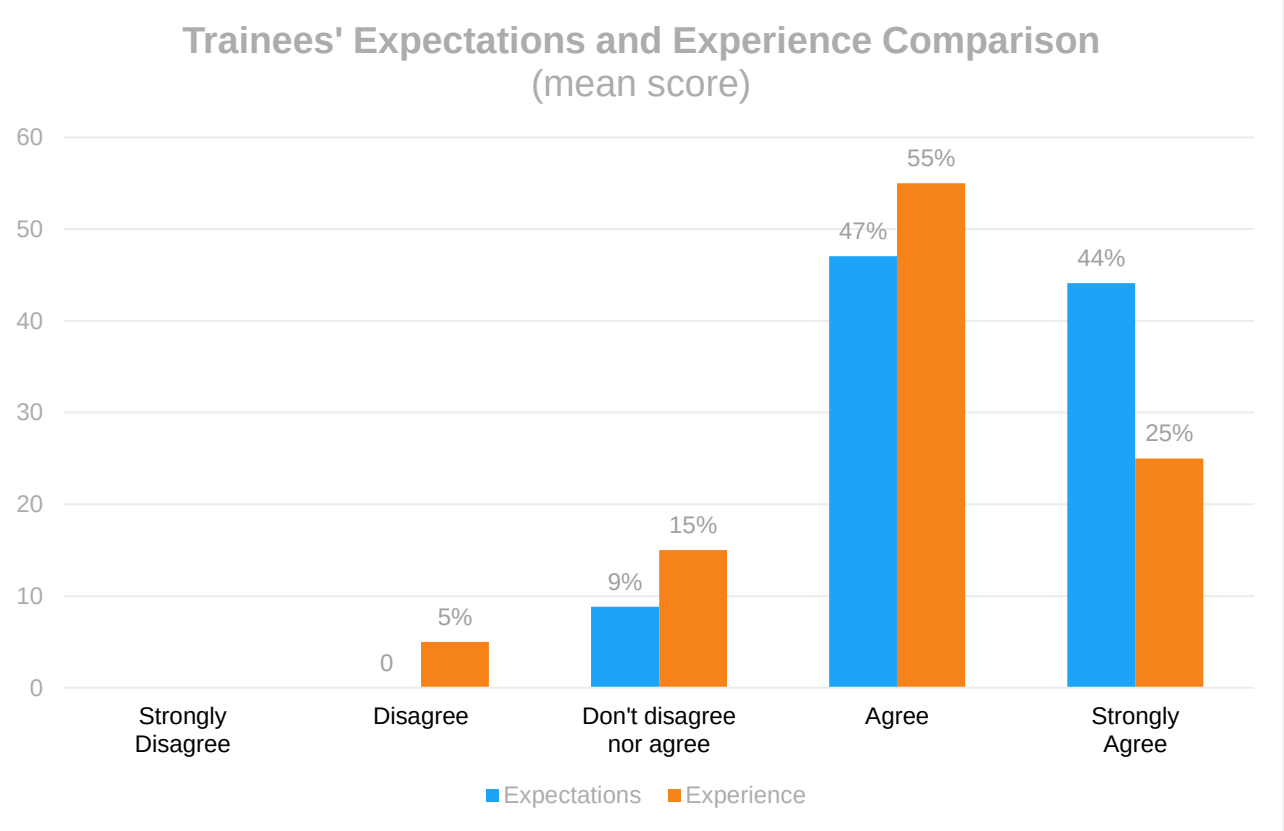


**Figure 89 - Trainees' expectations and experience comparison**

## *4.3.2 Trainer Satisfaction*

Satisfaction with the trainer was also analysed after the pilot sessions. Choo and Bowley (2007) found that trainees value a helpful and well-prepared trainer. Furthermore, Latif and colleagues (2013) found that trainer satisfaction was one of the most relevant contributors to overall satisfaction with the training.

Regarding the trainees' satisfaction with their trainer (*M* = 5; *SD* = 0,44; N = 14), this was overall very positive with all the answers being on the positive side of the scale, as can be seen in Figure 90.

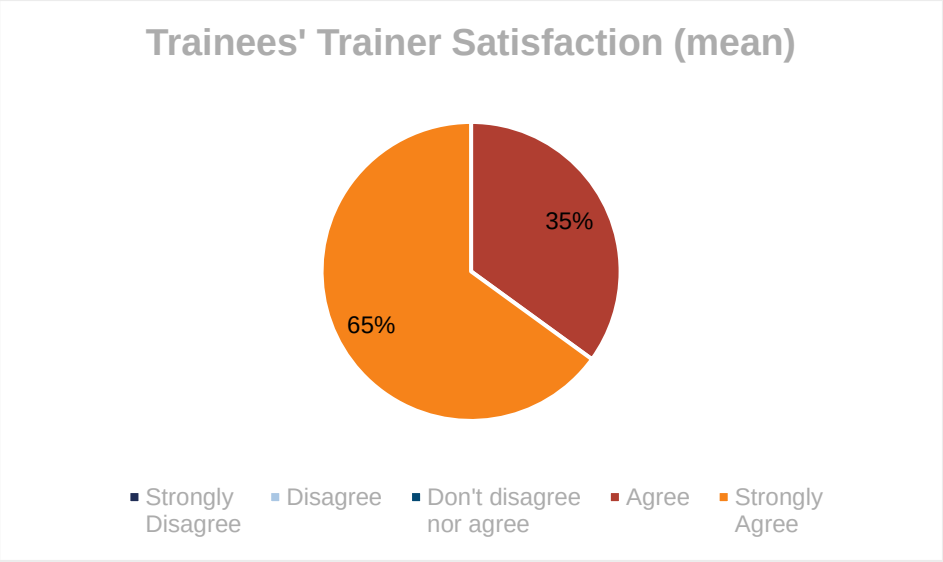


**Figure 90 - - Trainees' satisfaction with their trainer**

Furthermore, it was also analysed the satisfaction with the trainer by training module, as can be seen in the figure below (Figure 91). As seen in the figure below, it's possible to understand that the trainees were more satisfied with the trainers from the "Houston, we have a problem" and the "Managing Myself: towards a safer life", however, these training modules only had one answer comparatively with the other training modules "AI and ML for Aviation Applications" (*M* = 4.9; N = 6), "Deepening of Situation Awareness" (*M*= 4.2; n=4) and "How to Cope with stress and change to fit in future roles" (*M*= 4.5; n=8).

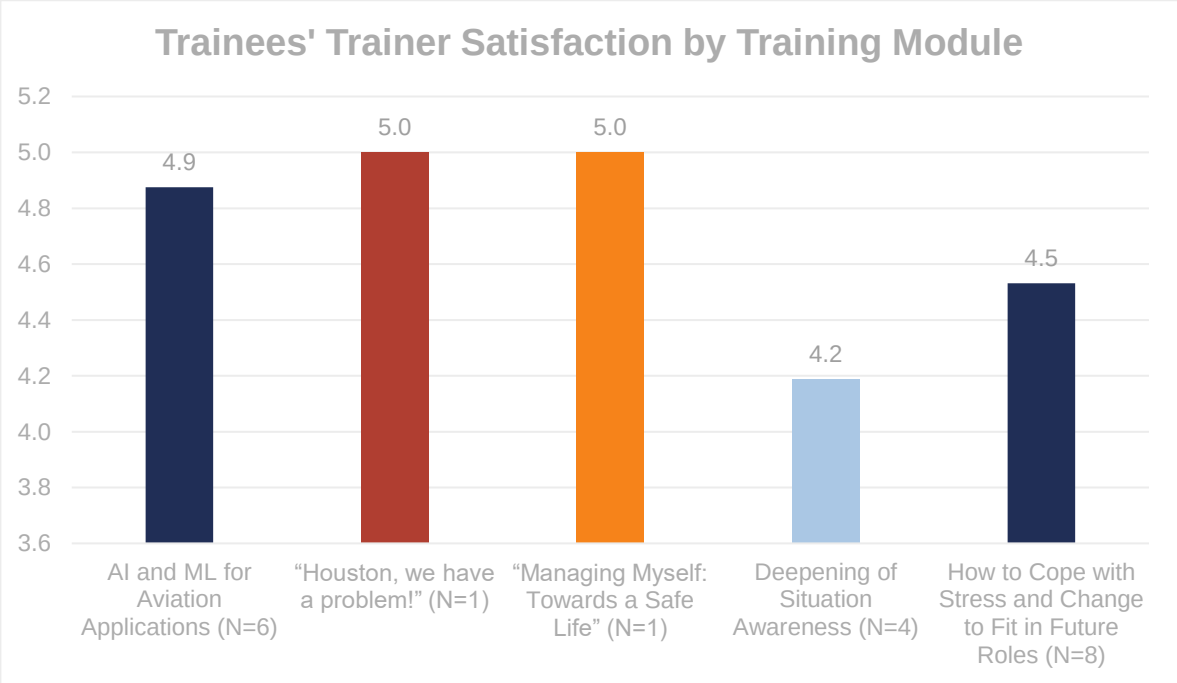


**Figure 91 - Trainees' satisfaction with their trainer by training module**

### 4.3.3 Overall Experience

Finally, overall participants seemed very satisfied with the training program that they experienced. As can be seen in the figure below (Figure 92), 30% (N = 6) stated that they were very satisfied with the training program and 55% (N = 11) were satisfied. From the responses analysed, no trainees were unsatisfied with the training program.

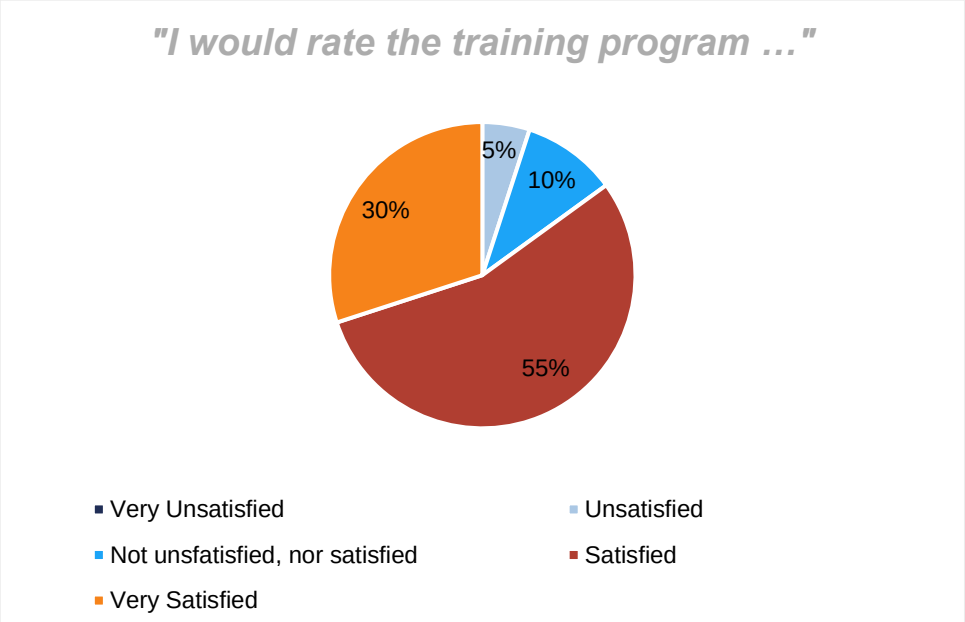


Figure 92 - Rating of the training program

Furthermore, the participants were also asked if they would recommend the training program to other people (Figure 93). 80% (*N* = 16) of respondents said they would be very likely to recommend the training program to other people. Only one respondent stated that they wouldn't recommend the training program.



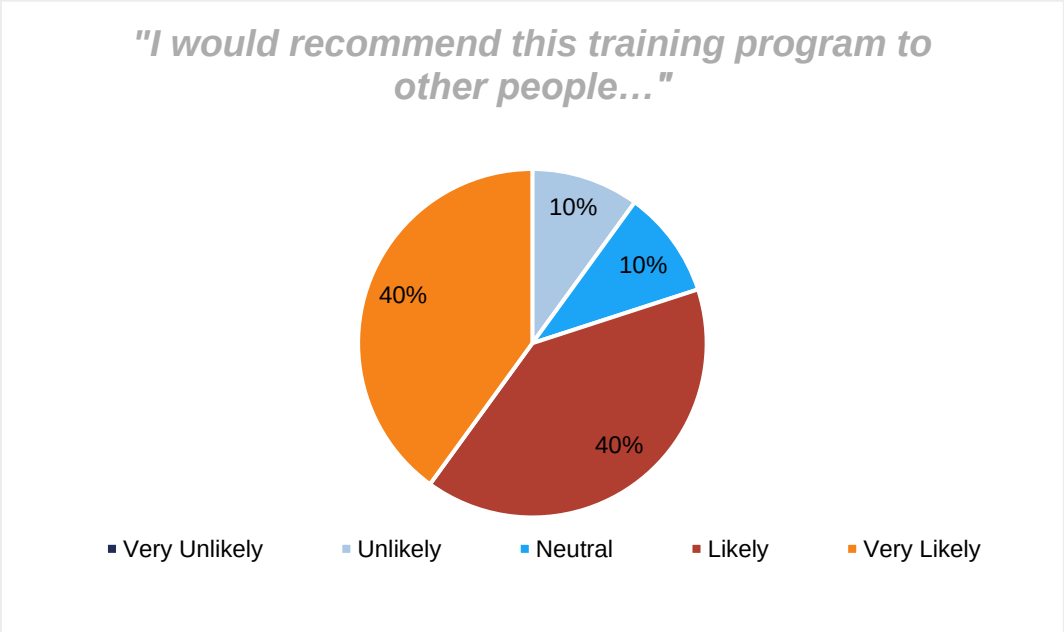


Figure 93 - Likeliness of trainees to recommend the training program

Finally, a final question asked participants to leave feedback or other inputs that they would like to add to the training program evaluation. One participant stated the following about the "Houston, we have a problem" training module:

> *"This program brings structured and insightful knowledge to problem-solving and decision-making to use on a day-to-day basis, which can be applied both to personal and professional sides of life. Some of the topics covered are "intuitive" and I feel have used them already, however, as shown by the program, these are much more complex than one "intuitively" can perceive, thus the importance of such a well-structured and accomplished course. Congratulations!"*

Another participant thanked the ENAC partner for providing the pilot session training. Furthermore, another participant from the "AI and ML for Aviation Applications" stated the following regarding their experience:

> *The script is great - with a bit more development it would be one of a kind. The content itself is good - and the syllabus is good too (...) If I had to grade the course in terms of usefulness - a 7 would be a good grade which would increase if practicality was increased. In terms of the learning experience, a bare 5 in that the platform interaction was not good. If interaction and potential immersiveness (e.g., VR/AR) with partners were explored, the course would be one of a kind. Hope this helps!"*

### *4.3.4 Behavioural Changes Assessment*

As the last assessment for the skill-UP pilot sessions, a behavioural changes self-assessment questionnaire was implemented 3 months after the pilot sessions ended. Behavioural changes are "*The extent to which trainees have changed their behaviour because of their participation in a training programme*" (Diamantidis & Chatzoglou, 2014, p. 158)

The usage of a self-assessment questionnaire will allow the trainees to consider and reflect on their learning, knowledge, performance and overall contribution to the training program in their personal and professional development.

To assess the trainees' behavioural changes a questionnaire with a 5-point liker scale from "1 – totally disagree" to "5 – totally agree" was used. The full questionnaire was published in Deliverable 4.1 (Skill-UP Project, 2022. D4.1 VET Training Assessment Portfolio).



Furthermore, the results obtained from the implementation of the abovementioned questionnaire are presented in this section. However, it's important to note that this questionnaire only had 17 responses which translates into a 24,7% adherence from the 69 total participants.

With this considered, it seems that the majority of the respondents did not experience any behavioural changes after the training program (*M* = 3; *S.D.* = 0.54; N = 17). As seen in the figure below (Figure 94) the majority of the responses (53%) were neutral ("*Don't disagree nor agree*").

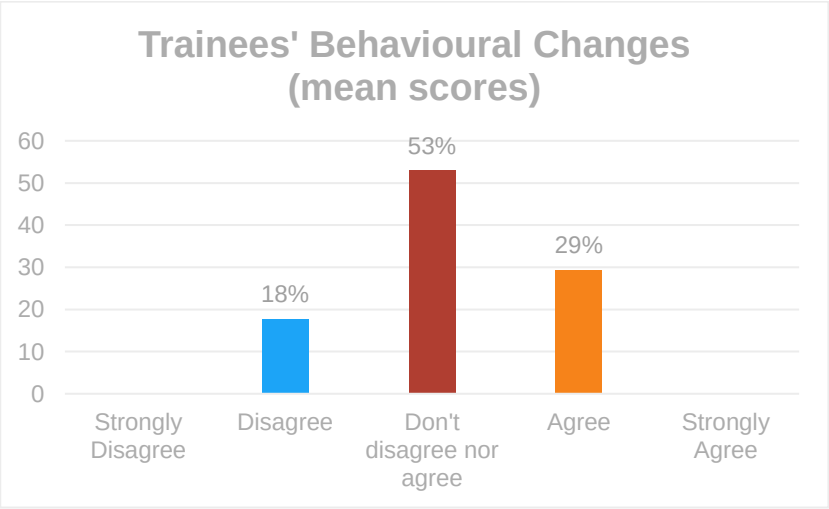


**Figure 94 - Trainees' self-assessment regarding their behavioural changes**

# 5 Conclusions and Next steps

The present deliverable offered a report and reflection on the pilot sessions implementation and its assessment tools.

Overall, more than half of the assessment tools developed were implemented with some exceptions due to various issues (e.g., problems with the Knowledge Centre Platform).

The information collected and reported in the deliverable allowed for the identification of what worked well for each training module, but also what could be improved not only on the training modules but in the skill-UP training programme.

For the total asynchronous and mixed (i.e., synchronous and asynchronous) training modules there was one issue pointed out in almost every training module, that was the Knowledge Centre Platform. Participants pointed out that the Knowledge Centre Platform detracted from their learning experience and suggested that improvements were made in the platform layout (e.g., making it more user-friendly and/or easier to navigate), others suggested that it would be beneficial if the platform was able to increase and decrease the video's speed.

Still regarding the total asynchronous and mixed training modules participants suggested that more interaction with the participants would be beneficial to the training (e.g., adding one or more moments to interact with the participants). Participants suggested that these new moments of interaction could be used to help the participants with the platform and with assessments.

For the two face-to-face training modules, participants stated that these were interesting and useful. The use of a VR device for one of the training modules was shown to be a plus, with participants rating the experience as fun and amusing and suggesting some minor improvements (e.g., adjusting the device to not be so sensitive).

Lastly, participants stated that the concepts and contents of the training modules were interesting, relevant, and well-approached. Although some participants mentioned (for asynchronous and mixed training modules) that the video lessons could be more interactive (e.g., by having exercises directly in the video lesson) and if the examples could be more related to the aviation workplace and reality of these occupations that would be beneficial for training (for all training modules).

Overall, participants across all training modules seemed happy and satisfied with their training and trainers. The overall results of the final assessment tools and the feedback provided by the trainees highlight retention and understanding of the training contents.

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