

ADDET: Apprenticeship for the Development of Design Thinking

Trainer's guide



Project Reference: 2020-1-RO01-KA202-079926



ADDET: Apprenticeship for the Development of Design Thinking

Trainer's guide

Project Partners

| | |
|-------------------------------------------|---------------------------------------------------------------------------------------|
| Colegiul Economic Ion Ghica, Romania |  |
| IDEC SA, Greece |  |
| KISMC, Bulgaria |  |
| Antalya Il Milli Egitim Mudurlugu, Turkey |  |
| CESIE, Italy |  |
| Magenta, Spain |  |
| ZBB, Germany |  |

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

Table of Contents

| | |
|------------------------------------------------------------------------|----|
| Introduction | 4 |
| Presentation and monitoring of the apprenticeship model | 5 |
| OBJECTIVES AND TARGET GROUPS | 5 |
| INVOLVED PARTIES | 6 |
| DESIGN THINKING METHODOLOGY | 6 |
| COMPETENCE GRID FOR PROBLEM SOLVING SKILLS AND COMPETENCES | 6 |
| Objectives of the trainers guide | 7 |
| Problem Based Learning | 7 |
| Methodology to use design thinking and problem-based learning | 9 |
| Application of Design Thinking during apprenticeships | 13 |
| Preparation phase | 13 |
| The 5 Phases of Design Thinking | 15 |
| Phase 1 Empathize: | 15 |
| Phase 2 Define: | 18 |
| Phase 3 Ideate: | 21 |
| Phase 5 Test: | 27 |
| Defining objectives and goals | 30 |
| Definition of learning outcomes on problem solving | 34 |
| Methodology for the assessment of the learning outcomes | 36 |
| Assessment methods | 37 |
| Assessment criteria | 37 |
| Writing assessment criteria | 37 |
| Methods of assessment of learning outcomes: | 38 |
| Multiple Choice Questions (MCQs) | 38 |
| Short answer questions | 38 |
| Projects, Group Projects and Dissertations | 38 |
| Presentations | 38 |
| Orals | 39 |
| Poster sessions | 39 |
| Example of how to fill in the apprenticeship programme design template | 40 |
| Sharing experiences and recommendations | 42 |
| Template for the apprenticeship programme design | 43 |
| REFERENCES | 45 |

Introduction

Nowadays, problem solving skills play an important role in coping with complexity and change in today's society (European commission, 2018). These skills can respond to the growing needs of individuals to develop personally and handle obstacles and change. Problem solving skills apply prior learning and life experiences, with the look for new opportunities to learn and develop.

The aim of ADDET is to develop the employability and problem-solving skills and competences of VET students. The specific objectives of the project are:

- To develop problem solving competences and design thinking mindset for upper secondary and higher VET students through an apprenticeship model
- To develop problem-based learning through an apprenticeship model that will follow a design thinking methodology
- To support VET trainers by developing a trainers' guide addressed to trainers in VET schools and companies that will apply the apprenticeship model and will design, support and evaluate the apprenticeship programme.
- To create VET-company partnerships, experiment and validate the apprenticeship model
- To spread the idea of problem-based learning in apprenticeship by organizing seminars for trainers in VET schools and companies that are interested to apply the apprenticeship model

To reach the above-mentioned objectives, partners of ADDET project have created a model for apprenticeship implementation oriented to the acquisition of problem-solving skills and competences which will be based on the design thinking methodology. The objective of the present guide is to support the design, implementation, management, evaluation, and validation of the apprenticeship model. The guide was designed to prepare and train trainers from VET providers and companies to apply the apprenticeship model and to integrate innovative learning approaches (problem based learning and design thinking). The guide also includes successful stories from the piloting of the model, as well as instructions, suggestions to enhance the apprenticeship programme among new coming enterprises.

Presentation and monitoring of the apprenticeship model

The aim of ADDET is to develop the employability and problem-solving skills and competences of VET students. For that aim, the project has developed an apprenticeship model for students in upper secondary and higher VET schools, based on the design thinking methodology as well as problem-based learning.

The ADDET apprenticeship is based on open-end real problems that the company faces. With the support of trainers, the apprentice will formulate realistic and viable business solutions to address the problems.

Students are taught on the five stages of design thinking (empathise, define, ideate, prototype and test). Each stage that the student will have to follow in order to accomplish the problem set up at the beginning, will be designed in order to evolve different problem solving skills: empathise - communication/team building/active listening, define - decision making/research, ideate - creativity/evaluation/planning, prototype - risk management/prioritising, test - adaptability/flexibility/analysis/assessment.

The apprenticeship model includes theoretical foundation and guiding principles for the design, implementation and evaluation of the apprenticeship programme for the development of problem-based skills based on the design thinking methodology.

OBJECTIVES AND TARGET GROUPS

The main **objective** of the model is to provide the overall guidance of how to develop and implement apprenticeship programs by involving students in the business process and develop their problem-solving skills by the Design thinking structured and holistic approach.

Target groups include companies and trainers of companies, who are involved in apprenticeship projects, students in upper secondary and higher VET schools.

The target groups are further defined within the context of the education systems of the partnership countries: Germany, Greece, Turkey, Italy, Bulgaria, Romania.

The **specific target groups** of the model are: managers, owners and other key decision makers of companies including innovation managers and employees who work with apprentices, and students from upper secondary education and higher VET schools.

INVOLVED PARTIES

The main parties involved in the ADDET apprenticeships are: Business organization – SME, large companies, startups with their managers and employees, VET schools – for upper secondary education and high schools with their students and Teachers and trainers.

It may be the case that participants have to carry out a psychometric evaluation, to identify the role that students are likely to take when working in a group.

This prior evaluation is very useful to create balanced groups of different personalities. As a general recommendation it can be indicated that: it is recommended to create multidisciplinary teams composed of 3 to 5 students. Each team needs an experienced mentor to support the work throughout the course.

DESIGN THINKING METHODOLOGY

Problem solving methodology of design thinking

Design Thinking is a problem-solving framework. The concept has been around for decades, but in the past five to ten years, IDEO, a design consultancy, has championed the process as an alternative to a purely analytical approach to problem-solving.

Design Thinking is appropriate to solve a great variety of challenges and in the current model it is advised to be combined with support for the company to develop innovation.

Some examples of challenge areas are: Redefining value, Human-centred innovation, Quality of life, Problems affecting diverse groups of people, involves multiple systems, shifting markets and behaviours, coping with rapid social or market changes, Issues relating to corporate culture, Issues relating to new technology, Re-inventing business models, Addressing rapid changes in society, Complex unsolved societal challenges and more.

COMPETENCE GRID FOR PROBLEM SOLVING SKILLS AND COMPETENCES

The design thinking methodology focuses on the development of problem-solving skills and competences which can be further divided into the following main groups concerning the process and project-based learning: Knowledge and understanding, Cognitive skills in being able to research, identify, analyse, Transversal skills and Teamwork.

Objectives of the trainers guide

The trainer's guide is addressed to trainers that design, organize and facilitate apprenticeships, while applying the apprenticeship model. It provides practical information of how trainers can apply the ADDET model with students.

The objectives of the trainers' guide are:

- to prepare and train trainers from VET centers and companies to understand the notion of acquiring problem solving skills in apprenticeship
- to explain the design thinking methodology - to build capacity of trainers to transfer the problem-solving skills to apprentices
- to present and promote the apprenticeship model developed (O1) - to identify and present successful apprenticeship stories derived by the experimentation phase in partner countries
- to offer a set of instructions, suggestions and successful examples in partners countries to enhance the apprenticeship programme among new coming enterprises
- to demonstrate the wide applicability of the apprenticeship model to every sector and country.

Problem Based Learning

The problem-based learning method is a process focusing on student and bringing the apprenticeships to solve problems essentially happening at work. Doing this task while acquiring competences such as teamwork, imagination, problem solving, taking risks, confidence, motivation.

This method is highly valued in vocational education since it consists of earning knowledge, developing teamwork and communication, giving the student an opportunity to develop their skills for their future careers. Apprentices can bring another competence in their theoretical learning, by applying their knowledge to elaborate solutions on problem-based learning.

PBL is important not only for the apprentices but for the employer as well, it is bringing benefits to both. While the learner is acquiring more skills and knowledge the employer can pretend to be more skilled employees with experience of the work.

PBL takes the goal to develop critical thinking and development, management skills and assessment. Learners have to evolve independently as well as in teamwork while

improving communication. Improvement is also taking more maturity, taking initiatives and demonstrating confidence and efficiency is just as much important as than developing management skills.

The most important goal for mentors/ trainers must be to establish a learning process which includes establishing technical competences, transversal competences and creative thinking. Those skills bring more competition for organizations in the future.

Giving each learner a task to solve a real- life open-ended problem, taking and having all the assets and help to determinate a solution to the problem. While executing this challenge, the apprentice will have to develop a method, plan, research the resources, settle the communication between supervisors and colleagues, make decisions and solve problems. This process will have to come out with a certain quality of work.

Autodidact learning is very important, however at first it needs some directives and comfort while being introduced to problem base learning. Another fundamental part is to support the learner's participation and commitment when they communicate with their group.

The content and plan of problem-based learning lessons may vary depending on the organization interests and their needs from the learners. One of the most important actions for problem-based learning is to pick the right problem.

The three main problems used are:

- Making decisions: determinate a solution from different options.
- Problem-solving: determination of errors and concrete solutions.
- Strategic performance: solving more challenging problems, needing a wide outlook and more approaches.

The level, period of time, and other details of the process will be determined by the trainers, depending on various parameters like the period of apprenticeship, the theme, the level of training etc. The ideas of challenges must be pertinent to the demand and hopes of the learners, meaning developing an appropriate level of complexity.

The outcomes-based approach to design lessons aims to make the trainers' expectations clearer to both the student and regular body. Escaping from the traditional learning system, with the trainer teaching what he/she thinks is important to know; however, the outcomes-based approach begin with the details of what the learners will be expected to achieve by the end of the apprenticeship.

Methodology to use design thinking and problem-based learning

Problem based learning (PBL) is a model of teaching that permits learners to have a leading and active role in their learning process. This model consists of bringing personal involvement in real world situations. We will include learners in a project in order them to take part and develop their skill with a concrete form of learning. In PBL the teacher or trainer is a facilitator and the problem is presented and identified in the beginning and not, as in traditional methods, in the end. (Kurt, 2020)

The most important thing to retain is the competences that the learner will develop:

- **Critical thinking:**

their ability to analyse a situation or text and think about a way of solving or developing the content. Critical thinking is also an essential competence for information society but also for lifelong learning. According to researchers D. Aswan, L. Lufri and R. Sumarmi PBL does affect effectively critical thinking, but also the affective and cognitive competences. (Kurt, 2020)

- **Problem solving:**

their aptitude for thinking of what the best solution to a given problem would be. For example: if there is a problem or organization within the project how will the person do to overcome it. Problem solving has to do with sets of skills that bridge education with real life, work with theory, and ideas with action but also embeds people in the cycle of the problem, from identification to possible designed experiments.

- **Teamwork and communication:**

their ability to work and exchange information together more effectively, serving a shared mutual goal and perspective and an attitude towards mutual understanding. Teamwork and communication skills help also students to stay more focused on the topic and use the maximum of their group potential.

The last thing to retain is that problem-based learning invests on exposing participants in real life problems and to enhance the recognition and identification skills.

Design thinking is a methodology that provides a solution-based approach, it is more practical and creative, to solve difficult problems that are not well defined or unknown, re-modelling into a human- centred design. Here the significance of the human factor is clear, and a shift happens towards more. Solution Based Thinking differs from Problem Based Thinking because its priorities the finding of the right solution rather than identifying the problem. Solution based thinking as a process is entirely different in how it starts to develop: focusing on the solution from the

beginning, keeping it in mind and finalising without forgetting the initial goal-solving attitude.

Design thinking has been widely used in companies that thrive in the business sector such as RBNB, NIKE, IBM, NETFLIX and many more. Netflix transformed itself into a web giant through design thinking in its business, RBNB was going down a decade ago but with design thinking they managed to find out the problem, empathise with their users, find new creative ways to apply new ideas and finally develop much further! As Voltage control writes, "Design thinking is a part of Airbnb's success; in particular, they built a culture of experimentation". They also refer to how IBM has seen "a 301% ROI (return of investment) by banking on design thinking" and they also offer their design thinking toolkits online here <https://www.ibm.com/design/thinking/>. It is interesting to observe how digital media based companies like RBNB have been using design thinking to enhance and reflect on their physical design processes but also to see how corporate giants such as IBM do consider the framework although they seem to be really successful.

Benefits of design thinking for a company:

Why should a company get to know and use this mindset? What are the qualities it has to offer? For sure it will change the mentality of problem solving for the company and it can also contribute in exploring new challenges and alternatives in corporate culture, new technologies, ecology and more.

In general, design thinking

- Increases thinking flexibility and revision: The phases of design thinking do not have to be followed in precise order which means that one can jump back to any phase of the process and revise
- It is easy to install: It does not require big amount of resources or expenses
- It is human centered: The solutions that can be brought up are human and client centered and specific
- It prioritized human experience: It zooms in people not in products nor services

Benefits of design thinking for students:

Why should a student use this mindset? What are the pros it has to offer and how could students benefit?

In general, design thinking

- Increases creativity, creative thinking, critical thinking
- Is human centered and aware which means it will take into consideration every person who is taking part or referred in the process, its values, emotions, attitudes and character, and this is important not only for the research subjects but also the students themselves

- It prioritizes human experience: It zooms in people not in products nor services and students will understand more and more the significance of the personality in any corporate, business, commercial or design process

Basic elements

The basic elements of design thinking are the

- human centered design
- the playful and creative character
- improving constantly and going back to previous points
- learning by doing
- practical prototyping as a notion of idea and action.

Important pillars of the method are

- creative thinking
- intense collaboration
- fixed plan of action working in cycles implementing innovations and revisions
- and the holistic view. (Talent education, *Design your education, create Tomorrow* 2021)

Mindset of Design Thinking (DT)

The mindset of design thinking can be described as following:

Developing new alternatives, many prototypes, revisions, and going back to the cycle of the process at any given point, is preferred than deciding on the spot. Identifying the problem in the beginning and not in the end contributes also to the creative mindset of DT. Participants become active listeners, creative thinkers that seek also solutions for future problems, revising their process anytime needed. Learning by doing, and a maker culture are quite supported. (Talent education, *Design your education, create Tomorrow* 2021).

Design thinking methodology in Work based learning:

Design thinking is a way of acquiring competences by practicing in real life work situation. It particularly fosters creativity, decision making, empathy, teamwork, and collaboration.

The **Trainer** part is important in a twofold aspect, both as a Supervisor/evaluator and as a guide.

As a guide he/she will have to give advice and listen carefully to the learner in order to give them feedback during the process without forgetting someone. Keeping a

stable and equal attitude for each one without making judgement and acknowledging the differences of level skills and abilities. The guide tries to keep the compass for the whole of the exploration, setting frameworks, limitations and directions.

As an evaluator, the trainer will give feedback on their improvement in their work, understanding and knowledge in the end. Also will give feedback on the application of design thinking phases and the approach of the challenges.

The role of the trainer here goes beyond traditional training in terms of flexibility and participation. He or she would now do a step back and let the participants constructively reflect on their own knowledge, the experiences of the others, the problems and possible solutions. The trainer of design thinking is more like a floating guide who connects all parts of the process, makes sure to follow the theme and serve human centered design.

The role of the trainer from the business side is to offer opportunities to the interns and observe them by providing resources that will help them complete the challenge. It is crucial to “break down” each step of Design Thinking to understand how this method will work in a workplace.

Applying the methods of DT

Solving problems in a creative way is the core. Learning by doing, collaborating, using human feedback and insights, all contribute to the holistic approach of DT. The method also works in a circular way, and one goes back at any phase any time needed.

Focusing on human feedback, improvisation, experimentation and analysing on the spot the pros and cons of prototypes. At the same time insisting in core values such as human centered design, innovation, new possibilities and imagination, creativity, collaboration and communication.

Application of Design Thinking during apprenticeships

Preparation phase

In order for the apprenticeship to start and unfold in good order we would suggest going through a preparation phase.

The preparation phase consists of two modules that entail steps to follow meticulously.

The first is more theoretical and the second more practical and pragmatic. They both can set the ground for the apprenticeship to work better for the company and the trainees/participants.

In principle, what we want to achieve in the preparation phase is to get totally ready, feel confident, make sure we are effective in terms of planning. At the same time this phase is important in order to self-reflect on values, methods, concepts, people, collaboration, communication, teaching / practicing and evaluating. Following the tables below can help structuring the apprenticeship a) before the participants come (theoretical) and when they are in the company (practical).

Theoretical module:

| Steps to follow | Check when already finished |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Initial conception of the apprenticeship program | <input type="checkbox"/> |
| Basic needs of the company for doing this program | <input type="checkbox"/> |
| Content of the apprenticeship | <input type="checkbox"/> |
| Basic needs of the apprenticeship itself (people trainers and other professionals, plans, timeplans, software and hardware, courses, materials) | <input type="checkbox"/> |
| Structuring in time and space (where are we going to work, when, how long, | <input type="checkbox"/> |

| | |
|-------------------------------------------------------|--------------------------|
| how often, this is a revised and more final timeplan) | |
| Do we meet all factors to move to call of interest? | <input type="checkbox"/> |

Practical module:

| Steps to follow | Check when already finished |
|-----------------------------------------------|-----------------------------|
| Call for interest for students/participants | <input type="checkbox"/> |
| Selection criteria | <input type="checkbox"/> |
| List of students/participants | <input type="checkbox"/> |
| Training of company trainers | <input type="checkbox"/> |
| Design of the course/apprenticeship structure | <input type="checkbox"/> |
| Design of the evaluation | <input type="checkbox"/> |

After the preparation phase, both theoretical and practical, the apprenticeship is ready to start. The development of plants and structuring will foster creativity, instructional qualities and will allow for in depth development of the design thinking process.

*** During the preparation phase, the apprenticeship programme design needs to be filled in and be updated during the course of the ADDET apprenticeship.**

An example of how to fill it is given in later chapters of this guide.

The 5 Phases of Design Thinking

| | |
|-------------------|------------------------------------------------------------------------------------------------------------------------|
| Phase 1 Empathize | Acknowledging and understanding the human factor |
| Phase 2 Defining | Acknowledging and understanding the problem or issue or challenge |
| Phase 3 Ideate | Fostering active, creative and intuitive participation |
| Phase 4 Prototype | Start building possible solutions |
| Phase 5 Test | Making sure the proposed solutions work, find errors, practise trials and try out, go back and re design where needed. |

Phase 1 Empathize:

Understanding human needs, emotions, desires. Focusing in the target group.

Here students will work collaboratively with other students, with interns, with employees or in mixed groups. They will conduct research and collect information about the topic-theme or challenge. This will help them understand better the situation or problem they have to deal with in order to approach it effectively.

Empathize is the first stage of the design thinking process. It focuses on empathy as the notion of understanding the others, specifically the people you design for and its important in order to define the problem which comes in phase 2. The first step will be to observe, take the information and ask questions if needed in order to be in tune with the needs want and objectives. It aims to have a clear idea before passing to the next step. The notion of empathy here also suggests that we cannot move forward if we do not understand the needs and objectives of the people we design for but also how they think, how they feel, what do they really need or expect, why they feel like this and why their needs are the ones that are described.

The main components of empathizing in practise are: active listening, observation, watching listening and understanding, and substantial engagement with the human factor.

Why is this important?

To finally create and design an efficient solution to the problem we have to understand fully the needs, desires and emotions of the people that consist the target group. Their feedback will define in a good extend our vision and will act as a compass to guide us through the design journey. At the same time it helps unfold needs of people that are not always clear to them and exploring the feelings that give directions to user needs and desires.

Steps:

The trainer should begin with explaining the phase, what empathizing means in the context. Then they should make sure that they explain enough to the students that this phase does not require as input their own assumptions, ideas, thoughts, but to map or document or claim the experience and needs of the people they are going to be involved with. Before starting the trainer can also have a short talk with students, introduce them to the people they are going to interact with, and try to install a positive atmosphere.

Suggested activities:

- 1.The trainer can motivate students engage in empathize stage through offering them questionnaires or design them together with students, discuss or do a presentation about how we do interviews and how beneficial they can be in exploring human needs or emotions.
- 2.The trainer could give also post it papers to students that have different colors and ask different questions written on them. Students should write down their responses on the paper after conducting the research, interview, or talk with other people. Questions could be exploring the reasons, feelings and needs and the extend of understanding them by students. For example, handing out post it papers with the question “ Why did....feel like this?” will make students constructively think about the personal reasons of peoples responses or feedback.
3. The trainer could also ask from the students to prepare and do short presentations to their group, showcasing their research to the group, but also use group feedback.
4. The trainer could also ask from students to take part in short debate about the urgency behind empathy and mutual understanding, and then bring also examples from their research so far in the group.
5. The trainer could also present video interviews from the web to the students (from athletes, celebrities, business people, scientists or every day people) in mute (without sound) and ask students to try to feel the human emotions that are depicted in the peoples expressions and faces, as an exercise on recognizing emotions.
6. Mindmaps and concept maps are also interesting forms to use at this phase, to organise ideas before talking with the target group.

7. Creating a diagram with the target group description and the needs, feelings and desires of them can help documenting that process. The trainer can ask students fill the following form:

| TARGET GROUP | NEEDS | EMOTIONS | DESIRES |
|---------------------------------|----------------------|----------------------|----------------------|
| Charakteristics and identities. | 1.... 2... 3.. | 1.... 2... 3.. | 1.... 2... 3.. |

Tips:

- taking notes and writing a description will help the learner put their ideas into order, using a highlighter will also facilitate the organization the main point.
- For the trainer, observing the people and their habits, thinking about them, stepping in their own shoes, and trying to put her or himself in their position as much as possible seems critical.
- Lets not forget that empathy is about leaving oneself behind and trying to see the world through the eyes of the other. As design thinkers or trainers we should be able to focus on the experience of the other in order to really understand their needs, find the problems and sketch solutions step by step.
- Think good about the human role because in design thinking humans and their experience are not excluded, the other way around, they become building blocks of our actions.

Empathize in practice example: The Athens Metro experience

Here the employees of the company (Attiko Metro in this case) with trainees and volunteers are going to set up questionnaires and oral interviews with metro passengers. The team is going to devise a simple method to find out the current condition of the passengers and their needs. They will eventually find out that passengers get frustrated from the busy moments and particularly in each station, before entering the metro, they often feel insecure.

Empathize in practice example: Web and Social media management of a certain company

Here the employees of the company are going to set up questionnaires towards the visitors and subscribers of the social media pages of their customer. They are going to find methods to reach the audience and explore their experience. They will find out that the new design disorients visitors. They will find out that the visitors are often annoyed by the complex new design.

Empathize in practice example: New smart phone, Confronting the decrease of sales

Here the employees of the company are going to work with customers of the company departments and stores all over the country. They will conduct interviews and they will not work. Then they are going to do real time test of the phone with users at the stores, to claim insights from their experience, showcasing its features and finding ways to understand peoples rejecting it. They will find out that the visual interface of the phone is really distracting from its own features.

Phase 2 Define:

Define the problem, open up perspectives!

The second phase is to define the problem by using and collecting all necessary information from the previous phase. Here we start to have a better understanding of the problem- In that respect we slowly form and respond to questions like: what difficulties and barriers are your users coming up against? What patterns do you observe? What is the big user problem that your team needs to solve? Do you understand why this is the case? What obstacles could you meet in recognising and identifying this problem?

After all this process its time to construct a clear problem statement. Of course this is essential before attempting to ideate or prototype because we first need to define needs and problems and then go design upon these. A problem statement is a document -statement of the current condition, the issues met and the actions required to explore and solve these issues. It should contain objective facts and data, not opinions and speculations and it should be easy to read, understand and

memorize. The statement should also reflect the process and main idea of human centered design.

Why is this important?

Because it will lead us acquire a good focus on the problem and at the same time help us express it in words. The define phase will also help clear out the most important points from the less importance one and will help create a problem statement which is to the useful, to the point and meaningful. Define phase also inspires the group, and by creating a focus merges all teams power in one!

Steps:

The trainer can start from explaining the idea of the establishment of a point of view. This is crucial and should reflect a balance between objectivity and opinion where opinion comes second, but is more important than in the previous stage of empathising. Then the trainer can explain the importance of clearing out what the problem is, and the fact that within this process we must do this in advance, and not wait to find this out in the end. Here what plays huge difference is exactly the fact that the problem is recognised in the beginning, after human feedback. Another element that the trainer could add here is the idea of information literacy. This would help the students understand that finding and collecting information is not enough until you are able to synthesize it in a manner that reflects the best way possible the real problem behind the words of the people interacted with. Presenting a video or showing a presentation about being information literate will help students understand the value of their sources which are primary, in this case, and the value of being able to reconstruct them in a problem statement.

Suggested activities:

1. The trainer can show a video or presentation, or talk about the significance of creating a good problem statement, and perspectives that help students to make it good. Focusing here mainly on human centered aspects, and the framework within which the statement should operate. Which are its limits should be seriously considered.
2. The trainer could also do small exercise with students to help them define words, particularly verbs that they can use in their statements and again reflect human centered design, such as feel, believe, think, experience, acquire, enjoy, dislike, have difficulties with ,etc.
3. The trainer can engage groups in peer to peer feedback on problem statements and talk about each groups ideas
4. The trainer could ask different groups to interpret in problem statements same data collected and then expose to comparison.

5. Creating a diagram with the problem statement together with target group needs, desires, and insights can be beneficial. The trainer can ask students fill the following form:

| TARGET GROUP | NEEDS, EMOTIONS, DESIRES | INSIGHTS | PROBLEM STATEMENT |
|---------------------------------|---------------------------------------|-----------------------------------------|-------------------|
| Characteristics and identities. | 1.... 2... 3... 4... 5... | 1.... 2... 3... 4... 5..... | |

Tips:

To ensure a great understanding of the problem we can ask ourselves some questions that will serve as a base for later.

- What will be the problem for the team to solve ? (Clear and brief description of the problem)
- What are the difficulties and barriers encountered? (Identifying the main keys to solve the problem)
- Can we identify any specific characteristics, unique to this problem?
- Can we identify general characteristics that are shared with other problems-situations we know or encountered previously?

In other words we can first describe the problem and then break it down to key issues in order to unfold our design upon them and avoid generalization.

It is useful to keep in mind that before the Define stage we do not have a clear idea of the problem that we need to solve. Its here where we acquire it and it is of critical significance in order to understand the design goal. It will also be hard to explain to stake holders what you working on. (Aswan1 et al., 2018)

The main components of define are the establishment of a point of view, and the human feedback collected previously through which the point of view is acquired.

Define in practice example: The Athens Metro experience

Here the data collected previously are considered in order to formulate a problem statement such as “The passengers often feel overwhelmed by the big amount of people and additionally this creates stress that they are going to be either robbed, or lost, or get sick. However, we want the passengers to feel safe and cozy.”

Define in practice example: Web and Social media management of a certain company

Here the employees will analyse and synthesize the data previously collected and will form a problem statement that is loyal to the point of view they acquired and the customers feedback such as “Visitors are often annoyed by the new design of the page and they seem to need something more friendly and simple, and we want to offer this to them.”

Define in practice example: New smart phone, Confronting the decrease of sales

Here the employees of the company are going to analyse all the visual and audio elements that seem distracting according to the users opinion. They will find out that the reason why this happens is because of the bad relationship of images and sounds. “Our customers find this interface distracting but we want to relaunch this phone with an revised inteface”.

Phase 3 Ideate:

Creative participation!

Here new ideas and new possible solutions will be formed and collected.

In the empathise stage we met the needs and personalities of the participants, where in the define stage we analysed their needs and formulated concrete problem statements. The third step is to bring solutions and ideas to approach creatively the problem. The aim will be to share solutions within the team without judgment, which

means that any possible, even bad idea, is welcome and should be embraced, because in a way it can lead to a great final idea!

The ideate phase of Design Thinking requires creativity and innovation, which both stand here for new adventurous and expanded versions of ideas, plans, speculations about fixing of problems, which also will manifest in an exiting manner, that can resemble a party of ideas.

Why is this important?

Because it will enable students use their ideas and mindset in their full capacity. At the same time it will enforce creativity, imagination, serendipity and surprise, to lead to the exploration of any possible even a crazy idea. This will help adding quality and creativity for the benefit of the target group and the experts involved.

Steps:

Here the trainer should motivate participants in depth on expressing their ideas and conceptions in their maximum capacity. They can talk about the importance of creativity in ideas, show videos or presentations about creative thinking and artful thinking or how designers approach their problems in a creative manner that sometimes falls out expected logic. Then the trainer should explain to the students that the goal of this session is to have a pool of lots of ideas in the end. The trainer should be prepared on how to collect and save all these ideas on the spot, either by writing down, or visually documenting etc. In the end the trainer can move to the session which should have a workshop, game, interactive character and can be done in a more relaxed setting. They have to explain also that their role will be to facilitate time constraints, and to keep the focus on the important elements.

Suggested activities:

1. **Brainstorming:** Brainstorming is a method to generate ideas to solve design problems. It consists of a collective creative act of thinking and talking, asking and replying, engaging though much more in a storm of ideas than a linear dialogue
2. **Bodystorming:** Expressing ideas with a group with your body, aiming to get a solution in a more creative way. This is a more bodily form of brainstorming that invests more on the mind, on senses and feelings within a certain space. Bodystorming exposes to body to natural conditions, a mix of simulation and performance.
3. **Mind mapping:** similar to brainstorming, it shares everyone's ideas one by one linking each idea, concept, starting from a base. A mind map is a diagram used to visually organize information. It is often created around a single concept. Major ideas are linked to the concept, and other ideas branch out from them. It can also be a really artistic process that brings together information, experience and aesthetics.

4. Dot voting: also known as dotmocracy is a process in which people vote for their favorite alternative. It is widely used to evaluate the ideas that come from brain or bodystorm.
5. Worse idea challenge: The concept here is to create a reverse brainstorming with ideas that seem silly, too simple, weird or impossible. This part can be a little humorous but often would engage effectively younger audiences!
6. Create a storyboard: Creating a simple story, dividing in some scenes and sketching one image per scene. In this way, the suggested solution can be seen more as a situation or action and it would be important to set good the space, time, characters and event, like a normal plot.
7. Creation of specific workshops in collaboration with employees, trainees and other experts within the company
8. Creation of specific workshops in collaboration with external partners, communication specialists, company managers, creative directors etc.
9. Creating a diagram of classifying and comparing ideas can be beneficial. The trainer can give the students fill this form:

| | |
|--------|-------------------|
| IDEA 1 | PROBLEM STATEMENT |
| | |
| PROS: | CONS: |
| IDEA 2 | PROBLEM STATEMENT |
| | |
| PROS: | CONS: |

Tips:

- Often that the solutions we pick can we thoroughly revised so feel free to do so.
- It's important to keep in mind that your learners have here the chance to bring again a lot from their personalities and subjectivities and possibly, sketch all together, interesting alternatives of some medium or bad ideas
- ideate is used to create an even more networked, creative, intuitive space for the problem to develop into a solution or some possibilities of solution.
- Try to open up the solution perspectives

The main components of ideate are the zooming into possible solutions, and the collection of as many ideas and suggestions as possible in order to create a good repository of proposals that could even be combined or considered strategically in relation.

Ideate in practice example: The Athens Metro experience

Here the problem statement from the previous phase will be the center of the creative process for finding new ideas and possible solutions. The participants in this phase participate in an evening of presentations, where each presenter has to show data, experiences or stories from metro passengers of other countries. Then they will all engage in a brainstorming session in smaller groups in order to map out a lot of ideas and inspiration on how to improve safety and its feeling in the metro for the passengers.

Ideate in practice example: Web and Social media management of a certain company

Here the employees will engage in a group session of bodystorm in order to understand creatively the feeling of navigation within the webpage and express possible solutions. They will also experience in a similar manner the navigation of suggested interesting websites in order to find out possible ideas or qualities they did not think about before.

Ideate in practice example: New smart phone, Confronting the decrease of sales

Here the employees will engage in brainstorm session with a mixed group of colleagues and possible customers, people all ages and identities. They will map in a gif animation ideas and keywords that come from all of them and the best ones will be selected after mutual agreement.

Phase 4 Prototype:

Build prototypes!

Right after ideate its a good moment to turn into experimentation. Here we should put ideas into application and practice, with a focus on producing a couple of tangible results as prototypes or mockups. In this phase we have to select the possible solutions to test further and we maybe need to adjust or redesign the prototypes. The trainer should make clear that this phase is not looking for a finished perfect product but either a mockup or a easy trial version of the possible final one.

During prototyping ideas will be modified, improved and tested. For this the most important thing is to look out for the advantages and disadvantages of each prototype.

Why is this important?

Because it will produce a good model of the solution proposed. It will also stretch the potential of the design as it will offer space for experimentation to any direction imagined.

Steps:

The trainer here is responsible for the facilitation of the transition from the ideas to become tangible so they should start with making clear that the goal of this phase is to produce prototypes that work. It does not matter if they work perfectly, but they have to work. Then the trainer can explain the different aspects of prototyping , for example, in web design, in medicine, in fashion etc and then focus more on what type of prototyping would be bests for serving the problem statement from before. Before going into action the trainer should check what type of equipment, media or tools are in the disposal of the trainees and share this with them.

Suggested activities:

1. The trainer can show explanatory videos or presentations about the design of mockups in order to bring them at the disposal of the participants
2. The trainer can explain and discuss that mockups can be instructionally used to devise a solution method.
3. The trainer can decide together with participants about types of materials or media that are going to be used and start experimenting in group workshops
4. The trainer can show concept maps or videos about hierarchies of concepts, in order to encourage the trainees in the design of central and less central elements
5. The trainer can divide people in groups to work separately, without having contact with other groups work. In the end the trainer facilitates a debate around pros and cons of each prototype
6. The train can engage participants in trial and error sessions where the prototypes are being run and criticised by their effectiveness
7. The trainer can give users the prototype to play, observe, experience and test, without explaining anything else before or

8. The trainer can give users the prototype to play, observe, experience and test, after sharing with them the problem statement.

Tips:

- making a board with pros and cons to get a clearer view of what needs to be changed
- Keep in mind that this is an experiment, a model, a prototype which for design thinking is the solid ground for developing further, changes can be made, and improvements can be also made in the near future.
- focus more on the free experimentation in the beginning and
- Criticising in the end
- The prototypes do not have to be expensive, they can be made with cheap and easily accessible materials

The main components of prototyping are the experimentation with alternative ways and approaches, the reclaiming of a variety of solutions from ideate phase and set up in practice, and the selection of the most promising ones.

Prototype in practice example: The Athens Metro experience

Here the idea pool from previous phase is going to be reclaimed. The participants will make use of the insights and other aspects that developed or unfolded previously and will design easy small scale experiments to approach possible solutions or designs around the safety and its perception in the Athens Metro. Some will design mockups with collages on boxes, others will create video mockups, and others will create new furniture and stairs mockups for the stations.

Prototype in practice example: Web and Social media management of a certain company

Here the employees will use all experiences and data collected so far, their own ideas will be put in practice and they will develop in pairs prototypes of a new website. Some prototypes are in digital software, others are coding experiments, and others are real website compartments like plugins. They will all together put these in faction and decide a couple to test soon.

Prototype in practice example: New smart phone, Confronting the decrease of sales

Here all experience and data are going to be used. The designers of the team will design new versions of the interface, all in a playful manner and not designing any final result. After collective discussion they put in test some of them.

Phase 5 Test:

Run to identify mistakes, bugs, errors !

This is the last phase where the prototype or the prototypes are getting tested. This could lead to a successful solution but also to going back to previous phases of the design thinking. Its critical to be open and able to see what is working good, having in mind the problem statement and to be open again for new ideas, if the existing one are not appearing so promising. Most often the solution is not found in one turn, one design thinking cycle. The test will help collect feedback from people outside of the project and they will give critics in order to improve the solution.

This part of course can be the last before the development of a new or updated product or service. It is then closer to the customer, possible recipient of the service. This is why its a phase where testing can be done also with future customers, with the audience and not only within the team of trainees, experts etc.

Testing will contribute in the validation of the design choices, the problem statement, the options that were selected.

Why is this important?

Because the insight of the target group and of colleagues are important and need to be considered in practice. Their feedback on the actual functioning of the prototype can bring important outcomes such as changes that need to be done or choosing the best prototype.

Steps:

The trainer here can show initially videos or material from different disciplines testing their prototypes, such as engineers, graphic designers, scenographers, other companies or scientists. They also have to set the context for the testing, explain who is going to take part, how and why. At the same time the trainer has to make sure that the problem statement and the human needs are still on focus and considered practically and conceptually. Before starting the testing the trainer can facilitate the

space, duration limit, and feedback form that is going to be given by the audience - users of the prototype.

Suggested activities:

1. The trainer facilitates a classic test by users.
2. The trainer can design feedback forms and charts
3. The trainer designs an inspired evaluation method, for example by handing out stickers or colored markers to the users, together with evaluation and feedback forms
4. The trainer can also facilitate video recordings with users testing and then describing their experiences with the prototypes
5. The trainer can facilitate a poll in the end of the testing and a group discussion where the users and the creators come in dialogue.
6. The trainer can facilitate a debate of users after the test, particularly if the results are not showing a specific prototype as favorite. In this case, the creators also participate actively in the debate by asking questions, filling forms with data and opinions etc.
7. Cyclical interrupted process: the trainer can ask the students to go back to any phase he or she asks in order to revise, remember, rethink.

Tips:

- Questionnaires can be made for feedback, with a comment section for the persons to write their opinion.
- Also, according to the nature of the group or learners, you may need to find alternative ways to collect their feedback, for example keep notes, record interviews etc
- Live showcasing and testing can always containing mistakes, showcase sensitivities or imperfections, be ok with that!

The main components of testing are the focus in a tailor solution, the possibility of going back to a previous phase and to redesign, and the improvement that will help the prototypes to advance.

Test in practice example: The Athens Metro experience

Here the participants are going to run the experiments, experience the mockups, watch the videos, and conclude which are the best ideas or which is the best idea. They will find two options for the best idea but the one of them has to go back to prototype phase, in order to undergo some changes. After this process they will test

it again and decide which they find more efficient: the furniture design, the navigation design or the safety rules?

Test in practice example: Web and Social media management of a certain company

Here the team will call also people that do not work with them, possible audience of the website, and they will all engage in collective and individual visiting of the website in all its prototype forms. They will then vote which is, after the test, the most efficient one, and if it needs any changes, from prototyping, even to ideate. If they do not find a good solution there, they will have to go back even to define.

Test in practice example: New smart phone, Confronting the decrease of sales

All new interfaces are tested by guests and experts of the team. A poll then is made to find out which one was the best , which was the worse, which could be improved.

Reflection after the 5 phases:

Its important to collaboratively reflect on the process when its finished, and for that purpose the trainer can ask the students the following questions:

| | |
|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • What did you like from this process? | <p>Focusing on the feelings and satisfaction (or not) of the students during the process, may include the actual practice undertaken, the interaction with the trainer, the interaction of the participants with each other, the activities done, any other aspect they feel like discussing.</p> |
| <ul style="list-style-type: none"> • Did you meet any difficulties? | <p>Focusing here on challenges the students faced, points they did not understand, other moments or details or aspects of the work they did not find so interesting, engaging or nice.</p> |

| | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Do you find a positive aspect to that process? | <p>Asking here if they found useful, new, innovative, compelling content or processes, and not what they liked as in the first question. Plus asking if they find what was done possible to be reclaim in their future work, if it affected positively their mindset etc.</p> |
| <ul style="list-style-type: none"> • Would you do things differently next time? If yes, what would you approach differently? | <p>Asking here about specific ideas-alternatives-versioning of things that happened, and not asking if they did not like some parts of the program.</p> |
| <ul style="list-style-type: none"> • What new did you learn throughout this process of the 5 phases of design thinking? | <p>Asking here about specific new knowledge they acquired, in the context of the design thinking and not generally for the program.</p> |
| <ul style="list-style-type: none"> • How do you feel about design thinking as a method and as a mindset? What is your honest idea upon your experience with design thinking? | <p>Focusing here on their idea about design thinking after their participation in the program.</p> |

It could also be beneficial to organise group feedback session with the students and others involved and talk in circle, sharing everyone's experiences with the team. Keeping notes from such a process is always helpful for the applications of the future.

Defining objectives and goals

Within educational or instructional work it's imperative to share our thinking and our learning goals with the students. From young learners to mature adults, when students or participants share the understanding of the learning goals, the educational process always functions in a more successful and substantial manner.

According to the work of researchers in Harvard University who have developed since decades the framework TFU (Teaching for understanding, as opposed to teaching - learning for-through remembering only), two core parameters of good teaching or instructing are to initially set a generative topic and then, among other points, to share the educator's goals with the students. Both points are critical because by using a generative topic in the beginning students imagination is activated, they receive

positive motivation and they can connect with prior knowledge on what they are going to work on. For example, when working with a theme such as “expanding profit through new types of advertisement” the trainer can use a generative topic such as “bridging emotions with economy through new forms of communication” which suggests a interdisciplinary, interconnected with human emotions study of economics or statistics or logistics and talks more directly to the minds of the students. In terms of goals, researchers in Harvard also taking educational theories into account, have concluded that sharing the goal in clear and engaging ways is always beneficial for students, teachers and the understanding of the topic, because it sets a common ground and a solid basis of working in the same direction and with focus on the explored topic. However, the benefits of sharing goals are not limited to educational or understanding ones. Sharing goals brings notions of collaboration, communication, responsibility and continuity within the work of a trainer and their students, and can save time, create the conditions for quality mutual communication, and foster a certain perception of the trainer in the students minds that is more honest, real and pragmatic.

But how can an educator set problem solving skills goals and apply them? And moreover, how can one share them and their significance with the students?

First of all the trainer- educator has to be clear in their mind about the goals they are going to set. Sometimes, the goals are many and unfold in a complex manner but it is essential to be able to write them down really simply, in the form of a simple sentence. In order to boost this writing process, one can use following structures to start with...and then fill with own goals in a simple sentence:

Example 1. Goal: The students are going to understand that....

Example 2. Goal: The students are going to get introduced in...

Example 3. Goal: The students are going to be able to distinguish this ...from that...

Example 4. Goal: The students are going to apply this....into that....

Example 5. Goal: The students are going to experiment with..

In other words, by using this simple form one can be sure about the real goal and how to express clearly (verbs like understand, get introduced in, know, practice, feel, explore, remember, speculate etc) but also how to communicate them with the groups of students.

Additionally its important to project-write down in a visible manner to all, these goals, and not just present them orally, and at the same time its suggested to go back to them and remind through the training process.

When it comes to setting problem solving skills (active listening, analysis, creativity, team building, communication and more) sometimes appears to be interesting to share with students a little bit more about these concepts and how they relate to the life and work in 21 century.

For example, it may be the case for a trainer to have a clear idea why active listening is critical in problem solving. However its not always clear to people who receive training why this can be important. Taking some time and discussing the notions, benefits and urgencies behind these skills is a good idea, particularly with trainees that seem not to totally engaged with these notions .

On the one hand sharing the goals, then phrasing them in a clean and clear manner, but also engaging trainees in the concepts and urgencies behind new types of skills they will acquire, will lead to a more substantial work for both parts.

Design thinking is a mindset which can help one set, understand, respect, apply their own goals better and this is why its so critical to have set clear goals in the design thinking process, otherwise a) students move different directions , or b)set their own goals, or even c)dismiss our goals as unimportant.

One practical way to engage students in the above necessities is to work together and reflect on the 5 stages of design thinking.

- Empathize, define, ideate, prototype and test.

Its critical to connect each stage with the skills and qualities that they relate to.

Therefore lets unfold these categories together:

Empathize relates to mutual understanding and respect, communication qualities and skills, active participation and listening of the other but also social qualities such as team building, respecting differences and the needs of the others. Here trainers can ask their students about their understanding of empathy, and its parameters, like mutual respect and at the same time trainers can also share with trainees videos, documentaries, artworks, poems, that talk about the notion of empathy.

Define relates to decision making, to linguistic and expressive skills, to research skills and abstraction skills. Here trainers can talk about expression, language, the linguistic parameters of thinking and decision making and can additionally talk about subjectivity and objectivity with their students, trying to also cover the notion of common sense.

Ideate brings together qualities of creativity, constructivism, designing and planning and representing real problems in real manners. Here trainers can spend some time talking or projecting artworks, videos, poems about the notion of the Idea, the concept and how it can emerge from inspiration in the mind but slowly get materialised to a prototype.

Prototyping relates to risk management and prioritising. Here trainers can talk with trainees about different notions of prototyping, in design, digital or web design ,architecture, art, commerce, advertisement, film, etc. Often students are not easily distinguish between prototype and ideate. What they should understand is that they are two stages of the concept making: first thinking and then experimenting.

Testing relates to qualities of adaptability, to analysis, to flexibility. Here again trainers can explore with trainees notions of testing, in design, web design, videogames, clothes, ads, etc in order to help them understand the importance and practice of it.

Definition of learning outcomes on problem solving

Learning outcomes are a definition of what a learner will be expected to know and present at the end of the learning process. The outcomes are very meaningful in the learning program, moreover in education and training, it improves in quality and relevance. When the plan of the apprenticeship has been determined, the next step is to establish the skills necessary to achieve the goal. It will also be necessary to put on the right method to complete the tasks.

The learning outcomes are a tool reference used in the *European Qualification Framework*³ to make the comparison easier and do a transfer of qualifications between countries, systems or even institutions. The *European Qualification framework* established eight levels of outcomes, from the lowest level 1 to the highest level 8 representing the most advanced qualifications. This process was made in order to improve and facilitate the transferability of qualification.

This system helps to clarify the program and qualifications intentions to make it easier for the people involved in the work including these outcomes. The learning outcomes statements bring benefits for the learner, it is a clear explanation for him to get a first touch on what he is supposed to learn. Also, for the trainer to support him in the orientation of the program, identify the best method to follow. For the labor market, to identify what are the skills required to respond to the criteria relevantly. For the training institution, they provide an important reference for quality and input to the review and development. Finally, it will benefit the assessor because the learning outcomes approach helps the assessment by applying the criteria of success, failing and even performance. Their relevance is due to the transparency the outcomes offer, verifying the accordance between society's need and the qualifications offered within education and training. Not all subjects and learning can be established in learning outcomes. Moreover, the learning method cannot be fully organized, the process will be both predicted and unpredicted with some undesirable outcomes.

Learning outcomes should only be focused on the learners and on what their knowledge, understanding and skills will be in the end.

Table: basic structure of learning outcomes:

| Learning outcomes | | | | |
|-------------------|----------------------|-----------|--------|--------------|
| Actions | Performance criteria | Knowledge | Skills | Competencies |

| | | | | |
|----------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| What will the learner will acquire at the end of the apprenticeship. | How the learner will show his/her knowledge, abilities, and competencies. | Theoretical and/or factual. | Cognitive (involving the use of logical, intuitive, and creative thinking) or practical (involving the use of methods, material, tools). | Responsibility and autonomy . |
|----------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|

Creating learning outcomes needs analyze and reflexion for the established objectives, the benefits and the possible alternatives. They must be composed with a wider context including learning inputs and written to reveal different benefits. Those can be used to define qualitative indicators, create curricula or even assessment. The most important are the concrete outcomes or the broader learning outcomes conditional the benefits or the goals.

The practice from the finished outcomes must be automatically used to improve statements of intentions, like in qualification or curricula. In the meantime, there will be a necessity to assess the others, even if learning outcome must be unique with an outcome directly linked to the goal.

The pertinence of learning outcomes statements to the learners will depend on their capacity to experience and use general knowledge lessons with their obtained knowledge. This process will only be effective with constant communication between learners, vocational education and training stakeholders. Learning outcomes must be written clearly and direct, with few statements, without being overdetailed. However, note that learning outcomes are a useful tool to orient learners and institutions, but do not organize and govern the overall process.

Using this tool will help to take care trainers and learners to lean on the statements to ease the teaching schedule, helps the learning process and might orient to accomplish assessment.

Methodology for the assessment of the learning outcomes

After having established the learning outcomes the next step will be to define the assessment criteria's learning outcomes, as well as method to evaluate the apprentices finding what did they retain from the program.

Defined assessment tasks support the apprentice into demonstrate achievement of learning outcomes. The difficulty of having an efficient assessment will be to match well the learning outcomes and activities chosen to determine if the goal was well achieved. They must be well linked without simply concentrating on the input but the process and capabilities as well.

It will be relevant to use those 4 interrogatives:

- **Who** will assess the apprentice: the trainer, the workplace instructor and the learner (for self-assessment). The combination of the three are here to confirm the quality of the evaluation process.
- **How** learning outcomes will be assessed, as well as where: it is a necessity to know from the beginning what the assessment method will be. The approach is selected depending on the most validate process of each learning outcome. Not to forget to consider the obstacles and difficulties that came out during the program, if any.
- **When** will the assessment be: apprentices will have to be informed to prepare.
- **Which** structures are in place for the quality of assessment: the quality procedures are important as well as the transparent criteria to ensure the reliability of the outcome.

The system of problem-based learning active needs data about the learners including, their educational background, work experience, knowledge needs and qualifications.

Therefore, it is necessary to gather information from learners about their aptitudes at the beginning. This process is essential to measure their skills. The gathering of information can be done by basic questionnaires, interviews or both, with the learners.

Getting this information assessment of competences will help in the future to measure their competences improvement at the end of the apprenticeship. This permit to get an input for the trainer about the strength and weaknesses point of the learner, it will help him/her as well to plan relevant activities or aspects of the apprenticeship; and to strengthen the learner skills.

Learning by the path of apprenticeship, get the learners to acquire a launch pad as well as an efficient time space for learner and their team to get into work and provide a great result. Then, this work is evaluated and analyzed to point out what was efficient or not. This will also permit for the future challenges in order to update the process aiming better results.

Assessment methods

The assessment methods are the strategies and tools to make evidence that the expectations were reached.

There are various assessment possibilities to choose. All method gets its advantages and disadvantages, and some of them will be more relevant depending on the type of learning outcomes. It is also important to know that mixing different types of evaluation methods will permit to get a wider range of outcomes.

Assessment criteria

Assessment criteria are information specifying the regulation that should be met and the confirmation that will be collected to show the achievement of learning outcomes.

The aim of the assessment criteria is to provide explicit standards of achievement for ever learning outcome. They must explain what will the learner is expected to provide to demonstrate that the learning outcome was successfully integrated. However, it important to make the distinction with the current assessment tasks. In brief, the assessment criteria explain how the task will be evaluated.

We can define three types of assessment criteria:

- Threshold standards explain to the learner what are the rules in order to show the accomplishment of the learning outcome, specifically the least requirements for passing the apprenticeship.
- Grading criteria gather the overall description of the standard demanded for success of established-grade, marking band or degree classification.
- General criteria bring general outcome descriptors that can be accomplished more or less well. Learners will be evaluated within a performance range and marks designated accordingly. This type of criteria are used to evaluate for referencing, language skill, quality of critical thinking etc.

Writing assessment criteria

Writing assessment criteria goes as same as developing, creating learning outcomes: being clear and brief while the language is well used, in order for the trainer and learner to understand.

Methods of assessment of learning outcomes:

Multiple Choice Questions (MCQs)

A classic method. This aims to evaluate a large scale of knowledges rapidly and can also take into account the level of understanding, analysis and problem solving skills. However, MCQs needs a bit of tome to develop, greater ones are from case studies or research papers. Also, it is simple to analyze the results as they are relevant for self-assessment and check-out with great reliability, validity and manageability. Feedback for learners is rapid as well. The risk is to receive assessment only for trivial knowledge. To reduce time, a group of assessor, dealing with the same learning outcomes, can brainstorm and develop a bunch of questions for half a day.

Short answer questions

Another classic method with the potential for measuring analysis, application of knowledge, problem-solving and evaluative skills. More simple to create then the MCQs but still a bit long. The feedback is also very fast.

Projects, Group Projects and Dissertations

Great potential for covering a large range of practical, analytical and interpretative skills, Make possible for a large exercise for knowledge, understanding skills to situations and bring an evaluation of project and time management. Group project offers a measure of teamwork attitude and leadership. Evaluate for feedback can be shorten with only peer and self-assessment and presentations. Learning acquirement can be elevated especially if reflective learning is part of the criteria. Differences between assessors' evaluation is allowed, however, applying criteria will reduce variability .

Presentations

These method evaluates, preparation, understanding, knowledge, organization aptitude, information and oral communication skills. Assessment can be made simultaneously by peers, trainers or self. Evaluation of ability to answer to questions and keeping a discussion can be added.

Orals

Orals are made to assess communication, understanding, aptitude to react fast while being pressured as well as knowledge of procedures. This is one of the most efficient for direct feedback. This are usually used to ensure reliability and validity.

Poster sessions

Assess the aptitude to present and interpret at the same time in an more original and attractive way. The risk is to be less concentrated on the content by being attracted to the design of the presentation, however, this can be controlled by using criteria, The Feedback potential are from trainers, self and peers. The used of criteria lessen variability.

Example of how to fill in the apprenticeship programme design template

The following shows an example of how to fill in the apprenticeship programme design. The empty template can be found in the next chapter.

A reminder that during the preparation phase, the design must be fulfilled by the company mentor, together with the student and the responsible teacher from the school.

| Step 1. Objectives and goals <i>Define the main objectives and goals of your apprenticeship program.</i> | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------------|
| Design thinking and product packaging challenges | | | |
| Mentor: (Name/Surname) | | | |
| Nikos Voyiatzis | | | |
| Step 2. Learning outcomes <i>Define the learning outcomes. You can use the following table.</i> | | | |
| Tasks | Performance criteria | Knowledge gained | Skills/competencies gained |
| Create a paper prototype of new versions of existing packages | Creative skills, Engagement, collaboration | Understand the role of a prototype | Handcrafts, communication and collaboration |
| Understand new ways of thinking for the design process | Ability for reflection, group feedback, Analysis and synthesis of data | Learn new thinking and learning method | Pattern recognition, abstraction, Critical reflection |
| | | | |
| Step 3. Assessment criteria <i>Define the assessment criteria and methods to find out if apprentices have achieved the learning outcome.</i> | | | |
| Interview with student. Assessment of prototypes, Live feedback from testing. Final discussion | | | |
| Step 4. Description of the proposed challenge (background info, resources available, tips) | | | |

The design thinking into product packaging session offers an in depth exploration of the challenges that product design and product packaging are characterised by. As designers try to fulfil the needs of the clients (people and companies) they often get misoriented from the previous packaging of each product.

This session offers a platform to deal with this challenge and prepare designers for a fruitful in depth exploration of new possibilities.

The available recourses for the session are:

Archival material from the previous package designs

Prototypes and rejected prototypes of previous packages.

Research into audience needs in word documents and google forms.

Interviews with previous designers of the company but also interview of other international designers.

The tips we offer to the participants are coming from the companies long experience and relate to trial and error, rejection of other variations of prototypes and our very human client based experience and group critique.

Step 5. Methodology

Initially we will introduce the topic to the group through this presentation...

Then we are going to offer two group lectures from international designers.

Then we are going to give hands on workshops to the group of participants.

Then we are going to go through the design thinking methods one by one in order to come up with interesting prototypes and to critique them in groups.

We, at the end, are going to group critique the prototypes and vote for the best one.,

Step 6. Support given to the learner

Timeframe for the implementation of activities

| | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| Preparation | x | | | | | | | |
| Implementation | | x | x | x | x | x | | |
| Evaluation | | | | x | | | x | x |

Sharing experiences and recommendations

ADDET model and guide was pilot tested during the project lifetime. Each partner, involved 5 students, who undertook their apprenticeships following the ADDET model. This chapter presents successful stories from the implementation in partner countries.

For partners: To report the successful stories, please use the following template. Max. 1 page.

| |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Title <i>Please give a title to your story.</i> |
| |
| Description <i>Describe the processes of the ADDET apprenticeship, how was it implemented? How did you use design thinking in the learning experience? What was the objective of the apprenticeship? How was the student supported? What did the student learn?</i> |
| |
| Lessons learned <i>What went well? What was the impact of the ADDET apprenticeship? What went wrong? What obstacles did you face?</i> |
| |
| Conclusions, suggestions for further evolvement of the ADDET apprenticeship. |
| |

Template for the apprenticeship programme design

| Step 1. Objectives and goals <i>Define the main objectives and goals of you apprenticeship program.</i> | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|----------------------------|
| | | | |
| Mentor: (Name/Surname) | | | |
| | | | |
| Step 2. Learning outcomes <i>Define the learning outcomes. You can use the following table.</i> | | | |
| Tasks | Performance criteria | Knowledge gained | Skills/competencies gained |
| | | | |
| | | | |
| | | | |
| Step 3. Assessment criteria <i>Define the assessment criteria and methods to find out if apprentices have achieved the learning outcome.</i> | | | |
| | | | |
| Step 4. Description of the proposed challenge (background info, resources available, tips) | | | |
| | | | |
| Step 5. Methodology <i>Describe the methodology you used during the apprenticeships.</i> | | | |
| | | | |
| Step 6. Support given to the learner | | | |
| | | | |

| Timeframe for the implementation of activities | | | | | | | | |
|------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 |
| Preparation | | | | | | | | |
| Implementation | | | | | | | | |
| Evaluation | | | | | | | | |

REFERENCES

Mindmapping. Mindmapping | Design Thinking Methods Catalogue. (n.d.). Retrieved November 27, 2021, from <https://www.designthinking-methods.com/en/3Ideenfindung/mindmappingID.html>.

mock-ups. Mock-Ups | Design Thinking Methods Catalogue. (n.d.). Retrieved November 27, 2021, from <https://www.designthinking-methods.com/en/4Prototypen/mockups.html>.

Aswan1, D. M., Lufri2, L., & Sumarmin, R. (2018, April 1). *IOPscience*. IOP Conference Series: Materials Science and Engineering. Retrieved November 27, 2021, from <https://iopscience.iop.org/article/10.1088/1757-899X/335/1/012128>.

Design your education, create Tomorrow. Talent Education. (n.d.). Retrieved November 28, 2021, from <http://www.talenteducation.eu/toolkitforteachers/designthinking/>.

How design thinking transformed Airbnb from a failing startup to a billion dollar business. First Round Review. (n.d.). Retrieved November 27, 2021, from <https://review.firstround.com/How-design-thinking-transformed-Airbnb-from-failing-startup-to-billion-dollar-business>.

Kurt, S. (2020, January 8). *Problem-based learning (PBL)*. Educational Technology. Retrieved November 27, 2021, from <https://educationaltechnology.net/problem-based-learning-pbl/>.

Kurt, S. (2020, January 8). *Problem-based learning (PBL)*. Educational Technology. Retrieved November 27, 2021, from <https://educationaltechnology.net/problem-based-learning-pbl/>.

Research as design - talenteducation.eu. (n.d.). Retrieved November 28, 2021, from <http://www.talenteducation.eu/toolkitforteachers/designthinking/assets/Uploads/Download/c50c87cab4/RAD-okt16-2-copy.pdf>.

Stevens, E., Emily Stevens Managing Editor at CareerFoundryOriginally from England, Emily Stevens Managing Editor at CareerFoundry, Stevens, E., CareerFoundry, M. E. at, & England, O. from. (2021, November 23). *What exactly is design thinking? (updated guide for 2022)*. CareerFoundry. Retrieved November 27, 2021, from <https://careerfoundry.com/en/blog/ux-design/what-is-design-thinking-everything-you-need-to-know-to-get-started/>.

Teaching for understanding: *Educating for depth, flexibility, and the unknown* (TFU). Harvard Graduate School of Education. (n.d.). Retrieved November 27, 2021, from <https://www.gse.harvard.edu/ppe/program/teaching-understanding>.

Voltage Control. (2021, August 26). *8 great design thinking examples*. Voltage Control. Retrieved November 27, 2021, from <https://voltagecontrol.com/blog/8-great-design-thinking-examples/>.

<https://www.emeraldgrouppublishing.com/archived/teaching/insights/outcomes.htm>

Qualifications & Credit Framework, Guidelines for writing credits-based units of assessment for the Qualifications and Credit Framework, 2010, www.linkinglondon.ac.uk

Yew, E. H., & Goh, K. (2016). Problem-based learning: an overview of its process and impact on learning. *Health Professions Education*, 2(2), 75-79.

Hamburg, I., & Vladut, G. (2016). PBL–Problem Based Learning for Companies and Clusters. *Transportation research procedia*, 18, 419-425.

Yew, E. H., & Goh, K. (2016). Problem-based learning: an overview of its process and impact on learning. *Health Professions Education*, 2(2), 75-79.