Erasmus+
Changing lives. Opening minds.

MAY 2024

Evaluation of the Training Materials

Revision: Final

Dissemination Level: Public

Co-funded by the Erasmus+ Programme of the European Union

ΙΔΡΥΜΑ ΚΡΑΤΙΚΩΝ ΥΠΟΤΡΟΦΙΩΝ ΙΚΥ

Document Information

Project Information	
Project name	Artful Educational Robotics to promote Computational Thinking in a Blended Learning context
Project acronym	FERTILE
Project number	2021-1-EL01-KA220-HED-000023361
Project web site	www.fertile-project.eu

Document Identification	
Document title	M 3.2Evaluation of the Training Materials
Document Type	Report
Filename	
Current status	Final
Current version	1.0
Project Coordinator	Cleo Sgouropoulou (UniWA)
Dissemination level	Public

Version history

Version	Contributor(s)	Contribution
0.0, 25/3/2024	UNIWA: Maria Tzelepi, Kyparissia Papanikolaou, Nafsika Pappa	Synthesize the first document's version. Apply structure and elaborate on the training material process development
0.1, 20/4/2024	UNIWA: Maria Tzelepi, Nafsika Pappa, Kyparissia Papanikolaou	Data analysis and results
0.2, 28/4/2024	URJC: : José María Cañas, David Roldán	Internal review
0.3, 10/5/2024	UNIWA:Nafsika Pappa, Kyparissia Papanikolaou	Address the internal review comments
1.0, 28/5/2024	UNIWA: Kyparissia Papanikolaou, Eleni Zalavra	Final refinement. Proofread and Publication

CONTENTS

ACRONYMS

List of abbreviations

FDM	Fertile Design Methodology
CT	Computational Thinking
CP	Community Platform
ER	Educational Robotics
DBR	Design Based Research
MSc	Masters of Science
UniWA	University of West Attica, Greece (project coordinator)
URJC	Universidad Rey Juan Carlos, Spain (project partner)
CUB	Comenius University Bratislava, Slovakia (project partner)
CUP	Univerzita Karlova, Czech Republic (project partner)
UVa	Universidad de Valladolid, Spain (project partner)
F2F	Face to face
TME	Training Material Evaluation

1. Executive Summary

This report presents the training material developed in the context of the "FERTILE" project and the evaluation procedure followed during the pilot studies organised in the four countries (Greece, Slovakia, Spain, and the Czech Republic). Finally, it presents the refinements decided in the 5th Transnational Meeting among partners.

The report is organised in three sections. The first section, "Training Material Development Process" briefly describes the process that was followed to develop the material, the guidelines proposed, and the tools used by all the partners. The second section "Training Material Contents" presents in tabular form all the material developed per module as well as the main objectives of each material and the responsible partner. Finally, the third section, "Evaluation of the training material", describes in detail the procedure followed to evaluate the training materials in the pilot studies organised per country participating in FERTILE. It presents the research questions, the sample, and the data collection process involving the trainees and the trainers. Then, the analyses of the quantitative and qualitative data collected are presented, leading to conclusions on the evaluation of the training material and suggestions for improvements.

2. Introduction

The "FERTILE" training materials support a modular training structure and provide all the necessary content, including face-to-face and online activities, multimedia study material, and exemplary Artful ER projects. Aiming to address the needs of educators for cultivating their students' digital skills and, at the same time, practice designing and implementing Artful ER projects in a blended learning context, the main modules of the training material are:

Module 1: Robotics as an Educational Tool for Cultivating Computational Thinking. It covers project-based and collaborative learning, CT skills linking ER with Arts, and ER technologies for various educational levels (elementary, secondary, and university).

Module 2: Interweaving Educational Robotics with Arts focuses on interweaving ER with Arts: the Art in the FERTILE project—audiovisual arts (animation, filmmaking, painting), performing arts (dance, theatre, music), and literary arts (poetry, drama, prose, fiction), triggering the design of artful ER artefacts for cultivating CT.

Module 3: Blending face-to-face with online learning in Artful Educational Robotics projects focuses on blending f2f with online experience through exemplar artful ER projects and using ER simulators.

Module 4: **The "FERTILE" design methodology and the "FERTILE" Community platform** presents the design methodology to co-design Artful ER projects. It suggests evaluation criteria for the artful ER projects. Also, it presents the FERTILE Community Platform used to share outcomes between f2f & online contexts.

The main innovation of this result is that the particular content supports an experiential type of training that aims to provide trainees-educators with Artful ER experiences. In these learning experiences students act as students and in this way, the expected impact relates to providing educators with the necessary means for approaching and implementing the FERTILE design methodology. The FERTILE training materials will be the cornerstone for actualising the impact of the FERTILE design methodology.

The training materials are available as open educational resources through the project site at https://fertile-project.eu/trainingmaterials. Their modular structure allows their adaptation to different educational contexts. They include various robotic technologies used at all educational levels and several Art forms representing Art education adopted in various educational curricula of the participating countries.

The developed contents include individual, collaborative, and peer-review activities that take place face-to-face, synchronously, or asynchronously, exemplar artful ER projects, presentations (PowerPoint or video), study material, scientific papers, and web resources.

Section 3 describes the process of developing the FERTILE training materials, while Section 4 presents the training material types. Section 5 includes the evaluation of the training material by trainers and trainees in the Pilot Studies. Section 6 shows the Key Findings, and finally, Section 7 summarises the conclusions.

3. Training Material Development Process

During the meeting at Valladolid, the consortium discussed the training material that needed to be developed and distributed the corresponding tasks between partners (see Table 1 in Section 4). The consortium decided to develop an initial version of the training materials in English. Then, each partner should provide source files and necessary guidelines for translation into the consortium languages. This initial version will be evaluated in Task 4.1 during the pilot studies.

The partners also prepared guidelines aiming to support trainers sharing the work and ensure coherence in the form of the training materials and compliance with FERTILE logos and aesthetics, as follows:
1. Create the videos in any software of your choice:

- always have an introduction and ending, i.e. the short videos that have been already suggested.
- the original video should be in English (text and/or voice).
- add free copyrighted images and music.

2. To allow translation of the original videos into home languages, for each video, the authors should also provide:

- a file with the text of the video.
- in case of videos with voice (human or AI) and/or subtitles, also the text file with the time coding of the video.

3. Upload the above files to the shared folder for Task 3 - Training materials/ Training Materials per module.

4. Copyright guidelines for copyright issues based on Creative Commons.

Partners also shared resources for developing multimedia content as follows:

1. Recommend Websites for free music: https://www.youtube.com/channel/UCQF2DyKUgg4yYo2h_f3jzcA, https://www.youtube.com/channel/UCQsBfyc5eOobgCzeY8bBzFg.
2. Recommend Websites for free images: https://www.freepik.com/.
3. Software;
   - for video editing: Kdenlive (https://kdenlive.org/)
   - Captions at YouTube: https://www.youtube.com/watch?v=8u-wtbCZq9c.
   - for AI voice: Clipchamp.
   - Interactive Presentations: Genially (https://genial.ly/create/presentations/).
   - Interactive video and other interactive material: H5P.
   - Quiz maker software: Kahoot, Wooclap.
   - Sharing ideas/Brainstorming: Padlet, Wooclap.

4. Training Material Contents

This report presents the training materials for the FERTILE methodology, which has been developed to facilitate educators in designing Artful ER Projects aimed at cultivating computational thinking skills in a blended learning context. All the materials, following the suggested order per module, are uploaded on the FERTILE website. (https://fertile-project.eu/trainingmaterial/). The core of this document lies in a tabular presentation (see Tables 1-4) of all the training materials structured by Module. Each material is framed based on its title, type, description, learning objectives and the partner who developed it. This systematic structure is intended to provide a clear and concise understanding of the content and applicability of each training material, enhancing its practical use.

Table 1. Module 1: Robotics as an educational tool for cultivating CT

TM	Title	Type of Training Material	Topic (Description)	Learning Objectives	Partner	File Location (Link)
1.1	Overview of the "FERTILE" initiative for integrating artful ER projects in the educational practice	Presentation (links in national languages)	A short overview of the "FERTILE" initiative regarding the "FERTILE" project and its objectives. Introduction to the innovative idea of integrating artful ER projects in the educational practice. Exploration of the trainee's background & expectations.	To identify the "FERTILE" idea of synthesizing Arts with Robotics to promote Computational Thinking in a blended learning context.	CUB	Presentation
1.2.	Teaching ER or with ER in various educational levels	Presentation & Docs	Presentation and Study material for teaching ER or with ER in primary, secondary, and higher education	To present educational robots, simulators, and types of programming environments at different levels of education using examples. To recognize educational robotic kits, simulators, and programming environments and select adequate ones for each educational level.	CUP	Primary education, secondary education, higher education, padlet 1, padlet 2
1.3	ER technologies and illustrative applications	Video Playlist on the "FERTILE" project YouTube channel with videos for (1) MakeBlock, (2) LEGO Spike, (3) Codey Rocky, (4) Arduino, (5) BeeBot, and (6) Microbit, (subtitles available in all the national	Videos present several ER technologies, including information about their technological features, programming options, and illustrative applications related to the Arts.	Identify the technological features and available programming options of widely used ER kits and recognize illustrative applications related to Art.	URJC	Playlist

		languages through YouTube Captions)				
1.4.	Introduction to Computational Thinking	Presentation and suggested tasks	Study material for Computational Thinking and the various approaches to Computational Thinking skills focusing on those addressed in the context of the FERTILE project.	To comprehend Computational Thinking and the skills it involves. Familiarize participants with basic definitions and terms. To show the ambiguity of several authors in defining CT skills. Explain the 5 selected skills with which the FERTILE methodology works. Practice these 5 skills on a graded series of tasks.	CUB, CUP	Presentation1, Presentation2
1.5	Computational Thinking in the FERTILE Project	Video	A video presenting learning activities developed in the context of the "FERTILE" project and outlining the cultivated CT skills.	To comprehend how a learning activity may cultivate particular CT skills.	UNIWA	Video link
1.6	Workshop on CT Skills	Presentation, Worksheets, and Quiz	Collaborative tasks promoting a design mindset that leads to CT skills' cultivation	To identify how to cultivate particular CT skills and design learning activities accordingly.	UNIWA	Presentation

Table 2. Module 2. Interweaving ER with Arts

TM	Title	Type of Training Material	Topic (Description)	Learning Objectives	Partner	File Location (Link)
2.1	Workshop on Arts Education Combined with Robotics	Collaborative Activity	Report on how to organize a workshop implementing an interdisciplinary ER project, including the worksheets used.	To experience how an interdisciplinary project is organised and practice combining Arts with Educational Robotics.	UNIWA	Workshop
2.2	Examples of combining several Arts forms with Educational Robotics	Video	Video illustrating examples of how several Art forms (Painting, Music, Literature, and Scenic Arts) may be interwoven with ER	To trigger interdisciplinary ideas by considering indicative examples of how Arts and ER may be combined.	URJC	Video
2.3	Examples of interdisciplinary projects combining Arts with Educational Robotics	Interactive presentation in Genially (in all national languages)	Interactive presentation for interdisciplinary project ideas of (1) Robots that perform art, (2) Robots that create art, (3) Artful robots, and (4) Robots that respond to art	To trigger interdisciplinary ideas by considering exemplary projects combining Arts with ER	URJC	Presentation
2.4	Interdisciplinary projects analysis	Guided Discussion	Collaborative tasks analyzing interdisciplinary projects of Arts with ER	To analyze the interdisciplinarity between Arts and ER in exemplary projects toward formulating project ideas.	UNIWA	Presentation
2.5	Interdisciplinary project idea generation	Worksheet	The 1st part of a Co-design activity aims to trigger educators to collaborate toward synthesizing an interdisciplinary project idea through an adequately structured worksheet.	To generate an interdisciplinary project idea, formulate learning objectives for both disciplines, consider the CT skills to be cultivated, choose an ER technology,, and define the target group (educational level).	UNIWA	Worksheet

Table 3. Module 3: Blending face-to-face with online learning in Artful Educational Robotics projects

TM	Title	Type of Training Material	Topic (Description)	Learning Objectives	Partner	File location (Link)
3.1	Learning Design ideas for Educational Robotics in a blended learning context	Presentation	Presentation of educators' design ideas and experience on Educational Robotics in online and blended learning contexts	To identify design practices for applying Educational Robotics (ER) in online and blended learning contexts, and appreciate the use of ER simulators.	UNIWA	Presentation
3.2	ER simulators and illustrative applications with Examples of ER activities on simulators where Art and CT are involved in a blended learning context (following the T1.1 Profiling).	Video Playlist on the "FERTILE" project YouTube channel with videos for (1) UniBotics, (2) EV3 Makecode, (3) Beebot, (4) Tinkercad, Arduino, and (b) Micro:bit, Makecode (subtitles available in all the national languages through YouTube Captions)	Videos presenting several ER simulators including information about their technological features, programming options, and illustrativeapplications related to Arts.	To identify widely used ER simulators' technological features and available programming options. Also, to recognize illustrative applications related to Art.	URJC	Playlist
3.3	Introduction to the "FERTILE" Community Platform.	Video	A Video Lecture for educators explaining the main features of the FERTILE Community Platform.	To get acquainted with the main features of the "FERTILE" Community Platform. To recognize how to register at the platform, interact with peers, author Artful ER projects, and create classrooms enacting projects with students.	UVa	Video
3.4	Practice the main functionalities of the "FERTILE" Community Platform	Worksheet with Practice Instructions	A worksheet guiding educators to explore the main functionalities of the "FERTILE" Community Platform, focusing on those supporting communication with peers, designing Artful ER projects, and enacting them with students.	To practice several functionalities of the "FERTILE" Community Platform and consider its affordances.	UVa	Worksheet

Table 4. Module 4: The "FERTILE" design methodology and the "FERTILE" Community platform.

TM	Title	Type of Training Material	Topic (Description)	Learning Objectives	Partner	File Location (Link)
4.1	Conceptualization of the "FERTILE" Design Methodology	Video	Video introducing the "FERTILE" Design Methodology, a comprehensive methodology aiming to support educators in designing blended learning projects that cultivate learners' Computational Thinking (CT) skills through the seamless integration of Educational Robotics (ER) and Arts. Presentation of its key dimensions: interdisciplinarity, blended learning and computational thinking. Elaboration on the steps involved in creating Artful ER projects. A starting point to apply the methodology!	To identify the key components of the methodology, including the integration of ER and Art, the importance of CT skills, and the steps involved in the methodology. To comprehend its key dimensions (interdisciplinarity, blended learning, computational thinking) and the steps involved in creating Artful ER projects.	UNIWA	Video
4.2	Interdisciplinary project idea generation culmination	Worksheet	The second part of a Co-design activity aims for educators to collaboratively culminate their interdisciplinary project idea. An adequately structured worksheet guides educators to consider enriching their initial project idea by applying blended learning.	To culminate the initial interdisciplinary project idea. To formulate online learning activities, consider integrating ER simulators and tools to enrich learners' experience by applying blended learning.	UNIWA	Worksheet
4.3	Exemplar Artful ER projects based on the "FERTILE" Design Methodology	Video Playlist on the "FERTILE" project YouTube channel with videos for exemplars (1) "RoboTerrorizing the playground"	Video presentations of pilot Artful ER projects designed based on the "FERTILE" methodology. They overview the projects and elaborate on the rationale of applying the "FERTILE" methodology's step sequencing to combine ER with particular Art forms in blended learning contexts toward cultivating learners' Computational Thinking (CT) skills. Also, they present indicative implementations at associated partner schools of various educational levels.	To comprehend how an Artful ER project is designed based on the "FERTILE" Design Methodology and consider pilot implementations in various educational contexts.	UNIWA	Video Playlist
		(2) "Educational Robotics and Anticipation"			UNIWA	
		(3) "Little Red Riding Hood"			CUB	
		(4)"Charlie and the Chocolate Factory"			CUB	
		(5)"SportWatch"			URJC	
		(6)"The 102 languages of the child?"			URJC	

		(7)"One-stroke drawing"			CUP	
		(8)"Folk songs"			CUP	
4.4	Artful ER project analysis	Worksheet	A worksheet guiding educators to analyze an Artful ER project. To analyze one of the exemplar projects, designed based on the "FERTILE" methodology.	The aim is to assess an Artful ER project's alignment with blended learning principles, computational thinking processes, and the integration of ER and the Arts.	UNIWA	Worksheet
4.5	Artful ER project evaluation	Evaluation Rubric	An evaluation rubric for Artful ER projects.	To assess how an Artful ER project applies the "FERTILE" Design Methodology.	UNIWA	Rubric

5. Training Material Evaluation

In this section, we elaborate on the three phases we have followed in the design and procedure of the training materials' evaluation (see Figure 1). We introduce the research questions that have driven the research, define objectives, and the sample. We also describe how we collected data based on questionnaires. Afterwards, we present the data analysis we have followed, the results, and their interpretation.

The procedure followed involved three phases.

1) Formulation of research questions and sampling process.

2) Data collection based on the questionnaires.

3) Data analysis and results.

Phase 1: Formulation of research questions and sampling process.
The training materials were used in five pilot trainings, one pilot in each university partner (UNIWA, URJC, UVa, CUP, CUB). After each pilot training event, both trainees and trainers were administered separate questionnaires to gather feedback and insights on the training experience.

Phase 2: Data collection.
After every pilot training event, each trainee answered the training materials evaluation questionnaire for trainees (TME-trainee), and each trainer answered the training materials evaluation questionnaire for trainers (TME-trainer).

Phase 3: Data analysis and results.

After gathering quantitative and qualitative data from the two questionnaires, the five partners synthesized and interpreted the findings.

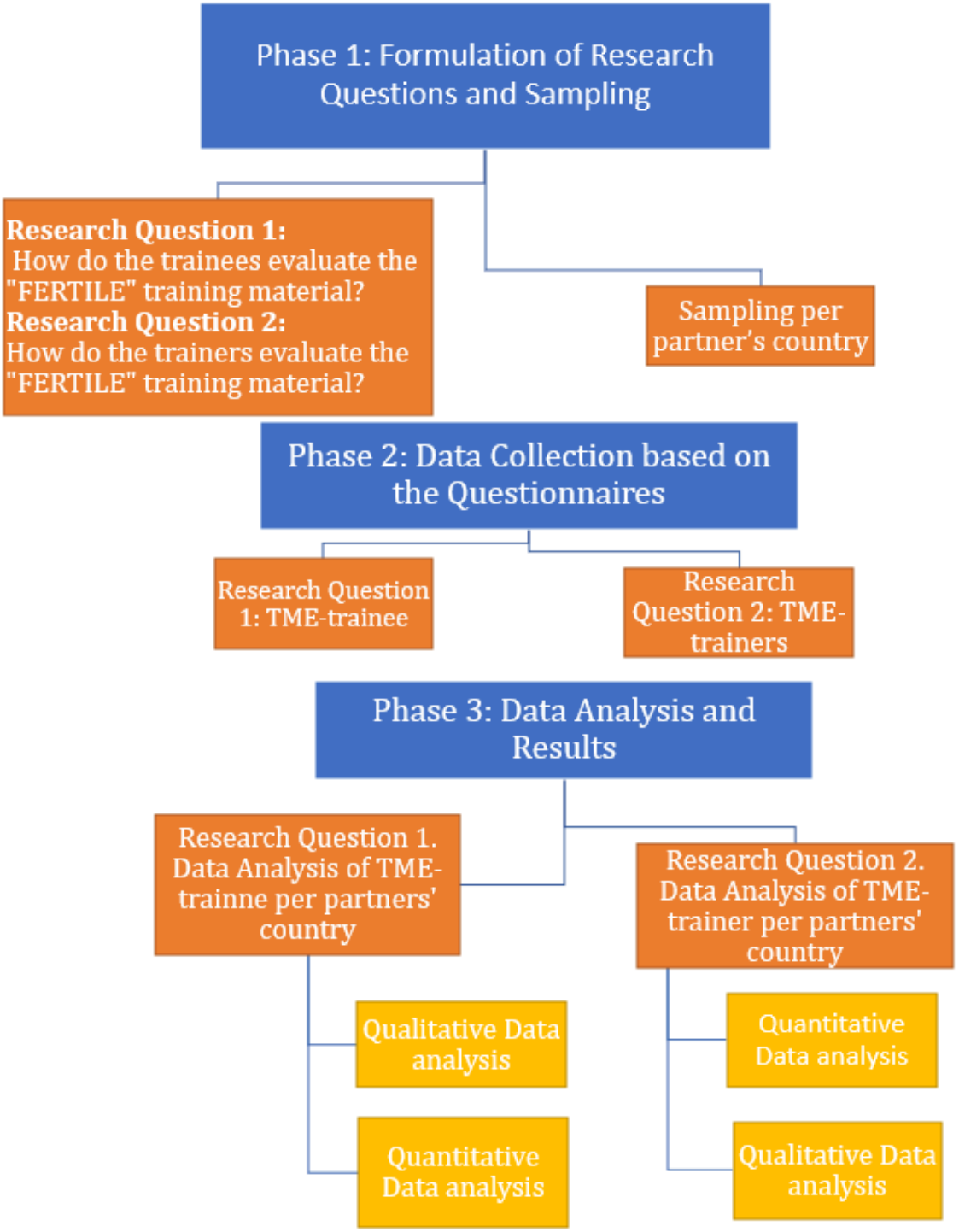


Figure 1. The Training Material Evaluation Process

5.1 Phase 1: Formulation of research questions and sampling

The objective was to utilise the pilot studies' findings to inform the training materials' refinement and enhancement. Thus, the research questions of this study are:

Research Question 1: How do the trainees evaluate the "FERTILE" training material?
Research Question 2: How do the trainers evaluate the "FERTILE" training material?
We conducted several pilot training events focused on the Fertile Design Methodology to address these research questions, utilising developed training materials. After the pilot training, participants were asked to complete the corresponding evaluation questionnaires.
Thus, we defined the following aspects to investigate from the trainees' perspective: **dependability, efficiency, perspicuity, stimulation, and novelty.**

Regarding the trainees, the **TME-trainee** (see APPENDIX A) is based on the UEQ (Laugwitz, Held, & Schrepp, 2008), which is an end-user quiz, and it was formulated according to the objectives of the training materials development described above. The scales of the UEQ questionnaire The questionnaire consists of twenty-six 7-point items with bipolar verbal anchors that measure six aspects, thereof three usability aspects that are called perspicuity, efficiency, and dependability, two hedonic aspects called stimulation and novelty plus one overall aspect that is called attractiveness.

For the trainers, the **TME-trainer** (detailed in APPENDIX B) was formulated in alignment with the quality indicators outlined in the quality plan in the FERTILE handbook and consists of 12 closed-ended Likert-like questions. This framework served as the basis for developing and evaluating the training materials from the trainers' standpoint.

Next, we present descriptive data for the sample used by each partner.

5.1.1 Greece (organised by UniWA)

The study was performed with 9 MSc students attending an inter-institutional postgraduate program on digital transformation and educational practice (2022-2023) at UniWA, Greece (see Table 1, column UNIWA).

The nine participants were predominantly female (78%). Their age distribution ranged from 20 to 55, with a notable representation of individuals between 30 and 40 (56%).

Participants exhibited varying expertise in educational robotics (ER) and art. The majority (67%) identified as ER novices, while 33% categorised themselves as ER experts. Three out of nine participants were ICT teachers, while the rest came from various disciplines.

5.1.2 Spain (organised by URJC)

22 participants participated in the pilot study. They were active teachers and future teachers (currently students of Bachelor degrees and MSc degrees in teaching education) from Universidad Rey Juan Carlos

and Universidad de Valladolid. Since only 12 participants answered all the questionnaires, we will only consider them. Of those participants, 9 were female and 3 were male.

The participants' ages were as follows: 67% were between 20 and 30, 25% were between 30 and 40, and 8% were over 55. Regarding their expertise, 11 categorised themselves as novice teachers, while one categorised themselves as experts.

The main discipline of the participants was Educational Robotics since 8 out of 12 were focused on that discipline, while 4 out of 12 were focused on Arts.

5.1.3 Czech Republic (organised by CUP)

In the Czech Republic, 15 participants attended the pilot study. They were mostly future teachers of the master's program from Charles University, Faculty of Education. Only 12 participants answered all the questionnaires, so we will consider only them. Five of those participants were female, and seven were male.

The participants' ages were as follows: 8 were between 20 and 30, 3 were between 40 and 55, and 1 was over 55. Regarding their expertise, 7 categorised themselves as novice teachers, while 4 were classified as experts. One stated that they had 3-5 years of teaching experience.

5 participants were from primary education, 5 were from secondary education and 2 were educators from university.

6 participants were Informatics teachers, focusing on educational robotics as their main discipline. The Art as the main discipline was for 3 participants and 3 stated the option "*Other*". The participants who said "*Other*" participated in the pilot as art teachers.

5.1.4 Slovakia (organised by CUB)

Twenty teachers from different schools and cities in Slovakia attended the pilot training. Most of them (80%) were female participants.

As 1 participant did not fill in the questionnaires, we provided further data only from the 19 teachers who did.

The participants' age composition included all categories above 30, with the following distribution: 31-40 years—21.1%, 41-55 years—63.2%, and above 55 years—15.8%. None of the participants were novice teachers; one declared to have 3-5 years of experience, and all the others identified themselves as experts with more than 5 years of experience.

Only two participants (10.5%) were primary teachers. Several of them teach at two or three levels of education: 63.2%, 42.1%, and 5.3% (1 participant) had experience teaching at the lower secondary, upper secondary, and university levels, respectively.

In terms of professional focus, participants were deliberately selected to form informatics teacher-art teacher pairs. Therefore, half fell into one discipline and the other half into the other. However, some of them taught both informatics and an art subject or even another subject. In several cases, pairs of teachers (informatics teacher-art teacher) from the same school have enrolled in the course.

Table 5 provides general information for participants from all countries on their gender, age, course, educational experience, and level of expertise.

Table 5. Frequencies of Sex, Age, Discipline, Teaching Experience and Expertise Level Across Partner Countries

Sex	**GREECE UNIWA (N=9)**	**SPAIN URJC (N=12)**	**CZECH REP CUP (N=12)**	**SLOVAKIA CUB (N=19)**
Female	8	9	5	15
Male	1	3	7	4
Age				
20-30	5	8	8	0
30-40	4	3	0	4
40-55	0	0	3	12
55+	0	1	1	3
Discipline				
Educational Robotics	8	8	6	9
Arts	2	4	6	10
Teaching Experience				
0-3 (novice)	8	11	7	0
3-5	0	0	1	1
5+ (expert)	1	1	4	18
Expertise Level				
Low	7	7	9	1
Moderate	2	3	0	15
High	0	2	3	3

5.2 Phase 2: Data collection based on the questionnaires

The TME trainee utilised in this study was carefully designed to gather comprehensive feedback from participants on their interaction with the training materials. It comprised two primary sections: a semantic scale section and open-ended questions.

Semantic Scale Section:

In this section, the participants were tasked with assessing various aspects of the training material's usability and appeal using a semantic scale rather than a traditional Likert-like scale. Drawing inspiration from the User Experience Questionnaire (UEQ), the semantic scale aimed to measure the nuances of perceptions. The aspects evaluated included Dependability (assessed through one item), Efficiency (two items), Perspicuity (two items), Stimulation (two items), and Novelty (two items). Participants were prompted to express their perceptions (1-5) along each aspect through a range of semantic descriptors, offering a more nuanced evaluation of their experiences.

Table 6 presents the descriptions of each aspect as defined by Schrepp and Thomaschewski (2019). These descriptions provide insights into the subjective impressions associated with various aspects of user experience when interacting with the training material.

Table 6. Descriptions of the aspects evaluated on the trainees' questionnaire

Aspect	**Description**
Dependability	The subjective impression to be in control of the interaction with the training materials.
Efficiency	The subjective impression that tasks can be finished without unnecessary effort.
Perspicuity	The subjective impression that it is easy to learn how to use the training materials.
Stimulation	The impression that it is interesting and fun to use the training materials.
Novelty	The impression that the product design or product idea is creative and original.

Open-Ended Questions:

The **TME trainee** also incorporated two open-ended questions to capture qualitative insights from trainees. These questions asked trainees to express their positive experiences by stating what they liked about the material. Additionally, participants were encouraged to provide constructive feedback by suggesting changes or improvements to the training material, thus offering valuable qualitative data to complement the quantitative feedback gathered from the semantic scale section.

Through the **TME-trainer** (SEE APPENDIX B), the trainers were asked to provide feedback on the adequacy and comprehensibility of the materials, their coverage of learning objectives, efficiency in facilitating activities, appropriateness for the target group, and support for different modalities of the pilot study (e.g., face-to-face, asynchronous, online synchronous) (8 Likert-like scale questions).

Additionally, participants were asked about any difficulties encountered while working with the training material, perceived usefulness of the material, and suggestions for potential improvements (3 open-ended questions).

5.3 Phase 3: Data analysis and results.

Research Question 1: Trainees' Perspective

The analysis process for addressing **Research Question 1 (RQ1)**, which evaluates the training materials in terms of user experience, involved examining 8 semantic scale responses (quantitative data) and 2 open-ended questions (qualitative data) of the **TME trainee** using SPSS.

Quantitative data analysis:

Raw data was entered into the statistical software and descriptive statistics, specifically, mean scores and standard deviations, were then computed for each question. The mean scores served as indicators of the central tendency, reflecting the average participant perception for each aspect. Concurrently, standard deviations provided insights into the dispersion of responses around the mean, offering an understanding of the variability in participants' assessments. The interpretation of mean scores allowed for a nuanced evaluation of the training materials, identifying areas of strength and potential improvement. For instance, higher mean scores indicated favourable perceptions, while lower scores pointed to aspects that might require attention. Additionally, the standard deviations shed light on the consensus or divergence in participants' opinions. This analysis approach facilitated a detailed examination of the user experience, offering valuable insights into the overall effectiveness of the training materials.

Qualitative data analysis:

The responses to the open-ended questions, "State what you like about the material" and "What do you suggest to change on the material?" were subjected to a thematic analysis to identify recurring patterns, key themes, and valuable insights. First, the qualitative data were transcribed and coded systematically, allowing for the identification of recurring topics across participants' responses. Subsequently, thematic categories (Classification themes) emerged from these codes, which were organised concerning the educational material they addressed. The second level of coding (Topic) was defined as the positive aspects that the participants valued in the first research question and the constructive suggestions for improvement in the second research question. The presentation of the qualitative results in tables is also enhanced by the "Frequencies" column which refers to the number of responses for each research question as well as by indicative quotes from the trainees' and trainers' responses. The emerging themes facilitated a holistic understanding of participants' perspectives. The combination of quantitative Likert scale data and qualitative responses provides a rich narrative that may complement the numerical findings and enrich the overall understanding of user experience with the training materials.

5.3.1 Greece (organised by UniWA)

Analysis of the Quantitative Data

The evaluation of training material by the trainees at UniWA in Greece reveals positive perceptions overall (see Table 7). The trainees rated the dependability of the materials highly, with an average score of 4.60, indicating strong supportiveness rather than obstruction. Similarly, the aspects of perspicuity—precisely ease of understanding and clarity—received high mean scores of 4.65 and 4.81, respectively. This suggests that trainees found the materials mostly uncomplicated and clear. Regarding efficiency, the average rating was 4.50, indicating a perceived level of effectiveness, although with slightly more variability in opinions compared to other aspects. Trainees generally found the materials interesting (average score of 4.76) but less exciting (average score of 4.40), with moderate variability in responses for both stimulation aspects. Overall, the data highlight positive perceptions of the training materials, particularly in terms of perspicuity and stimulation, with some variation in opinions on efficiency and novelty.

Table 7. Quantitative Findings (mean and Standard Deviation) regarding the Greek trainees' perception of the training materials

	The training material was:							
	Obstructive - Supportive (Dependability)	**Complicated - Easy (Perspicuity)**	**Inefficient - Efficient (Efficiency)**	**Confusing - Clear (Perspicuity)**	**Boring - Exciting (Stimulation)**	**Not interesting - Interesting (Stimulation)**	**Conventional - Inventive (Novelty)**	**Usual - Leading edge (Novelty)**
MEAN	4.60	4.65	4.50	4.81	4.40	4.76	4.38	4.44
STANDARD DEVIATION	0.37	0.33	0.50	0.18	0.36	0.31	0.48	0.39

Analysis of the Qualitative Data

Based on the responses provided by the trainees regarding what they liked about the training materials in the pilot training for the FDM and what they suggested to change, a content analysis was conducted to classify and analyse the feedback. The table below illustrates the identified themes along with their respective frequencies and representative quotes (Table 8):

Table 8. Qualitative Findings regarding the Greek trainees' perception of "what they liked" and "suggested changes " on the materials - inductive content analysis

Question1: State what you like about the material (responses = 32)			
Classification theme		**Freq.**	**Representative Quote**
a) (1.3 & 3.1) Videos of Robots/ Simulators		6	"The training material-videos with simulators was comprehensive."
b) (3.3 & 3.4) Community Platform		10	"The manual was fully informative, and solves any questions about using the platform." "There was completeness and clarity in the instructions for using the platform and it was quite informative"
c) (4.1 & 4.2) FDM video and worksheets		7	" ..clarity and completeness in terms of what the steps of the Fertile methodology were and what these steps involved (FDM video and worksheet for analyzing a project)"
d) 4.3 Exemplar Artful ER projects based on the FDM		5	" The example of the project and what steps were followed in each activity"
e) Overall comments	Material Organisation	4	" Well organized in general and a large number of relevant resources.
Question 2. What do you suggest to change on the material? (responses = 6)			
Classification theme	**Topic**	**Freq.**	**Representative Quote**
a) (1.3 & 3.1) Videos of Robots/ Simulators	Provide more ER artful project examples	1	"The examples for the project categories were limited"
	Provide user guides for each simulator	1	" …just that the training material could be enriched with a user guide for each simulator for those teachers who are not familiar with their use"
	Provide videos for more robotic technologies	1	" .. In some technologies, there were no videos".
b) (3.3 & 3.4) Community platform	Provide exemplars in the CP	2	"I would like there to be a written example developed with the categories in the fertile platform/community"
	Provide duration in the worksheets of the activities	1	"I would like the completion form for the FERTILE Online Platform to indicate how long it will take approximately because it took longer than I thought."
	Provide more information on CP video	1	"The platform video could have included a slightly more detailed description of the platform, so that its

			use and purpose can be understood by people encountering it for the first time."
	Provide hovering on the steps	2	"Some terms are difficult to identify their subtle differences, such as between the terms formulating - creating the solution"
	Provide hovering on the activity	2	"Maybe we should have analyzed some aspects of the construction activities in more detail to be able to better reflect them in the project we prepared".

The feedback from participants in the pilot study of UniWA regarding the "FERTILE" training materials reveals positive sentiments towards specific themes. Respondents appreciated the comprehensive robot and simulator videos for their clarity in explaining new robotics technologies. Additionally, the training materials for the CP, including the manual and Google Form worksheet, were commended for being informative and offering clear instructions.

The FDM video and accompanying worksheets were noted for their completeness in explaining the methodology and project analysis steps. The exemplary Artful Er projects provided through videos were praised for demonstrating project development effectively. Participants also commented positively on the overall organization and availability of resources in the materials. Suggestions for improvement included enriching robot videos with more technologies, developing project exemplars in the CP, enriching interactive presentation with more project examples, indicating time estimates for CP form completion, enhancing the CP video with more detailed explanations, and enhancing the design process with explanations and detailed instructions for the steps and the activities.

These insights highlight areas of strength and areas of opportunity for refinement in the FDM training materials, aiming to enhance clarity and user experience for educators engaging with interdisciplinary projects. The suggestion to provide user guides for simulators is identified as unrelated to refining the training materials, as the focus is primarily on improving the educational content and support related to the Artful ER projects through the CP.

5.2.2 Spain (organized by URJC)

Analysis of the Quantitative Data

The evaluation results of the training material show a generally positive perception across all questions (>= 4.0). The participants felt that the material supported them in achieving their objectives (4.50), but sometimes they also felt that the material was not so easy to understand (3.92). There were some high discrepancies regarding the scores in the area of efficiency (4.17), clearness (4.00), and stimulation (4.42) since the standard deviation for those items was 1.34, 1.21, and 1.22 respectively. This means that some participants believed the materials were inefficient, somewhat confusing, and at times become boring. This matches with the results in the area of stimulation (4.42) which, with a standard deviation of 1.16, also means that there were different opinions among the participants. However, most participants thought the materials were inventive (4.33) and had not seen something similar before (4.17). The overall results show that some areas could still be improved.

Table 9. Quantitative Findings (mean and Standard Deviation) regarding the Spanish trainees' perception of the materials

	Obstructive - Supportive (Dependability)	**Complicated - Easy (Perspicuity)**	**Inefficient - Efficient (Efficiency)**	**Confusing - Clear (Perspicuity)**	**Boring - Exciting (Stimulation)**	**Not interesting - Interesting (Stimulation)**	**Conventional - Inventive (Novelty)**	**Usual - Leading edge (Novelty)**
MEAN	4.50	3.92	4.17	4.00	4.25	4.42	4.33	4.17
STANDARD DEVIATION	0.67	0.90	1.34	1.21	1.22	1.16	0.98	1.03

Analysis of the Qualitative data

We performed a content analysis on the feedback from trainees about their preferences and suggested changes to the FDM pilot training materials. This analysis aimed to categorize and examine their responses. The following table (Table 10) presents the identified themes, their corresponding frequencies, and representative quotes.

The feedback from participants in the pilot study conducted by URJC about the "FERTILE" training materials reveals that the participants highly appreciated the large number of possibilities regarding robots and simulators when designing activities for different education levels. Many of them stated that the materials were innovative, and the videos and presentations significantly clarified the contents. Participants also stated that they would have liked to have more face-to-face sessions where they could have tinkered more time with the different robots. One participant expressed that the robotics solutions were expensive and that it would be difficult to include them in real classrooms due to the lack of funding. Considering their work with the Community Platform, some participants stated that they would like to be able to work with other participants at the same time on the same project.

Table 10. Qualitative Findings regarding the Spanish trainees' perception of "what they liked" and "suggested changes" on the materials - inductive content analysis

Question1: State what you like about the material (responses = 23)			
Classification theme	**Topic**	**Frequency**	**Representative Quote**
a) (1.3 & 3.1) Videos of Robots/ Simulators		9	"I have enjoyed learning about the variety of robots that exist for use in education and in any field." "The different robots and/or devices that are currently being used in the classroom, along with the explanatory videos."
b) General Comment	Innovation	8	"How innovative is the material!"
c) (3.3 & 3.4) Community Platform		6	"The text guide is quite clear"
Question 2. What do you suggest to change on the material? (responses = 13)			
Classification theme	**Topic**	**Frequency**	**Representative Quote**
a) Pilot Studies Organisation	Duration	7	"More time for face-to-face activities."
	Sessions	3	"Incorporate a little more practice."
b) (1.3 & 3.1) Videos of Robots/ Simulators	Provide cost-effective alternatives	1	"Perhaps, in the robotics part, present more economical options."
c) (3.3 & 3.4) Community Platform	Provide opportunities to work in groups.	2	"Being able to work with several people at the same time on the project."

5.2.3 Czech Republic (organised by CUP)

Analysis of the Quantitative Data

The evaluation results of the training material show a generally positive perception across all questions (>= 3.38). The participants felt that the materials supported them in achieving their objectives (4.85), also they considered them positively as interesting (4.31). but sometimes they also felt that the material was not so easy to understand (3.92). The less positive result can be seen in the aspect of novelty where the mean for invention is 3.38 and for leading edge is 3.54. The highest standard deviation can be seen in these two last results (1.12 and 1.08), which means that the point of view among the participants was different.

Table 11. Quantitative Findings (mean and Standard Deviation) regarding the Czech trainees' perception of the materials

	The training material was:							
	Obstructive - Supportive (Dependability)	**Complicated - Easy (Perspicuity)**	**Inefficient - Efficient (Efficiency)**	**Confusing - Clear (Perspicuity)**	**Boring - Exciting (Stimulation)**	**Not interesting - Interesting (Stimulation)**	**Conventional - Inventive (Novelty)**	**Usual - Leading edge (Novelty)**
MEAN	4.85	4.08	4.23	3.92	3.62	4.31	3.38	3.54
STANDARD DEVIATION	0.38	0.95	0.73	0.86	1.12	0.75	1.12	1.05

Analysis of the Qualitative Data

A content analysis was carried out on the feedback provided by trainees concerning their preferences and suggested modifications to the FDM pilot training materials. The primary goal of this analysis was to categorize and thoroughly examine their responses. The results of this analysis are summarized in the following table (Table 12), which presents the identified themes or topics along with their corresponding frequencies and representative quotes. These insights aim to enhance the understanding of trainee perspectives and guide future improvements to multiplier events.

Table 12. Qualitative Findings regarding the Czech trainees' perception of "what they liked" and "suggested changes" on the materials - inductive content analysis

Question1: State what you like about the material (responses=8)			
Classification theme	**Topic**	**Frequency**	**Representative Quote**
a) Overall Comments	Examples	3	"I liked the variety of possibilities and concrete examples of the connection between robotics and art." "The materials show a relatively large number of illustrative examples"
	Variety and clarity of the material	4	"The diversity was interesting - from videos to worksheets."
b)(1.4-1.6) Computational Thinking		1	"topics for CT parts ... especially for presentations, these are very good"
Question 2. What do you suggest to change on the material? (responses =13)			
Classification theme	**Topic**	**Frequency**	**Representative Quote**
a) (1.3 & 3.1) Videos of Robots/ Simulators	Translate the video rather than provide subtitles	2	"Editing of video subtitles - there was an overlap between English and Czech subtitles."
	Improve the quality	3	"The informational videos were not very convincing, especially with the choice of underdeveloped graphics and soundtrack. However, the content was useful."
b) (3.3 & 3.4) Community Platform	Adjust the size of the worksheet	1	"The project description has many items, perhaps it would be good to write which are key ("mandatory")"
c) Overall Comments	Adjust the size of the worksheet	1	"some of the materials were too extensive, but I understand that they were designed for distance learning"
	Enrich materials	5	"I would add some comprehension questions or quizzes to the materials in the distance section" "Add more links on the topic - they will be useful for novice and experienced teachers."
	Provide more art activities	1	"for computer science purposes, the art was sufficiently included, but for art education purposes, more art would need to be included in the activities

The feedback from the participants showed that they appreciated the clarity and the variety of the materials in a general way. They also stated that they liked the many illustrative examples, for example on the topic of combining Arts and ER.

When asked to suggest changes to the materials, they elaborated more. Even if they appreciated the content of the videos, they pointed out shortcomings in their processing or in the solution of their translations. The overlapping of the English subtitles with the Czech subtitles was mentioned as disturbing. In general, the participants suggested enriching the materials with some other interactive activities, but without mentioning specific materials. Among other less frequently mentioned suggestions (see quotes in Table 12) there were some interesting statements about the structure of the design description in the CP or about the depth of the artistic aspect as opposed to the CT skills.

5.2.4 Slovakia (organised by CUB)

Analysis of the Quantitative Data

The evaluation of training materials by the trainees at CUB in Slovakia (see Table 13) reveals mixed perceptions across different aspects. Trainees rated the dependability of the materials moderately high, with an average score of 4.63, suggesting a generally supportive rather than obstructive nature. However, perceptions of perspicuity (ease of understanding) were less positive, with a mean score of 3.63, indicating that trainees found the materials somewhat complicated. The aspect of efficiency received a moderate rating of 4.16, suggesting perceived efficiency but with noticeable variability in opinions (standard deviation of 0.76). Trainees rated the clarity of the materials (4.11) and their level of stimulation (4.05) slightly lower, with moderate variability in responses. Interestingly, the materials were considered more inventive (4.63) rather than conventional and more leading-edge (4.00) rather than usual, with relatively low standard deviations for both novelty aspects (0.68 and 0.58). Overall, while there were positive perceptions of innovation and dependability, there were also areas where trainees found the materials less clear and stimulating, highlighting room for improvement in certain aspects of the training materials.

Table 13. Quantitative Findings (mean and Standard Deviation) regarding the Slovak trainees' perception on the materials

	The training material was:							
	Obstructive - Supportive (Dependability)	**Complicated - Easy (Perspicuity)**	**Inefficient - Efficient (Efficiency)**	**Confusing - Clear (Perspicuity)**	**Boring - Exciting (Stimulation)**	**Not interesting - Interesting (Stimulation)**	**Conventional - Inventive (Novelty)**	**Usual - Leading edge (Novelty)**
MEAN	4.63	3.63	4.16	4.11	4.05	4.26	4.63	4.00
STANDARD DEVIATION	0.68	0.96	0.76	0.88	0.71	0.56	0.68	0.58

Analysis of the Quantitative Data

Table 14. Qualitative Findings regarding the Slovak trainees' perception of "what they liked" and "suggested changes" on the materials - inductive content analysis

Question1: State what you like about the material (responses =19)			
Classification theme		**Freq.**	**Representative Quote**
a) (1.3 & 3.1) Videos of Robots/ Simulators		3	"Nicely made videos"
b)(1.4-1.6) Computational Thinking		1	"The CT activities were great"
c) Overall Comments	Variety and clarity of the material	12	They were clear, simple, and concise." "They were clear, detailed and illustrative"
	Innovation	3	'They offered a new perspective and traditional topics" "New ideas for working with robots"
Question 2. What do you suggest to change on the material? (n=15)			
Classification theme	**Topic**	**Freq.**	**Representative Quote**
a) (1.3 & 3.1) Videos of Robots/ Simulators	Translate the video rather than provide subtitles	5	"I would translate them to Slovak, it's difficult to watch the video and subtitles at the same time"
b)(1.4-1.6) Computational Thinking		2	"I would have appreciated the introductory pictures translated into Slovak" "giving more examples for each skill."
c) (3.3 & 3.4) Community Platform	Provide exemplars in the CP	1	"The videos which we analyzed weren't submitted in the community platform"
d) Overall Comments	Worksheets	2	"The worksheets seemed unnecessarily time-consuming to me"
e) No changes		5	"I wouldn't make any changes"

Most participants appreciated the materials for their creativity, clarity, relevance to the topic, and ease of accessibility. They also praised the use of different types of materials, especially videos, for their visual appeal. They liked the specific examples for each topic explained, the number of references provided, and the division of some sections according to the age of the students. Among the specific activities, they highlighted a workshop with robots (activity 2.1) and CT-skills activities (activity 1.6).

Their suggestions for **changes to the materials** were mostly related to the videos. Several suggested translating the **videos** (dubbing) rather than subtitling, as they could not manage to watch the video content and read the subtitles at the same time. Some commented that "fewer and better videos are more than a lot of worse ones". Another suggestion commented on the **worksheets** as "unnecessarily

time-consuming". According to the material for CT one participant suggested translating the images from the introductory presentation on CT skills (not just the presentation itself) into English and giving more examples for each skill.

Research Question 2: Trainers' Perspective

The analysis process for addressing **Research Question 2 (RQ2)**, which evaluates the training materials through the **trainers' perspective**, includes 7 closed-ended Likert-like questions for quantitative responses (1- strongly disagree- 5 strongly agree), along with 3 open-ended questions seeking qualitative feedback on faced difficulties, experienced usefulness, and proposed changes regarding the training material used in the pilot trainings of the TME-trainer using SPSS. The TME trainer was answered by a total of 9 trainers: 3 from UniWA, 1 from CUP, 3 from CUB, and 2 from URJC.

Quantitative Data Analysis

The trainers' evaluation of the TME-questionnaire responses (see Figure 2) indicates positive perceptions overall regarding the training materials used in the pilot study. The variety of materials available was deemed adequate for achieving the learning objectives, with a mean score of 4.4 and a standard deviation of 0.7, suggesting some variability in opinions among trainers. Similarly, the comprehensibility of the training materials was rated as sufficient, with a mean score of 4.4 and a lower standard deviation of 0.5, indicating more consistent perceptions among trainers. The training materials were found to effectively cover the learning objectives (mean score of 4.9) and efficiently support related activities (mean score of 4.6), with moderate variability in responses as indicated by the standard deviations. Additionally, trainers believed the materials were appropriate for the target group (mean score of 4.7) and effectively supported various modalities of the pilot study (mean score of 4.3), though opinions were more varied in these areas as suggested by the higher standard deviations of 0.9 and 0.7, respectively. Overall, the positive mean scores reflect favourable perceptions of the training materials' adequacy, comprehensibility, and effectiveness in meeting the pilot study's objectives, while the standard deviations highlight areas where opinions varied among trainers, needing further investigation.

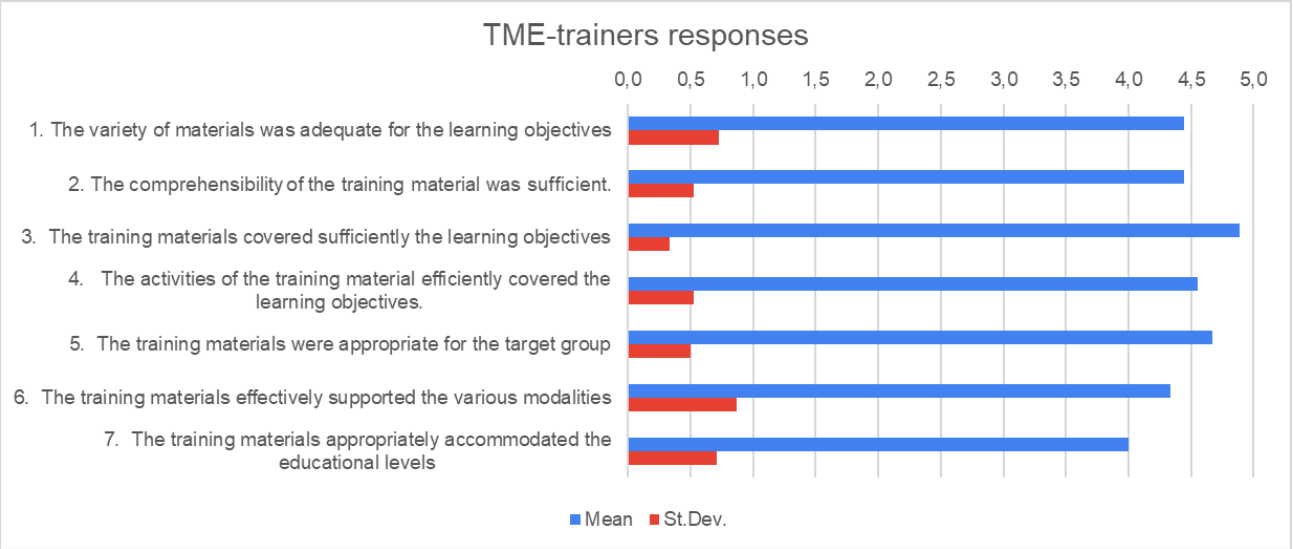


Figure 2. The mean and Standard Deviation of the trainers' responses in the TME-trainer questionnaire

Qualitative Data Analysis

Based on the trainers' responses, we conducted a content analysis classified into themes focusing on the perceived difficulties, usefulness, and suggested improvements regarding the training materials (see Table 15). This approach allowed for a comprehensive examination of educators' feedback, capturing insights on the faced challenges, the value derived from specific training materials, and the recommendations for enhancing the overall training material experience.

Table 15. Qualitative Findings regarding the trainers' perception of difficulties, usefulness, and "suggested changes" on the materials - inductive content analysis

Question 10. What difficulties did you face working with the particular training material? (responses = 11)		
Classification theme	**Frequency**	**Representative Quote**
a) No difficulty	4	"Not any significant difficulty " (UniWA)
b) Insufficient training time	2	"However, there was too much information in them and it was impossible to get it all done. " (CUB)
c) Insufficient support for designing blended learning	2	"Difficulties with "how to incorporate online parts into the project", and "how to effectively do blended learning " (CUB)
d) Low cognitive content of video	1	"difficulties with videos that did not have very high information value "(CUB)
e) Order of the material	2	"I think it would be more appropriate to work on the face-to-face materials of the methodology and on the community platform with more time in between"(URJC) "The step from the FDM to the community platform is too abrupt. I believe participants need more time in the middle of both steps so they can adapt in a better way how the FDM works when using the platform" (URJC)
Question 11. How did you find it useful to work with the particular training material?(responses = 8)		
Classification theme	**Frequency**	**Representative Quote**
a) Classification of TM according to educational level and discipline	2	"the plurality of the material can support a variability of contexts on educational levels and technologies, art forms "(UniWA)
b) Appropriate for both disciplines	4	"The material I worked with was well-suited for both Robotics and Art teachers and this was very helpful" (UniWA)
c) Instructive	2	"The training material for computational thinking module is excellent, with pertinent examples, rigorous and at the same time very instructive." (URJC)

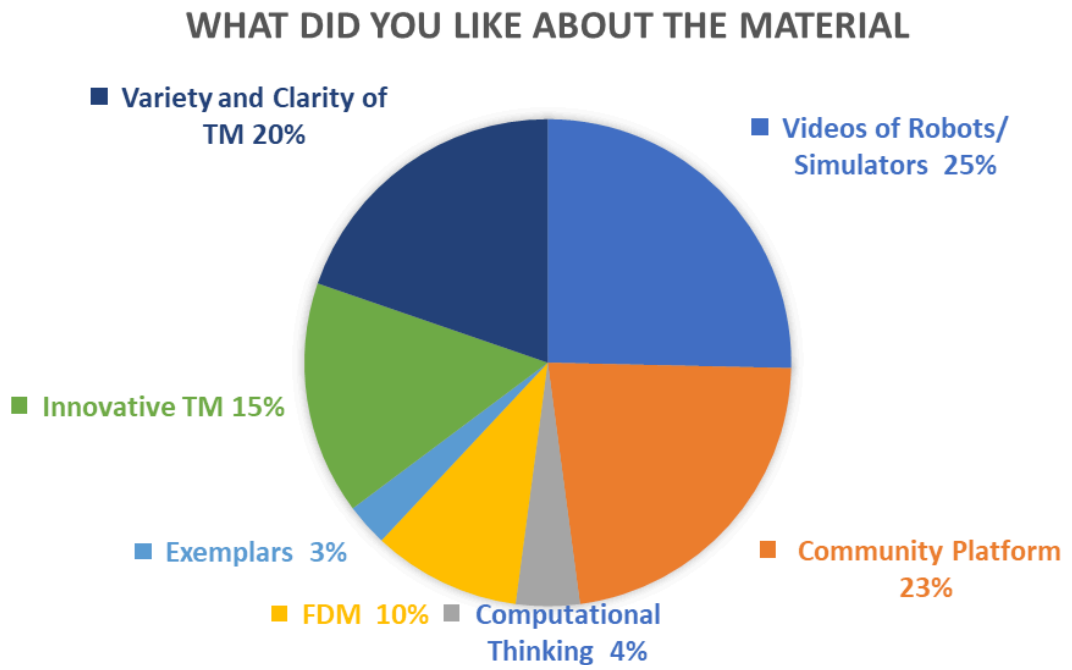
Question 12. What would you propose to change in the training material of the pilot study? (responses = 10)			
Classification theme	**Topic**	**Frequency**	**Representative Quote**
a) (1.3 & 3.1) Videos of Robots/ Simulators	Improve the quality of the videos	3	"I prefer fewer videos, but of good quality. Some of them had a small benefit for the participants" (CUB) "videos need to be updated (remove rendered English. subtitles)" (CUP)
b) (3.3 & 3.4) Community Platform	Provide exemplars in the CP	2	"Regarding the platform, I would suggest that there should be more exemplar-designs for the trainees to understand better."(UniWA)
	Practice on the CP after presenting the FDM material (4.1, 4.2)	2	"I would propose to move the FDM module forward (perhaps it could be done in a synchronous online format) before the second face-to-face session. "(URJC)
c) No changes		3	"Nothing to change"

The content analysis of the trainers' responses regarding the difficulties, usefulness, and proposed changes to the training materials reveals important insights for modification and improvement. The trainers highlighted challenges with the overwhelming amount of information presented, indicating a need for more streamlined content delivery. Additionally, difficulties in integrating online components into projects underscored the necessity for clearer guidance on blended learning strategies. Some trainers also expressed dissatisfaction with the informational value of certain videos, emphasizing the importance of higher-quality and more impactful video resources. Moreover, feedback on timing and pacing suggests that adjustments in scheduling and sequencing could enhance the learning experience. On the positive side, the trainers found the material beneficial for project design and educational implementation, particularly appreciating their adaptability to different audiences and contexts. Suggestions for improvement include a) adding more exemplar designs on the community platform and b) improving the quality and relevance of robot/simulator videos. Optimizing the timing and pacing of workshops to accommodate educators' needs and preferences better is considered out of the scope of this evaluation, which primarily focuses on the refinement of training materials.

These trainer insights provide context for the quantitative results from the TME-trainer, where overall mean scores reflecting positive perceptions of material adequacy and effectiveness were contributed by trainers from UniWA, CUP, CUB, and URJC.

6. Key Findings and Implications for Refinement

The data analysis provided evidence of the overall positive perceptions: Trainees from all four countries viewed the training materials positively (see Table 16). The mean ratings indicated that the materials were dependable, clear, stimulating, interesting, and innovative. This suggests that the materials were generally well-received across different aspects.



Graph 2. Trainees' responses to the question "State what you like about the material" on the TME-trainer questionnaire

In particular, based on the **quantitative ratings** provided by **trainees** from all countries regarding the training material, notable differences and similarities emerge. In Greece, trainees reported highly positive perceptions, with mean ratings indicating strong agreement that the material was dependable (mean = 4.60, SD = 0.37), clear (mean = 4.81, SD = 0.18), stimulating (mean = 4.40, SD = 0.36), interesting (mean = 4.76, SD = 0.31), and leading edge (mean = 4.44, SD = 0.39). They also found the material relatively easy to comprehend (mean = 4.65, SD = 0.33) and efficient (mean = 4.50, SD = 0.50).

Table 16. Quantitative Findings (mean and Standard Deviation) regarding all trainees' perception of the materials

	Greece		Slovakia		Spain		Czech Rep.		Total Mean
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
Obstructive – Supportive (Dependability)	4.60	0.37	4.63	0.68	4.50	0.67	4.85	0.38	4.65
Complicated - Easy (Perspicuity)	4.65	0.33	3.63	0.96	3.92	0.90	4.08	0.95	4.07
Inefficient – Efficient (Efficiency)	4.50	0.50	4.16	0.76	4.17	1.34	4.23	0.73	4.27
Confusing – Clear (Perspicuity)	4.81	0.18	4.11	0.88	4.00	1.21	3.92	0.86	4.21
Boring Exciting (Stimulation)	4.40	0.36	4.05	0.71	4.25	1.22	3.62	1.12	4.08
Not interesting – Interesting (Stimulation)	4.76	0.31	4.26	0.56	4.42	1.16	4.31	0.75	4.44
Conventional – Inventive (Novelty)	4.38	0.48	4.63	0.68	4.33	0.98	3.38	1.12	4.18
Usual – Leading Edge (Novelty)	4.44	0.39	4.00	0.58	4.17	1.03	3.54	1.05	4.04

Meanwhile, Spanish trainees provided slightly lower ratings, particularly in terms of perceived ease (mean = 3.92, SD = 0.90) and efficiency (mean = 4.17, SD = 1.34), suggesting a more challenging experience with the material. However, they still found it generally dependable (mean = 4.50, SD = 0.67) and stimulating (mean = 4.25, SD = 1.22).

Slovakian trainees also reported positive perceptions overall, aligning closely with Greek trainees in terms of dependability (mean = 4.63, SD = 0.68), clarity (mean = 4.11, SD = 0.88), stimulation (mean = 4.26, SD = 0.56), and novelty (mean = 4.63, SD = 0.68). Notably, Slovakian trainees found the material less easy to comprehend (mean = 3.63, SD = 0.96) and somewhat less efficient (mean = 4.16, SD = 0.76) compared to Greek counterparts.

Czech trainees found the material generally positive (>= 3.38 across all questions). They rated the material as highly supportive (4.85). Also, they considered it as interesting (4.31) and less easy to understand (3.92). The less positive result can be seen in the aspect of novelty where the mean for invention is 3.38 and for leading edge is 3.54. In the last two results, the high standard deviation (1.12 and 1.08) suggests that the participants had different points of view.

These findings suggest areas for improvement, particularly in enhancing clarity and ease of use across all training material, tailored to the specific needs and preferences of trainees from each country.

Differences in Perceived Ease and Efficiency: There were noticeable differences in how trainees from each country perceived the ease of comprehending the material and its efficiency. Greek and Czech trainees following, reported higher ratings for ease of understanding and efficiency compared to Spanish and Slovakian trainees. Spanish and Slovakian trainees, on the other hand, provided slightly lower ratings in these areas, indicating that they may have encountered more challenges or perceived the material as less efficient.

Consistency in Dependability and Novelty: Trainees from all countries rated the training material consistently high in terms of dependability (reliability) and novelty (innovation). This suggests that the content was viewed as trustworthy and cutting-edge, which are positive aspects of the training materials.

Differences in Perceived Novelty: There is a notable difference in how the Czech trainees perceived the novelty of the material. In particular, compared to the overall mean (total mean = 4.65) they found it less innovative (mean = 3.54).

Opportunities for Improvement: The lower ratings in perceived ease and efficiency from Spanish and Slovakian trainees and novelty from the Czech trainees, highlight potential areas for improvement. These findings suggest that adjustments could be made to enhance the clarity and user-friendliness of the training materials, especially to better accommodate the needs and preferences of trainees from different backgrounds and experiences.

In conclusion, while the training material generally received positive feedback across all countries, there are specific aspects such as ease of comprehension and efficiency that could be refined to further enhance the overall training experience and effectiveness for all trainees.

Additionally, the **quantitative ratings** provided by **trainers** align with the positive perceptions observed by the trainees regarding the training material used in the pilot studies. The trainers indicated overall positive views on the variety and comprehensibility of the materials, with mean scores of 4.4 and 4.4, respectively. The standard deviations of 0.7 and 0.5 suggest some variability in opinions among trainers, reflecting differing perspectives on the adequacy and clarity of the training material. Furthermore, trainers noted that the materials effectively covered the learning objectives (mean score of 4.9) and efficiently supported related activities (mean score of 4.6), with moderate variability in responses indicated by the standard deviations. The positive mean scores affirm the trainers' confidence in the material' ability to meet the pilot study's objectives. However, opinions were more varied on whether the materials were appropriate for the target group (mean score of 4.7) and effectively supported various modalities (mean score of 4.3), as suggested by the higher standard deviations of 0.9 and 0.7, respectively. This variability underscores the importance of addressing specific areas of concern to enhance the overall effectiveness and adaptability of the training material based on trainers' feedback.

Based on the **qualitative insights** from **trainees** in four countries, as well as the analysis from trainers across all countries, key findings emerge that shed light on the quantitative results obtained from trainees in Greece, Spain, and Slovakia. Trainees from Greece (Table 8) appreciated the clarity and comprehensiveness of robot and simulator videos, along with the informative nature of training materials provided through the Community Platform (CP), including manuals and Google Form worksheets. Similarly, trainees valued the completeness of the FDM video and accompanying worksheets for

explaining the methodology and project analysis steps effectively. Suggestions for improvement centered around enriching robot videos with more technologies, developing project exemplars within the CP, enhancing interactive presentations with additional project examples, and providing time estimates for completing CP forms.

In Slovakia (Table 10), participants appreciated the creativity, clarity, and relevance of the training material, particularly the variety of materials offered, such as videos and the division of sections according to students' age. Specific activities like workshops with robots and CT-skills activities were highlighted positively. Suggestions for improvement in Slovakia focused on translating videos via dubbing instead of subtitles for improved accessibility, reducing the number of videos to focus on quality, and streamlining worksheets to be less time-consuming.

Trainees from the Czech Republic highlighted the clarity and variety of the material and the existence of illustrative examples.

In Spain (Table 14), learners expressed their preference for videos and simulators and described the material as innovative. Suggestions for improvement in Spain focused more on organisational issues related to how they interacted with the material. Several participants suggested more face-to-face meetings and practical activities.

The **trainers' evaluation** of the TME-questionnaire responses aligns with positive trainee perceptions, indicating overall satisfaction with the variety and comprehensibility of the materials. However, trainers noted some variability in opinions regarding the adequacy and clarity of the training materials, especially in terms of suitability for the target group and support for various modalities. While the mean scores reflect confidence in the material's effectiveness in meeting objectives, higher standard deviations highlight areas of varied opinions that require attention.

The insights coming from the **qualitative data analysis** of the trainees (Tables 8, 10, 12,14) and the trainers (Table 15) into actionable improvements on the particular training materials, a table outlining suggestions for refinement and their corresponding implementation strategies is presented below:

Table 17. Overall suggestions and discussion on possible refinement of the material (Trainees & Trainers)

Training Material	Suggestions	Responses	Country	Suggested Changes
MODULE 1				
(1.3 & 3.1) Videos of Robots/ Simulators	Provide user guides for each simulator Provide duration in the worksheets of the activities Translate the videos rather than provide subtitles Propose cost-effective alternatives Improve the quality of the videos	1 4	GR, SP, SK, CZ	1.Add voice-over subtitles in the national language or remove subtitles. 2. Provide duration in the worksheets of the activities

1.4 Introduction to CT	Translate images and add more examples Adjust time for the CT material	3	SK	
MODULE 3				
(3.3 & 3.4) Community Platform	Provide exemplars in the CP Provide duration in the worksheets of the activities Provide opportunities to work in groups. Practice on the CP after presenting the FDM material (4.1, 4.2) Solution: Hoverings of the Steps in the CP Solution: Provide hoverings for the types of activities in the steps	17	GR, SP	1. Upload all project exemplars in the CP. 2. Change the order of the material
Overall Comments				
Incorporation of blended learning	Support on "how to incorporate online parts into the project" - how to effectively do blended learning “	2	SK	Create a new more detailed video about the use of simulators
Worksheets	Adjust the size of the worksheets	3	SK	Revise worksheets to prioritize key tasks and streamline instructions for efficiency.
Pilot Organisation	Incorporate more practice and time for F2F activities	13	SP	Important for the organization of the multiplier event

7. Conclusions

Based on the findings of the evaluation of the training material, we conclude that both trainees and trainers had a positive impression overall, although specific refinements were proposed.

The 5th Transnational Project Meeting, held at Comenius University in Bratislava on May 23rd and 24th, presented and discussed the results of the evaluation of the training material in detail. The responses and suggestions related to organizing the training events will inform the Report on the evaluation of the pilot studies. The partners jointly decided to refine the material in particular, as described below.

1. Concerning the **videos** of training material 1.3, 3.2, and 4.1 that are open access (developed at Kdenlive and Canvas) for modification, the universities concerned will modify part of the videos to be more understandable in their national language.
2. Given the difficulty encountered with implementing the **blended learning framework**, the partners of URJC and UniWA decided to further collaborate to design a new exemplar that will highlight the use and integration of educational robotic simulators. Also, additional material will be developed to material 3.1, «Learning Design Ideas for Educational Robotics in a blended learning context, which will elaborate on the context for integrating the simulators.
3. For the **Community Platform**, all partners decided to upload at least two exemplars they have designed so that good practices are present in each national language.

REFERENCES

Laugwitz, B., Held, T., & Schrepp, M. (2008). Construction and evaluation of a user experience questionnaire. In HCI and Usability for Education and Work: 4th Symposium of the Workgroup Human-Computer Interaction and Usability Engineering of the Austrian Computer Society, USAB 2008, Graz, Austria, November 20-21, 2008. Proceedings 4 (pp. 63-76). Springer Berlin Heidelberg.

Schrepp, M., & Thomaschewski, J. (2019). Handbook for the modular extension of the User Experience Questionnaire. In Mensch & Computer (pp. 1-19).

APPENDICES

APPENDIX A

THE TRAINING MATERIAL EVALUATION QUESTIONNAIRE FOR THE TRAINEES

1. The training material was *	Obstructive – Supportive
2. The training material was *	Complicated - Easy
3. The training material was *	Efficient - Inefficient
4. The training material was *	Confusing - Clear
5. The training material was *	Boring Exciting
6. The training material was *	Not interesting - Interesting
7. The training material was *	Conventional - Inventive
8. The training material was *	Usual – Leading Edge
9. State what you like on the material *	
10. What do you suggest to change on the material?	

APPENDIX B

THE TRAINING MATERIAL EVALUATION QUESTIONNAIRE FOR THE TRAINERS (TME-trainer)

1. The variety of materials (study material, presentations, videos, and activities) was adequate for the pilot study's learning objectives.
2. The comprehensibility of the training material was sufficient.
3. The training materials covered sufficiently the learning objectives of the pilot study.
4. The activities of the training material efficiently covered the learning objectives.
5. The training materials were appropriate for the target group of the pilot study.
6. The training materials effectively supported the various modalities of the pilot study, i.e. f2f, asynchronous, online synchronous.
7. The training materials appropriately accommodated the educational levels, i.e. primary, secondary, and higher education.
8. The training materials effectively supported the modalities of the pilot study, i.e. f2f, asynchronous, online synchronous.
9. What difficulties did you face working with the particular training material?
10. How did you find it useful working with the particular training material?
11. What would you propose to change in the training material of the pilot study?