Effective training of transferable skills related to open science and innovation for PhD candidates and early-stage researchers

H2020 – SWAFS – 2018-2020

Deliverable No. 2.2.

Report on DISCOVERY LEARNING Proof of Concept

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WP/Task Related	WP2 – Testing and validating DISCOVERY LEARNING paradigms and methodologies
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Reviewers	All partners
Key Words	Teaching, gamification, practitioners, real-work-based learning, pilot, transferable skills, open science and innovation, effective training, personalized learning.

Revision History

Version	Date	Notes
1.0	20/05/2022	1st version by RTDI presented to the partners for feedback.
1.1	31/05/2022	Final version ready for submission.

Information about how this deliverable may influence other Discovery Learning's tasks:

Linked Task	Points of Relevance
WP1: Map of transferable skills for open science and innovation and Career counselling	Experiments will need to be aligned with the final outcomes from this WP, and vice versa.
WP3: Communication, Dissemination and Exploitation	WP2 will be the main source of contents for dissemination and communication and main source of results to be exploited, together with WP1.

Table of Contents

List of Abbreviations

AT= After training survey

BT= Before training survey

D= Deliverable

DL= Discovery Learning (short project acronym to enhance readability of certain texts)

EC= European Commission

FECYT= Fundación Española de Ciencia y Tecnología

GA= Grant Agreement

HEI= Higher Education Institution

OEE= Open Educational Experience

OER= Open Educational Resource

PhD= Doctorate

RTDI = Research, Technology Development and Innovation, S.L.

SAIA= Slovenská Akademická Informačná Agentúra

UiO= University of Oslo

WP= Work Package

1. Introduction

This deliverable compiles the analysis of experimental results during Discovery Learning. In D2.1 "Detailed protocol for DISCOVERY LEARNING pilot", three piloting stages were defined, being the 1st one exploratory, to become able to properly formulate research hypotheses and methods. Results from this 1st stage are compiled within D2.1, so they will not be repeated in this document.

The focus now is to learn from stages 2 and 3. It is important to highlight that this deliverable is about learning from the experimentation (reaching conclusions through scientific analysis of the results, and learning as much as possible to keep up activities in the future, beyond the project's lifetime and Discovery Learning consortium). Thus, **it is not about compiling the data obtained, which has been made public in D3.6 "Research data from project to open data pilot", in the project's website, and in Zenodo.**

As an introduction, it is also worth highlighting the experimental activities that generated the research data compiled in D3.6 and analysed here. Three main activities have been carried out:

1. The most relevant one: **a programme of webinars in different topics related to open science and innovation, which covered all categories of transferable skills included in Discovery Learning ontology** (see D1.1 "DISCOVERY LEARNING Ontology"). **Nineteen webinars were organised by all partners** implementing **enriched activities with practitioners**, from October 2021 to May 2022, **open to any PhD candidate and early-stage researcher (ESR) at international and multidisciplinary levels. 812 people registered to these webinars, and 539 participated in them**, for which this programme is considered a high impact activity from the project. Section 3 describes the topics covered, the distribution of participants, and the scientific and educational outcomes obtained. It also leverages knowledge creation by carrying out analysis of data from different perspectives, and enriching conclusions by organising a focus group with PhD candidates and ESRs.

2. The second one in terms of relevancy were the **mini-projects**. The idea was to experiment around what we are calling ***real-work-based learning***: learning which not only belongs to real projects or cases but also, they are happening in real-time (they are alive as the PhD candidates and ESRs work in them). This activity was not so relevant in terms of numbers (23 people registered, and just 6 went through all steps); but it was the most disruptive educational activity tested. Results and outcomes are fully analysed in Section 4, which are considered quite relevant given how challenging it seemed to explain the activity to potential participants and implement it without a formal acceptance within their PhD programmes (only based on the participants' intrinsic motivation to learn and practice).

3. The final one were 3 seminars at UIO (2) and La Salle Campus in Madrid (1), after which **in-depth reflections were written by the professors and practitioners engaged** to enrich the analysis with their perspective.

Pedagogic methods used to enrich the engagement of practitioners, organising the mini-projects, and meta-reflections by professors and practitioners, have been compiled into one of

the main results from Discovery Learning towards sustainability of its impact: an **open platform of what we have called *Open Educational Experiences* (OEEs)**, fully described in Section 5.

OEEs are personal and specific strategies from educators working with different learners in different contexts, shared openly via Internet in such a way that they can be easily found, understood, assessed and reused / recycled by other educators.

Experience is every conscient and perceived event that improves how we put into practice a certain knowledge or skill. Educational experience is when this knowledge or skill is put into practice within any educational setting. To create an OEE in Discovery Learning Platform, the educator is guided to think of her/his teaching experience or his/her own learning experience, and how it can bring something to education (meta-reflection). Then, the Platform assures that the information is shown in a structured and usable way, rich and at the same time, concise enough not to lose clarity and remain executive. Visual clarity and appeal are also taken into consideration.

To achieve these purposes, we have worked with Scenikus start-up into adapting their platform for contents from performing arts to hosting and sharing OEEs. The same way Scenikus claims that one of their key advantages is that their platform is build from artists for artists; in Discovery Learning we wanted to develop a Platform from educators to educators (bottom-up approach). Educators include teachers, professors, and stakeholders in non-formal education (such as professional trainers and, even, coaches).

The idea was to reach Proof of Concept level for the platform: to implement a beta version, feed it with a minimum critical mass of OEEs, and test the potential interest from the community of educators and institutions. Results show quite promising for the future, and a continuation proposal has been already submitted to the EC for evaluation.

2. Relevancy of Discovery Learning hypotheses

Two hypotheses were defined in D2.1 "Detailed protocol for DISCOVERY LEARNING pilot" to be addressed during the project's lifetime:

Hypothesis
If specific / punctual enriched activities by practitioners are inserted within the training programme, then: 1. The level of engagement and performance improves significantly ('engagement' meaning their level of activation and participation in the activities, discussions and practice; 'performance' referring to the quality of their contributions). 2. Then institutions can train more students in transferable skills related to open science and innovation.
If trainees are given SMART[1], work-based training activities within real situations in real time, and engage in them with the real owners of the activity (practitioners), then: 1. Trainees can develop several transferable skills simultaneously, and take them to a further level in a time-efficient way; 2. Trainees can increase their awareness of their skills and their relevance for career development (facilitating metareflection about skills and, therefore, increasing the level of acquisition of related skills as well as their interest to keep improving in the mastery of these skills).

At the time of defining experimental activities during Discovery Learning pilots, it had to be assured that research data would be compiled to advance towards validating these hypotheses, at least their core parts. This way, during the programme of webinars, participants were surveyed before and after around variables related to the 1st hypothesis, in order to test point 1 (about the level of engagement). Numbers in participation and registration to these webinars somehow serve as demonstration evidence around point 2 (number of students institutions can train), at least for the time and resources available during this project.

In relation to the 2nd hypothesis, the disruptive idea of the mini-projects was tested, and participants were interviewed at the end to compile data that could help towards the validation of their impact over the development of transferable skills, both in terms of number of skills trained an awareness for the empowerment of PhD candidates and ESRs.

These 2 hypotheses and the experimentation around them, are considered important cornerstones towards the fulfilment of the project's vision (a participatory, empowered and evolutionary work-based learning in PhD programmes for effectively training transferable skills related to open science and innovation, as described in D2.1).

[1] Specific, Measurable, Achievable, Relevant, Time-bound.

3. Enriched engagement of practitioners in training

3.1 Research approach: DISCOVERY LEARNING Hypothesis

DISCOVERY LEARNING aimed at exploring the positive impact that punctual enriched activities with practitioners have over the level of engagement during training of transferable skills of PhD candidates and early-stage researchers (ESRs), having been demonstrated in bibliography that 'engagement' considered the level of activation and participation in the activities, discussions, and practice, is proportional to the level of learning gained (in example[2].

Experimental hypothesis	Punctual activities with practitioners enriched with gamification and/or work-based learning, increase the level of engagement in the development of transferable skills of PhD candidates and early-stage researchers (ESRs).

3.2 Variables

Table 1 represents the variables analysed during DISCOVERY LEARNING experimentation through webinars; and Table 2 describes the contents, structure and layout of the data collection gathered.

Table 1
Variables of the study

Variable	Nature	Function	Type	Leve lof measurement
Leve lof engagement	Quantitative	Dependent variable	Discrete	Ordinal
Gender	Qualitative	Control	Polytomous	Nominal
Age	Qualitative	Control	Polytomous	Nominal
Nationality	Qualitative	Control	Polytomous	Nominal
Teaching practice	Qualitative	Intermediate	Polytomous	Nominal

Table 2
Codebook

Item	Variable	Variable label	Code	Values lable
C.0	C.0 Web.	Webinar identification	1, 2 …	----------
C.1	C.1 Ident	Individual identification	01, 02…	----------

[2] Anaya Nieto, D. (2014). Bases del aprendizaje y educación. UNED/Sanz Torres, 2ª edición.

C.2	C.2 Gen.	Gender	0 1 2	Male Female No answer
C.3	C.3 Age.	Age	0 1 2 3	From 18-20 From 20-25 From 25-30 >30
C.4	C.4 Nation.	Nationality	----------	Name of country
C.5	C.5 Teach.	Teaching practice	0 1 2	Gamification Work-based learning Mixed (gamification + work-based learning)
C.6	C.6 Engag.	Level of engagement	1, 2, 3, 4, 5	----------

In relation to variable C.7 Level of engagement, full explanations about its functioning are given in Section 3.4.

3.3 Methodology

A programme of webinars has been organised from September 2021 through May 2022. Different topics where selected to cover several transferable skills related to open science and innovation (see Table 3). The purpose was to cover all categories of skills identified in DISCOVERY LEARNING's ontology of transferable skills related to open science and innovation (see deliverable D1.1). All webinars had a 3h duration.

This programme was divided into 2 loops:

- Loop 1, from September to December 2021.
- Loop 2, from January to May 2022.

Topics were mostly repeated in both loops. The idea was to make it possible to do as many analysis as possible, also beyond the project's lifetime (see further comments in sections 3.4.4 and 3.5) and, at the same time, be able to refine procedures and methods from loop to loop, and manage the efforts from Discovery Learning's Partners (members of the project's consortium).

Some new topics appeared in loop 2 coming from participants' or practitioners' requests.

Table 3
Topics and dates

C.0	Topic	Dates	Responsible partner	Target skills	Teaching practice	Type of practitioner engaged
1	Building careers as scientist diplomats	Oct 2021 (loop 1) Jan 2022 (loop 2)	FECYT	Knowledge transfer management Complex problem solving Working in team Embracing diversity Networking and building alliances Communicating ideas to different audiences	Mixed	Professional from inside academia
2	R&I Project Management and Leadership	Oct 2021 (loop 1)[3]	RTDI	Managing projects Leadership Working in team Analysing problems	Mixed	Professional from outside academia
3	Connecting dots between science and policy	Nov 2021 (loop 1) March 2022 (loop 2)	FECYT	Understanding possible impact of research Complex problem solving Data-driven decision making Working across boundaries Communicating results of research Communicating ideas to different audiences Engaging stakeholders	Mixed	Professional from inside academia
4	ABC of career planning for researchers	Nov 2021 (loop 1) March 2022 (loop 2)	SAIA	Asking questions Growth mindset and initiative Networking and building alliances	Work-based learning	Professional from outside academia
5	Building integral project ideas and get them ready to grow	Nov 2021 (loop 1) Feb 2022 (loop 2)	RTDI	Creative thinking Understanding possible impact of own research Prototyping Understanding innovation User focus Getting buy-in and negotiating Mobilising funding Analysing problems	Mixed	Professional from outside academia

[3] Loop 2 was uptaken by SAIA (see webinar number 12).

C.0	Topic	Dates	Responsible partner	Target skills	Teaching practice	Type of practitioner engaged
6	Agile, agile everywhere…but what does it really mean?	Dec 2021 (loop 1)	SAIA	Working in team Understanding innovation Prototyping Managing projects	Work-based learning	Professionals from outside academia
7	Innovation modelling to create impact from research	Dec 2021 (loop 1) March 2022 (loop 2)	RTDI	Understanding innovation Growth mindset and initiative Understanding possible impact of own research Getting buy-in and negotiating User focus Mobilising funding Communicating results of research	Gamification	Professional from outside academia
8	Communicating research results to different audiences	Jan 2022 (loop 1) April 2022 (loop 2)	RTDI	Communicating results of research Working across disciplinary boundaries Embracing diversity Analysing problems Communicating ideas to different audiences Mobilising funding User focus Networking and building alliances	Mixed	Professional from outside academia
9	Organize and document your data for Open Science	Feb 2022 (loop 2)	UIO	Sharing own work with others Working across boundaries Managing projects Working in team	Work-based learning	Professional from within academia
10	Sharing data for open collaboration	Feb 2022 (loop 2)	SAIA	Sharing own work effectively (Open Science) Working in team Working across disciplinary boundaries Encouraging co-creation	Work-based learning	Experienced researchers
11	The art of communicate science	March 2022 (loop 2)	FECYT	Communicating results of research Sharing own work with others Analysing problems Embracing diversity Seeking and processing information Communicating ideas to different audiences Engaging stakeholders,	Work-based learning	Professional from outside academia

C.0	Topic	Dates	Responsible partner	Target skills	Teaching practice	Type of practitioner engaged
12	A very basics of the project management	April 2022 (loop 2)[4]	SAIA	Working in team Understanding innovation Prototyping Managing projects	Gamification	Professional from outside academia
13	How leadership plays a crucial role in research and innovation	May 2022 (loop 2)	RTDI	Managing projects Leadership Working in team Analysing problems	Mixed	Professional from outside academia

[4] Loop 1 was done by RTDI (see webinar number 2).

Webinars were open, and anybody interested could register. Our target were PhD candidates and ESRs from any discipline. English was used as common language both for the training and related surveys.

Eventbrite was used as registration platform; and webinars were disseminated via the project's website and social networks, as well as via the partners' contacts network. MS Teams was used as online platform, since it allowed to split participants into smaller working groups for carrying out activities. This was considered a relevant feature.

Participants were made aware about the fact that they were taking part into a pedagogic research project, and the webinars were part of the experimentation planned. They were all invited to participate into "before the training" and "after the training" surveys to contribute to this research, which was voluntary. Surveys could be left anonymous or voluntarily giving name and email in case we needed to deepen up in the responses given.

Surveys were managed with Survey Anywhere platform because it allowed creating most usable surveys by allowing multiple types of questions and interactions. They can be accessed from:

- "Before the training" survey (BT): https://su.vc/wnuycdlp
- "After the training" survey (AT): https://su.vc/aidswvhs

Questions in these surveys are also included in Annex 1, although not showing the advanced options Survey Anywhere offered to make it more fun and intuitive for participants to give their answers.

All participants staying for more than 60% of the webinar duration were given a certificate of attendance, as the one shown in Annex 2.

Data obtained was then processed at 2 levels:

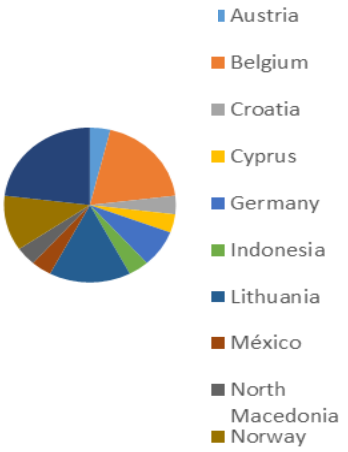
- **Descriptive**: Distribution of frequencies were analysed in relation to variables: gender, age, nationality, and discipline. In the following section, graphics representing these distributions are presented per variable, to offer a global vision of the group. Full data is compiled and made open in D3.6 "Research data from project to open data pilot".
- **Inferential:** To draw conclusions about the higher-level education of PhD candidates and ESRs through observations of the data compiled (samples), through analysis of correlations and hypothesis testing.

3.4 Data analysis

3.4.1 Control variables: Distribution of frequencies.

The following graphs show the distribution of frequencies for variables: C.2 Gen., C.3 Age., and C.4 Nation., which are the control variables for the study. They are analysed per webinar. No data is available for webinars 11, 12 and 13.

Webinar 1: Building careers as science diplomats

Country:	Gender:	Position:
		

Webinar 2: Active training in R&I Project Management and Leadership - 25 October 2021

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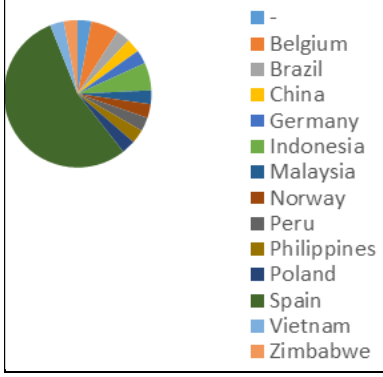	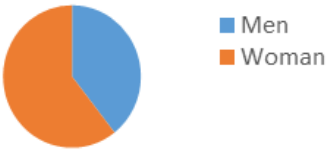	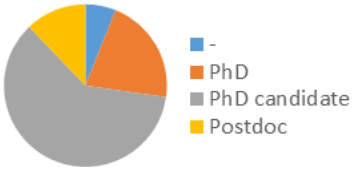

Webinar 3: Connecting dots between science and policy - 19 November 2021

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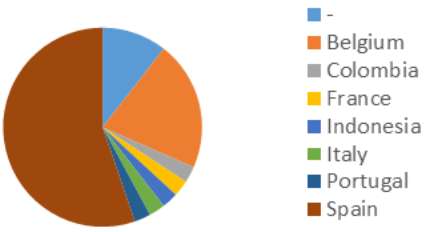	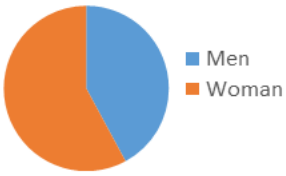	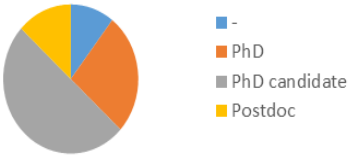

Webinar 4: ABC of career planning for researchers - 10 November 2021

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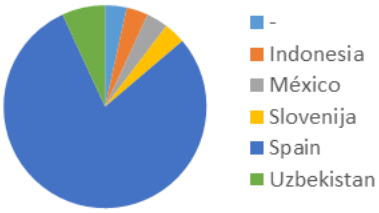	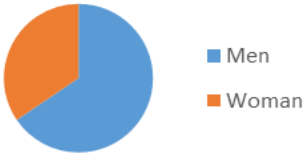	

Webinar 5: Building integral project ideas and get them ready to grow – 23 November 2021

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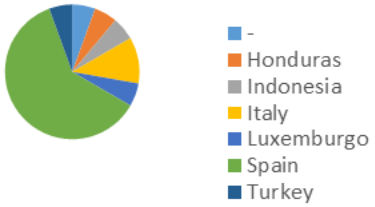	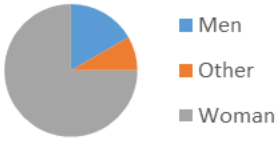	

Webinar 6: Agile, agile everywhere…but what does it really mean? – 3 December 2021

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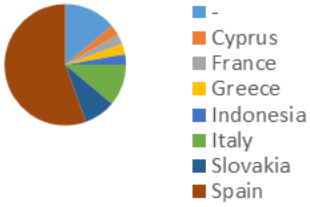	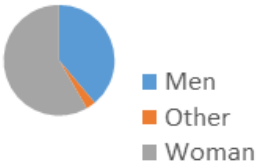	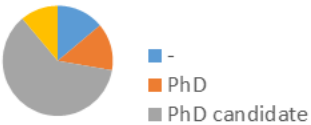

Webinar 7: Innovation modelling to create impact from research – 9 December 2021

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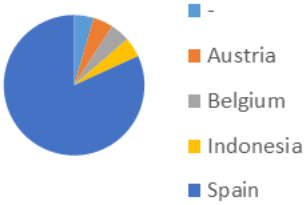	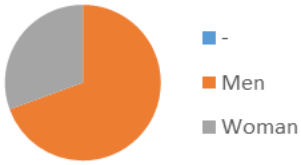	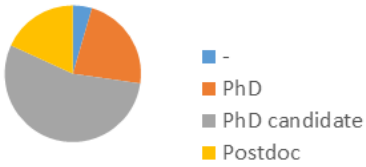

Webinar 8: Communicating research results to different audiences – 13 January 2022

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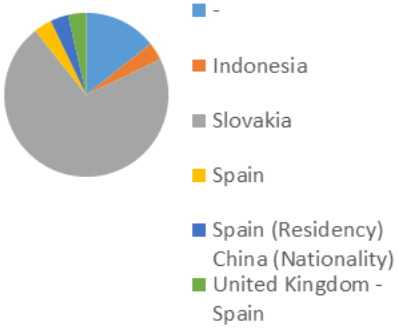	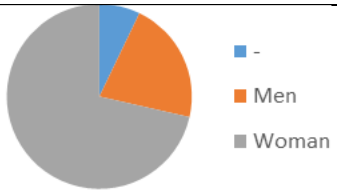	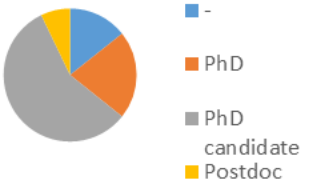

Webinar 9: Organize and document your data for Open Science – 3 February 2022

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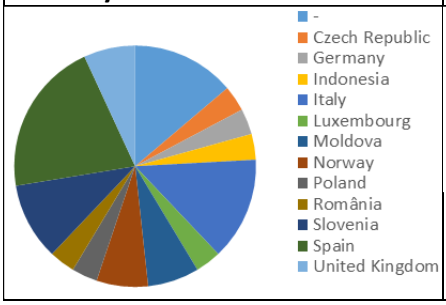	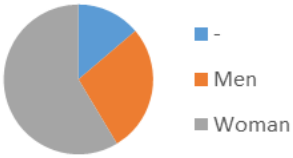	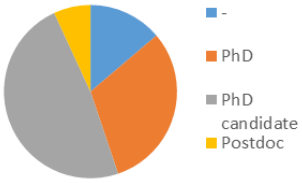

Webinar 10: Sharing data for open collaboration – 18 February 2022

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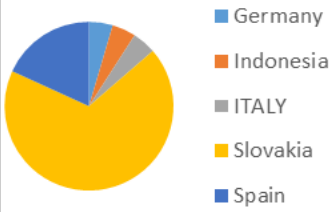
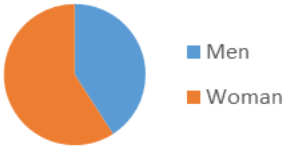
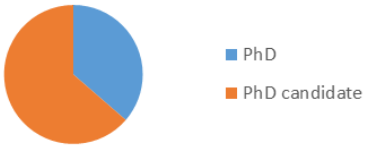
		

It can be observed that people from very diverse nationalities took part in these webinars, with almost all countries in the European continent represented (including Turkey), as well as participants from America (Mexico, Peru, Colombia, Honduras and Brazil), Asia (Uzbekistan, Philippines, Malaysia, China, Indonesia and Vietnam), and Africa (Zimbabwe). This is something that participants really appreciated in the after-webinar surveys, and turn out to be one of most valuated aspects (together with the fact that they belonged to also very diverse disciplines).

It is also observed that, with a few exceptions, a majority of women took part in the webinars; and that most participants were PhD candidates, which was the project's main target.

3.4.2 Level of engagement before and after the training

To assess the level of engagement of participants before and after DL's training enriched activities with practitioners, they were surveyed through open and qualitative questions, and opinion-leaded questions (see Annex 1). The idea was to prevent them from feeling they were evaluating themselves ("putting themselves a grade"), because during exploratory experiments at the beginning of the project, it had been detected that this introduced strong biases in their responses[5].

Examples of open and qualitative questions that follow this strategy are: *What did you like the most from this session?; What do you think was most valuable?; You are given a wish in relation to how to run this interaction with practitioners during training, what would you wish?.* Examples of opinion-leaded questions are: *Rate how much do you agree or disagree with the statement "I think having sessions hand in hand with practitioners (active and senior professionals in the*

[5] In D2.1 "Detailed protocol for DISCOVERY LEARNING pilot", two experimental phases are described as Pilot 1 and Pilot 2 activities; and results from Pilot 1 are fully described.

target topic) will be very valuable for the efficiency of my training", or with "I really wish these interactions with practitioners were done in my classes".

Of course, this created the challenge to find a way to transform the open / qualitative responses from participants into a measurement of their level of engagement, so that statistical analysis around the hypothesis was possible. It was decided to break responses into keywords and classify these into families. Some of these families were related to the participants' level of activation and participation in the activities, discussions, and practice and, therefore, accounted for their level of engagement (as explained in Section 3.1). This strategy allowed to define the following scale:

Level of engagement	1	*Family of words mentioned is 0 or 1*
	2	*Family of words mentioned is 2 or 3*
	3	*Family of words mentioned is 4 or 5*
	4	*Family of words mentioned is 6 or 7*
	5	*Family of words mentioned is 8, 9 or 10*

Thus, the responses to open-field, qualitative and opinion-leaded questions within the "before the training" (BT) and "after the training" (AT) surveys provided to all participants in the webinars have been synthesized into keywords as described below. Questions are numbered Q1, Q2, QN. A minimum of one and a maximum of three keywords have been extracted from each response.

BEFORE THE TRAINING SURVEY

As it can be seen in the links provided and in Annex 1, this survey is structured in 3 parts:

Before the training survey (BT)	PART 1 - From Q1 to Q6	Referential information and control variables (affiliation, discipline, age, gender, etc.)
	PART 2 – From Q7 to Q9	Participant's preferences and thoughts around training with the engagement of practitioners
	PART 3 – From Q10 to Q13	General participant's expectations ("wishes") around training.

Parts 2 and 3 are the target of this study.

Keywords from the participants' responses to **BT/Q12 (*You are given a wish in relation to how to run this interaction with practitioners during training. What would you wish?*)** were extracted according to the following families: 1) [*Topics*] responses that emphasize topic-related issues (include words as: 'science diplomacy', 'research', 'career path'); 2) [*General Assets*] responses that emphasize generic, conceptual, or abstract issues (include words as: 'knowledge', 'experience', 'information'...); 3) [*Personal Assets*] responses that emphasize a particular or personal interest of the respondent (include words as: 'personal skills', 'personal research', 'personal growth'); 4) [*Activities/Participation*] responses that emphasize either activities that require multiple participants, or activities that imply a high level of participant's engagement (include words as: 'networking', 'collaboration', 'exploration'); 5) [*Reactive actions*] responses that emphasize activities that require little participant's engagement (includes words as: 'listening', 'mentoring'); 6) [*Actors*] responses that address some of the actors engaged in the sessions (includes words as: 'practitioners', 'lecturers', 'peers').

The following example is meant to illustrate the keyword-extracting process conducted:

RESPONSE:
"It would be great to make the session interactive [1] and immersive [2] –but first of all, have clear [3] instructions!"
EXTRACTED KEYWORDS:
[1] [*Activities/Participation*]: interaction;
[2] [*Activities/Participation*]: immersion;
[3] [*General assets*]: clarity.

Keywords from the participants' responses to **BT/Q13 (*You are now given a wish in relation to how NOT to run these sessions with practitioners. What would you wish?*)** were extracted and categorized according to the following categories or families: 1) [*Avoid*] responses that address aspects participants would like that were avoided during the sessions (includes words/concepts as: 'useless exercises', 'too much theory', 'unapplicable concepts', 'unspecific jargon'); 2) [*Foster*] responses that address positive aspects which participants would like that were applied in the sessions (includes words/concepts as: 'share experiences', 'share knowledge', 'balance').

Figure 1: *Word-clouds representing the families of keywords obtained from BT surveys to participants in DL's webinars.*

AFTER THE TRAINING SURVEY

As it can be seen in the links provided and in Annex 1, this survey is structured in 3 parts:

After the training survey (AT)	PART 1 - From Q1 to Q7	Referential information and control variables (affiliation, discipline, age, gender, etc.). Since the surveys were in principle anonymous, we needed to gather these again. Also, the title of the webinar in which they had taken part.
	PART 2 – From Q8 to Q11	Participant's preferences and thoughts around training with the engagement of practitioners; to try to see the evolution.
	PART 3 – From Q12 to Q16	General participant's perceptions around the webinar.

Parts 2 and 3 are the target of this study.

The keywords from the responses to **AT/Q13 (*What did you like the most from this session?*)**, **AT/Q14 (*What do you think was most valuable?*)** and **AT/Q15 (*What would you do differently?*)** were initially extracted and categorized according to the following categories: 1) [Topic-related], and 2) [Session-related].

Keywords under [Topic-related] were further categorized according to the following families: 1) [*Topics*] responses that address the specific topic discussed in the webinar session (e.g., science-diplomacy, business ideation); 2) [*Assets*] responses that address unspecific, conceptual or abstract issues related to the webinar session (e.g., information, knowledge, experience); 3) [*Tools*] responses that address some specific tool introduced or used during the webinar session (e.g., business model canvas, read-me file, etc.).

Keywords under [Session-related] were further categorized according to the following families: 1) [*Activities*] responses that address activities carried out in the webinar session, without direct reference to the topic itself (e.g., interaction, sharing, discussing, etc.); 2) [*Emotions*] responses that address personal emotions/feelings triggered during the webinar session (e.g., challenging, confidence, thankfulness); 3) [*Structure*] responses that address directly to organizational aspects, methodologies or procedures carried out during the webinar session, without direct reference to the topic itself (e.g., time-management, Q&A dynamics, clarity, pragmatism, etc.); 4) [*Actors*] responses that address directly to some of the actors involved in the webinar session (e.g., practitioners, lecturers, experts, peers, etc.).

Non-specific responses to AT/Q13, AT/Q14 and AT/Q15 (including words as 'all', 'everything', 'none' or 'nothing') were not considered for extracting keywords.

Figure 2: *Word-cloud representing new keywords discovered by participants in AT surveys for DL's webinars.*

All responses to the surveys have been compiled within D3.6 "Research data from project to open data pilot". This deliverable also includes all data related to counting and grouping keywords. These research data have been published under a FAIR and open model in Zenodo at: https://zenodo.org/record/6594358#.YpTLHVRBw2w

ANALYSIS OF DATA

Table 4 defines the values for variable "Level of engagement" as a result of the described strategy around keywords. The variable is calculated before the training (BT) and after the training (AT), which will allow to carry out a statistical hypothesis testing based on the level of

change achieved by the enriched training with practitioners. This way, the participants in DL's webinars will serve both as control and experimental group and data will be paired, since it was not possible for this project to gather data from outside this sample (from non-participants in webinars). Being the level of engagement an ordinal variable (see table 1), for this analysis the Wilcoxon signed-rank test has been chosen.

Table 4
Data related to number of keywords related to participation and activation of trainees and their corresponding level of engagement

C.0 Web.	N BT	N AT	Num. of family keywords BT	Num. of family keywords AT	C.6 Engag. (BT)	C.6 Engag. (AT)	C.6 Engag. BT-AT	Signed-rank
1	55	18	4	7	3	4	-1	4.5
2	8	7	4	6	3	4	-1	4.5
3	47	25	3	4	2	3	-1	4.5
4	20	20	2	4	2	3	-1	4.5
5	27	21	3	3	2	2	0	
6	18	11	2	6	2	4	-2	9.5
7	37	40	4	3	3	2	1	4.5
8	13	28	6	3	4	2	2	9.5
9	35	14	4	4	3	3	0	
10	18	12	4	3	3	2	1	4.5
11	19	12	2	2	2	2	0	
12	10	15	0	3	1	2	-1	4.5
13	15	0	3	0	2	1	1	4.5

**Results have been normalized to correct differences in the number of responses to BT and AT surveys.*

For the statistical hypothesis testing, the first step is to define a null and alternative hypothesis; in this case:

Null hypothesis	The is no significant difference in the level of engagement before and after the training with enriched participation of practitioners.
Future hypothesis	The level of engagement after the training is significantly higher than the level of engagement before the training.

Taking into account there are 10 pairs having BT-AT differences not equal to 0, the critical value for Wilcoxon test is 8 (for a significance level α=0.05 - taken from standard tables). Since the value calculated from experimental ranks is equal to 23 (> critical value), it means no significant difference is shown between before and after the training with this research methodology.

3.4.3 Teaching practice vs level of engagement: Correlation analysis.

At this moment, the purpose is to analyse if there is a significant correlation between the level of engagement after the training and the teaching practice implemented during the webinar. For this purpose, given the type of these variables (ordinal or polytomous), the Spearman rank-order correlation coefficient is chosen.

Table 5
Range values for the level of engagement and teaching technique used and their differences. Calculating Spearman rank-order correlation coefficient.

C.0 Web.	C.5 Teach. (X)	C.6 Engag. (AT) (Y)	Range (X)	Range (Y)	D^2
1	2	4	10,5	11	0,25
2	2	4	10,5	11	0,25
3	2	3	10,5	8	6,25
4	1	3	5	8	9
5	2	2	10,5	2	72,25
6	1	4	5	11	36
7	0	2	1,5	2	0,25
8	2	2	10,5	2	72,25
9	1	3	5	8	9
10	1	2	5	2	9
11	1	2	5	2	9
12	0	2	1,5	2	0,25
13	2	1	10,5	1	90,25

The resulting r_S is equal to 0,14, which means no significant correlation detected.

3.4.4 Further observations

During this project, some general comparisons could be done between the 2 loops of webinars described in section 3.3, and also between the answers to specific questions in the "before the training" (BT) and "after the training" (AT) surveys provided to all participants in the webinars, since there are direct relations between certain questions:

- **Between question BT/Q9 (*I really wish these interactions with practitioners were done in my classes*) and question AT/Q8 (*I wish more sessions with practitioners were embedded into my training*)[6]**: These questions are intended to measure the attitude of participants towards the engagement of practitioners in education, before and after taking part in an enriched training activity with them around specific transferable skills related to open science and innovation. The difference between responses to these questions before and after, gives an indication of the impact of DL's 3-hour webinars.
- **Between question BT/Q7 (*I think having sessions hand in hand with practitioners will be very valuable for the efficiency of my training*) and question AT/Q9 (*Working with practitioners enriches training very importantly*)[6]:** BT/Q7 is aimed to measure the added value that participants expect to extract from the trainings with practitioners. AT/Q9 aims to measure such same value in relation to the direct experience of the session. Thus, the difference between the responses to each question indicates the impact that the experience has generated on their expectations. Positive differences (at a minimum variation of ±5%) indicate that the session has exceeded their expectations in relation to the value they have extracted.
- **Between question BT/Q8 (*Just listening to the practitioner talking about the topic will be enough to get value out of his/her "visit"*) and question AT/Q11 (*Enriched sessions***

[6] Answer to these questions was given in the form of a percentage of agreement with the statement.

***with practitioners allow training to go beyond average limits / to go further in training*)[6]:** BT/Q8 is aimed to measure the level of expected activeness/passiveness of the participants before the training. AT/Q11 is aimed to measure the acceptance/adequacy of the enriched activities conducted during the webinar. The difference between the responses to these questions indicates the level of acceptance of active training as opposed to passive training. Positive differences (at a minimum variation of ±5%) indicate the transformation of participants' acceptance towards more active webinars.

- Firstly, about the comparison between BT/Q9 and AT/Q8, Table 6 shows the results before and after the webinars for both training loops.

Table 6
Transformations in participants' predisposition towards sessions with practitioners

	Loop 1	Loop 2	△	Average*
BT/Q9	76,50	70,73	-5,77	72,43
AT/Q8	81,94	78,59	-3,35	79,58
△	+5,44	+7,86		+7,15

**Average results have been weighted to correct differences in the number of participants of each Loop.*

Responses to loop1 present a higher initial predisposition and show a significant improvement in relation to participants' predisposition towards sessions with practitioners, while responses to loop 2 present lower initial and final predisposition, but the relative improvement of this variable is higher. This somehow validates that webinars were effective in improving the predisposition of participants towards sessions with practitioners.

- Secondly, in relation to questions BT/Q7 and AT/Q9, Table 7 shows the results before and after the webinars for both training loops.

Table 7
Transformations in participants' expected value

	Loop 1	Loop 2	△	Average*
BT/Q7	87,10	80,34	-6,76	82,32
AT/Q9	85,78	85,72	-0,06	85,74
△	-1,31	+5,38		+3,42

**Average results have been weighted to correct differences in the number of participants of each Loop.*

The negative gap in loop 1 (-1,31%) could mean certain underachievement of the webinars in terms of exceeding participants' expectations. However, the positive gap in loop 2 indicates a significant improvement in that same respect (+5,38%). A transversal reading of the data indicates significant differences in participant's expectations: whereas loop 1 started from higher positive expectations and did not get to improve them, loop 2 started with lower expectations which were significantly exceeded. This may point to several issues: 1) That the impact of the webinars in the perception of added value is related to external factors of the participants that were not controlled in this study (e.g.: it is easier to exceed expectations if initial expectations are low); 2) That there may be a threshold of expectation which is statistically difficult to exceed.

- Finally, in relation to questions BT/Q8 and AT/Q11, Table 8 shows the results before and after the webinars for both training loops.

Table 8
Transformations in participants' acceptance of active sessions

	Loop 1	Loop 2	△	Average*
BT/Q8	67,47	62,37	-5,10	63,88
AT/Q11	80,50	76,56	-3,94	77,72
△	+13,03	+14,19		+13,84

**Average results have been weighted to correct differences in the number of participants of each Loop.*

It can be observed that DL's webinars seem successful in improving participants' acceptance towards active sessions, which is a very relevant observation in relation to the hypothesis under research, since it is directly related to the level of engagement. The positive transformation of participants' acceptance towards active sessions is consistent and significant in both loops.

Several further observations around this idea can be extracted from the answers to questions related to the participants' expectations and perceptions (PART 3 of both surveys). Table 9 shows a) the number of keywords distributed among families, and b) their percentages in relation the overall number of keywords.

Table 9
Wishes on how to run the training. BT/Q12[7]

	Topics	General Assets	Personal Assets	Activities / Participation	Reactive Actions	Actor-Related
Loop 1 (N = 107) *a. Number of keywords in the family from participants' answers*	10	25	10	33	9	20
b. % Over total number of keywords	9,35%	23,36%	9,35%	30,84%	8,41%	18,69%
Loop 2 (N = 219) *a. Number of keywords in the family from participants' answers*	23	55	13	73	18	37
b. % Over total number of keywords	10,50%	25,11%	5,94%	33,33%	8,22%	16,89%
△	+1,15%	+1,75%	-3,41%	+2,49%	+0,19%	-1,80%
Average*	10,12%	+24,54%	7,05%	32,51%	8,28%	17,48%

**Results have been weighted to correct deviances due to differences in the number of participants.*

Despite some minimal variations, there is a strong consistency of results from loop 1 to loop 2: 1) 30-33% of wishes from participants before the training are related to Activities/Participation ('networking', 'collaboration',); 2) 16-25% of wishes are related to either Actors ('practitioners', 'peers') or General Assets ('knowledge', 'experience'); and 3) 5-10% of wishes are related to Topics ('science diplomacy', 'career path'), Personal Assets ('personal skills', 'personal growth') or Reactive Assets ('listening', 'mentoring').

This distribution points out that participants openly emphasize initiative-taking activities during training sessions (such as "work," "collaboration," or "networking"), in a clear opposition to

[7] Question text: *You are given a wish in relation to how to run this interaction with practitioners during training. What would you wish? Fill in your wish card!*

more reactive, passive training schemes. Participants are eager to engage in their training during the webinars, and this message is reinforced by their answers to other questions in PART 3 of the "before training" survey. Table 10 exemplifies this by showing a ranking of the most repeated keywords in BT/Q13.

Table 10
Wishes on how not to run the training. BT/Q13[8]

	'Avoid' Keyword	Nº	'Foster' Keyword	Nº
Loop 1	"Only theory"	11	"Practice"	14
	"Too much theory"	6	"Experiences"	3
	"Unidirectional communication"	3	"Practical [...]"	3
Loop 2	"Too much theory"	31	"Theory/Practice"	18
	"Too much practice"	6	"Combination/balance"	15
	"Unidirectional communication"	4	"Practice"	15
	"No examples"	4	"Interaction"	4

There is a consistent emphasis in participants' wishes to avoid "Too much theory." Likewise, there is a consistent emphasis in participants' wishes to foster "practice," or a "balanced" combination of "theory/practice."

In line with this, Tables 11 and 12 show the distribution of keywords among structured families for AT/Q13 and AT/Q14.

Table 11
What participants liked the most from the session. AT/Q13[9]

	Topics	Assets	Tools	Activities	Emotion	Structure	Actors
Loop 1 (N = 70) *a. Number of keywords in the family from participants' answers*	2	13	4	25	10	14	2
b. % Over total number of keywords	2,86%	18,57%	5,71%	35,71%	14,29%	20,00%	2,86%
Loop 2 (N = 152) *a. Number of keywords in the family from participants' answers*	10	45	15	37	7	15	23
b. % Over total number of keywords	6,58%	29,60%	9,87%	24,34%	4,61%	9,87%	15,13%
△	+3,78%	+11,03%	+4,16%	-11,31%	-10,19%	-10,13%	+12,27%
Average*	5,40%	26,13%	8,56%	27,93%	7,66%	13,06%	11,26%

**Results have been weighted to correct deviances due to differences in the number of participants.*

Even though loop 2 shows an important increase in keywords referring to Assets, keywords referring to specific Activities are consistently used by participants to express their preferences

[8] Question text: *You are now given a wish in relation to how NOT to run these sessions with practitioners. What would you wish? Fill in your wish card!*
[9] Question text: *What did you like the most from this session?*

from the webinars. More specifically, issues of "participation" and "gamification" were highly considered among participants.

Table 12
What participants consider most valuable from the session. AT/Q14[10]

	Topics	Assets	Tools	Activities	Emotion	Structure	Actors
Loop 1 (N.: 63) *a. Number of keywords in the family from participants' answers*	6	24	9	16	2	5	1
b. % Over total number of keywords	9,52%	38,10%	14,29%	25,40%	3,17%	7,94%	1,59%
Loop 2 (N.: 118) *a. Number of keywords in the family from participants' answers*	26	50	9	17	2	2	12
b. % Over total number of keywords	22,03%	42,37%	7,63%	14,41%	1,69%	1,69%	10,17%
△*	+12,51%	+4,27%	-6,66%	-10,99%	-1,48%	-6,25%	+8,58%
Average*	17, 68%	40,88%	9,94%	18,23%	2,21%	2,21%	7,18%

**Results have been weighted to correct deviances due to differences in the number of participants.*

In addition to this, it is also observed that participants primarily used keywords related to Assets to express what they considered to be the most valuable aspect extracted from the webinars. These assets show closely related to the active presence of the practitioner, as further detailed in Table 13.

Table 13
Ranking of keywords referring to Assets. AT/Q14[11]

	Keyword	Nº
Loop 1	"Knowledge"	5
	"Examples"	4
	"Expertise"	4
	"Information"	3
	"Insights"	3
Loop 2	"Information"	8
	"Tips/Advice"	7
	"Experience"	5
	"Insights"	4

Finally, in relation to answer to the question "*What would you do differently?*", most common comments are related to time-management (finishing exactly at the planned time) and technical issues, together with more online interaction and smaller working groups.

[10] Question text: *What do you think was most valuable?*
[11] Question text: *What do you think was most valuable?*

3.4.5 Focus group with PhD candidates and ESRs

In May 2022 a focus group was organized with PhD candidates and ESRs. Initially, it was planned to organize it with participants in DL's webinars who had answered to the before-training and after-training surveys identifying themselves in case we needed to consult them further (name and email were only provided voluntarily). However, after several attempts with different samples, it was decided to open it up to any interested PhD candidate or ESR in order to have an optimum number of participants. The purpose was to gather as much feedback as possible around the methods being used in Discovery Learning to enrich the training with the participation of practitioners. Annex 3 includes the detailed programme and disaggregated insights compiled. In this section, we focus on the main conclusions around Discovery Learning hypothesis.

Focus groups result into open/qualitative feedback and inputs that need to be processed systematically. At this stage, we aimed to assure that results:

1. Would be complementary or integrable with the results obtained from the surveys;
2. Would bring added value to the research;
3. Would be reliable enough to at least pave the way to further research around the hypothesis under investigation.

The structure and dynamics of the agenda in Annex 3 had already been designed taking these into consideration. At the time of processing data, it was decided that following a strategy similar to the one described above of breaking inputs into keywords, classifying them into families, and analysing their relationship with the hypothesis, was appropriate to meet the expected aims. Table 14 shows the list of keywords detected and their frequency within participants' inputs and answers. From this table, a new cloud of keywords was prepared (see Figure 3).

Table 14

Keywords and frequencies from participants during the focus group.

Key word	Nº
With practitioners	4
Group work	3
Multi-actor	3
Multidisciplinary	2
With peers	1
Continuous feedback	1
Safe learning space	1
Joint knowledge	1
Learner empowerment	1
Comprehensive	1
Continuous learning support	4
Learning community	1
Lifelong learning	3
Community of practice	2
Continuous learning	4
Real-work-based-learning	2
Meaningful	1
Creativity for impact	1

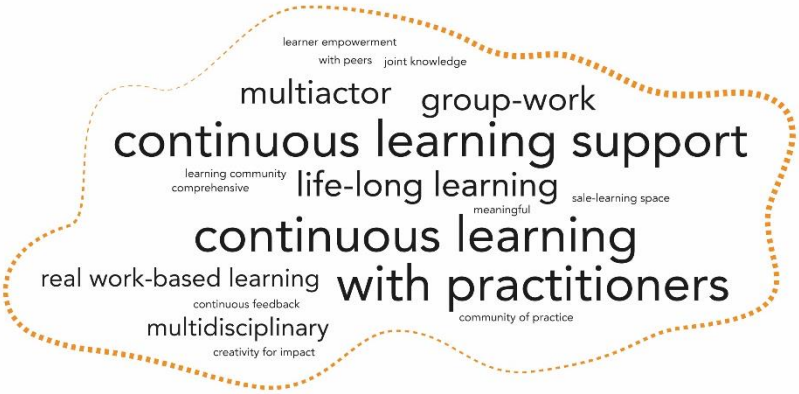


Figure 3: *Word-cloud representing new keywords discovered by participants in AT surveys for DL's webinars*

Putting all clouds of keywords together, a new version of the formulation of the hypothesis has been designed for future research:

Present hypothesis	Punctual activities with practitioners enriched with gamification and/or work-based learning, increase the level of engagement in the development of transferable skills of PhD candidates and early-stage researchers (ESRs) ('engagement' considered the level of activation and participation in the activities, discussions, and practice).
Future hypothesis	Periodic activities with practitioners and peers enriched with gamification and/or work-based-learning, increase the level of engagement during training of transferable skills of PhD candidates and early-stage researchers (ESRs) ('engagement' considered the level of activation and participation in the activities, discussions, and practice), and: 1) increase the awareness and understanding of the targeted skills, 2) accelerates the generation of experience[12], and 3) build open learning communities towards lifelong learning.

3.5 Conclusions and future research

From the experimentation and further analysis described, it is concluded that:

- DL's webinars significantly attracted PhD candidates and ESRs from very diverse nationalities and disciplines, with a majority of women. Multiculturalism and multidisciplinarity create opportunities for peer interaction during webinars highly valued by participants. This is a discovery from the project in which further research would be interesting.
- Participants openly emphasized initiative-taking activities during training (such as "work," "collaboration," or "networking"), in a clear opposition to more reactive, passive schemes. Participants in DL webinars were eager to engage in their training.
- New control variables could be considered, such as the initial level of expectation. Also, it could be analysed if there are threshold values for some of these variables over which it becomes very difficult to have an impact with statistical significancy.
- The level of impact of enriched training with practitioners and peers could be increased if these activities were embedded periodically along PhD programmes (not just one-time webinars). This is worth investigating.
- It could also be explored to make webinars a little bit longer (4 hours), to facilitate the management of time and agenda, and give participants more time to participate and interact. 1-week format trainings could also help optimizing outcomes, as during the seminars carried out by UIO (although this possibility does depend on the training being formally integrated into the PhD programmes, for the participants to have availability and the effort to be accounted for in the form of ECTS).
- Using this continuity to build learning communities could increase the motivation of participants to learn in the medium and long terms and facilitate lifelong learning. This is also worth investigating.

[12] The proficiency, facility, or dexterity that is acquired or developed through practice.

- Participants that identified themselves at the “before” and “after” surveys (giving their names was optional), offer the possibility to carry out statistical analysis with their data that fell beyond Discovery Learning’s timeframe and resources.
- Statistical studies performed during the project, show no significant differences between the participants’ level of engagement before and after the enriched training with practitioners. However, further investigation is needed because: 1) Some questions in the surveys show that Discovery Learning’s webinars have been significantly successful in improving participants’ acceptance towards active learning with practitioners (BT/Q9 vs AT/Q8 and BT/Q8 vs AT/Q11); 2) Participants primarily used keywords related to Assets to express what they considered to be the most valuable aspect extracted from the webinars, and these assets showed closely related to the active presence of the practitioner, and 3) The fact that PhD candidates and ESRs were so eager from the beginning to participate, raises the need for more precise instruments to measure impact.

4. Real-work based learning

4.1 Research approach: DISCOVERY LEARNING Hypothesis

DISCOVERY LEARNING aims at demonstrating that if trainees are given SMART[13], work-based training activities within real situations in real time, and engage in them with the real owners of the activity, then:

3. Trainees can develop several transferable skills simultaneously, and take them to a further level in a time-efficient way;
4. Trainees can increase their awareness of their skills and their relevance for career development (facilitating metareflection about skills and, therefore, increasing the level of acquisition of related skills as well as their interest to keep improving in the mastery of these skills).

4.2 Variables

Table 4 represents the variables analysed during DISCOVERY LEARNING experimentation through mini-projects; and Table 15 describes the contents, structure and layout of the data collection gathered.

Table 15
Variables of the study

Variable	Nature	Function	Type	Leve lof measurement
Training efficiency	Quantitative	Dependent variable	Continuous	Interval
Gender	Qualitative	Control	Polytomous	Nominal
Seniority	Qualitative	Control	Polytomous	Nominal
Discipline	Qualitative	Control	Polytomous	Nominal
Number of skills	Quantitative	Intermediate	Continuous	Interval
Discovery	Qualitative	Intermediate	Dichotomous	Nominal
Utility	Qualitative	Intermediate	Dichotomous	Nominal

Table 16
Codebook

Item	Variable	Variable label	Code	Values lable
C.1	C.1 Ident	Individual identification	01, 02…	----------
C.2	C.2 Gen.	Sex	0 1 2	Male Female No answer

[13] Specific, Measurable, Achievable, Relevant, Time-bound.

C.3	C.3 Senior.	Seniority	0 1 2	Not yet PhD candidate PhD candidate ESR
C.4	C.4 Discipl.	Discipline	0 1 2 3	- Arts and Humanities (History and Archaeology, Languages and Literature, Philosophy, Ethics and Religion…) - Social Sciences (Business, Law, Educational Science, Sociology…) - Applied Sciences (Civil Engineering and Geodesy, Mechanical Eng., Sport, Medicine, health Sciences…) - Natural and Life Sciences (Electrical Eng., Biotechnical, Pharmacy, Chemistry, Mathematics and Physics…)
C.5	C.5 Discov.	Discovery	0 1	Yes No
C.6	C.6 Util.	Utility	0 1	Yes No
C.7	C.7 Num.	Number of skills	0-5*	----------
C.8	C.8 Effic.	Efficiency	1-10	----------

* During interviews, this question was formulated as *"Witch skills from DL`s ontology where trained? (choose 2-5 of them and list them in order of level/depth of training)".*

In relation to variables:

- Discovery: means if participants discovered any skill that they ended up thinking it is important.
- Utility: means if participants are using or planning to use what they learnt.
- Efficiency: Participants are asked to evaluate it in a scale from 1 to 10.
- Number of skills: Number of skills trained simultaneously as claimed by participants during in-depth interviews after the training.
- Awareness impact: means if participants got aware of the transferable skills they had been trained into.
- Life-long learning: focused into knowing of participants claim an interest in continuing training the target skills in the future, and are reflecting about career development plans.

4.3 Methodology

A programme of mini-projects has been organised from October 2021 until May 2022. A mini-project was a small task:

1) Directly related to the contents of a training that were being offered via the webinars described in Section 3, or a highly-demanded transferable skill related to research and innovation;

2) That come from the real world in that particular moment (real time) and, therefore, have an owner (organisation or professional engaged in the task);

So that they can gain experience carrying the task out, with the special motivation of knowing it is for real; increasing the efficiency of the learning, because they will be able to compare their answers to the reality, discuss with the task owner…; in a way that this experience can be showed in their academic record / personal CV.

Table 17
Topics and dates

#	Mini-project (title)	Dates	Responsible partner	Target skills	Number of participants
1	Participating in organizing a project consortium meeting	Nov 2021 Jan 2022	RTDI	-Managing projects -Working in team -Asking questions	1 (full) 1 (only in launching webinar) (6 registered)
2	Patent search feeding unique research solutions	Dec 2021 Jan 2022	RTDI	-Seeking and processing information -Data-driven decision making -Creative thinking	0 (2 registered)
3	Project search feeding unique research solutions	Dec 2021 Jan 2022	RTDI	-Seeking and processing information -Data-driven decision making -Creative thinking	0 (0 registered)
4	Defining the Quantified Value Proposition and getting impactful research	Dec 2021 Feb 2022	RTDI	-Analysing problems -Opportunities alertness -Creative thinking -User focus	1 (full)* 1 (only in launching webinar) (3 registered)
5	Designing an infographic for a high-impact R&D project funded by the EC	Dec 2021 Jan 2022	RTDI	-Communicating results of research -Creative thinking -Understanding possible impact of own research -Seeking and processing information -Prototyping	0 (0 registered)
6	Disseminating findings of EU funded project on research careers in life science sector	Jan – March 2022	SAIA	-Analytical thinking -Creative thinking -Communicating results of research -Communicating ideas to different audiences -Engaging stakeholders -Working across disciplinary boundaries	0 (2 registered)

7	Preparing and facilitating discussion panel for interactive online career workshop	Jan – March 2022	SAIA	-Asking questions -Networking and building alliances -Communicating ideas to different audiences -Engaging stakeholders	0 (2 registered)
8	Developing key communication messages to promote EU funded project in the business and start-up community	Jan – March 2022	SAIA	-Creative thinking -Communicating results of research -Communicating ideas to different audiences -Engaging stakeholders -Working across disciplinary boundaries	1 (full) 1 (only in launching webinar) (5 registered)
9	Drafting a white paper	Jan – Feb 2022	FECYT	-Seeking and processing information -Creative thinking -Working in team -Communicating results of research	1 (full) (1 registered)
10	Participating in organizing a focus group	Jan – May 2022	RTDI	-Engaging stakeholders -User focus -Encouraging co-creation -Working in team	1 (full) (1 registered)

* Did not join the final in-depth interview

Mini-projects were open, and anybody interested could register. Our target were PhD candidates and ESRs from any discipline. English was used as common language both for the training and related interviews.

Eventbrite was used as registration platform; and mini-projects were disseminated via the project's website and social networks, as well as via the partners' contacts network. MS Teams was used as online platform.

Participants were made aware about the fact that they were taking part into a pedagogic research project, and the mini-projects were part of the experimentation planned. All mini-projects started with a 1-2 hour webinar around the task to carry out and the real-world context in which it were to be carried out (in direct contact with the task owner), continued with the task itself, and concluded with the final feedback by the task owner and an in-depth individual interview to the participants to gather data around the hypothesis being tested. Annex 4 compiles the questions during interviews, and the answers from participants.

All participants were given a certificate after completion of the final interview, as the one shown in Annex 2.

Data obtained was then processed at 2 levels:

- **Descriptive**: Distribution of frequencies were analysed in relation to variables: gender, age, nationality, and discipline. In the following section, graphics representing these distributions are presented per variable, to offer a global vision of the group. Full data is compiled and made open in D3.6 "Research data from project to open data pilot".
- **Inferential:** To draw conclusions about the higher-level education of PhD candidates and ESRs through observations of the data compiled (samples), through analysis of correlations and hypothesis testing.

4.4 Data analysis

4.4.1 Control variables: Distribution of frequencies.

Table 18 shows the data related to the control variables of this study from those who completed the cycle from registration to final interview (some registered but never answered to the final invitation mail and some started but could not finish). This accounts for 5 people.

Table 18
Experimental data

#	Mini-project (title)	Target skills	C.1 Ident	C.2 Gen.	C.3 Senior.	C.4 Discipl.
1	Participating in organizing a project consortium meeting	-Managing projects -Working in team -Asking questions	01	Woman	PhD candidate	Natural and Life Sciences
4	Defining the Quantified Value Proposition and getting impactful research	-Analysing problems -Opportunities alertness -Creative thinking -User focus	02	Man	PhD candidate	Social Sciences
8	Developing key communication messages to promote EU funded project in the business and start-up community	-Creative thinking -Communicating results of research -Communicating ideas to different audiences -Engaging stakeholders -Working across disciplinary boundaries	03	Man	PhD candidate	Social Sciences
9	Drafting a white paper	-Seeking and processing information -Creative thinking -Working in team -Communicating results of research	04	Woman	PhD candidate	Natural and Life Sciences
10	Participating in organizing a focus group	-Engaging stakeholders -User focus -Encouraging co-creation -Working in team	05	Woman	ESR	Natural and Life Sciences

It can be observed that, more or less, the idea of mini-projects seems to equally attract men and women (also confirmed if analysing the gender of people registered). Most of them are PhD candidates, because Discovery Learning's community focuses mainly in this group, and most dissemination activities are devoted to them (this is somehow a proof-of-sample-quality variable). There seems to be a balance between participants coming from Natural and Life

sciences and Social Sciences; and nobody from Arts and Humanities, and Applied Sciences participated in mini-projects. This is something to further look into in the future.

4.4.2 Number of skills trained: Qualitative and descriptive analysis.

During the final in-depth interviews carried out with every full participant in a mini-project, one of the main questions was asking them to list the skills they considered they had developed further as a result of the mini-project. Table 19 compiles the data obtained.

Table 19
Statistical analysis of variable "Training efficiency"

C.1 Ident	C.8 Num.	Descriptive statistics
01	5	Average: 4,5 Standard deviation: 1,29 Median: 4,5
02	Null	
03	4	
04	3	
05	6	

Although the sample is very small, descriptive statistical analysis shows clearly that mini-projects trained several transferable skills simultaneously (>3), and participants were aware of this fact.

4.4.3 Level of efficiency: Qualitative and descriptive analysis.

During the final in-depth interviews carried out with every full participant in a mini-project, one of the main questions was asking them to rank in a scale from 1 (lowest level) to 10 (highest level) the level of achievement of their learning objective when they registered to the mini-project. Table 20 compiles the data obtained.

Table 20
Statistical analysis of variable "Training efficiency"

C.1 Ident	C.9 Effic.	Descriptive statistics
01	7	Average: 7,25 Standard deviation: 0,5 Median: 7 Mode: 7
02	Null	
03	8	
04	7	
05	7	

Although the sample is very small, descriptive statistical analysis shows good results in terms of efficiency of training transferable skills related to open science and innovation through mini-projects, particularly when reasons for grades are taken into account, mostly related to the awareness amongst participants about the path to increase the level of development of the target skill/s *("I would give 7/10, because to give a higher rate I would need to develop a project more related to my field of study"; "I would give 7/10, because I know better now what I still have to learn."*).

4.4.4 Correlation between dependant and intermediate variables

In this section, the correlations between the "Training efficiency" and variables "Number of skills", "Discovery" and "Utility" are analysed. The number of skills trained is most relevant since it directly belongs to the hypothesis being tested. In relation to valuable skills discovered by participants by taking part in a mini-project ("Discovery"), it also belongs to the hypothesis, since

it is related to the level of awareness about skills and result of meta-reflections promoted by the training. Finally, whether they find the learning useful and, therefore, are using it or planning to do it shortly ("Utility") is considered interesting from its potential to rise some valuable lesson learnt towards future trainings

Table 21
Analysis of correlation between "Training efficiency" and "Number of skills". Pearson correlation coefficient.

C.1 Ident	C.8 Num. (X)	C.9 Effic. (Y)	X^2	Y^2	XY
01	5	7	25	49	35
02	Null	Null	Null	Null	Null
03	4	8	16	64	32
04	3	7	9	49	21
05	6	7	36	49	42
	18	29	86	211	130

This results into a Pearson correlation coefficient equal to -0,26, which seems to mean that the correlation between these variables is slightly negative, meaning that the greater number of skills trained simultaneously, perception of efficiency of training by participants tends to lower. This could be in line with the descriptive analysis in the previous section, and the reasons given by participants to their evaluation of learning efficiency.

In relation to variables "Discovery" and "Utility", during in-depth interviews all participants expressed to have discovered some skill which they think is important, and this was complemented by the fact that they all considered to have learnt something that would have not been possible to learn if not through real-work-based learning (see Tables 22 and 23). Also, there was unanimity in the opinion that they would use directly what they learnt (with opinions validated by the fact that they could all explain what they would use it for).

Table 22
Answers from participants in Discovery Learning mini-projects - 1

Did you discover any skill that you think now it is important?
"I learnt to always congratulate and give positive feedback, to highlight achievements and the people involved in them"
"'Sharing our own work with others' and 'encouraging co-creation'. For me, they are complementary, and both need structures that allow them to be promoted among doctoral students"
"People need to be more open and extroverted in the private sector. You also need to be flexible, search for solutions to many specific problems and adapt to lot of situations depending on factors outside you."
"I experienced improvisation (adapting to reality on the go), which I found pleasant and refreshing"

Table 23
Answers from participants in Discovery Learning mini-projects - 2

What did you learn that you think wouldn´t have been possible if not via real work-based learning?
"The experience helped me realise that I have the skills I wasn´t aware of and I can use them in different contexts"
"I learnt to land the debates on specific things so that the discussion moves in the same direction"
"Through doing the work, I got a strong reminder of my own creative side, that was a bit dormant. I perceived the importance of crafting and formulating the questions in a particular manner, to be more mindful and intentional in this."
"The greatest opportunity offered by the mini projects is the possibility of challenging paradigms and working in real time and in a practical way."
"Creating something new that brings together all the ideas provided during the process. This is why, the mini projects were extremely useful in showing me the advantages of collaborative and continuous work."

4.4.4 Other insights

Further valuable feedback was obtained during the end-of-mini-project interviews. Table 23 summarizes the main ones:

Table 23
Valuable feedback from end-of-mini-project interviews to participants.

C1.Ident.	01	02	03	04	05
Life-long learning	Null	Null	Yes	Yes	Yes
Reason for joining	Contact with real-world	Null	Contact with real-world	Contact with real-world	Contact with real-world

Most of them expressed their intention and interest to keep training the covered skills in the future (in fact, all those who answered to the question – sometimes the interview took divergent direction and the question was not finally covered, or the interview could not be held). Additionally, all answers express the main reason for them to join the mini-project training activity was to "have the possibility to work in contact with a real project", "Put the theoretical knowledge into practice", "The taste of pudding is in eating!", "Help the real project", or similar sentences. The last example, shows something that is also shared by all participants during the interviews held: the desire to do something that was really helpful or valuable for the task, something that would really be used by the task owner (beyond their learning). And in all cases, it happened this way (e.g.: some participants have been mentioned as contributors to Discovery Learning White Paper and this deliverable). We believe this is a unique outcome from this experiment.

Some of the things participants valued most for their learning:

- "Here the ideas are reviewed over and over again, and a final product is achieved through the contributions of the whole team (collaborative work), creating something new that brings together all the ideas provided during the process. In the future, I think

I will feel freer (and less prejudiced) to express my own ideas in presence of other professionals and researchers."

- "This kind of project is also helpful in increasing the visibility of skills PhD have for the private sector. Thanks to similar activities, private companies can experience what is an added value of collaborating with PhDs."
- "It feels great to live the experience of what it is to get a project going, especially when it engages people from different countries and disciplines."
- "The ontology of skills from DL is very interesting for me, I would like to continue creating opportunities for deliberate training through real work."

Participants interviews also helped us detecting potential improvements towards the future, described in the following section.

4.5 Conclusions

From the experimentation and further analysis described, it is concluded that:

- A great satisfaction is perceived from PhD candidates and ESR having participated into a mini-project.
- The level of interest in the programme of mini-projects is assessed positively, with 23 registered participants to a disruptive training initiative which was not easy/fast to explain (a video was used to make this more effective), attracting people who very often feel packed up with their own activities.
- More or less, mini-projects equally attracted men and women. No participants were attracted from Arts and Humanities, and Applied Sciences; this is something to investigate in the future.
- Materialising initial interest into completion of the mini-project is the great challenge around this training opportunity, with a stiff funnel along registration (23) → Accepting the invitation (8) → Finishing the task (6) → Participating into the final interview (5).
- Mini-projects were highly successful in training several transferable skills simultaneously (4.5 in average, with boundaries between 3 and 6), as well as making participants aware of this fact.
- Positive results were also achieved in relation to the efficiency in training transferable skills related to open science and innovation (average 7,25 grading in a 1 to 10 scale, with 0,5 standard deviation). It is also considered a positive result that participants got plans on how to increase their level of development of the skills targeted during the mini-project.
- Previous result is complemented by the fact that all participants expressed to have discovered some skill which they think is important, and to have learnt something that would have not been possible to learn if not through real-work-based learning. Also, there was unanimity in the opinion that they would use directly what they learnt, and most of them expressed their intention and interest to keep training the covered skills in the future.
- All participants desired to do something that was really helpful or valuable for the task, that would really be used by the task owner (beyond their learning). And in all cases, it happened this way. We believe this is a unique outcome.
- All these results together make it really worth it to keep exploring the mini-project training model in the future.

- There seems to be a slightly negative correlation between the number of skills developed and the perception of effectiveness of the training, meaning that the greater number of skills trained simultaneously, perception of efficiency by participants tends to lower. This could be related to the fact that they become more aware of lifelong learning opportunities and needs. It would be interesting to carry out further research about this aspect.

In general, both participants and DL's partners agree that mini-projects are well designed. And although challenging (also for trainers, because they tend to become more time consuming than expected), they are felt as worth it. However, certain improvements and new ideas will be considered for the future:

- To optimize the funnel described above, very clear communication about the type of activities included and expected outcomes from the mini-project should be provided in the recruitment phase and selection process. Also, it could be stressed if the mini-project could be most interesting for certain disciplines.
- The initial communication with the participants should also focus on assessing their level of experience and skills with regards to the task to be completed. Based on this, task holder can adapt the task and its difficulty (which is not always easy), If possible, this should be considered in the task design already.
- It would be great to explore doing mini-projects in small groups of PhD candidates and ESRs. They really enjoy this type of interactions (expressed during the interviews as well as through the surveys around the webinars and related focus group). This was attempted to be done during Discovery Learning, and mini-projects 1 and 2 managed to have 2 participants in the kick-off webinar. But some of them did not finish the task, so teamwork could not be implemented. Towards the future, it is recommended that participants face the task in parallel and then interact to prepare a joint result or, at least, discuss together about their outcomes.
- A participant recommended to somehow align mini-projects with the participant's thesis, and also making mini-projects a little bit longer to allow participants having visibility over the evolution of the outcomes of the task (e.g., for 6 months having short meetings every first Friday of the month).

- Some participants strongly recommend keeping mini-projects online, to enable to conciliate schedules and calendars in a simpler way.
- One participant proposed to package the theoretical part about focus group into a pre-recorded video, and recommend some further reading. This could be explored in the future, although the initial contact with the owner of the task is crucial.

5. The role of professors and Open Educational Experiences (OEEs)

DISCOVERY LEARNING also set the focus into demonstrating that if professors receive clear / executive explanations about the training practices that can be used for enriched activities (including good examples), their level of performance can improve in online and face-to-face settings independently of their personality.

There was no time and resources during Discovery Learning to address this research, so the project focused into preparing the baseline to carry it out in the future. For this purpose, a platform of what we are calling **Open Educational Experiences (OEEs)** has been deployed – https://oee.innowizard.eu

OEEs are personal and specific strategies from educators working with different learners in different contexts, shared openly via Internet in such a way that they can be easily found, understood, assessed and reused / recycled by other educators[14]. They need to have been successfully used in real scenarios in science and technology education as well as in training relevant transferable skills (validated). They go beyond the idea of Open Education Resources (OERs), of which there are many repositories already, since OEE is something an educator has really done in class for a specific purpose, potentially using some educational resource, and shares his/her experience to help other educators know what they can really do that is pedagogically sound. They also aim at promoting joint research and experimentation around educational methods.

An example of OEE can be seen in Annex 5.

The interest of professors in OEEs has been pre-tested with a survey during the focus groups organised (see Figure 4). Some exploratory contacts have been done also with universities around Europe, and the idea was presented at the PRIDE Network's annual conference. We have received great expressions of interest, which is very promising towards the future.

[14] Experience is every conscient and perceived event that improves how we put into practice a certain knowledge or skill. Educational experience is when this knowledge or skill is put into practice within any educational setting. To create an OEE, the educator will be guided to think of her/his teaching experience or his/her own learning experience, and how it can bring something to education (meta-reflection).

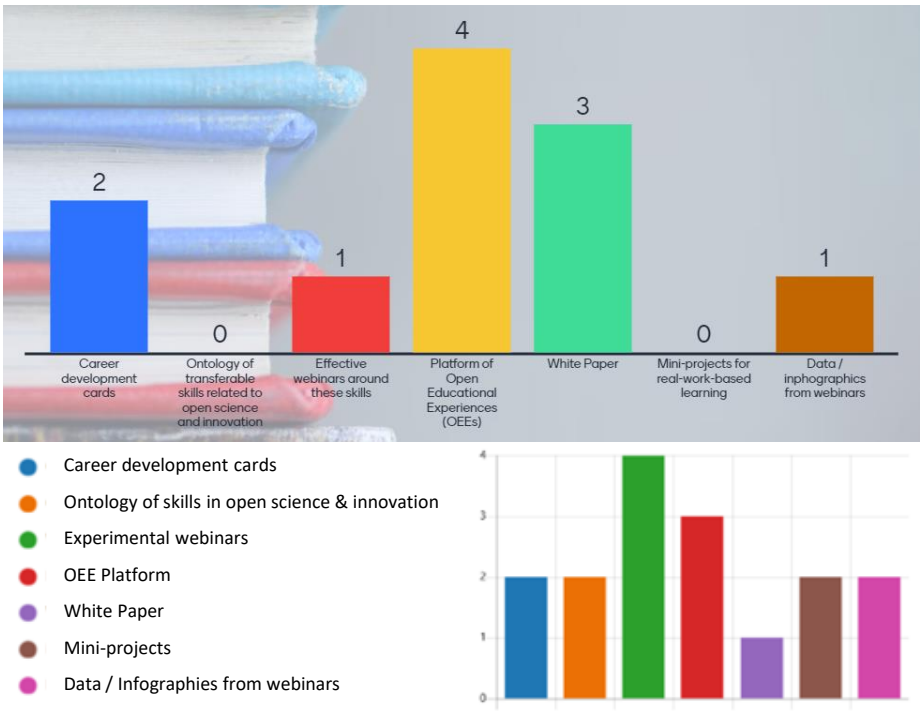


Figure 4: *Answer to question "What result from Discovery Learning you find most valuable?" during focus groups with policy makers (above) and VET and lifelong learning professionals (below).*

Annex 1: Questions to before-training and after-training surveys to participants in DL webinars

DL - SESSIONS WITH PRACTITIONERS (BEFORE)

Intro

DISCOVERY LEARNING - WEBINARS (before training) This is an inquiry about participation in a research project founded by the European Commission under contract number 101006452 (https://discoverylearning.eu), where the main purpose is to test ways to better train transferable skills related to open science and innovation. In this letter we will give you information about the purpose of the project and what your participation will involve. Purpose of the project The purpose of this research project is to test different student active training methods in order to define a best practice on how to efficiently train early career researchers in transferable skills. The objectives of the project is to clearly define transferable skills that are prevalent in open science and innovation and further test which training methods provide the best learning outcome of these skills. Who is responsible for the research project? This is a joint research project between Spanish Foundation for Science and Technology (FECYT; Spain), Slovak Academic Information Agency (SAIA; Slovakia), the University of Oslo (UiO; Norway) and Research, Technology, Development and Innovation (RTDI; Spain), the latter being the project leading institution. Why are you being asked to participate? You are receiving this survey as a registered participant in a project's webinar. What does participation involve for you? If you chose to take part in the project, this will involve that you fill in an online survey both before and after the webinar, in addition to attending the webinar itself. It will take approx. 5 minutes to fill out each of the surveys. The survey includes some background questions (gender, country, age (interval), place and level of education) and your preferences for lectures/training. We do not require you to give your name and e-mail address but you are free to give it at the end of the survey for any follow-up questions we might have. Your answers will be recorded electronically. Participation is voluntary Participation in the project is voluntary. If you chose to participate, you can withdraw your consent at any time without giving a reason. All information about you will then be made anonymous. There will be no negative consequences for you if you chose not to participate or later decide to withdraw. Your personal privacy – how we will store and use your personal data We will only use your personal data for the purpose(s) specified in this information letter. We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act). Only the project leader, Eva García Muntión from RTDI, will have access to the collected raw data. Further, only personnel directly involved with the project from the four collaborative institutions (FECYT, SAIA, UiO and RTDI) will have access to the metadata. If you choose to give your name and e-mail address, these details will be replaced with a code. The list of names, contact details and respective codes will be stored separately from the rest of the collected data on a separate server. No individuals will be recognizable in publications related to this project. Only metadata on trends related to gender, country, age, level of education, institution or discipline of study will be published. The online survey provider in this project is Survey Anyplace. What will happen to your personal data at the end of the research project? The project is scheduled to end 31.05.2022. At the end of the project the metadata will be published in a closed archive with the potential to request access to personal data for future research. Any given names or e-mail addresses form the surveys will be deleted and not uploaded for any further use. Your rights So long as you can be identified in the collected data, you have the right to: access the personal data that is being processed about you; request that your personal data is deleted; request that incorrect personal data about you is corrected/rectified; receive a copy of your personal data (data portability), and; send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority regarding the processing of your personal data. Where can I find out more? If you have questions about the project, or want to exercise your rights, contact: Research, Technology, Development and Innovation (RTDI), via Eva García Muntión (evagarcia@rtdi.eu). Acceptance By clicking 'Start' I confirm I have received and understood information about the project Discovery Learning - Effective training of transferrable skills related to open science and innovation for early-stage researchers and have been given the opportunity to ask questions. And I give consent: to participate in this online survey for my personal data to be processed until the end date of the project, approx. 31.05.2022, and in accordance to GDPR limitations.

Questions

1. PART 1: REFERENTIAL INFORMATION A few general questions to be able to work with the information in the future.

No answer to show

2. In which discipline are you studing / researching?

1	Arts and Humanities (History and Archaeology, Languages and Literature, Philosophy, Ethics and Religion..)
2	Social Sciences (Business, Law, Educational Science, Sociology…)
3	Applied Sciences (Civil Engineering and Geodesy, Mechanical Eng., Sport, Medicine, heatlh Sciences…)
4	Natural and Life Sciences (Electrical Eng., Biotechnical, Pharmacy, Chemistry, Mathematics and Physics…)

Additional Text
Other – Please specify

3. Could you please tell us the name of the university or institution where you are studying / researching?

No answer to show

4. At what level are you studying / researching?

1	Bachelor’s degree
2	Master’s degree
3	PhD candidate
4	Post-doc

5. Now please just a few statistical information that help us understanding anwers better and carrying out differential research:

Dropdown 1	Gender
Text - Single Line 2	Country
Dropdown 3	Age
Dropdown 4	How do you access online training
Dropdown 5	This device or equipment...
Dropdown 6	Do you have access by high-quality WiFi? (optic cable, high speed)
Dropdown 7	What language(s) do you manage in on-line training?

6. PART 2 - YOUR PREFERENCES In this part you will see a series of statements. Can you grade in which % do you agree with them? This is probably the longest part of the 4 that make this survey... Thanks for your effort!

No answer to show

7. I think having sessions hand in hand with practitioners (active and senior professionals in the target topic) will be very valuable for the efficiency of my training

Low end value	/
Low end label	0
High end value	100
High end label	100
Default value	0

Additional Text
If you disagree completely, could you please tell us why? If you strongly agree, could you let us know what value do you think this interaction will bring / what will be the best thing from it?

8. Just listening to the practitioner talking about the topic will be enough to get value out of his/her "visit".

Low end value	/
Low end label	0
High end value	100
High end label	100
Default value	0

Additional Text
If you disagree completely, could you please tell us why? If you strongly agree, could you let us know what do you agree most with?

9. I really wish these interactions with practitioners were done in my classes.

Low end value	/
Low end label	0
High end value	100
High end label	100
Default value	0

Additional Text
If you disagree completely, could you please tell us why? If you strongly agree, could you let us know what do you agree most with?

10. Could you please tell us what knowledge or experience do you have in relation with the topic of the training?

No answer to show

11. PART 3 - YOUR WISHES

No answer to show

12. You are given a wish in relation to how to run this interaction with practitioners during training. What would you wish? Fill in your wish card! Examples of wishes from other persons: "Working with the practitioner in one task or case in which he/she is working when the session takes place"

No answer to show

13. You are now given a wish in relation to how NOT to run these sessions with practitioners (and this is the last question, thanks a lot for making it up to here!). What would you wish? Fill in your wish card! Examples of wishes from other persons: "Lot of theory / Little practice"

No answer to show

14. THANKS SO MUCH!! Your feedback is important, and we promise to put it to good use! Would you like to give us your name and email in case we would need to ask you something about your answers, or to invite you if we organise some activity with other respondents to get more insights? This is and will always be absolutely voluntary!

Text - Single Line 1	Name
Text - Single Line 2	eMail address

15.

No answer to show

Outro

Thanks again for taking our survey. Bye! This activity belongs to a project funded by the European Commission under Grant Agreement No. 101006452

DL - SESSIONS WITH PRACTITIONERS (AFTER)

Intro

DISCOVERY LEARNING - WEBINARS (after training) This is an inquiry about participation in a research project founded by the European Commission under contract number 101006452 (https://discoverylearning.eu), where the main purpose is to test ways to better train transferable skills related to open science and innovation. In this letter we will give you information about the purpose of the project and what your participation will involve. Purpose of the project The purpose of this research project is to test different student active training methods in order to define a best practice on how to efficiently train early career researchers in transferable skills. The objectives of the project is to clearly define transferable skills that are prevalent in open science and innovation and further test which training methods provide the best learning outcome of these skills. Who is responsible for the research project? This is a joint research project between Spanish Foundation for Science and Technology (FECYT; Spain), Slovak Academic Information Agency (SAIA; Slovakia), the University of Oslo (UiO; Norway) and Research, Technology, Development and Innovation (RTDI; Spain), the latter being the project leading institution. Why are you being asked to participate? You are receiving this survey as a registered participant in a project's webinar. What does participation involve for you? If you chose to take part in the project, this will involve that you fill in an online survey both before and after the webinar, in addition to attending the webinar itself. It will take approx. 5 minutes to fill out each of the surveys. The survey includes some background questions (gender, country, age (interval), place and level of education) and your preferences for lectures/training. We do not require you to give your name and e-mail address but you are free to give it at the end of the survey for any follow-up questions we might have. Your answers will be recorded electronically. Participation is voluntary Participation in the project is voluntary. If you chose to participate, you can withdraw your consent at any time without giving a reason. All information about you will then be made anonymous. There will be no negative consequences for you if you chose not to participate or later decide to withdraw. Your personal privacy – how we will store and use your personal data We will only use your personal data for the purpose(s) specified in this information letter. We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act). Only the project leader, Eva García Muntión from RTDI, will have access to the collected raw data. Further, only personnel directly involved with the project from the four collaborative institutions (FECYT, SAIA, UiO and RTDI) will have access to the metadata. If you choose to give your name and e-mail address, these details will be replaced with a code. The list of names, contact details and respective codes will be stored separately from the rest of the collected data on a separate server. No individuals will be recognizable in publications related to this project. Only metadata on trends related to gender, country, age, level of education, institution or discipline of study will be published. The online survey provider in this project is Survey Anyplace. What will happen to your personal data at the end of the research project? The project is scheduled to end 31.05.2022. At the end of the project the metadata will be published in a closed archive with the potential to request access to personal data for future research. Any given names or e-mail addresses form the surveys will be deleted and not uploaded for any further use. Your rights So long as you can be identified in the collected data, you have the right to: access the personal data that is being processed about you; request that your personal data is deleted; request that incorrect personal data about you is corrected/rectified; receive a copy of your personal data (data portability), and; send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority regarding the processing of your personal data. Where can I find out more? If you have questions about the project, or want to exercise your rights, contact: Research, Technology, Development and Innovation (RTDI), via Eva García Muntión (evagarcia@rtdi.eu). Acceptance By clicking 'Start' I confirm I have received and understood information about the project Discovery Learning - Effective training of transferrable skills related to open science and innovation for early-stage researchers and have been given the opportunity to ask questions. And I give consent: to participate in this online survey for my personal data to be processed until the end date of the project, approx. 31.05.2022, and in accordance to GDPR limitations.

Questions

1. PART 1: REFERENTIAL INFORMATION A few general questions to be able to work with the information in the future.

No answer to show

2. Could you please tell us the title of the Discovery Learning's training you have taken part in in relation to this survey?

No answer to show

3. In which discipline are you studing / researching?

1	Arts and Humanities (History and Archaeology, Languages and Literature, Philosophy, Ethics and Religion..)
2	Social Sciences (Business, Law, Educational Science, Sociology…)
3	Applied Sciences (Civil Engineering and Geodesy, Mechanical Eng., Sport, Medicine, heatlh Sciences…)
4	Natural and Life Sciences (Electrical Eng., Biotechnical, Pharmacy, Chemistry, Mathematics and Physics…)

Additional Text
Other – Please specify

4. Could you please tell us the name of the university or institution you are studying / researching at?

No answer to show

5. At what level are you studying / researching?

1	Bachelor’s degree
2	Master’s degree
3	PhD candidate
4	Post-doc

6. Now please just a few statistical information that help us understanding anwers better and carrying out differential research:

Dropdown 1	Gender
Text - Single Line 2	Country
Dropdown 3	Age
Dropdown 4	How do you access online training
Dropdown 5	This device or equipment...
Dropdown 6	Do you have access by high-quality WiFi? (optic cable, high speed)
Dropdown 7	What language(s) do you manage in on-line training?

7. PART 2 - YOUR PREFERENCES In this part you will see a series of statements. Can you grade in which % do you agree with them? This is probably the longest part of the 4 that make this survey... Thanks for your effort!

No answer to show

8. I wish more sessions with practitioners were embedded into my training.

Low end value	/
Low end label	0
High end value	100
High end label	100
Default value	0

Additional Text
If you disagree completely, could you please tell us why? If you strongly agree, could you let us know what do you agree most with?

9. Working with practitioners enriches training very importantly.

Low end value	/
Low end label	0
High end value	100
High end label	100
Default value	0

Additional Text
If you disagree completely, could you please tell us why? If you strongly agree, could you let us know what do you agree most with?

10. Using gamification or other active / participatory training practice helps a lot to make the most out of training sessions.

Low end value	/
Low end label	0
High end value	100
High end label	100
Default value	0

Additional Text
If you disagree completely, could you please tell us why? If you strongly agree, could you let us know what do you agree most with?

11. Enriched sessions with practitioners (i.e. via gaming) allow training to go beyond average limits / to go further in training.

Low end value	/
Low end label	0
High end value	10
High end label	/
Default value	0

Additional Text
If you disagree completely, could you please tell us why? If you strongly agree, could you let us know what do you agree most with?

12. PART 3 - YOUR ADVICE

No answer to show

13. What did you like the most from this session?:

No answer to show

14. What do you think was most valuable?:

No answer to show

15. What would you do differently?:

No answer to show

16. What did you learn that you think was really new for you / will be most useful for you?

No answer to show

17. THANKS SO MUCH!! Your feedback is important, and we promise to put it to good use! Would you like to give us your name and email in case we would need to ask you something about your answers, or to invite you if we organise some activity with other respondents to get more insights? This is and will always be absolutely voluntary!

Text - Single Line 1	Name
Text - Single Line 2	eMail address

Outro

Thanks again for taking our survey. Bye! This activity belongs to a project funded by the European Commission under Grant Agreement No. 101006452

Annex 2: Example of certificate of attendance for participants in webinars and mini-projects

discovery learning

CERTIFICATE OF PARTICIPATION in the webinar on

How leadership plays a crucial role in research and innovation

NAME OF PERSON

has participated in the webinar on leadership skills which took place on May 19th (3,5 hours) within the framework of the H2020 project DISCOVERY LEARNING. The aim of this webinar was to train the candidates on understanding the differences between management and leadership skills, feel confident with the main functions of a leader and gain real experience in these functions by working hand in hand with practitioners over real study cases.

DISCOVERY LEARNING pursues a new working model in the curricula for early-stage researchers through the implementation of an innovative teaching method that emphasizes the importance of transferrable skills in order to promote open science and innovation in the EU. The project includes several different training sessions to test the teaching-learning methods with PhD students on real-time basis and train them on transferable skills.

19th May, 2022

Eva García

Project Coordinator of Discovery Learning

RTDI

FECYT FUNDACIÓN ESPAÑOLA PARA LA CIENCIA Y LA TECNOLOGÍA

UiO : University of Oslo

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 766499

discovery learning

CERTIFICATE OF PARTICIPATION in the mini project on

"Draft the project's final white paper"

NAME OF PERSON

has participated in the mini project on 'meeting organization' which took place on February-March 2022 (10 hours) within the framework of the H2020 project DISCOVERY LEARNING. The student has participated in the drafting process of Discovery Learning White Paper, actively contributing to the definition of the adopted framework and developing the contents of the first part of this document (introduction). By doing so, the student has proven to be proactive in the following transferable skills:

- **Seeking and processing information**
- **Creative thinking**
- **Working in team**
- **Communicating results of research**

DISCOVERY LEARNING pursues a new working model in the curricula for early-stage researchers through the implementation of an innovative teaching method that emphasizes the importance of transferrable skills in order to promote open science and innovation in the EU.

The project includes several mini projects, an initiative carried out and developed by Discovery Learning. The mini projects are real-time, small and specific tasks, carried out in connection with a wide network of practitioners and organisations, which allow participants to get an insight into a new field of action as well as to test and further develop their transferable skills.

4th April, 2022

Eva García

RTDI

FECYT FUNDACIÓN ESPAÑOLA PARA LA CIENCIA Y LA TECNOLOGÍA

UiO : University of Oslo

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 766499

Annex 3: Agenda and programme for the focus group with PhD candidates and ESRs

discovery learning

FOCUS GROUP WITH PhD CANDIDATES AND EARLY-STAGE RESEARCHERS – MAY 2022

Main research question:

What processes can help PhDs to develop and train the transferable skills?

Reflection questions for students:

A) How do you understand a transferable skill?
B) 2 Questions:
   a. How do you use any of the transferable skills you have trained? How do they help you being a better researcher, professional and person?
   b. What are things and tasks that you would be able to do with assistance (e.g. to communicate the message to the lay audience in media, or to policymakers at an event), or things you are not able to do right now, not even with the assistance? (think of some relevant example)
C) 2 Questions:
   a. For participants taking part in any of DL's webinars: How did they helped you to become a better researcher and professional / train transferable skills? Which ones? Did you feel any difference from other trainings you have taken? What do you remember about it?
   b. For all: How did other training activities taken during your PhD did it? Is there something you liked a lot? (topic, type of speaker or activity)

Proposition of agenda for the focus group with students

- 10 minutes for joining and introduction:
  - Welcome by Mayya explaining the purpose of the meeting: 2 minutes
  - DL presentation by Eva: 5 minutes
  - Practical issues by Eva: 2 minutes (ASK FOR PERMISSION TO RECORD THE SESSION. ANY QUESTIONS OR CONCERNS BEFORE WE START?)
- Reflection questions for students: Mayya opens up the questions one by one. We allow 10min discussion for each. During discussions Eva will take "visual notes" of the comments and ideas, sharing her screen so that students see this outcome, to enrich / inspire discussion. She will use a MIRO board for that, in which the questions will also be shown. Participants will be invited to join the MIRO and co-edit if they want (optional – they will always be able to just speak up). Total: 55 minutes

  Everytime they talk for the 1st time, they will be asked to start by saying their names, affiliation and area of research.

  Depending on what they say, we could ask them about their professional interests, as a "keep it warm" question.

- "Thinking hats"[1] around DL Hypotheses – Timing: 20 minutes. Eva will show participants the hypothesis as in a formula in her screen (remind the participants what is the term "practitioner" means in this context), and will ask them to:

[1] Edward de Bono

- Put on the Yellow hat, which is "Positivity", and send comments about it via the chat (Mayya will send a 1st comment saying "YELLOW" so we can easily differentiate messages in the chat). (10 minutes). Mayya and Eva will reinforce the process with some questions such as "What are the positive aspects of having a practitioner at the training", "What do you learn better when practitioners are at the training?", "When did you feel particularly motivated to participate during the training? What was happening?», and «What was particularly satisfying during the training?».

COLOURED HAT	THINK OF	DETAILED DESCRIPTION
	*White paper*	The white hat is about data and information. It is used to record information that is currently available and to identify further information that may be needed.
	*Fire and warmth*	The red hat is associated with feelings, intuition, and emotion. The red hat allows people to put forward feelings without justification or prejudice.
	*Sunshine*	The yellow hat is for a positive view of things. It looks for benefits in a situation. This hat encourages a positive view even in people who are always critical.
	*A stern judge*	The black hat relates to caution. It is used for critical judgement. Sometimes it is easy to overuse the black hat.
	*Vegetation and rich growth*	The green hat is for creative thinking and generating new ideas. This is your creative thinking cap.
	*The sky and overview*	The blue hat is about process control. It is used for thinking about thinking. The blue hat asks for summaries, conclusions and decisions.

- Put on the GREEN hat, which is "Creativity", and send comments via de chat (Mayya will send a comment "GREEN" first to differentiate them). (10 minutes). Again, Mayya and Eva will reinforce the process with questions such as: «Which type of training would you like the institutions to offer you for developing transferable skills? In which skills? What should these trainings look like? What was the most important thing for you that you took away from a training? What could be your next steps?

- 5 minutes closure. ASK THEM IF IT WILL BE OK TO USE MIRO FOR THE POST-INTERACTION

Total time: 1.5h

After the sessions, organisers stay 15-30 more minutes to wrap-up.

Pre and Post interaction process with participants:

- The questions: "How do you understand a transferable skill?" and "How do you use transferable skills helped you to become a better researcher, professional and person?" will be sent to them a few days before the focus group.

  The idea is to show them the focus group will be useful for them through guiding this meta-reflection and sharing it with peers (it is not just useful for our project).

- Visual notes will be shared with them after the session offering them the possibility to make corrections and add-ons. They will also be invited to share it with colleagues. 1-week period.

Annex 4: Questions and answers during in-depth interviews after mini-projects

Interview after mini-project 'Organising a consortium meeting'

1. Would you do it again?

Yes

2. Would you recommend including this mini-project in doctoral programs?

Yes

3. What did you want to learn and why?

To manage a European consortium, because it is important for my future

4. On a scale of 1 to 10, do you think you have achieved it?

7

5. What have you learned that wouldn't have been possible if it wasn't through this mini-project mechanism?

To join an international management; learn to always congratulate and give positive feedback, to highlight achievements and the people involved in them; learn to land the debates on specific things so that the discussion moves in the same direction.

6. Do you think the meeting was really efficient answer?

Yes

7. Witch skills from DL`s ontology where trained? (choose 2-5 of them and list them in order of level/depth of training)

- Ask questions
- Work across boundaries
- Managing people (feedback)
- Encouraging co-creation (discussion)
- Managing projects

8. What will you use in the future and in your research?

Give feedback in a positive way; learn to manage and, above all, lead the heterogeneity in the debate and in the work, and finally know when and how to ask. I wish this had happened while I was working on my thesis.

9. Any suggestions for future mini-projects?

Align some mini-projects with the theme of the thesis of the participants, and make it a more continuous training, not so punctual (for example, maintaining the visibility of the results over

time once a month for 6 months - all the first Friday of the month brief revision to be able to see the phases, the evolution, and the beyond).

Testimony: Great experience of what it is to carry out a project that involves different places and disciplines.

Interview after mini-project ''Draft the project final white paper''

1. What did you want to learn and why?

On the one hand, I found very interesting the possibility to work in contact with a real project, in real time and with real practitioners in the field (development and implementation of H2020 projects).

On the other hand, it also found interesting the possibility of training my communication skills (report writing+ content structure)

2. From 1 to 10, did you achieve it?

I would give 7/10, because to give a higher rate I would need to develop a project more related to my field of study.

3. What did you learn that you think wouldn ´t have been possible if not via real work-based learning?

The greatest opportunity offered by the mini projects is the possibility of challenging paradigms and working in real time and in a practical way. Unlike the academia, where training is based on more rigid and structured approaches, here the ideas are reviewed over and over again, and a final product is achieved through the contributions of the whole team (collaborative work), creating something new that brings together all the ideas provided during the process. This is why, the mini projects were extremely useful in showing me the advantages of collaborative and continuous work.

5. What will you use/do different in the future?

I will take my own ideas into a better consideration on future occasions. Many times, throughout my career as a PhD, I feel that my contributions are of lower quality and inferior in front of what a senior researcher can provide. The same happens when we meet to discuss ideas with our thesis supervisors and/or other renowned researchers. This experience has taught me that it is also important to value your own ideas, and that even if the other person has a completely different idea from your own, it is good to express your own ideas and evaluate the possibilities and complementarities of both ideas. In the future, I think I will feel freer (and less prejudiced) to express my own ideas in presence of other professionals and researchers.

6. Witch skills from DL`s ontology where trained? (choose 2-5 of them and list them in order of level/depth of training)

1. Sharing own work with others (+++)
2. Working in team (+)
3. Encouraging co-creation (+)
4. Grow mindset and initiative
5. Analysing problems
6. Prototyping

7. Did you discover any skill that you think now it is important (from the ontology or beyond)?

'Sharing our own work with others' and 'encouraging co-creation'. For me, they are complementary, and both need structures that allow them to be promoted among doctoral students. As I have said before, it is difficult for doctoral students to express our own ideas when we think we are dealing with ''renowned academics''

8. Will you keep training them in the future?

I would like to develop more trainings on project management and specially in European funded projects (such as Horizon Europe calls)

9. What are your career plans (if any)?

I am more comfortable with the idea of an hybrid scenario (between academia and the private sector). I don't particularly see myself in the field of university education and I really like the possibility of working with multidisciplinary research groups focused on health sector.

10.Any suggestions for what could be improved about the activity? How it was run?

I would like to include more participants (other PhD candidates) in order to exchange ideas and create a common document.

Also, I think it would also be more interesting if the candidates were filtered by branches of specialisation (for example, this mini project would be developed by a young researcher in pedagogy).

As for the format (online) I think it is a great asset of the mini project, enabling to conciliate schedules and calendars in a simpler way.

Interview after mini-project 'Key communication messages to promote EU project (for business & start-ups)'

1. What did you want to learn and why?

To do something that I didn´t do before. Put the theoretical knowledge I have into practice. And to help the real project.

2. From 1 to 10, did you achieve it?

I fulfilled my goals. It worked for me. I was able to apply my theoretical knowledge in practice. I learnt, there are actually a lot of things I didn´t know I knew.

3. What did you learn that you think wouldn't have been possible if not via real work-based learning?

The experience helped me realise that I have the skills I wasn´t aware of and I can use them in different context.

4. Witch skills from DL`s ontology where trained? (choose 2-5 of them and list them in order of level/depth of training)

Analysing problems, creative thinking, growth mindset and initiative, communication.

5. Did you discover any skill that you think now it is important (from the ontology or beyond)?

This is not based on the mini project only but also on my experience from the private sector in general: data analytics and research. Private sector is turning a little bit on this kind of profile. This is where PhDs are becoming interesting.

From the transferable skills I would mention the communication skills – people need to be more open and extroverted in the private sector. E. g. business analytics is basically a consulting on for that you need to know how to talk to people. You also need to be flexible, search for solutions to many specific problems and adapt to lot of situations depending on factors outside you.

6. Will you keep training them in the future?

Yes, I always want to learn new things.

7. What are your career plans (if any)?

I would like to do business analytics and big data. There are lots of opportunities in this field. Actually, recently I have started a job at legal company doing business analytics for them. The owner had a vision they want someone who does not have to understand legal issues but knows how to do data analysis. More than on specific narrowly defined profile she focused on the skills. This is still not usual in private sector and most of the private sector companies do not understand what is the added value of employing PhDs.

General comment:

In general, the activity (the mini-projects in general) is well designed I wouldn´t change anything about it. What you are doing is great. If I would be in position that I would not have an experience I have, it

would allow me to learn the new skills. And as majority of PhD students do not have any experience form outside academia such activity would help them a lot.

But this kind of project is also helpful in increasing the visibility of skills PhD have for the private sector. Thanks to similar activities private companies can experience what is an added value of collaborating with PhDs.

Comments form SAIA:

- The PhD student participating in this activity had an extensive experience with working outside academia and, to the large extent, he was in the role of the consultant for this activity. Through this, we realised that the learning process in this activity should be perceived as more equal and mutual (although this is not always the case as many PhD student have no experience from outside academia). On the one hand PhDs can learn new skills and experience something that is new for them. On the other hand, PhD students can practically apply the advanced skills and knowledge they have in a new context and become more aware of and confident with those skills which can then also help them in searching for suitable opportunities.
- The initial communication with the PhD should also focus on assessing the level of experience and skills PhD student has with regard to the task to be completed. Based on this task holder can and should adapt the task and its difficulty (which is not always easy and if possible, should be considered in the task design already).
- As for the activity setup – in general it is well designed. To ensure that it delivers the expected results it requires a clear communication about the type of activities included and expected outcomes in the recruitment phase and selection process.

Interview after mini-project 'Organising a focus group'

1. What did you want to learn and why?

I wanted to learn more about qualitative methods of research, in its most practical application, which I would be able to use in different setting. I was interested in learning about focus groups, because it would allow me to practice formulating questions with intention, interviewing and facilitating a group discussion.

2. From 1 to 10, did you achieve it?

I would put 7. I am satisfied, I learned a great deal, but I also see how much I do not know. In particular, now that I have finished the mini-project and learning a bit more about qualitative methods, I am thinking about my own bias (moderator bias). I was not very critical of it during this mini-project.

3. What did you learn that you think wouldn´t have been possible if not via real work-based learning?

The taste of pudding is in eating! I could have read about focus groups and imagined doing them, but the real work was really exciting. I am not sure that I can already say "I learned". I experienced, and it still is settling down into a sense of learning.

Through doing the work, I got a strong reminder of my own creative side, that was a bit dormant. I perceived the importance of crafting and formulating the questions in a particular manner, to be more mindful and intentional in this. I experienced my own behaviour as a group facilitator, in a virtual online environment, in a multicultural group, where English is a second (or even third) language. And I experienced improvisations, which I found pleasant and refreshing . I appreciated the importance of working together with a more experienced person (Eva), which made me feel safer (and helped me with creativity).

5. What will you use/do different in the future?

In the future I would like to be more proactive in asking questions, asking for clarifying uncertain moments, to test my understanding earlier (e.g. during the first "lecture" during the first call). I definitely feel more confident and empowered to learn and try new things, thinking of where I could apply these skills now.

6. Witch skills from DL`s ontology where trained? (choose 2-5 of them and list them in order of level/depth of training)

- Engaging stakeholders
- User focus
- Encouraging co-creation
- Working in team
- Others

I think there was Idea cluster (Growth mindset and initiative, Creative thinking), Core cluster exercise for me (asking questions, team work, embracing diversity). I would say, some exercise for Implementation (Encouraging co-creation). I wonder which skills were trained from Impact cluster.

7. Did you discover any skill that you think now it is important (from the ontology or beyond)?

Improvisation – adjust agenda on the go

8. Will you keep training them in the future?

Yes I will definitely be practicing them in the future. The ontology of skills from DL is very interesting for me, I would like to continue creating opportunities for deliberate training through real work.

9. What are your career plans (if any)?

I would like to have in my career more elements of training other people, creative problem solving, design and testing, community building and facilitating. I am not sure in which job titles here in Spain such activities can be most represented, and how to look for those opportunities/pathways to creating those opportunities. I would be really grateful for any suggestions.

10.Any suggestions for what could be improved about the activity? How it was run?

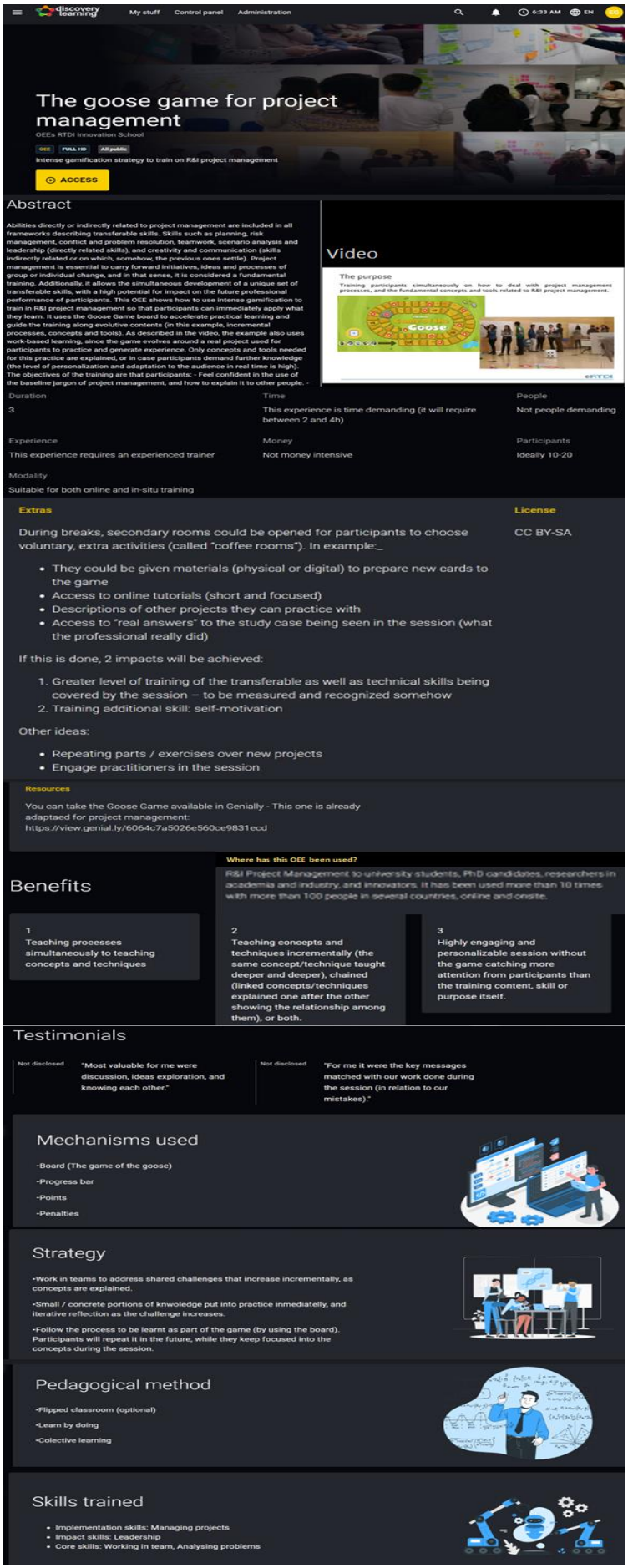
It was awesome! I really enjoyed the project, the time and attention I received from Eva, the co-developing the mini-project.

If I could choose how I wish it could be improved, I would recruit more participants (maybe 2 or 3, to work on the organizing). I would package the theoretical part about focus group structure into a pre-recorded video + give some reading.

In the live video call I would dedicate time to testing what we have learned through shared reflection and time to discussing the DL hypothesis and trying to generate questions straightaway). Then the rest I would leave the same, working in parallel, and then checking the drafts and co-developing. Having more participants could be fun, it could increase learning and enrich the ideas about the agenda, and then during the focus group roles could be divided as well.

Thank you!

Annex 5: Example of OEE



discovery learning My stuff Control panel Administration

The goose game for project management

OEEs RTDI Innovation School

OEE FULL HD All public

Intense gamification strategy to train on R&I project management

ACCESS

Abstract

Abilities directly or indirectly related to project management are included in all frameworks describing transferable skills. Skills such as planning, risk management, conflict and problem resolution, teamwork, scenario analysis and leadership (directly related skills), and creativity and communication (skills indirectly related or on which, somehow, the previous ones settle). Project management is essential to carry forward initiatives, ideas and processes of group or individual change, and in that sense, it is considered a fundamental training. Additionally, it allows the simultaneous development of a unique set of transferable skills, with a high potential for impact on the future professional performance of participants. This OEE shows how to use intense gamification to train in R&I project management so that participants can immediately apply what they learn. It uses the Goose Game board to accelerate practical learning and guide the training along evolutive contents (in this example, incremental processes, concepts and tools). As described in the video, the example also uses work-based learning, since the game evolves around a real project used for participants to practice and generate experience. Only concepts and tools needed for this practice are explained, or in case participants demand further knowledge (the level of personalization and adaptation to the audience in real time is high). The objectives of the training are that participants: - Feel confident in the use of the baseline jargon of project management, and how to explain it to other people. -

Video

The purpose

Training participants simultaneously on how to deal with project management processes, and the fundamental concepts and tools related to R&I project management.

Duration	Time	People
3	This experience is time demanding (it will require between 2 and 4h)	Not people demanding
Experience	**Money**	**Participants**
This experience requires an experienced trainer	Not money intensive	Ideally 10-20

Modality

Suitable for both online and in-situ training

Extras

During breaks, secondary rooms could be opened for participants to choose voluntary, extra activities (called "coffee rooms"). In example:_

- They could be given materials (physical or digital) to prepare new cards to the game
- Access to online tutorials (short and focused)
- Descriptions of other projects they can practice with
- Access to "real answers" to the study case being seen in the session (what the professional really did)

If this is done, 2 impacts will be achieved:

1. Greater level of training of the transferable as well as technical skills being covered by the session – to be measured and recognized somehow
2. Training additional skill: self-motivation

Other ideas:

- Repeating parts / exercises over new projects
- Engage practitioners in the session

License

CC BY-SA

Resources

You can take the Goose Game available in Genially - This one is already adaptaed for project management:
https://view.genial.ly/6064c7a5026e560ce9831ecd

Benefits

Where has this OEE been used?

R&I Project Management to university students, PhD candidates, researchers in academia and industry, and innovators. It has been used more than 10 times with more than 100 people in several countries, online and onsite.

1. Teaching processes simultaneously to teaching concepts and techniques
2. Teaching concepts and techniques incrementally (the same concept/technique taught deeper and deeper), chained (linked concepts/techniques explained one after the other showing the relationship among them), or both.
3. Highly engaging and personalizable session without the game catching more attention from participants than the training content, skill or purpose itself.

Testimonials

Not disclosed "Most valuable for me were discussion, ideas exploration, and knowing each other."

Not disclosed "For me it were the key messages matched with our work done during the session (in relation to our mistakes)."

Mechanisms used

- Board (The game of the goose)
- Progress bar
- Points
- Penalties

Strategy

- Work in teams to address shared challenges that increase incrementally, as concepts are explained.
- Small / concrete portions of knwoledge put into practice inmediatelly, and iterative reflection as the challenge increases.
- Follow the process to be learnt as part of the game (by using the board). Participants will repeat it in the future, while they keep focused into the concepts during the session.

Pedagogical method

- Flipped classroom (optional)
- Learn by doing
- Colective learning

Skills trained

- Implementation skills: Managing projects
- Impact skills: Leadership
- Core skills: Working in team, Analysing problems