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T2.1 FERTILE Community Platform Design Requirements

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0.3	UniWA: Maria Tzelepi	Elaboration of the FERTILE methodology's current version
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1.0	UVA: Juan I. Asensio-Pérez, Paraskevi Topali, Yannis Dimitriadis	Revised report after internal review process

CONTENTS

Executive Summary

FERTILE task T2.1 “Design Requirements” is the first step towards Result R2: “The FERTILE Community Platform”. The Community Platform (CP) is envisioned as an online meeting point for teachers interested in (co-)designing, sharing and reusing Artful Educational Robotics (ER) learning projects. The CP is also expected to help students during the enactment of Artful ER learning scenarios, providing instructions and learning resources, as well as facilitating interaction with the teachers. In order to take advantage of the expertise of FERTILE partners in Artful ER, the CP design requirements will reflect the main phases of the FERTILE Design Methodology (task T1.3), thus providing teachers with a pragmatic way of tackling the challenges posed by the design of those Artful ER projects This report provides a brief review of the state of the art in community support for learning design. Then, the report explains how the FERTILE Design Methodology is expected to influence the CP, and details the internal process followed for eliciting the design requirements for the FERTILE CP. Finally, the report describes the elicited design requirements by means of representative scenarios and use cases, which will be the basis for task T2.2 “Platform development”.

1. INTRODUCTION

The FERTILE project's main aim is to propose a design methodology for blended learning Artful ER projects that cultivate Computational Thinking (CT), as well as a Community Platform (CT) for remote collaboration of teachers and students that design and enact such projects, respectively. The CP is the expected R2 result from FERTILE, focused on three main goals, as stated in FERTILE Description of Work (DoW): 1) to allow educators to have access to the projects' results, including the FERTILE design methodology, training materials, and Artful ER projects developed during the project; 2) to provide community functionalities allowing online interaction/collaboration among educators/participants and thus promoting a sense of community; 3) to provide community analytics. To achieve these goals, work around R2 is organised in three main tasks and corresponding milestones: T2.1 Design requirements; T2.2 Platform development; T2.3 Evaluation of the FERTILE Community Platform. This report focuses on T2.1 (Design requirements) and its main goal: Milestone M2.1 Design Specifications.

The FERTILE partners have worked in T2.1 with the main aim of eliciting and agreeing on a set of functional requirements that the FERTILE CP is expected to comply with. To do so, the FERTILE partners have combined their previous knowledge from, on the one hand, the field of Learning Design (LD): the process and products that support teachers, instructional designers and other related stakeholders in setting up the conditions to foster learning (Mor & Craft, 2012). On the other hand, FERTILE partners have also contributed with their expertise on ER, as well as on the work carried out so far in the context of result R1 of the project, with special emphasis on the evolution of task 1.3 Design Methodology. This combined goal, the LD community support customised for the innovative case of Artful ER projects, is the main challenge the FERTILE CP needs to tackle.

In addition to the state of the art in community support for LD (summarised in section 2 of this report), three main sources of information have been analysed for proposing design requirements for the FERTILE CP: the FERTILE Design Methodology in its current state (section 3.1); the discussion among project partners during the Transnational Project Meeting in Prague (TPM2, September 2022); and, the answers to a "Feedback questionnaire" in which project partners contributed with their opinions (from the perspectives of LD, ER and Art) about the desired functionalities of the CP (the analysis of the two latter sources of information covered in section 3.2 of this report). The analysis of these three sources of information led to the proposal of a first set of functional requirements for the FERTILE CP (section 3.3), as well as some open issues (section 3.4) that will need further discussion and elaboration during task T2.2 (FERTILE CP development). All the proposed functional requirements are later illustrated in the context of several sample "scenarios" and described in detail as "use cases" (see section 4). This document finishes with a set of conclusions (section 5) that will be the input for subsequent tasks in the context of FERTILE's result R2.

The requirements elicitation process reported in this document triggered a reflection process among FERTILE partners that has generated a shared understanding about the role and affordances of the CP. This shared understanding incorporates different expertise and perspectives (LD, ER, Art, and CT). Therefore, it may increase the chances for a higher acceptance by the stakeholder groups targeted by the project, including educators from both the

ER and Arts domains, as well as students that will participate in the enactment of Artful ER learning projects.

2. Background on Community Platforms for Learning Design

As mentioned in the introductory section, the main objective of Task 2.1 is to elicit the requirements for a platform that would enable community support of the proposed design methodology (see Task 1.3) for Artful Educational Robotics (ER). This design methodology may be understood as a special case that can be framed in the field of Learning Design (LD) since it refers to the process and products of design for learning, typically carried out by teachers, instructional designers and other related stakeholders (Mor & Craft, 2012). Therefore, it is expected that the proposed community platform will benefit from previous works on community support for learning design, as adapted to the specific requirements for the teaching and learning domain of Artful Educational Robotics.

The field of Learning Design has attracted significant attention in the last decades, partially adopting and adapting elements and procedures of mature Instructional Design approaches, such as ADDIE (Analysis, Design, Development, Implementation, Evaluation) (Reiser & Dempsey, 2012). However, the socio-constructivist view of learning, the student-centred approaches for learning or even the emergence of technological proposals such as the so-called Educational Modeling Languages (EML) (Koper & Manderveld, 2004), motivated the proposal and development of multiple frameworks, methods and tools in the emergent field of Learning Design. According to the Activity-Centred Analysis and Design (ACAD) framework (Goodyear, Carvalho & Yeoman, 2021) design for learning may involve the tasks that students should undertake and the supporting actions by the teachers, the physical environment (including any digital tools or artefacts/resources) in which they progress towards the learning objectives, and the social environment in which learners work (the overall social context and groupings). We should also note that learning is indirect, which implies that students' activities may diverge from their assigned tasks due to the learners' agency. Moreover, it has been shown that LD approaches and tools should support an effective representation of the learning designs to be produced, guide the designers to take pedagogically informed decisions, and allow for efficient sharing of successful design products and methods within a community of learning designers (Dalziel et al., 2016).

It has been widely acknowledged that teachers, especially in Technology Enhanced Learning (TEL) environments, share many common characteristics with professional designers, such as engineers and architects (Kali, McKenney, & Sagy, 2015). Teachers are stakeholders who develop and apply their design knowledge, either explicit or tacit, during their professional practice. Teachers are trained through initial and professional development programs to acquire, develop and refine their design knowledge, aiming at achieving the teaching and learning objectives subject to real-world constraints of a technology-rich educational context. Throughout their professional career, the teachers' TPACK (Technological, Pedagogical, Content Knowledge) evolves, and eventually, teachers become proficient practitioners of designing for learning. In fact, Dobozy and Campbell (2016) argue that LD can help develop teachers' TPACK in actual design practice (Boschman, McKenney, & Voogt, 2015). In their daily practice, teachers act as designers of curricula, programmes, modules, lesson plans, or even specific learning tasks under the constraints of the wider context and in collaboration with other stakeholders, such as

professional instructional designers, domain experts, researchers, technology support personnel or educational administrators.

Multiple LD approaches, tools or integrated design environments have been proposed, implemented and evaluated since the early 2000s (Persico, et al., 2013, Prieto, et al., 2013, Quieros et al., 2019). The most relevant tools and environments for learning design include: Learning Designer (Laurillard, Kennedy, Charlton, Wild, & Dimakopoulos, D., 2018), Learning Design Studio (LDS) (Law, Li, Herrera, Chan, & Pong, 2017), Learning Activity Management System (LAMS) (Dalziel, 2003), Pedagogical Planner (PP) (Pozzi, Ceregini, Dagnino, Ott, & Tavella, 2015), WebCollage (Villasclaras-Fernández, Hernández-Leo, Asensio-Pérez, & Dimitriadis, 2013), Glue!PS (Prieto, Asensio-Pérez, Muñoz-Cristóbal, Dimitriadis, Y Jorrín-Abellán, & Gómez-Sánchez, 2013), LdShake (Hernández-Leo, Romeo,Carralero, Chacón, Carrió, Moreno, & Blat, 2011), GRAASP (de Jong, Gillet, Rodríguez-Triana, et al., 2021), PeerLAND (Papanikolaou, Makri, Sofos, Tzelepi, & Zalavra, 2022), Cloudworks (Conole, & Culver, 2009) and Integrated Learning Design Environment (ILDE) (Hernández-Leo, Asensio-Pérez, Derntl, Pozzi, Chacón-Pérez, Prieto, & Persico, 2018). Most tools cover the conceptualisation and authoring phase of the learning design process (e.g., Learning Designer, PP, LDS), and a few of them also support the implementation (delivery) of the learning design products in a target learning environment (e.g., LAMS, Glue!PS), a few offer explicit support for co-design and sharing of learning designs (e.g., LdShake, GRAASP), while others provide an integrated environment of specific LD tools that support the different phases of the LD process (e.g., ILDE, LAMS). The aforementioned LD tools and environments have shown their ability to promote design thinking, reinforce the teachers' TPACK, support the learning design practice and achieve stronger teacher development practices that eventually lead to better learning outcomes. Evaluation studies show the need for flexible support of teachers as (co-)designers through the full cycle of the learning design process (Asensio-Pérez, Dimitriadis, Pozzi, Hernández-Leo, Prieto, Persico, & Villagrá-Sobrino, 2017). Although multiple barriers still need to be overcome to meet the learning designers' needs in real-world contexts towards a wider adoption of the LD tools and approaches (Dagnino, Dimitriadis, Pozzi, Asensio-Pérez, & Rubia Avi, 2018).

With respect to current task 2.1 of the FERTILE project, we should especially mention the importance of the community support that should be provided to the learning designers, who co-design following the design methodology proposed in task 1.3 of this project, and share the resulting learning designs. Significant examples of community support for Learning Design are ILDE (which provides social features around the LD tools it integrates, such as WebCollage) or GoLab (https://www.golabz.eu/) (which maintains a community of learning designers around the GRAASP authoring tool). Research results around these existing platforms (see, e.g., Michos & Hernández-Leo, 2018) suggest that the reuse of contributions from other designers, having a ranking of community contents and understanding how students perceive designs, are some significant expected functionalities. Other empirical studies (see, e.g., Gutiérrez-Páez et al., 2021) identify the main motivation to participate in community platforms for LD: "to improve their skills and extend their knowledge (intrinsic motivation) through the exploration and sharing of learning designs in an easy-to-use environment". Interestingly, the research carried out around community platforms for LD has triggered the interest in the potential affordances of the so-called "community analytics": "metrics and patterns of design activity within a

community of teachers and related stakeholders" (Hernández-Leo et al., 2019). Providing teachers with community analytics indicators can contribute to triggering awareness and reflection about the community behaviour and thus suggest ways of improving design practices. Examples of such indicators are (Hernández-Leo et al., 2019): types of designs by subject matter, pedagogical approach, targeted objectives/skills; designs started, co-created or commented by an individual participant; learning designs created using or refining another design as a starting point; differences among the various versions of the same learning design; social appraisal of a learning design within a community, typically in the form of a scale; etc. All these lessons learnt from the existing learning tools and environments may be considered in (i) the subsequent analysis of functionalities to be included in the community platform of this project, (ii) the selection of the underlying technology for the platform, and (iii) the design and development of the FERTILE community platform in Task 2.2.

Finally, the large body of literature regarding Communities of Practice (Wenger, 1998) and supporting community platforms may be considered in Task 2.2, although their discussion is beyond the scope of this technical report.

3. Requirements Elicitation

This section describes the steps followed during task T2.1 to elicit the main functional requirements of the FERTILE CP. Three main sources of information have been used: 1) the FERTILE Design Methodology that is being proposed in task T1.3, and whose support is the main goal of the FERTILE CP (see section 3.1), has helped understand the type of design projects in which the community members are expected to get involved in; 2) feedback gathered from project partners during brainstorming sessions in ongoing and transnational project meetings (see section 3.2) has helped devise a first set of coarse-grained functional requirements; and, 3) the analysis of the responses to an online questionnaire (see section 3.3) distributed among project partners has helped refine the initial requirements and identify which ones are more important for the different stakeholders. All the gathered data was analysed and led to the proposal of a first set of functional requirements for the FERTILE CP (see section 3.4), although several open issues (see section 3.5) will need to be tackled during the actual development of the CP in the context of task T2.2.

3.1 Supporting the FERTILE Design Methodology

The FERTILE Design Methodology (result R1) aims at supporting educators in designing blended Artful ER projects. To do so, the FERTILE Design Methodology will provide methodological guidelines to help educators of Arts and Educational Robotics decide on the core idea of the project and the final artifact, and then design together their own courses in a blended learning mode. To this end, they select appropriate ER technologies for the targeted (potentially blended) learning context in order to cultivate certain Computational Thinking (CT) skills with Artful ER projects. The methodological guidelines need to be reflected in the way the FERTILE CP supports the community of teachers in creating, sharing, and reusing their Artful ER design projects. Therefore, there needs to be a close alignment between results R1 (the Design Methodology) and R2 (the Community Platform) of the project.

The final version of the FERTILE Design Methodology is expected for month M18 (Task 1.3, milestone M1.3). However, the partners have already made significant advances in that task, and it is worth incorporating the first batch of decisions in eliciting requirements for the FERTILE CP.

More concretely, UNIWA presented, during the 2nd Transnational Project Meeting (TPM2) in Prague (Sept. 2022), an analysis of existing proposals for cultivating CT skills through educational robotics activities. After brainstorming and discussion among partners, it was decided to adapt the methodological approach proposed by Chevalier et al. (2020), called CCPS (Creative Computational Problem-Solving), for modelling ER activities aimed at CP skills development. The challenge that FERTILE needs to address is how to adapt the selected methodological approach of Chevalier et al. (2020) to the specific needs of combining Arts and ER for blended learning contexts.

The current version of the FERTILE design methodology proposes 5 phases or steps that educators should consider when designing their Artful ER projects:

- Understanding the challenge: the educator proposes learning tasks aiming at supporting the students to identify and understand a challenge that combines ART and ER and if possible to break down the requirements of addressing the challenge into individual issues that need to be solved.
- Generating ideas: the educator proposes learning tasks aiming at triggering ideas that can be discussed among the students to sketch one or more ideas that could meet the requirements of the challenge in order to be effectively addressed.
- Formulating the solution: The educator supports the students in transforming one of the ideas proposed in the previous step into the formulation of a solution, considering the challenge's requirements, and leveraging knowledge related to the characteristics of the robot and the artistic artefact.
- Creating the solution: the educator proposes learning tasks by means of which the students transform their formulated ideas into a specific artistic artefact and a fully-fledged programmed robot.
- Evaluating the solution: the educator proposes learning tasks aimed at supporting the students to observe the created artefact and the programmed robot and evaluate their correspondence to the requirements of the challenge, and their adequacy in general.

Educators are expected to propose learning activities for the 5 phases or steps, detailing them in terms of (Figure 1):

- Title and description in natural language
- Temporal sequencing
- Duration
- Type of activity (engagement, new content, challenging problem, plan, program, construct and evaluate)
- Subject (Art, ER or both)
- Fostered CT skill (patterns recognition, abstraction, decomposition, algorithmic thinking, evaluation)
- Modality (face-to-face, online synchronous and online asynchronous)
- Class orchestration (individual activity, group activity, plenary activity)
- Material/resources needed for carrying out the learning activity

In addition to the definition of the learning activities for all the aforementioned steps/phases, the educators are also expected to provide a general description of the project (Figure 2), including:

- Project category (Program Robot to create Art, Program Robot to perform Art, Create Artful Robots, Program robot to respond to artful triggers)
- Title and description of the design project
- Learning objectives (both art-related and robotics-related)
- Technical requirements for the robot to be built and programmed regarding technology used and construction elements (physically or virtually, by means of a simulator)
- Description of the minimum requirements for the expected behaviour of the robot
- Art form the project focuses on

- Educational level (lower primary, upper primary, lower secondary, upper secondary and higher)
- Extension Ideas

While working on result R1, the FERTILE consortium has reflected all these steps/phases and learning activity description elements in a spreadsheet template that is currently being used for proposing sample design projects, thus identifying aspects of the methodology that need refinements. Thus, for instance, Figure 1 shows the detailed description of each activity for one of the steps/phases of an Artful ER design project, and Figure 2 shows the overall description of the design project.

Once a design project is completed, having used the methodology, the FERTILE consortium has also discussed how a "summary" of the project should look. Figure 3 shows a potential summary visualisation that is currently under discussion within FERTILE.

These initial ideas about how to support educators in the design process of Artful ER learning activities and steps will be incorporated in the description of the main FERTILE CP functional requirements described in section 4 (especially in those devoted to design support).

FERTILE Methodology Step	Description	Output
Understanding the challenge	the students identifiy the given challenge	Art: a description of the requirements concerning the artistic part ER: a description of the technical requirements regarding educational robotics

Sequence	Type of Activity	Subject	CT Skill	Modality	Activity Description	Title	Duration (Minutes)	Materials	Class Orchestration
1	New Content	ER	Algorithmic Thinking	F2F	Students practice different ways of constructing simple robots with a motion axis and programming it.	Build and programm various simple robots	45		teamwork
2	Engagement	Art	Decomposition	F2F	The teacher shows scenes from sports, silent films, and cartoons in order for the students to spot and perceive anticipation, and then supports the students to synthesize a story. The students embody the heroes with anticipation and thus play the roles in the story.	Introduce and perform with anticipation	25	videos	plenary
3	Challenging Problem	Both	N/A	F2F	Challenging problem (assignement):Art: the teacher asks the students to re-enact the story using the robots they have already built; they should modify the robots to express a role in the story. ER: They should use at least one sensor and one motor per robot.	Give the challenge to be solved	10		plenary
4	Plan	Art	Decomposition, Abstraction	F2F	The students explore and analyze the requirements of the challenge that they have to face, regarding Art: a)what decorating materials they will need for the robots, b) how the robots will move with anticipation, c) what should be the main behaviour that would distinguish a robot playing a particular character, how the environment of the scene will be formed	The students decompose the challenge trying to identify its main requirements (brainstorming) regarding Art	5		plenary
4	Plan	ER	Abstraction, Decomposition	F2F	the students explore and analyze the requirements of the challenge that they have to face: a) what constructing materials they will need for the robots, b) what will be the movement of the robots, c) how the robots will represent the anticipation etc	The students decompose the challenge trying to identify its main requirements (brainstorming) regarding ER	5		plenary

Figure 1. Activities defined for one of the phases of a design project using the current version of the FERTILE Methodology spreadsheet.

Project Title	Project Description
Anticipation through Educational Robotics	*the students will recreate story characters that move according to the principle of anticipation through programming and constructing robots*

Authors	Maria Tzelepi
Project Category	Program Robot to perform Art

Learning Objective - Art:			
Learning Objective - ER:	**Construction:**	*robot axis with one motor*	
	Programming:	*sequence, variables*	
Art form(s):	**Category:**	*VISUAL*	*PERFORMING*
	Subcategory:	*animation*	*theatre*
Technical requirements for the robot:			
Technology Used:	**Robotic Kit:**	*Lego WEDO*	
	Programming Environment:	*N/A*	
	Simulator:	*OpenRoberta*	
Construction Elements:	**Actuators:**	*one motor*	
	Sensors:	*distance or accelerometer*	
Description:	*be able to move forward and turn according to the obstacle encountered or the position of the robot*		

Educational Level	*Lower Primary*
Extension ideas	

Figure 2. Overall description of a design project using the current version of the FERTILE Methodology design spreadsheet.

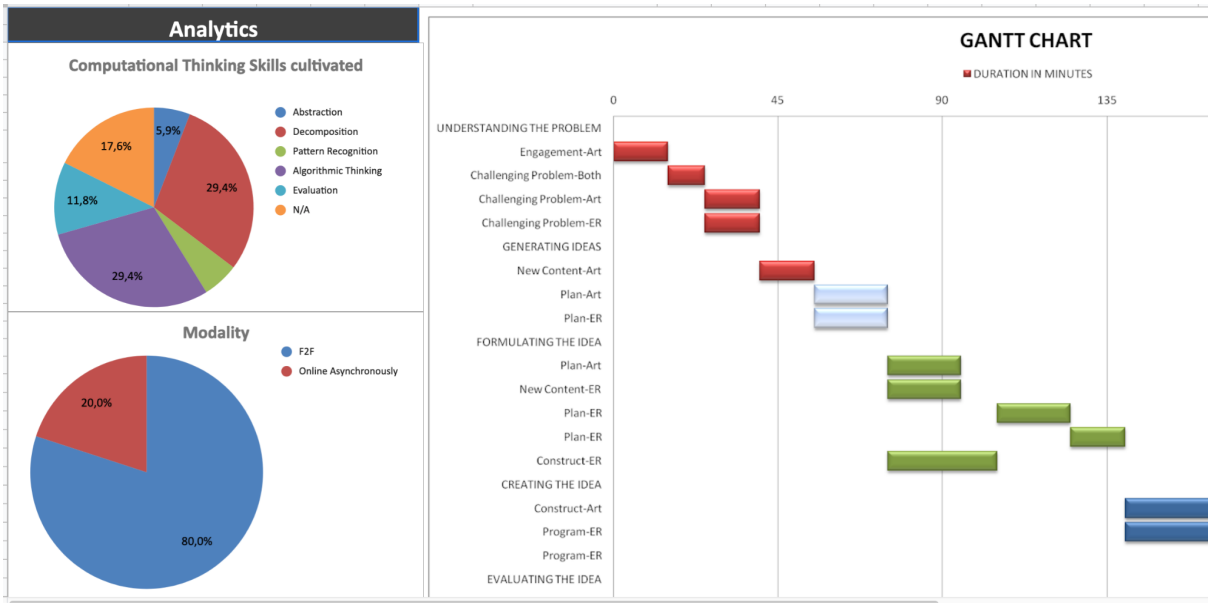


Figure 3. Summary of a project design, using the current version of the FERTILE Methodology spreadsheet.

3.2 Partners' Brainstorming about the FERTILE CP requirements

During the 2nd Transnational Project Meeting (TPM2) in Prague (Sept. 2022), all FERTILE partners participated in a 2.5 hours session devoted to the "Review and discussion about T2.1 Design requirements", led by UVA[1]. The session started with a presentation by UVA that reviewed the open questions and doubts about the CP design requirements that were identified during the 1st Transnational Project Meeting (TPM1) held in Madrid (May 2022). Additionally, some ideas discussed in a meeting between UNIWA and UVa in July 2022 were also presented. The core of the presentation dealt with a proposal about the types of users of the platform (teachers and students), as well as a first sketch of the potential main functionalities of the platform, illustrated by a set of user interface mockups. This first proposal of functionalities for TEACHERS included:

- Registration, log in/out, main page with "timeline" and social functionalities
- Contacting other teachers (messaging)
- Participation in discussion forums
- Creating and editing Artful ER designs
- Creating co-design teams
- Commenting on other teachers' designs

However, and regarding expected functionalities for STUDENTS and COMMUNITY ANALYTICS (a mentioned desired functionality in the project's description), UVA presented a range of possibilities, subject to further discussion among the partners.

After the presentation, the representatives of the partners attending the meeting provided a first round of feedback and achieved some agreements about the raised open questions:

- It was not clear whether the CP should support different types of teachers (e.g., some teachers "approving" the contributions from others). This issue was left open for further discussion.
- Regarding the support for teachers (co-)design of Artful ER projects, the partners agreed on also including the possibility of reusing and customising designs proposed by other teachers.
- There was a debate among the partners about what the co-design functionality of the CP should look like. It was acknowledged that this would strongly depend on how the Design Methodology evolves (see section 3.1) and, therefore, that the present report would only include a first approach to this functional requirement of the CP. Subsequent reports for result R2 (mainly the one devoted to the CP development) would incorporate ongoing advances in FERTILE's design methodology (R1).
- Regarding analytics functionalities of the CP, it was agreed that the platform would provide analytics' indicators about the community's behaviour (community analytics), and not necessarily about the learning process of the students (learning analytics).
- A significant part of the discussion covered the CP support for students during the enactment of the learning situations designed by the teachers using the CP. In other words, the debate was about to what extent the CP should support the actual learning

[1] Slides used during the brainstorming session are available at Appendix A.

tasks designed by the teachers and intended to be carried out by the students. After the debate, it was agreed that the CP should include support for:

- Providing students with instructions about the learning tasks that they are expected to carry out (these instructions should be provided by the teachers as part of their artful ER learning designs). Those instructions (in the form of, e.g., a web page) might include links to resources and online ER programming environments or simulators needed for the learning tasks (also provided by the teachers).
- Enabling students to rate the ER designs they have carried out as well as contribute with their suggestions.
- Enabling students to ask for help (from the teachers or other students) regarding the artful ER learning design they are involved in.

At the end of the discussion, it was agreed that UVA would create a more detailed questionnaire to collect more systematically all the feedback and additional ideas/suggestions from the partners about the desired functional requirements of the CP. The description of that questionnaire and the analysis of the collected feedback data is described in the following subsections.

3.3 Feedback Questionnaire about the FERTILE CP requirements

To collect feedback and ideas from FERTILE partners about the main requirements of FERTILE CP, we distributed a questionnaire consisting of both open-ended and multiple-choice items[2]. The questionnaire was delivered in English, and its completion was expected to last 1 hour. At the beginning, the participants were informed about the purpose of the questionnaire, and later they were asked to provide profiling information, such as experience in educational robotics or arts. Afterwards, participants were asked about the following **5 topics,** aligned with the outcomes from the previous discussions about partners (see previous subsection): i) their initial ideas about the concept and purposes of a CP, ii) the main roles of the CP participants and their responsibilities, iii) the functionalities that the CP should provide to teachers and students, iv) other aspects to be discussed and v) the Community Analytics. In total 10 answers were received during Oct./Nov. 2022.

3.3.1 Feedback questionnaire data analysis

Content analysis was employed to analyse the data collected using emic categories, i.e., categories emerging from the participants' responses analysis, during the coding process (Given, 2012). Attending the participants' selection, we followed a purposive sampling method (Fraenkel, Wallen, & Hyun, 2012). According to this method, "*the researchers use their judgement to select a sample that they believe, based on prior information, will provide the data they need*" (Fraenkel et al., 2012, p. 100). The main sampling inclusion criterion was based on the participants' compliance with one or more of the following roles: (a) experience as researcher/designer/teacher of educational robotics, (b) experience as

[2] Questionnaire available at Appendix B.

researcher/designer/teacher of arts. Figure 4 shows the participants' profiling information. According to the information presented, it was shown that participants had multiple roles. That is, a teacher of educational robotics, can also be a designer of educational robotics scenarios and/or researcher. Also, the chosen sample represented all roles, albeit in a non-uniform way.

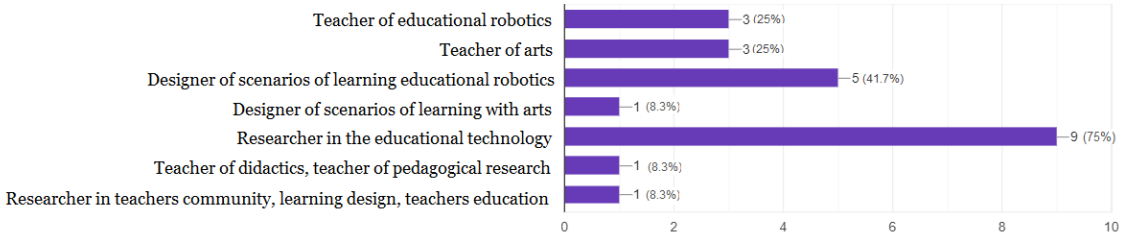


Figure 4. Participants' profiling information about their experience in educational robotics and arts.

Although this was not an intended goal a priori, additional feedback from **teachers of Arts** was sought in order to check whether their opinions about the requirements for the FERTILE CP were aligned with those provided by the members of the FERTILE consortium. Only 3 additional responses were collected by 3 teachers of Arts (2 primary education teachers and 1 university teacher) that collaborate with UNIWA. In spite of this small sample of participants, their answers to the questionnaire are briefly commented at the end of subsection 3.2.2.

3.3.2 Results from the feedback questionnaire

The results of this Section (3.3.2) are presented using the scheme of the five topics shown in the Section above (3.3.1). The findings are accompanied by explanatory tables and figures as well as indicative excerpts of evidence.

Participants' perceptions about CP

From the 10 questionnaire respondents, 8 mentioned they had prior experience with CPs. Table 1 presents the list of CPs mentioned by the participants. Nevertheless, all participants, even the ones with no experience in using a CP, reflected upon and contributed various ideas about the CP functionalities. The whole process enabled us to get a common understanding on the basic functionalities that a CP should have regarding the teacher and the student roles. Given the frequency of the ideas mentioned attending the role of teacher, we have defined **three clusters of CP functionalities: a) mandatory, b) desirable and c) optional functionalities** (see Table 2). The mandatory ones regarded the ability of the teachers to search for projects, resources and collaborators (n=11), to create (or co-create) projects, educational resources/ material, and courses (n=7), and to connect with other educators or projects (n=7). Regarding the desired functionalities, participants highlighted the possibility of (i) sharing (or keeping private) the educational material with other teachers or students (n=5), (ii) saving the educational material either for their students or themselves for eventual future reuse (n=5), (iii) registering a profile by adding information about their interest, their educational level, etc (n=3), and (iv) providing feedback either to students' work or to other teachers' projects (n=3). Other potential (optional) functionalities regarded the ability to access others' (teachers or students) material and to

evaluate students' work. Note that respondents seem to consider that "sharing material" is not identical to "accessing to others' materials", given that accessing material depends on whether the owner provides access rights to those materials. Similarly, respondents mention "evaluating students' work", but it is unclear whether they refer to formative or summative assessment. Further clarifications might be necessary in Task 2.2.

Table 1. CP mentioned by the participants

CP	CP Link
ILDE	https://ilde.upf.edu/about/
eTwinning	https://school-education.ec.europa.eu/en/etwinning
Facebook	No specific URL
Scratch	https://scratch.mit.edu/studios/2050636
Moodle	https://moodle.com/community/
ClipIt	https://www.clipitgame.com/
Learning Designer	https://www.ucl.ac.uk/learning-designer/
Peerland	http://peerland.aspete.gr/
European School Radio	https://community.europeanschoolradio.eu/
Photodentro	https://photodentro.edu.gr/lor/community-list
e-me Digital Educational Platform	https://pafse.eu/e-me-collaboration-platform/

Table 2. Proposals of CP functionalities for teachers mentioned by the participants

Mandatory	**Desirable**	**Optional**
Create-co create	Register a profile	Access others' material
Search	Share	Evaluate
Connect/Communicate	Provide feedback	
	Save/Store	

Other ideas regarded the assets that a CP should have to benefit the teachers, such as:

· A **repository with best practices, lesson plans, tutorials, exemplars** (i.e., "*[For teachers, the platform should] provide support on how to design [a learning project] based on the FERTILE methodology, with tutorials about the FERTILE methodology and exemplar designs.*", "*[For teachers, the platform should] "have structured information about the topic AER (from theory*

to methodology); best practices, proven lesson plans, simple collaboration space for teachers for working on project/lesson plans").

· A **graphic design editor** (i.e., "*For teachers, the platform should provide teachers with a learning design editor. This editor should trigger teachers in designing based on the FERTILE methodology. To this end, the editor should provide a graphical environment that incorporates all the fields relevant to the FERTILE methodology. [...]*")

· **Community Analytics** (i.e., "[*The platform should] provide community analytics about educators' 'presence' on the platform, communication with others, access to content.")*

Concerning the CP functionalities for the students, the respondents expected only basic community support for students. That involves the possibility to: a) register a profile (i.e., "*Provide students with a login name assigned by the teacher and distribute them to classrooms*"), b) access material, c) save material either storing it or downloading it, d) search projects or other people, e) connect with projects or people and f) provide feedback.

Attending the question "*Why do you think a Community Platform is important for the field of artful educational robotics?*", n=3 participants noted that a CP should support the **interdisciplinarity** and **collaboration among educators of different disciplines** (i.e., "*A teacher community holds the potential to enhance teachers' practice by considering their peers' practice. A community specifically for artful ER may promote an interdisciplinary approach to ICT and Art teachers.").* Other reasons concerned the need to share **material** in educational robotics (n=2) ("*Because there are not many places where robotic teachers can easily share their experiences* "), the need for **communication** (n=2) (i.e., "*Since in everyday educational practice the teachers' common time is very limited, a common place for communication and design seems necessary*") and the **guidance it may offer under a concrete methodology** (n=2) ("*providing a place to design based on FERTILE methodology will help educators understand and follow the process*"). Other ideas mentioned individually regarded the current lack of available material/experiences in ER, the use of community analytics for evaluation and co-creation, and the research encouragement.

<u>Roles in CP</u>

Attending the question "*who are the users/participants in the FERTILE Community Platform?*", there was an agreement about the 'teacher role' and a high agreement about the 'student' role (see Figure 5). Out of 12 respondents, 6 proposed a differentiation of the teacher's role (i.e., "*I think that differentiating between roles is important because novice users feel free to participate if they are confident that they can't delete or mess anything up*") and 4 preferred to keep the platform with the basic roles of teacher and student ("*Due to the small group of potential users from my point of view, it does not make sense for me to differentiate the platform among too many roles. Teachers and students are ok*"). Some proposals for different teachers' roles regarded the options of: a) Moderators/managers (the ones who will validate and evaluate the material), b) Teachers with no right to edit, c) Teacher/ edit-apply (the ones with permissions to edit-publish), d) Visitors/read only educators (the ones who can view the already published material). In summary, there is no strong positioning regarding the different CP roles. The

distinction about the different teacher roles is based on the editing and privacy rights of the 'teachers', thus, it may be reasonable to include these options as 'desirable requirements'.

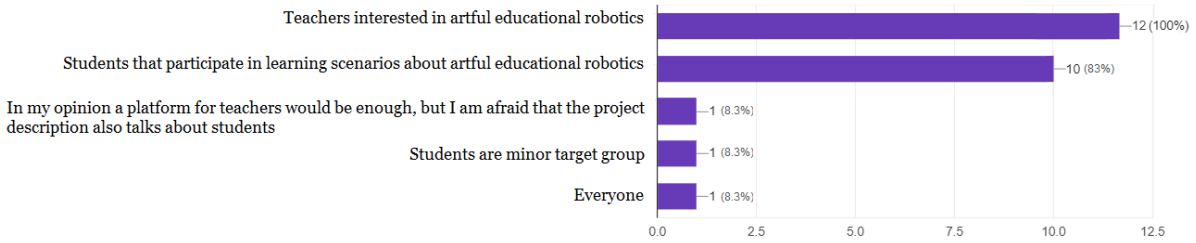


Figure 5. The users that CP should target.

Feedback about potential Teachers' & Students' Functionalities

Having as a baseline the outcomes from previous discussions among FERTILE partners (see previous section), participants were then asked to provide their opinions about the importance of several eventual social, design, and enactment support functionalities of the CP.

Functionalities for Teachers

Regarding the social functionalities for the teachers in CP, as Table 3 shows, there is **a high level of agreement** with participants to rate all items above 4.33. The social functionalities of Table 3 concern the ones discussed previously (see Table 2). Their high ratings suggest the participants' strong recommendation to include them in CP.

At the open-ended question to complement the social functionalities of teachers, one participant highlighted the privacy options that CP should support (i.e., "*the teacher should have the right to decide whether the learning design he or she has created should be made fully public or only private*"), the interaction with the material through the possibilities of creating copies of a project and of rating the users' interest on it (n=2) (e.g., "*I really appreciate the possibility to duplicate and edit an existing design*") and the search options (n=2) (e.g., "*I would like the teacher to be able to search for collaborators based on a core idea or other items of their profile*"). Two participants raised their doubts about the implementation of the proposed social functions and its added value (e.g., "*The only doubt I have is about whether some of the communication and commenting functionalities may end up being of little use to the project and deviate too much from the project*").

Another issue explored via the questionnaire was related to the functionalities (for teachers) of the **design of an Artful ER project**. Table 4 depicts the respondents' reflections on the topic. The ratings of the items and the standard deviation suggest that the participants did not have a strongly shared opinion about the design of the learning projects. Indeed, participants' open-ended answers confirmed the lack of common consensus, with a few preferring structured templates and a few preferring structured text-based templates. Further ideas about the concrete design functionalities were related to the following options:

- Users overview the design of a project
- Users check the progress flow (e.g., completed steps of the design)
- Users add/ skip steps of the design methodology

- Users takes a step backwards in the design methodology
- The CP provides the users with exemplars of Artful ER projects

Given that the design related functionalities are directly associated with the Design Methodology developed in T1.3, these preferences might be taken into account regarding the final design functionalities to be implemented.

Table 3. CP social functionalities for the teachers (St D stands for Standard Deviation)

Statements	Mean	St D
Do you agree with the following statements (1-strongly disagree, 5-strongly agree)		
Teachers search, by name, for other teachers in the platform	4.67	0.5
Teachers search for other teachers on the platform that are interested in the same set of art-related learning topics (e.g., painting, animation, etc...)	4.67	0.7
Teachers search for other teachers on the platform that teach at a certain educational level (primary, secondary, etc...)	4.56	0.7
Teachers get a complete list of artful ER learning designs available in the platform	5	0
Teachers search, by name, for specific artful ER learning designs	4.33	1.1
Teachers search for artful ER learning designs related to specific topics (e.g., painting, animation, etc...)	5	0
Teachers search for artful ER learning designs aimed at specific educational levels (primary, secondary, etc...)	4.78	0.4
Teachers send a message to other teachers	4.44	0.9
Teachers create new threads in discussion forums	4.56	0.7
Teachers participate in discussion forums	5	0
Teachers get a list of their own artful ER designs	5	0
Teachers create a "design team" for a specific artful ER design	4.44	0.9
Teachers make a copy of an existing artful ER learning design (created by him/her or by other teachers)	4.67	0.5
Teachers comment on others' designs	4.33	1.1

Table 4. Reflections about the design functionalities in the CP (St Dev stands for Standard Deviation)

Statements	Mean	St Dev
Do you agree with the following statements (1-strongly disagree, 5-strongly agree)		
A blank canvas in which I can freely draw and/or write my ideas about an artful ER learning design	2.78	1.6
One or several rigid document templates (i.e., with black spaces) that I can fill up in the order that I want	3.44	1.0
One or several rigid document templates (i.e., with black spaces) that need to be filled up in a specific sequence of steps	3.11	0.8

Functionalities for Students

Regarding the **social functionalities** for the students, as Table 5 indicates, once again there is a high level of agreement about the functionalities that the CP should support. All items received ratings equal to or higher than 4.22. The reflections of the open-ended questions showed ideas similar to the ones reported previously about the students' general functionalities in CP. That is, the students' possibility to a) interact with a project by sharing it with other communities (e.g., Facebook) or saving it to their profile (i.e., "*Add the projects they work on to their profiles and be able to open their profile to others, share a 'place' like fb where they can post their work progress*"), b) evaluate the projects in more meaningful terms (i.e., "*And I would like some intelligent form of evaluation, in the sense, not only of the number of stars, but to evaluate, for example, the difficulty, interestingness of some design that they took part in*"), c) collaborate with each other (i.e., "*They should also have the opportunity to collaborate on one project*"), d) be flexible to submit solutions in various forms (i.e., "*I think that students should also be able to submit their solutions in doc, photos, video, code, mind maps*").

Table 5. CP social functionalities for the students (St Dev stands for Standard Deviation)

Statements	Mean	St Dev
Do you agree with the following statements (1-strongly disagree, 5-strongly agree)		
Students create new threads in discussion forums	4.22	0.1
Students participate in discussion forums	4.78	0.7
Students rate the artful ER learning designs they are enacting	4.22	1.3
Students comment and/or ask for help in forums specifically related to the artful ER learning designs they are enacting	4.67	0.7

Concerning the **instructions to students**, Table 6 depicts the respondents' reflections on the topic. Participants propose the following two educational robotics websites to guide how to shape the instructions: https://ebotics.com/activities/ and https://education.lego.com/en-au/lessons/wedo-2-science. According to these sites, the students' activities are presented as lesson plans including learning objectives, proposed tasks,

foreseen time per task, etc.

Table 6. Reflections about the instructions to students

Ideas of instructions	Frequency	Excerpts
Webpages/ web-based application	5	*"Html, accessible to students via a webpage"*
Printable material (e.g., in form of PDF)	3	*"option to export them as PDF or other printable documents"* *"A list of tasks that can be "printed" should be enough"*
Lesson Plans	2	*"I only have experience with Lego WeDo. I liked the materials https://education.lego.com/en-au/lessons/wedo-2-science.* *I would consider something like this for FERTILE CP as well"*
Downloadable Worksheets	2	*"Students may have access to the project description and download any worksheets provided at specific phases of the project"*
Instructions inserted to platform designs via pictures/text to design	1	*"Personally, I could imagine that if we were able to create a design that would have certain, fixed parts-paragraphs, then in that case the instructions could be divided into these paragraphs, where the teachers would only add some text, pictures, or links to external resources (e.g. instructions for building a model, to a motivational video, etc.)"*
Video Tutorials	1	*"...very short video tutorials"*

Community Analytics

The last aspect explored through the questionnaire regarded the use of the CP Analytics. Table 7 presents the respondents' agreement with basic Community Analytics. Once again, building on previous findings, the statements received high ratings from the participants (with minimum rating being 4).

Likewise, the questionnaire respondents reflected about which of the above functionalities (see Table 7) should be available. Table 8 presents the results. **We observe that there is no strong opinion about using Community Analytics from students, as happens with administrators or teachers.** Additionally, n=2 participants proposed the teachers to be the responsible ones for providing the Community Analytics information to the other roles (e.g., "*Teachers may choose to whom they open this information i.e. teachers, students*", "*Students do not have to see this information. Maybe only something, if the teacher would allow it in the settings*").

Table 7. Reflections about the Community Analytics (St Dev stands for Standard Deviation)

Statement	**Mean**	**St Dev**
Do you agree with the following statements (1-strongly disagree, 5-strongly agree)		
Providing information about the types of learning designs created in the platform (in relation to subject topic, educational level, and other metadata)	4.56	0.5
Providing information about the participation of teachers (number of created designs, co-editions, comments about others' designs, etc.)	4.11	1.1
Providing information about learning designs created using or refining another design as starting point	4	0.9
Providing information about the social appraisal of a learning design within a community, typically in the form of a scale	4.33	0.9

Table 8. Target Audience of the Community Analytics

Community Analytics Proposals	**Community Analytics Receivers**		
	Administrators ***(frequency of preferences)***	**Teachers** ***(frequency of preferences)***	**Students** ***(frequency of preferences)***
Providing information about the types of learning designs created in the platform (in relation to the subject topic, educational level, and other metadata)	3	3	
Providing information about the participation of teachers (number of created designs, co-editions, comments about others' designs, etc.)	5	1	
Providing information about learning designs created using or refining another design as starting point	4	2	
Providing information about the social appraisal of a learning design within a community, typically in the form of a scale	3	3	2

All the above findings permitted us to gain a common understanding of the participants' needs related to a CP. The findings concerning the teachers' and students' functionalities led to the CP requirements proposal presented in the following Section.

As an **additional result of this phase**, it was mentioned at the end of section 3.3.1 that **3 teachers of Arts**, not belonging to the FERTILE consortium also provided their feedback about the functionalities of the FERTILE CP. In spite of this small sample of participants, it is interesting to briefly comment on their answers to the questionnaire. Regarding the social functionalities for the teachers in the CP (see Table 3) there is a high level of agreement since the 3 participants rate all items above 4.0, except the functionality of searching teachers by name (M=3.7). In the case of social functionalities for the students in the CP (see Table 5), the lowest valued functionality is that of allowing students to create their own new threads in discussion forums (M=3.7). Similar scores were given to the functionalities related to community analytics (see Table 7), being the lowest one related to the functionality of providing information about the participation of teachers (M=3.7). Interestingly, the 3 teachers agreed that community analytics should only be provided to teachers or administrators of the platform, not to students. Another interesting outcome of these 3 answers to the feedback questionnaire is that the Art teachers did not have either a strongly shared opinion about the design functionalities of the CP (i.e., as seemed to happen with the answers from the members of the FERTILE consortium, see Table 4): one teacher preferred one or several rigid document templates to be filled up in a specific sequence; another teacher preferred the option of the document templates, but with a flexible order; and, the third teacher was happy with the 3 provided options. Finally, regarding the issue of how the instructions for the enactment of the Artful ER projects should be delivered to the students, 2 of the teachers did not have a clear opinion, while the third one was in favour of providing a web page with instructions and links to the resources. All in all, these 3 answers from Art teachers are quite aligned with those provided by the members of the FERTILE consortium.

3.4 FERTILE Community Platform Main Functional Requirements

The results from the analysis of the brainstorming among partners and their suggestions (see sections 3.2 and 3.3) have provided valuable information about the specific set of functional requirements to include in the FERTILE CP. Those functional requirements can be clustered into 5 main groups: user management, community support, design support, enactment support, and community analytics. The functional requirements are listed in Table 9 and will be described in detail in section 4, also incorporating the suggestions from section 3 (see, e.g., Tables 5, 7, and 8). This report does not include functional requirements corresponding to stakeholders different from teachers and students (e.g., for CP administrators).

Table 9. FERTILE CP main functional requirements

USER MANAGEMENT ● User registration ● User log-in, log-out
COMMUNITY SUPPORT *(see Table 3, section 3.3.2)* ● Send messages to other teachers ● Create/remove forum thread ● Participate in forum thread ● List teachers ● Search for teachers ● List CP Artful ER projects ● Search for CP Arful ER projects ● Comment on Artful ER project ● Rate Artful ER project
DESIGN SUPPORT *(see Table 3, section 3.3.2)* ● List own Arful ER projects ● Create/Edit/Delete Artful ER project ● Visualise summary of Artful ER project (see section 3.1) ● Share Artful ER project and Manage (co-)design team ● Reuse Artful ER project ● Publish Artful ER project for enactment
ENACTMENT SUPPORT *(see Tables 5 and 6, section 3.3.2)* ● Access instructions for enactment ● Participate in forum thread associated to a design project
COMMUNITY ANALYTICS *(see Table 7, section 3.3.2)* ● Access community analytics

3.5 Synthesis and open issues

This section presents a synthesis of the main conclusions after the requirements elicitation process described in the previous subsections. The evidence gathered during the project meeting in Prague, the questionnaire delivered to the project partners, and the current state in the development of the FERTILE Design Methodology resulted in some concrete points about the CP functionalities (see Table 9). However, the analysis carried out so far also raises issues open for further discussion within the consortium. The refinement of the Design Methodology (see T1.3) is expected to allow the subsequent consolidation and refinement of the requirements for the Fertile CP.

The input gathered helped concretise the social functionalities within the CP to be employed by teachers and students, the students' instructions when working with designs in the CP and the role of Community Analytics. Furthermore, the questionnaire answers allowed us to collect some preliminary ideas about the CP design functionalities. In general terms, participants proposed using a flexible graphic/visual environment based on tables. Yet, this topic remains open for discussion as it is associated with the Design Methodology developed in T1.3, and the final decisions will be incorporated in T2.2.

The following topics also remained open pending further reflection:

- The specification of the different teacher roles in CP. This issue was raised during the meeting in Prague and remained undecided, given the questionnaire answers of the participants. More specifically, there was no wide consensus on whether the CP should support different teacher roles. As reported in Section 3.2, we observed that the distinction about the different roles was based on the editing and privacy rights of the users when working on a design project. As a result, we deem as interesting the CP support various editing rights (e.g., comment, only view, edit, publish…) and privacy rights (e.g., a user can choose to share a project with everyone, or with concrete collaborators, or to keep it private).

- The need for a Graphic Designer. Creating a Graphic Designer (GD) was another topic on which participants did not show a general agreement. That is, in Prague's meeting, the partners considered GD as a core CP element. Yet, the questionnaire answers uncover doubts about the added value of a GD and how the partners envision such GD.

- The Community Analytics visualisation. Lastly, the analytics functionalities of the CP and its target audience received attention both in the meeting in Prague and in the questionnaire answers. The questionnaire respondents noted a high agreement about the basic Community Analytics, available for the CP administrators and the teachers. Two participants proposed that teachers should be the ones managing who has access to Community Analytics and about what. However, what remains unclear is how the selected Community Analytics will be displayed. This issue will be addressed during the CP design and development together with the stakeholders in T2.2.

4. Scenarios and Use Cases

Once a first list of functional requirements for the FERTILE CP have been identified (see section 3), the goal of this section is twofold: on the one hand (section 4.1), it provides two fictional narrative "scenarios" that try to illustrate, using non-technical terms, how the different functional requirements are related and can be used by both teachers and students that participate in the CP; then, on the other hand (section 4.2), it represents each functional requirement in the form of a so-called "use case". Use cases are typically used, in software development, as a detailed description of functional requirements of a system, indicating interactions with its users and serving as starting point for subsequent analysis models and design activities (Booch, 2005).

4.1 Sample scenarios

Before describing each functional requirement in detail, the following paragraphs describe two prototypical fictional "scenarios" that try to explain how the different functional requirements are related and can be used by both teachers and students. Obviously, these are just two examples of how the FERTILE CP might be used. Along the "scenarios" (one involving teachers and the other one involving students), **the references to the main use cases (further described in subsequent subsections) will be highlighted using bold font**. These main sample "scenarios" are later divided into smaller parts that are included in the corresponding tables of each individual use case.

SAMPLE SCENARIO FOR TEACHERS

"*Pam, a high school ER teacher, has received a newsletter from the FERTILE project suggesting to participate in the CP for meeting other colleagues interested in ER and for accessing a repository of existing learning projects that make use of ER and arts. Pam is interested in introducing artful elements in her ER projects, an interest shared with Paul and John, two colleagues from the same school. They decide to give the FERTILE CP a try and create an artful ER design project focused on fostering "animation skills". Therefore, Pam clicks on the provided URL of the FERTILE CP and, when realising that* ***registration*** *is required, she clicks on the "Register" button of the web page. Then, Pam is guided through a set of menus in which she needs to provide some personal data (Name-Surname, working institution, educational level, speciality, years of experience, etc.), as well as a user name and a password. Once this process is finished, she receives an email in her account asking her to click on a certain URL to confirm and finish the registration process. After that, and using their credentials, Pam can* ***log in*** *to the FERTILE CP.*

Once Pam is logged in to the platform, the "home page" of the CP displays a personal space for Pam in which she gets a ***list of her own design projects****, which is initially empty. That "home page" also gives Pam the possibility of browsing the community (****listing and searching for other teachers*** *in the CP) and browsing design projects (****listing and searching for other teachers' design projects****). Pam starts browsing the community: she first gets a* ***list of other teachers****, which is quite large… so she decides to* ***search for teachers****, and more particularly, she wants to check whether her colleagues*

Paul and John are already registered on the platform. Pam searches for Paul and John using their names and surnames, and the CP confirms that they are already registered.

Before creating her own design project on "animation skills", Pam would like to check whether there are existing design projects in the FERTILE CP that might be similar to what she is thinking about for her students. She first ***lists other teachers' design projects*** *and, since she realises there are many of them, she* ***searches for design projects*** *that are aimed at secondary education and that deal with animation skills. A list of two potentially interesting projects are returned and Pam clicks on each one of them to* ***visualise a summary of the design projects****. These summaries contain a set of tables (each one corresponding to a phase of the FERTILE design process), as well as a chronogram of the involved learning activities and a pie chart indicating how many of them are face to face, how many are online, which computational skills they foster, etc. After having checked the summaries, Pam* ***rates both design projects*** *(giving 3 and 4 stars, respectively, out of 5) and* ***posts a comment about the design*** *she likes the least, since she thinks that the teacher that created it is using an ER kit that is too challenging for secondary education students. Pam decides that the other design project has many elements that might be repurposed for her students… so she clicks on the "Duplicate this design" button in order to* ***reuse the design project*** *instead of* ***creating a new design project****. The platform asks Pam to provide a name for the new duplicated project and Pam enters "Animation Skills". The platform now provides a representation of the design project that can be edited by Pam. Pam realises that there is a button labelled "Sharing options" aimed at* ***sharing the design project*** *with other teachers. She clicks on that button and she adds Paul and John to the "design team" of this new project on animation skills. Pam clicks on the "Save" button of the design project and the CP takes her again to the "home page" where she gets a* ***list of her own design projects****, which now includes the one on "animation skills".*

Pam would like to inform Paul and John about some additions she wants to include in their shared design. Therefore, Pam uses the FERTILE CP ***to send a message*** *to Paul and John. Once she gets their positive replies, Pam* ***edits the design project*** *and starts applying her changes and additions. During the editing work, Pam, John and Paul realise they have some doubts about the technical skills that their students would need to use the ER simulator they want to include as a resource in their project. Therefore, Pam goes to the section of the FERTILE CP that maintains discussion forums for the FERTILE community of teachers. She* ***creates a new forum thread*** *within the forum on ER kits and* ***posts a forum message*** *asking the specific questions they have got. They get some replies from the community and, once they have enough confidence on their approach, they continue editing their design project.*

Once Pam, John and Paul finish their design project, they decide to ***publish*** *it, so that their students can access its description and associated learning resources. This way, when her students later log in to the FERTILE CP, they will get a link to the design project they will participate in. Pam also gets an URL for the student-oriented description of the project and posts it in the LMS being used in her course, so that the students have an alternative way to access it.*"

SAMPLE SCENARIO FOR STUDENTS

"Bill is a high school student participating in an arts lesson about "animation" that makes use of robots. Bill logs into the FERTILE CP, using the credentials provided by her teacher[3], Ms. Pam Winslow, and gets a list of Artful ER design projects in which he is participating. Bill selects the project about "animation" to ***access instructions for enactment****, and gets a web page with all the details about the learning tasks he needs to carry out. Bill reads the instructions but he is not sure about whether a certain ER software has to be installed in his own computer at home, or whether he can access that software online (i.e., by means of a web browser). Bill realises that, together with the instructions, in the very same web page, there is a "window" with a* ***forum thread associated with the project in which he can post messages*** *that will be eventually read by the teacher and the rest of the class. Bill writes his doubt there and awaits for an answer. Once he gets the answer, Bill starts carrying out the requested learning activities. Bill thinks this lesson is very funny and he is enjoying it a lot. Therefore, Bill decides to* ***add a comment to the project****, using the form provided by the FERTILE CP. Additionally,* ***he rates the design project*** *with 5 stars (out of five). "*

4.2 Use Cases

The following subsections present use cases that further describe each functional requirement of the CP within the five categories identified in Section 3.4: user management, community support, design support, enactment support, and community analytics. Each use case is described using a table with the following elements:

- **Use case name.**
- **Short description** about what the functional requirement consists of.
- **Involved Roles**: teacher, student, or both. In some cases, subroles are specified (e.g., teachers that lead a design team).
- **Sample scenario**: a brief, short example of how particular teachers and/or students might make use of the described functionality.
- **Pre- and post-conditions** that explain: the prerequisites that the platform should satisfy for the functionality to happen (pre-condition); how the described functional requirement might change the current status of the platform (post-condition).
- **Diagram/screenshot**: user interface mockup that provides a glimpse of what the involved stakeholders might get when involved in the described functionality. These mockups should not be considered as a final decision about how the user interface will be implemented. They are rather intended to help better understand the functionality and to trigger internal discussion among FERTILE partners. A more thorough design of the user interface will be carried out during Task 2.2 ("Platform Development"). In some cases, these diagrams/screenshots reuse elements and ideas from existing community platforms' user interfaces (e.g., Joomla[4] or ILDE[5]).

[3] In this case, we are assuming that students are already registered in the FERTILE CP platform using some kind of "batch-mode registration" carried out by the platform administrator (administration use cases are not described in this document).
[4] https://www.joomla.org/, last access: January 2023.
[5] ILDE (Integrated Learning Design Environment) https://www.upf.edu/web/tide/tools/ilde2, last access: January 2023.

Figure 6 depicts a UML[6] use case diagram that visually summarises the main roles and use cases that will be described in the following subsections. The ovals represent the use cases, clustered in the groups defined in section 3.4 (see Table 9). The different types of users (actors in UML terminology) are related to the use cases in which they participate. Figure 6 also indicates that teachers can be further "specialised" (see arrows with white triangles) into "Team coordinator" and "Team member" for a specific use case.

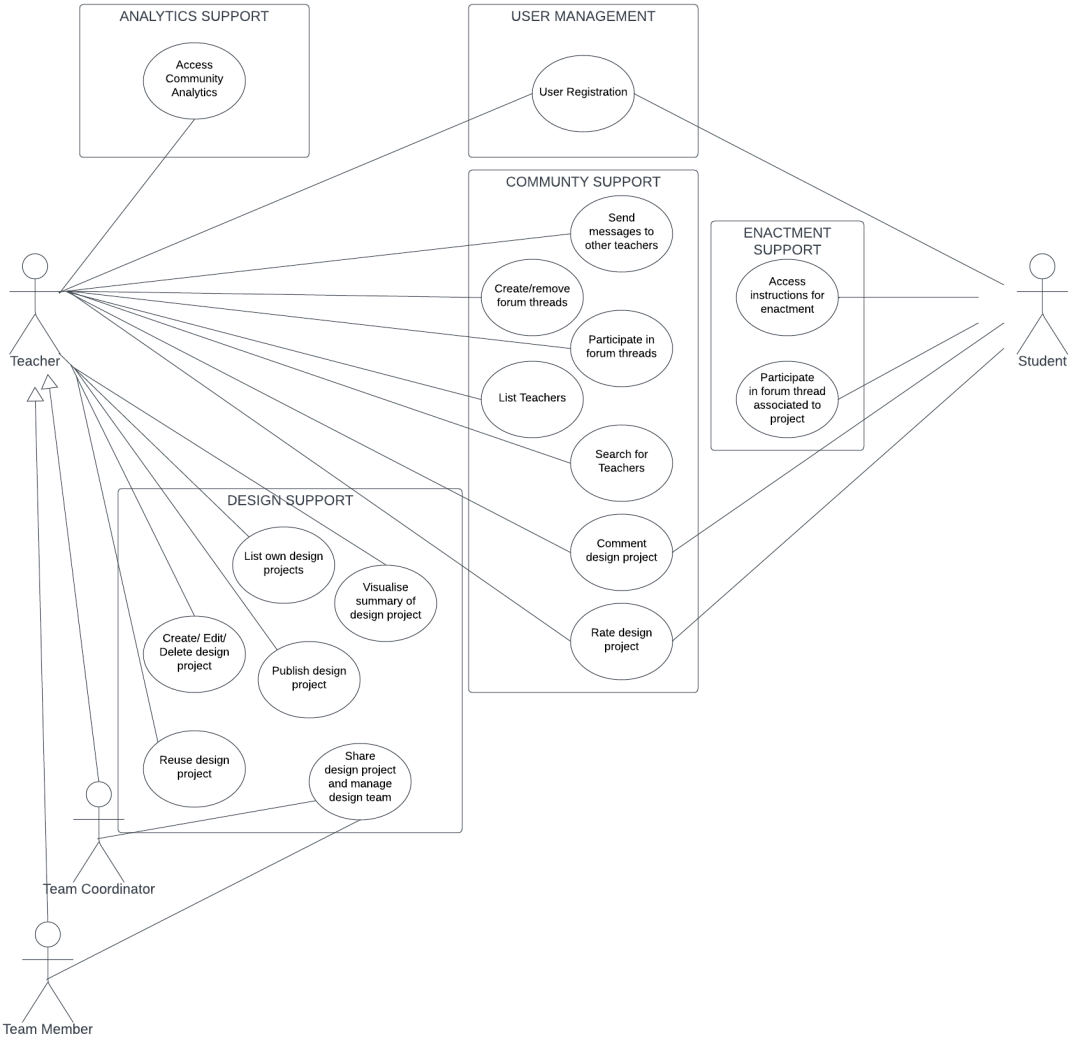
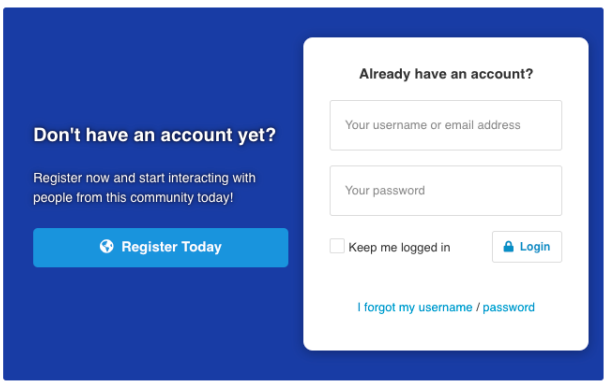


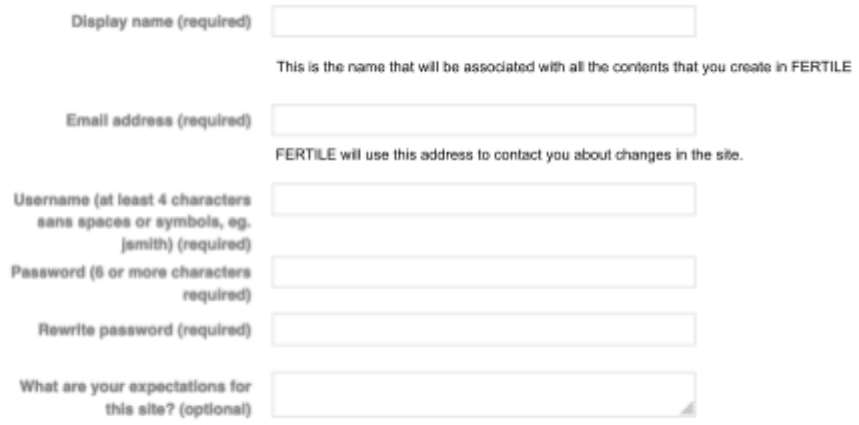
Figure 6. FERTILE CP use cases diagram.

[6] Unified Modeling Language, http://www.uml.org/. Last access: January 2023.

4.2.1 User Management use cases

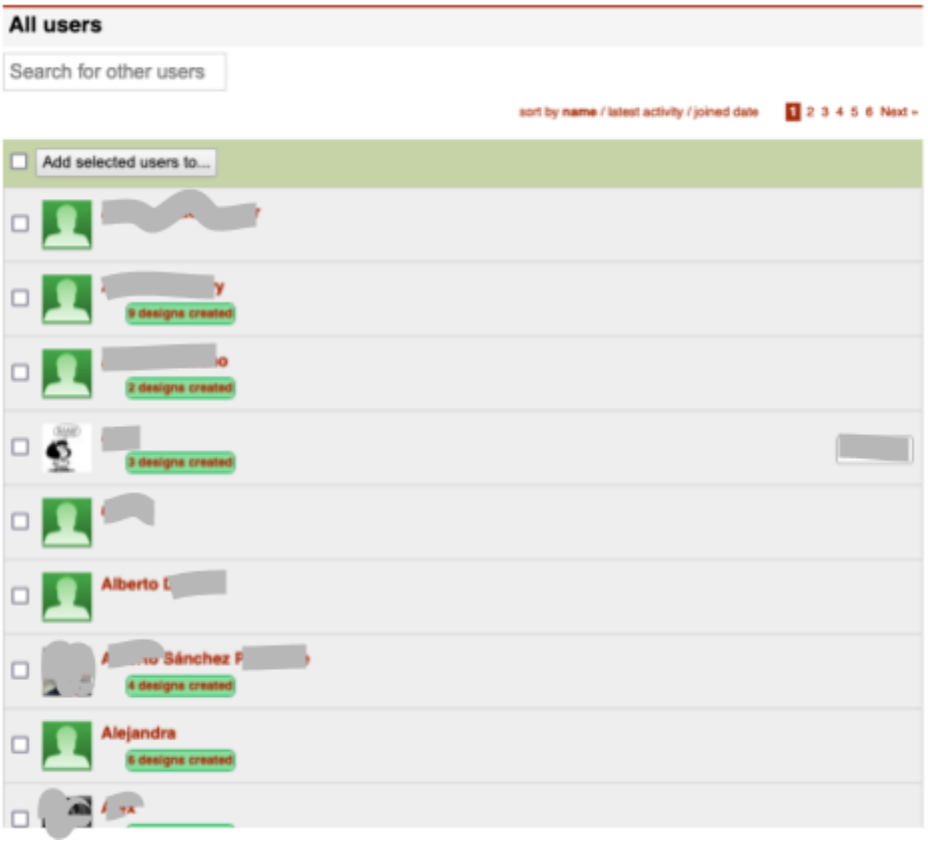
Out of the identified functional requirements regarding user management ("user registration", "user log-in", "user log-out") only the first one is described in detail, since the other two are similar to those found in any other web-based system. Similarly, we are not including detailed use cases for other related and very common functionalities. For instance: user profile edition, user removal, etc.

Use case	**User registration**
Involved Roles	Teacher, Student
Short Description	Both teachers and students participating in the FERTILE CP are expected to register on the platform.
Sample Scenario	Pam, a high school ER teacher has received a newsletter from the FERTILE project suggesting to participate in the CP for meeting other colleagues interested in ER and for accessing a repository of existing learning projects that make use of ER and arts. Pam is interested in introducing artful elements in her ER projects so she clicks on the provided URL of the FERTILE FP and, when realising that registration is required, she clicks on the "Register" button of the web page. Then, Pam is guided through a set of menus in which she needs to provide some personal data (Name-Surname, working institution, educational level, speciality, years of experience, etc.), as well as provide a user name and a password. Once this process is finished, she receives an email in her account asking her to click on a certain URL to confirm and finish the registration process.
Pre-conditions	The user is not registered on the platform.
Post-conditions	The user is registered on the platform, with a specific role (teacher or students) using a provided username and password. The user is allowed to log into the CP once s/he has confirmed the registration via the link provided via email to the address provided during the registration process.
Diagram/ Screenshots	When accessing the main CP URL, the user is provided with the option to log in or, in case the user is not registered, to carry out the registration process. 

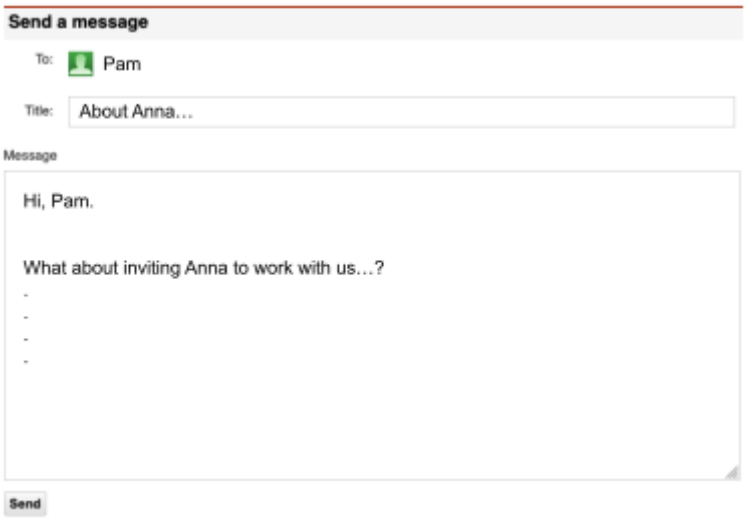
	The user will provide all the needed data to complete the registration process.  Once all the needed registration data has been provided, the user will receive an email message with an URL to confirm the registration process.

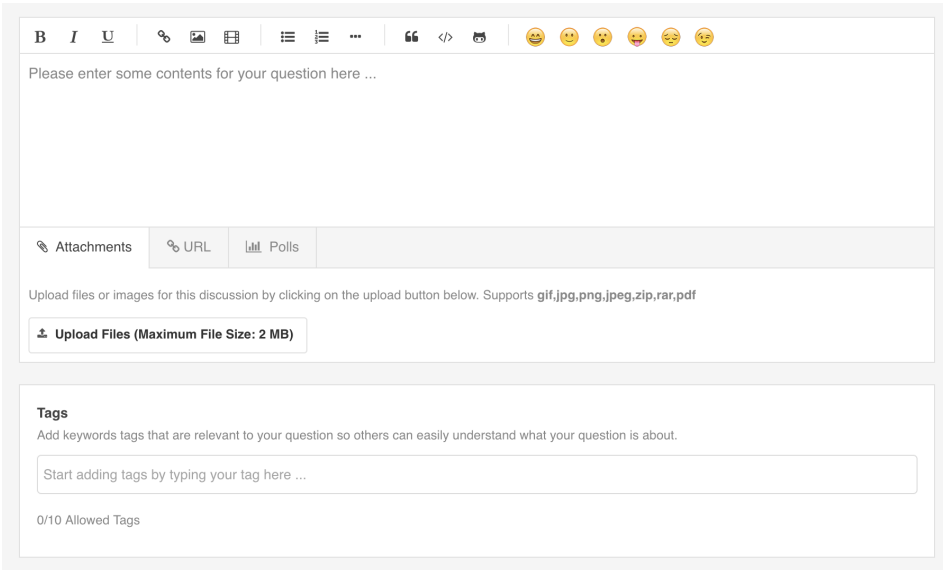
4.2.2 Community Support use cases

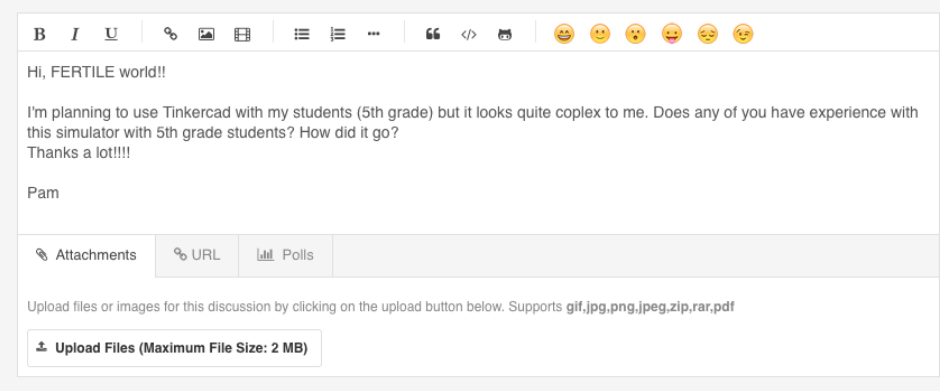
Use case	**Send messages to other teachers**
Involved Roles	Teacher
Short Description	Teachers already registered in the FERTILE CP can list/search for other teachers and send messages to them (in a chat-like fashion).
Sample Scenario	Pam, a high school ER teacher, is working with Paul and John (two other teachers of the same high school) on an ER project for fostering the acquisition of "animation skills". Paul has met Anna, a teacher from another high school who has a long experience teaching animation techniques. She has told Paul that she would be interested in joining their design team because she is intrigued about the possibilities of using ER for teaching animation. Paul wants to talk to Pam and discuss with her the possibility of inviting Anna to join the team. Therefore, Paul uses the messaging capabilities of the CP to contact Pam and establish a dialogue with her.
Pre-conditions	Teachers exchanging messages need to be registered in the CP
Post-conditions	A message thread between teachers is kept in the CP
Diagram/ Screenshots	The teacher can list/search already registered teachers:

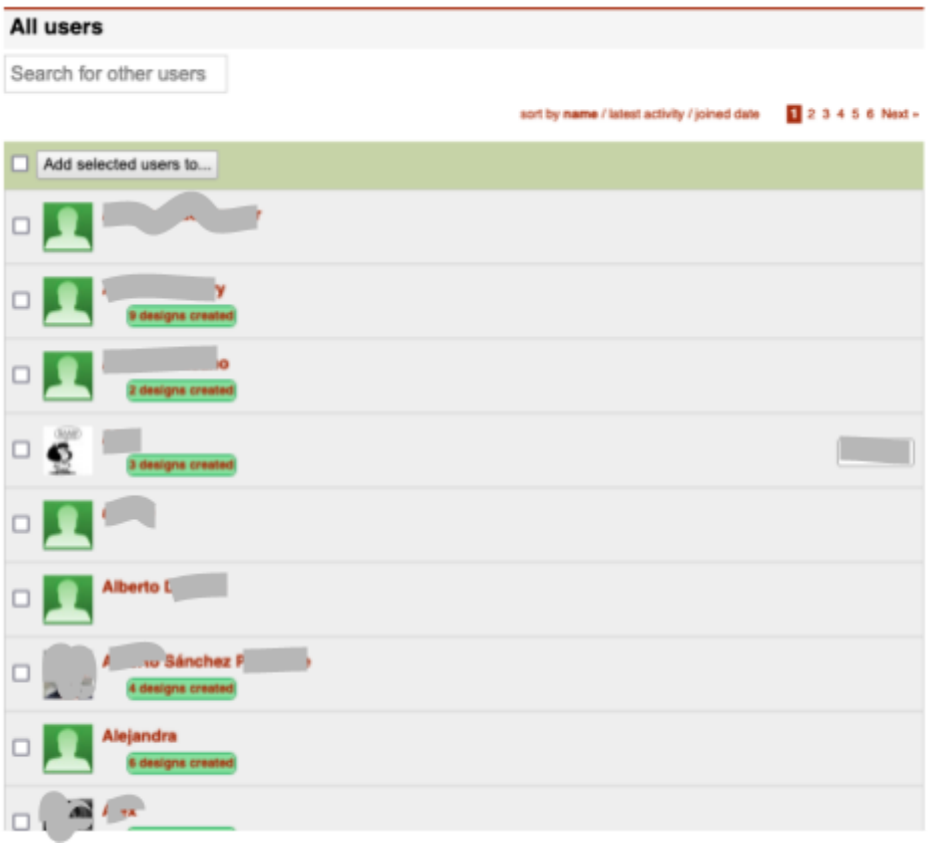


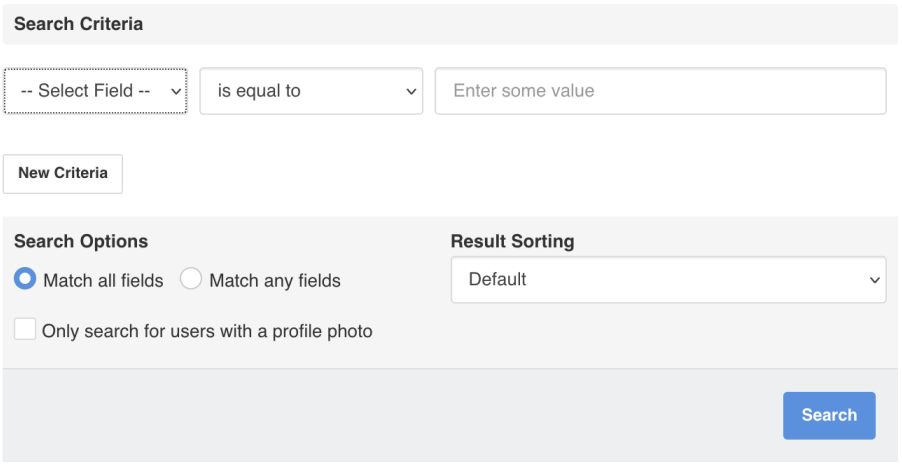
and then send a message:



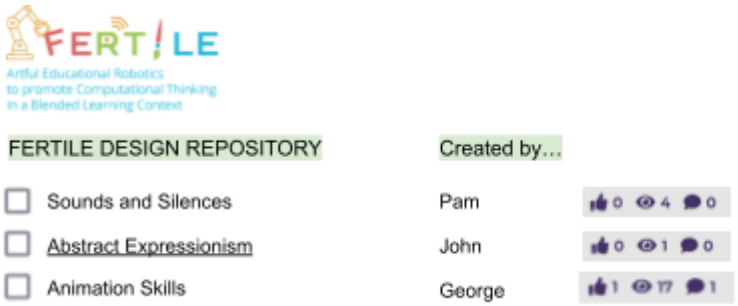
Use case	**Create/Remove forum thread**
Involved Roles	Teacher
Short Description	Teachers already registered in the FERTILE CP can create/remove forum threads for discussing Artful ER topics.
Sample Scenario	Pam, a high school ER teacher is working with Paul and John (two other teachers of the same high school) on an ER project for fostering the acquisition of "animation skills". Pam is concerned about the technical skills that her students would need to use the ER simulator she wants to include as a resource in her project. Therefore, she creates a new forum thread asking the FERTILE CP teachers about their experience with that very same ER simulator.
Pre-conditions	Teachers creating/removing forum threads need to be registered in the FERTILE CP.
Post-conditions	A new forum thread is available for posting new messages.
Diagram/ Screenshots	Pam checks the existing discussion "TOPICS" and, since her topic is not discussed yet, she requests the creation of a "New Post" that would trigger a new discussion thread.  She posts her message: 

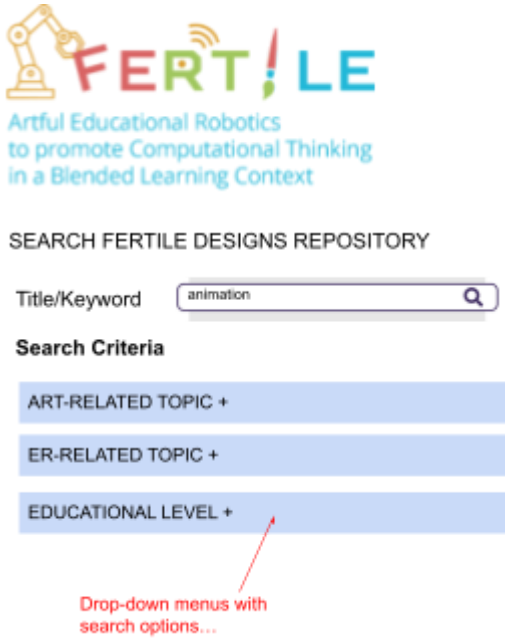
Use case	**Participate in forum threads**
Involved Roles	Teacher
Short Description	Teachers already registered on the FERTILE CP can list/search for existing forum threads and post new messages (or responses to existing ones).
Sample Scenario	Pam, a high school ER teacher is working with Paul and John (two other teachers of the same high school) on an ER project for fostering the acquisition of "animation skills". Pam is concerned about the technical skills that her students would need to use the ER simulator she wants to include as a resource in her project. Therefore, she searches for existing forum threads related to the specific ER simulator she is interested in. She finds that there is an ongoing thread about it so she posts a message asking about her specific doubt.
Pre-conditions	Forum threads of interest are already created. Teachers posting messages need to be registered in the FERTILE CP.
Post-conditions	The new posted message is kept in the CP so that other teachers can read it or react to it (e.g., posting additional messages)
Diagram/ Screenshots	A teacher posts a message that can be read by any other teacher in the platform: 

Use case	**List teachers**
Involved Roles	Teacher
Short Description	Teachers participating in the FERTILE CP can browse the list of other registered teachers.
Sample Scenario	Pam, a high school ER teacher, has just registered on the FERTILE CP. She wants to take a look at the participants in the community and check whether there are known faces among them.
Pre-conditions	Teachers browsing the list of the FERTILE CP participants need to be registered.
Post-conditions	
Diagram/ Screenshots	

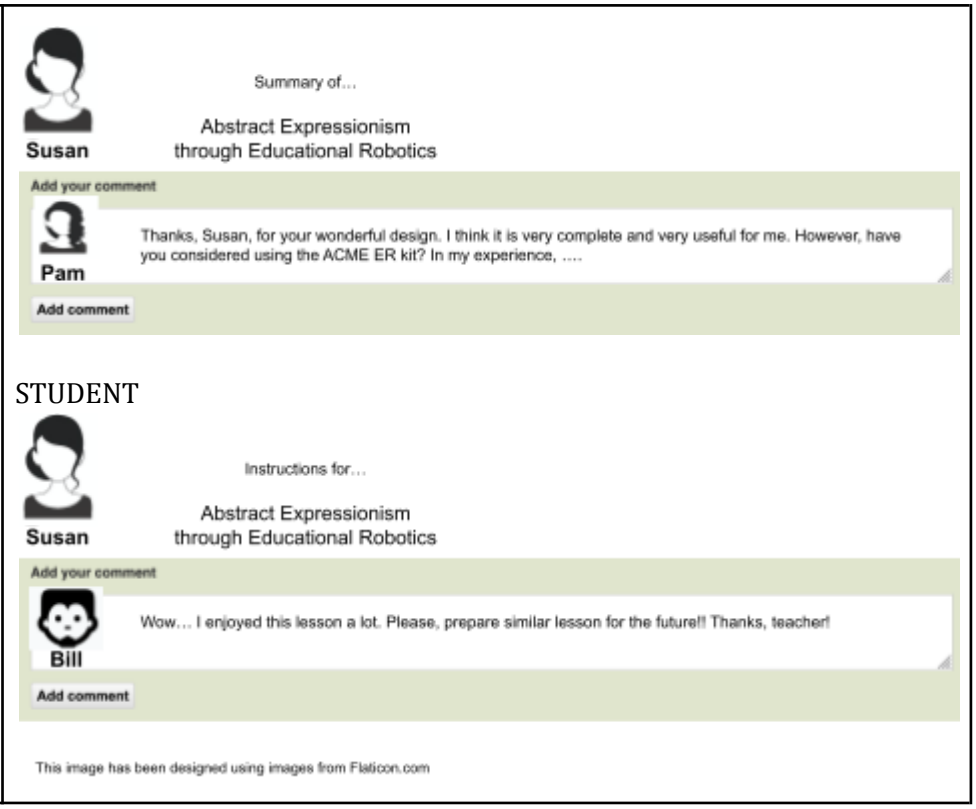
Use case	**Search for teachers**
Involved Roles	Teacher
Short Description	Teachers participating in the FERTILE CP can search for specific teachers in the community. Search criteria should include, at least, name of the teachers, speciality, art-related and ER-related interests (as indicated during the registration process), educational level.
Sample Scenario	Pam, a high school ER teacher, has just registered into the FERTILE CP. She wants to check whether Paul, another teacher she intends to work with, is already registered in the CP.
Pre-conditions	Teachers searching for other teachers of the FERTILE CP participants need to be registered.
Post-conditions	
Diagram/ Screenshots	SEARCH FOR TEACHER 

Use case	**List CP Artful ER project**
Involved Roles	Teacher
Short Description	Teachers participating in the FERTILE CP can browse the list of publicly available artful ER projects available in the CP. The provided list should also indicate the (teacher) "rating" of each project ("likes", "stars", or similar approach), number of visits, comments, etc. to provide an idea of how each particular project is valued by the community.
Sample Scenario	Pam, a high school ER teacher, has just registered into the FERTILE CP. She wants to take a look at the existing artful ER design projects available in the platform to have an idea of what other colleagues are proposing.
Pre-conditions	Teachers browsing the list of the publicly available artful ER projects need

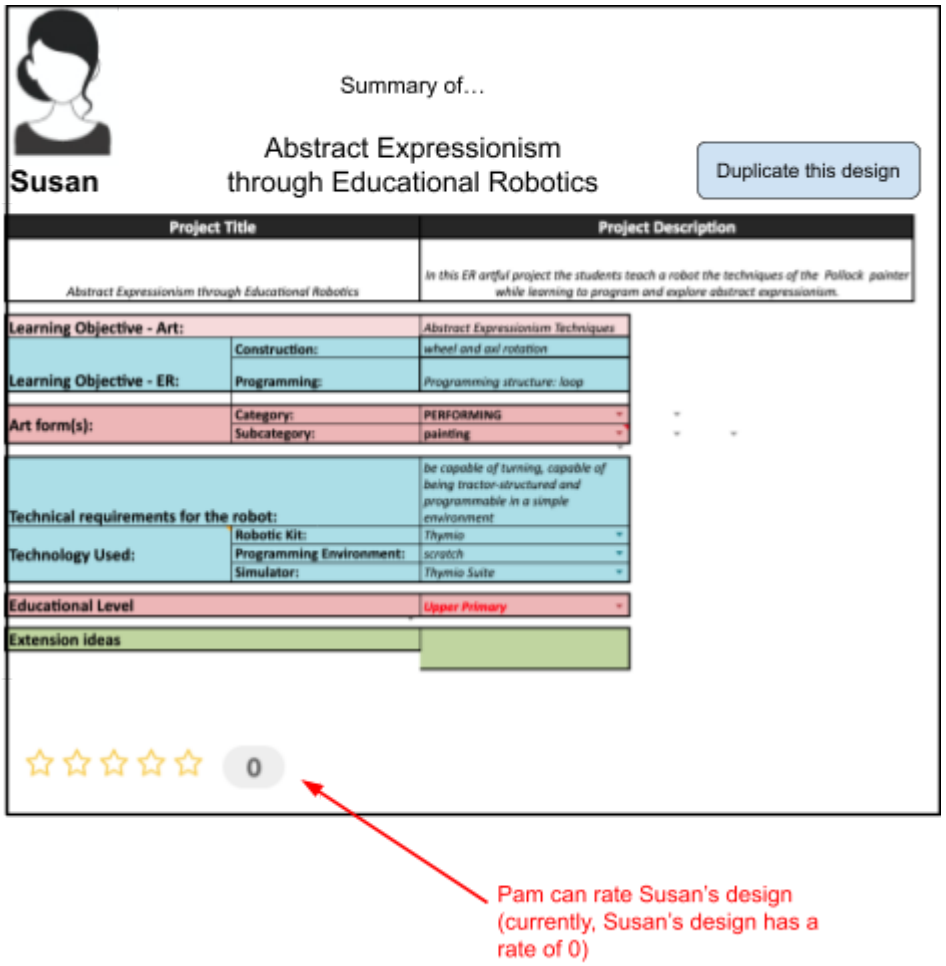
	to be registered.
Post-conditions	
Diagram/ Screenshots	

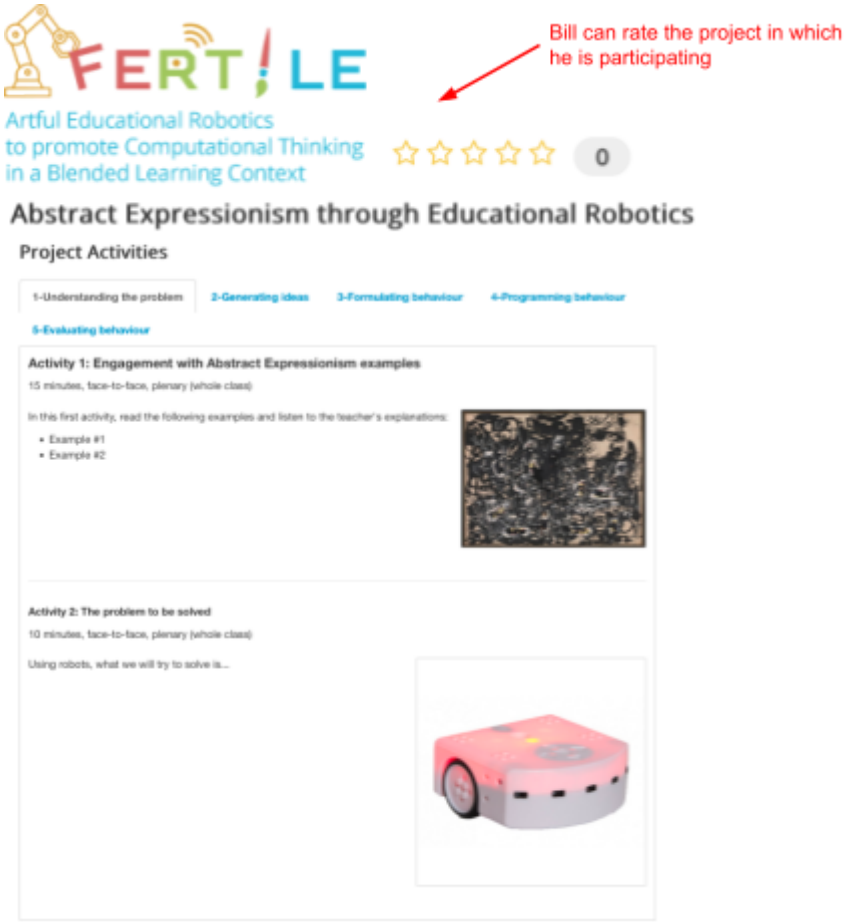
Use case	**Search for CP Artful ER projects**
Involved Roles	Teacher
Short Description	Teachers participating in the FERTILE CP can search for specific publicly available artful ER design projects in the community. Search criteria should include, at least: title word, art-related and/or ER-related topic, educational level.
Sample Scenario	Pam, a high school ER teacher, has just registered into the FERTILE CP. She wants to find design projects that make use of the Lego Boost ER kit.
Pre-conditions	Teachers searching for publicly available artful ER design projects need to be already registered.
Post-conditions	
Diagram/ Screenshots	

Use case	**Comment on Artful ER project**
Involved Roles	Teacher, Student
Short Description	Teachers can add comments on other publicly available Artful ER projects. Students already registered in the FERTILE CP can post comments onthe Artful ER design projects in whose enactment they are participating.
Sample Scenario	(Teacher) Pam, a high school ER teacher, wants to work with Paul and John (another two teachers of the same high school) on an artful ER design project for fostering the acquisition of "abstract expressionism". Pam wants to check whether there are other publicly available design projects dealing with the same Arts-related topic, so she uses the CP search functionality and finds several existing projects that might be of interest. Pam checks the summary of the found projects and decides that a project created by a teacher called Susan has many elements that might be applicable to the problem she, Paul and John want to address. Nevertheless, she thinks that there are better options, in relation with the one employed by Susan, regarding the ER kit to use in this type of learning scenario. So Pam decides to write a short comment in case Susan finds it useful. (Student) Bill is a high school student participating in an arts lesson about "animation" that makes use of robots. Bill is reading the instructions about what he needs to do in a web-based platform called FERTILE CP. Bill thinks this lesson is very funny and he is enjoying it a lot. Therefore, Bill decides to add a comment to the project, using the form provided by the FERTILE CP.
Pre-conditions	The teacher posting the comment is already registered on the FERTILE CP. The design project to comment about must be shared by its original creator with the whole community (i.e., making that project publicly available). Students commenting on a project need to be registered in the FERTILE CP.
Post-conditions	(Teacher) The posted comment is added to the list of comments associated with that design project (and will be visible to any other teacher visiting the commented design project, unless its original creator decides that it should not be publicly available any longer). (Student) Comments can be read by the teachers of the design team of the project, as well as by the rest of students participating in its enactment.
Diagram/ Screenshots	TEACHER

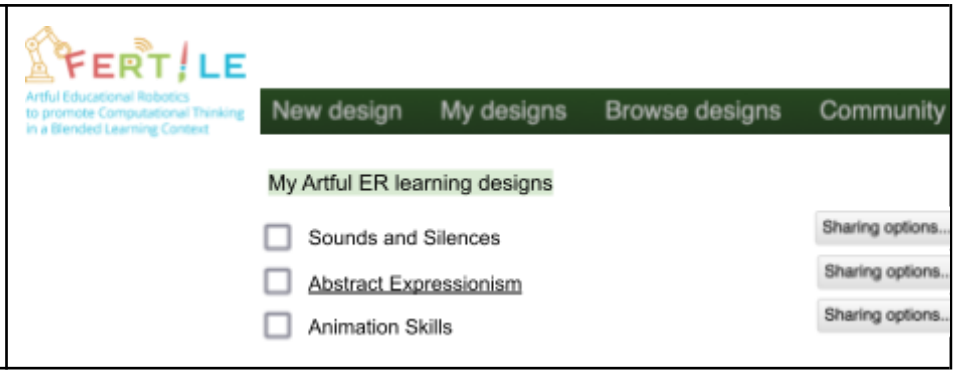
Use case	**Rate Artful ER projects**
Involved Roles	Teacher, Student
Short Description	Teachers can rate other publicly available projects. Students already registered in the FERTILE CP can rate the Artful ER projects in whose enactment they are participating.
Sample Scenario	(TEACHER) Pam, a high school ER teacher, wants to work with Paul and John (another two teachers of the same high school) on an artful ER design project for fostering the acquisition of "abstract expressionism". Pam wants to check whether there are other publicly available design projects dealing with the same Arts-related topic, so she uses the CP search functionality and finds several existing projects that might be of interest. Pam checks the summary of the found projects and decides that a project created by a teacher called Susan is quite relevant for her. Additionally, Pam realises that Susan's design is very complete and informative. Therefore, Pam decides to rate Susan's design with "5 stars". (STUDENT) Bill is a high school student participating in an arts lesson about "animation" that makes use of robots. Bill is reading the instructions about what he needs to do in a web-based platform called FERTILE CP. Bill thinks

	this lesson is very funny and he is enjoying it a lot. Therefore, Bill decides to rate the project with “five stars”!.
Pre-conditions	(TEACHER) The teacher carrying out the rating is already registered in the FERTILE CP. The design project to be rated is shared by its original creator with the whole community (i.e., making that project publicly available). (STUDENT) Students rating a project need to be registered in the FERTILE CP.
Post-conditions	(TEACHER) A new average rating is calculated for the rated design using the new rating provided by the teachers (STUDENT) A new average rating is calculated for the rated design using the new rating provided by the students.
Diagram/ Screenshots	(TEACHER) 

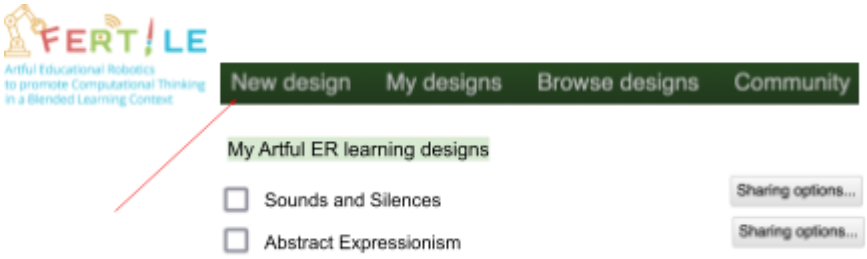
	(STUDENT) 

4.2.3 Design Support use cases

Use case	**List own Artful ER projects**
Involved Roles	Teacher
Short Description	Teachers already registered on the FERTILE CP can access a personal space in which they can visualise the list of artful ER projects in whose creation they are participating (they might be created by themselves, or created by other teachers and shared with them).
Sample Scenario	Pam, a high school ER teacher is registered in the FERTILE CP and she has already created 3 artful ER projects.
Pre-conditions	Teachers need to be registered on the platform in order to access their personal space.
Post-conditions	
Diagram/ Screenshots	

Use case	**Create/Edit/Delete an Artful ER projects**
Involved Roles	Teacher
Short Description	Teachers already registered on the FERTILE CP can create and/or edit new or existing Artful ER designs. They can also delete designs created by them.
Sample Scenario	Pam, a high school ER teacher is working with Paul and John (another two teachers of the same high school) on an ER project for fostering the acquisition of "animation skills". Pam wants to use the design support of the FERTILE CP to make explicit all the design decisions she (together with the design team) is taking. Also, she wants to check that she is not missing any key aspect of the Artful ER project. Therefore, she creates a new design project and begins to enter information about it, following the design process that the FERTILE CP suggests (and that is based on the "FERTILE Design Methodology").
Pre-conditions	Teachers creating/editing/deleting Artful ER projects need to be registered in the platform. For editing/removing a project, the project needs to have been created beforehand.
Post-conditions	The teacher that creates a new design project is considered as the "Team coordinator" of the design team associated with the project. The "Team coordinator" has the capability of inviting other teachers to be part of the design team. If a new project is created, it should appear in the list of available projects for the creator and his/her collaborators. If marked as "public available", it should be visible for all the participants in the FERTILE CP. If an existing project is deleted, it should be removed from the lists of existing projects. It should also appear in the list of "removed projects" until permanently deleted.
Diagram/ Screenshots	Pam requests the creation of a new design project about "Animation Skills"...



Currently, the work on FERTILE's result R1 (Design Methodology) is envisioning a visual language for the design of artful ER design projects based on the metaphor of tables and forms, with several steps. This approach to the visual representation of the designs is currently being discussed within task 1.3 (Design Methodology) and its evolution will be incorporated in the implementation of the CP (task 2.2).

FERTILE Methodology Step	Description	Output
Understanding the problem	the problem solver identifies the given problem	Art: a description of the requirements concerning the artistic part ER: a description of the technical requirements regarding educational robotics

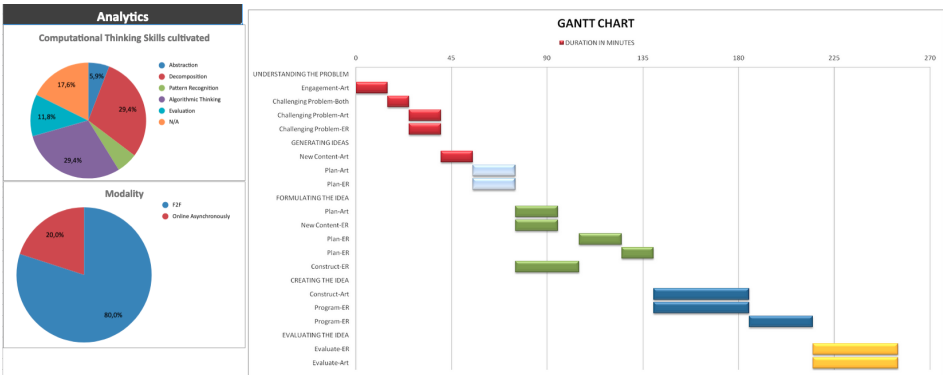
Sequence	Type of Activity	Subject	CT Skill	Modality	Activity Description	Title	Duration (Minutes)	Materials	Class Orchestration
1	Engagement	Art	Pattern Recognition	F2F	the teacher gives examples to introduce students to the concept of abstract expressionism and its specific characteristics.	Engagement with Abstract Expressionism examples	15		plenary
2	Challenging Problem	Both	N/A	F2F	Challenging problem (assignement):the teacher asks the students to create an environment (playground) in which robots paint based on abstract expressionism and to program these robots.	Give the problem to be solved	10		plenary
3	Challenging Problem	Art	Decomposition		the students explore and participate in defining the problem they have to face: a) the form of the playground, b) the main parts of the playground, c) the colours they will use and d) the design of the drawings that are expected on the playground.	problem definition	15		plenary
3	Challenging Problem	ER	Decomposition	F2F	the students explore and participate in the definiton of the problem that they have to face: a) what materials the robot will need, b) how the robot will paint, c) what obstacles the robot may face when painting, etc.	problem definition	15		plenary

Use case	**Visualise summary of Artful ER projects**
Involved Roles	Teacher
Short Description	Registered teachers, when browsing the list of CP design projects (or the results of a search for CP design projects) can access and visualise a summary of a specific design project before reusing and/or editing it (in case the teacher belongs to the design team of that project)
Sample Scenario	Melissa, a high school arts teacher, has searched for artful ER design projects dealing with "animation skills". One of the search results is a design project created by another ER teacher, Pam. Melissa wants to have a preliminary idea of what Pam's design project is about. Therefore, she visualises the "summary" of Pam's design project, which combines textual and graphical elements.
Pre-conditions	Teachers visualising the summary of Artful ER projects need to be registered on the platform. Artful ER projects whose summaries are visualised need to have been publicly shared with the visualising teachers of with the whole FERTILE CP community.
Post-conditions	

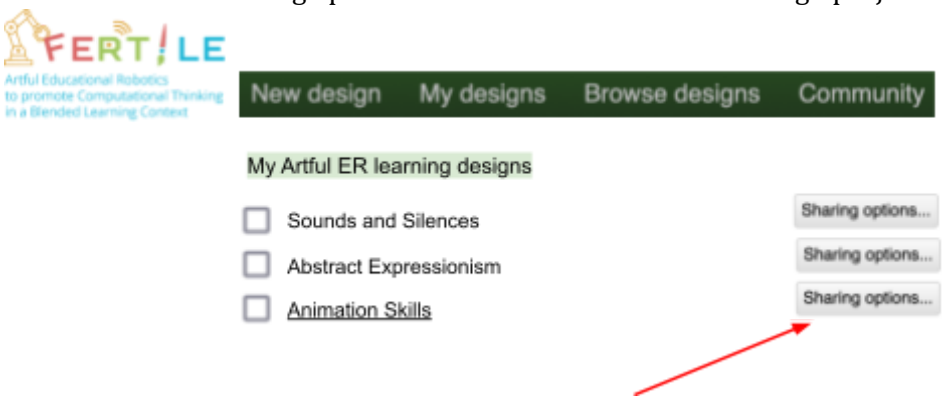
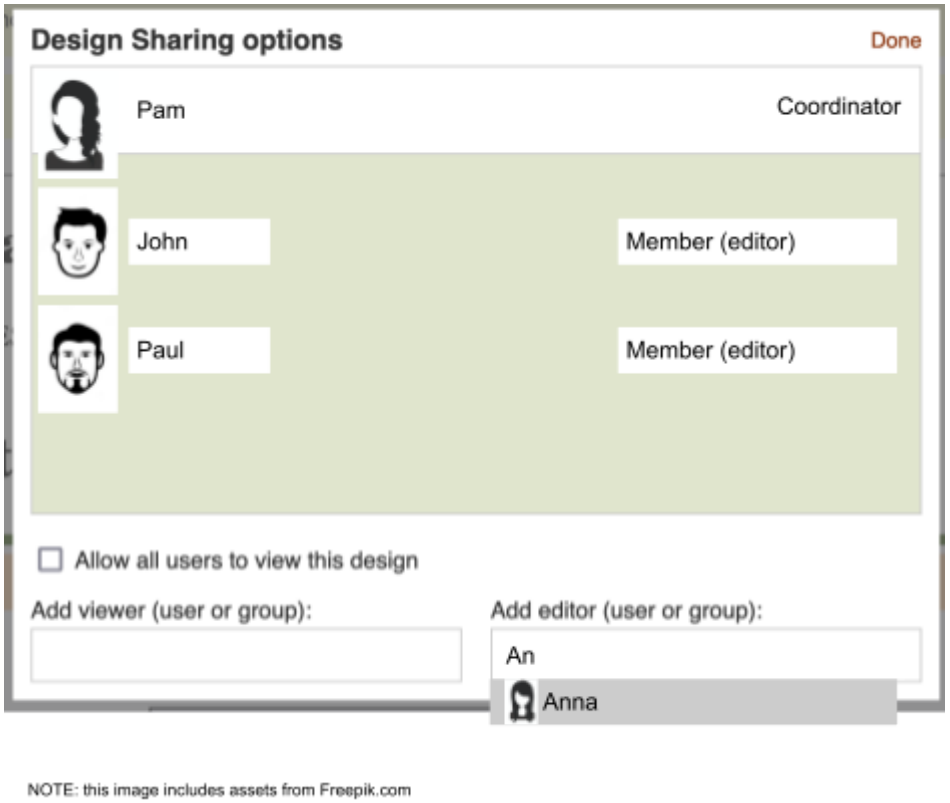
Diagram/ Screenshots	Currently, the work on FERTILE's result R1 (Design Methodology) is envisioning a summary for design projects that combines chronological information, cultivated computational thinking skills, and modalities (face-to-face, online). Additionally, an overview of the project (title, description, learning objectives, technical requirements, etc. could also be included.

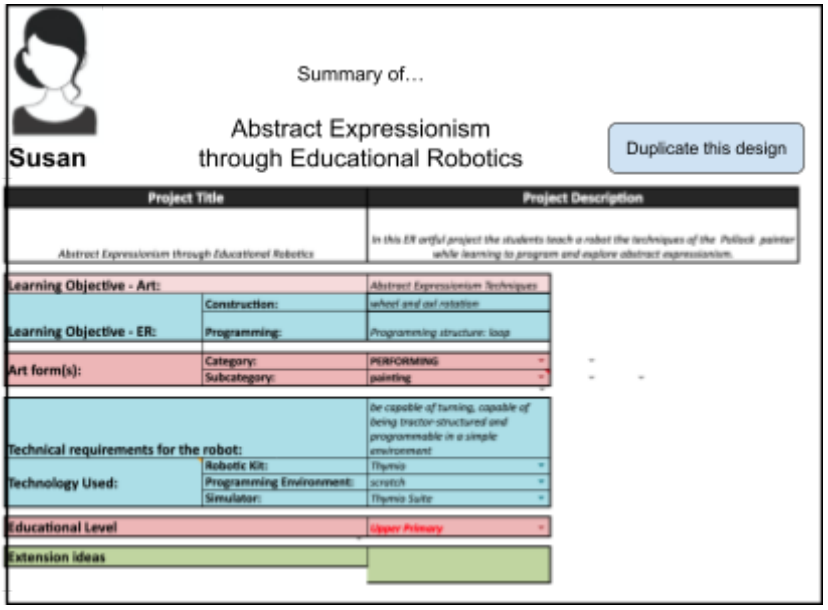
Project Title	Project Description
Abstract Expressionism through Educational Robotics	*In this ER artful project the students teach a robot the techniques of the Pollock painter while learning to program and explore abstract expressionism.*

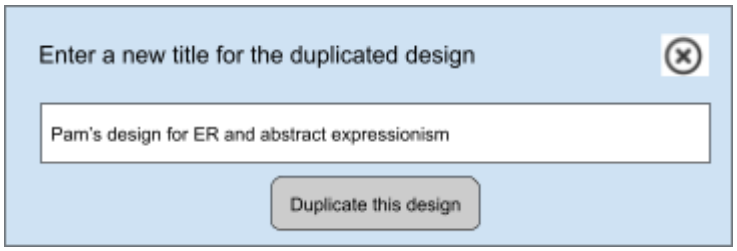
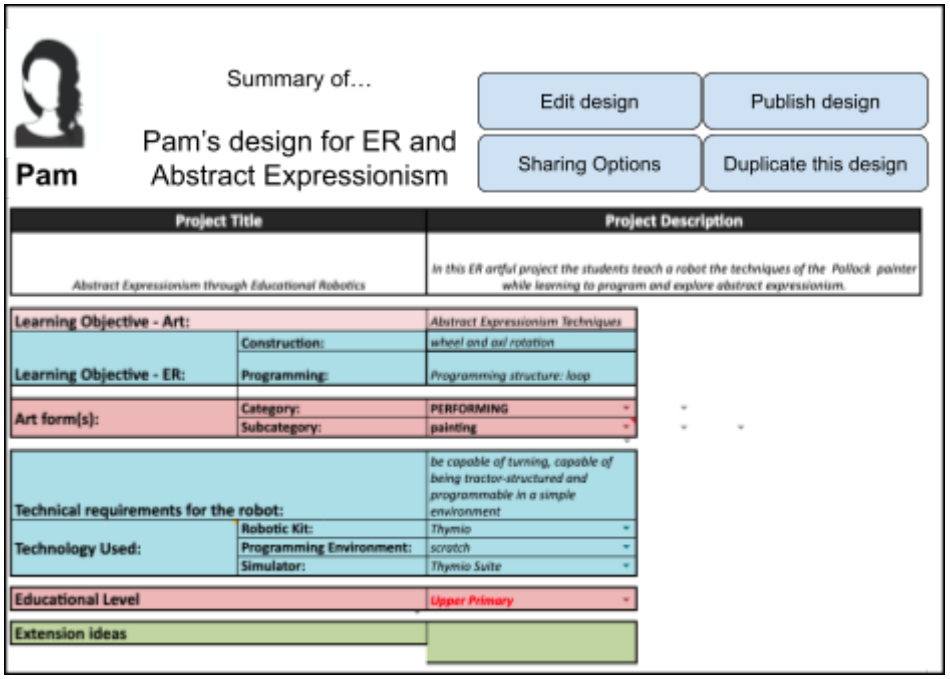
Learning Objective - Art:		*Abstract Expressionism Techniques*
Learning Objective - ER:	**Construction:**	*wheel and axl rotation*
	Programming:	*Programming structure: loop*
Art form(s):	**Category:**	**PERFORMING**
	Subcategory:	**painting**
Technical requirements for the robot:		*be capable of turning, capable of being tractor-structured and programmable in a simple environment*
Technology Used:	**Robotic Kit:**	*Thymio*
	Programming Environment:	*scratch*
	Simulator:	*Thymio Suite*
Educational Level		***Upper Primary***
Extension ideas		



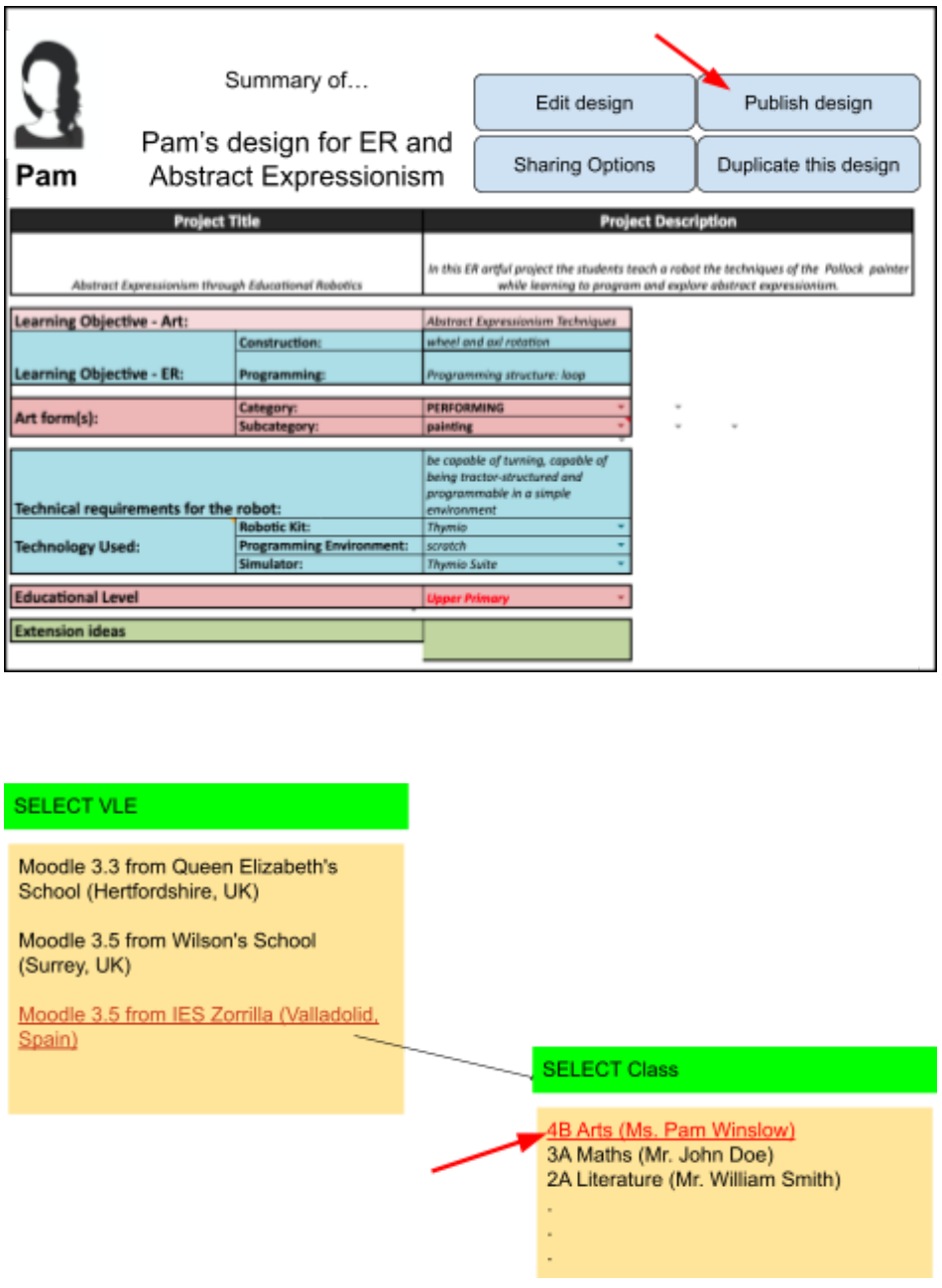
Use case	**Share Arful ER project and Manage (co-)design team**
Involved Roles	Team coordinator (Teacher), team member (Teacher)
Short Description	A teacher that coordinates a (co-)design team (Team coordinator) invites another teacher to join the team with editing rights (team member) so that s/he can contribute with his/her expertise.
Sample Scenario	Pam, a high school ER teacher is working with Paul and John (another two teachers of the same high school) on an ER project for fostering the acquisition of "animation skills". Paul has met Anna, a teacher from another high school who has a long experience teaching animation techniques. She has told Paul that she would be interested in joining their design team because she is intrigued about the possibilities of using ER for teaching

	animation. Paul asks Anna to register into the FERTILE CP. Then, Paul contacts Pam through the FERTILE CP and asks her to invite Anna to join the team. Once added to the design team, Anna can access Pam, Paul and John's (co-)design team workspace, including the internal forums and the versions of the project developed so far.
Pre-conditions	There is an active (co-)design team coordinated by the Team coordinator. The new Team Member is registered on the platform before s/he can be invited to join the design team.
Post-conditions	The new Team Member has access and read/editing rights for the resources associated with the (co-)design team.
Diagram/ Screenshot?	Pam selects the "Sharing options" for the "Animation Skills" design project  John and Paul already belong to Pam's design team. She requests the addition of Anna, by entering her email address. 

Use case	**Reuse of Artful ER projects**
Involved Roles	Teacher
Short Description	A FERTILE CP teacher can "duplicate" an existing design project (publicly available), thus creating a "clone" of it that, from that moment on, can be considered as belonging to the set of teachers' own design projects.
Sample Scenario	Pam, a high school ER teacher, wants to work with Paul and John (another two teachers from the same high school) on an artful ER design project for fostering the acquisition of "abstract expressionism". Pam wants to check whether other publicly available design projects deal with the same Arts-related topic, so she uses the CP search functionality and finds several existing projects that might interest her. Pam checks the summary of the found projects and decides that a project created by a teacher called Susan has many elements that might apply to the problem she, Paul and John want to address. Therefore, Pam requests the "duplication" of Susan's design so that Pam's design team can continue editing/customising it.
Pre-conditions	The teacher requesting the duplicate is already registered in the FERTILE CP. The design project to duplicate must be shared by its original creator with the whole community (i.e., making that project publicly available).
Post-conditions	A new design project is created, with the contents of the original project, but with the name chosen by the duplicating teacher.
Diagram/ Screenshots	Pam checks the summary of Susan's design, which seems to be interesting… Once Pam has decided that she might reuse part of Susan's design, she requests its duplication. 

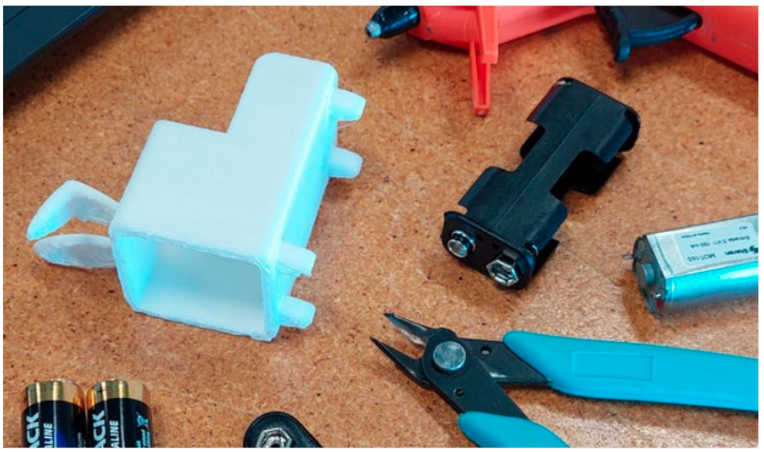
	Pam chooses a new name for the duplicated design project:  And, now, she can edit it, share it, etc… 

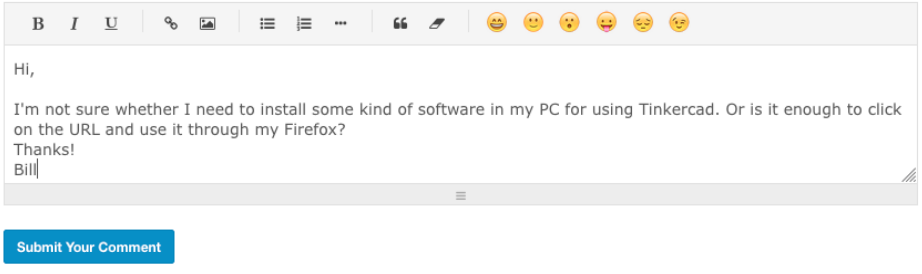
Use case	**Publish Artful ER projects for enactment**
Involved Roles	Teacher
Short Description	A FERTILE CP teacher can "publish" one of the finished design projects created by him/her so that students can access it for enactment.
Sample Scenario	Pam, a high school ER teacher, together with Paul and John (another two teachers of the same high school) have finished working on an artful ER design project for fostering the acquisition of "abstract expressionism". Now Pam, Paul and John want their students to enact this design project, following its sequence of learning tasks and using its associated learning resources. Pam clicks on the design's " Publish " button and is provided with the URL to the web page with the enactment instructions. This way, Pam might distribute the URL among her students using other means (e.g.,

	using a forum within the LMS itself, thus not requiring her students to register into the FERTILE CP).
Pre-conditions	The teacher requesting the publication is already registered in the FERTILE CP. The design project to publish must be created by the teacher(s) of the corresponding design team.
Post-conditions	Enactment instructions corresponding to the published design project are available as a web page in the FERTILE CP.
Diagram/ Screenshots	

4.2.4 Enactment Support use cases

Use case	**Access instructions for enactment**
Involved Roles	Student
Short Description	Students already registered in the FERTILE CP can see a list of the design projects in whose enactment they are currently participating in. When accessing a particular design project, a set of instructions will be displayed, explaining to the students which learning tasks they have to carry out, as well as providing links to the online resources they should use (e.g., ER simulators, videos, etc.). Students can also access the instructions for enactment if they receive the URL in which those instructions are published.
Sample Scenario	Bill is a high school student participating in an arts lesson about "animation" that makes use of robots. Bill logs into the FERTILE CP platform and gets a list of Artful ER design projects in which he participates. Bill selects the project about "animation" and gets a web page with all the details about the learning tasks he needs to carry out.
Pre-conditions	Students need to be registered in the FERTILE CP. The instructions for enactment need to correspond to a previously created Artful ER design project.
Post-conditions	
Diagram/ Screenshots	

Use case	**Participate in forum thread associated to a design project**
Involved Roles	Student
Short Description	Students already registered in the FERTILE CP can send messages to forum threads associated with the Artful ER projects whose enactment they are participating in.
Sample Scenario	Bill is a high school student participating in an arts lesson about "animation" that makes use of robots. Bill is reading the instructions about what he needs to do in a web-based platform called FERTILE CP. Bill is unsure whether a certain ER software must be installed in his own computer at home, or whether he can access that software online (i.e., by means of a web browser). Bill realises that, together with the instructions, in the very same web page, there is a "window" to post messages that the teacher and the rest of the class will read. Bill writes his doubt there and awaits for an answer.
Pre-conditions	Forum thread is created together with the corresponding Artful ER project. Students posting messages need to be registered in the FERTILE CP.
Post-conditions	Message threads are visible to the teachers of the project's design team and the rest of the students participating in its enactment.
Diagram/ Screenshots	A student posts a message that will be read by the teacher and the other students participating in enacting that particular Artful ER project. The possibility to post a message is available right under the instruction for students regarding a specific Artful ER project (NOTE: the image displayed in the mockup screenshot below has been reused from: https://www.tinkercad.com/projects/Evolution-Games-Building-Creatures-With-Basic-Elec, CC licensed): **Supplies**  **Software CAD:** • Tinkercad 3D Designs • Tinkercad Circuits (optional) **Software CAM:**

	(more instructions would follow…, showing the possibility of posting a message at the bottom of the page, in a separate tab, etc.) 

4.5 Community Analytics use cases

Use case	**Access community analytics**
Involved Roles	Teacher
Short Description	Teachers registered in the FERTILE CP can access a web page summarising the main community analytics indicators (see tables 7 and 8, section 3.2.2): ● information about the types of learning designs created in the platform (in relation to subject topic, educational level, and other metadata) ● information about the participation of teachers (number of created designs, co-editions, comments about others' designs, etc.) ● information about learning designs created using or refining another design as starting point ● information about social appraisal of a learning design within a community, typically in the form of a scale
Sample Scenario	Pam, a high school ER teacher, wants to work with Paul and John (another two teachers of the same high school) on an artful ER design project for fostering the acquisition of "abstract expressionism". Pam has just registered into the FERTILE CP and wants to get a first idea of the current activity level in the platform. Pam goes to the section on "The FERTILE Community in a Glimpse" and gets a web page with all that information in a graphical representation.
Pre-conditions	Teachers accessing the Community Analytics must be registered into the FERTILE CP.
Post-conditions	
Diagram/ Screenshots	(NOTE: adapted from Michos & Hernández-Leo, 2018)


DESIGNS
Explored from others
568
Not explored from others
138
Re-used designs
514
Designs created from scratch
192
Public shared designs
536
Private designs
170
Total
706
COMMUNITY ANALYTICS
Total
260
Contributors
136
Co-creators
6
Publishers
132
Commenters
87

5. Conclusions and Next Steps

This document has reported the work carried out by FERTILE partners in the context of Task 2.1 for the FERTILE CP: Design Requirements. Different sources of information have been analysed in order to propose a first complete set of functional requirements for the FERTILE CP. These requirements are aligned with the current status of the FERTILE Design Methodology (ongoing work in the context of Task T1.3), but also have considered partners' opinions and expertise in the fields of Learning Design and Educational Robotics. All that input has been reflected in two representative "scenarios" that illustrate how FERTILE partners envision the future CP, as well as in a catalogue of detailed "use cases" that also provide a first idea of how the CP user interface might look from the perspective of its users. By means of a CP incorporating all the elicited requirements, the FERTILE consortium expects to nurture and sustain a strong community of teachers interested in including innovative Artful ER projects in their teaching practice with the ultimate goal of fostering the acquisition of CT skills by their students.

Several proposed functionalities may be subject to further refinements or modifications, mostly due to potential changes in the current FERTILE design methodology. Similarly, several aspects of the CP, such as the support for different types of teachers, the graphical nature and specific visual metaphors of the design support, and the visualisation of community analytics (see section 3.5) have not yet been completely defined and are expected to take a more concrete shape during Task T2.2: CP development.

The work reported in this document enables FERTILE partners to start making technical decisions and carry out the actual development of a FERTILE CP (milestone M2.2). Although the developed CP will need to be evaluated during T2.3 in authentic conditions, the design and development process can start now based on a set of functional requirements agreed among the partners, and that incorporates the different perspectives needed to achieve the projects' goals (community support, LD support, Artul and ER domain viewpoints).

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LIST OF ACRONYMS

ACAD: Activity-Centred Analysis and Design

ADDIE: Analysis, Design, Development, Implementation, Evaluation

CCPS: Creative Computational Problem-Solving

CP: Community Platform

CT: Computational Thinking

EML: Educational Modeling Language

ER: Educational Robotics

GD: Graphic Designer

ILDE: Integrated Learning Design Environment

LAMS: Learning Activity Management System

LD: Learning Design

LDS: Learning Design Studio

PP: Pedagogical Planner

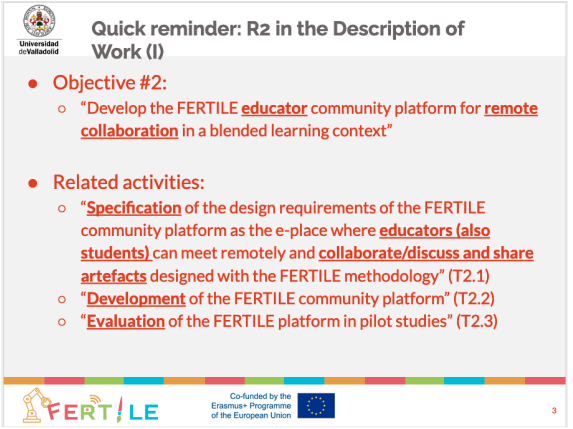
TEL: Technology-Enhanced Learning

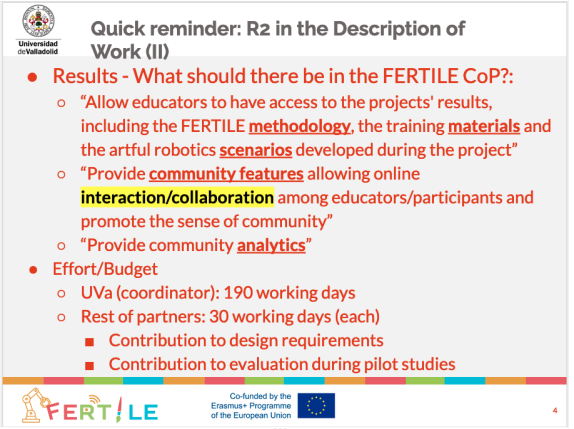
TPACK: Technologal, Pedagogical, Content Knowledge

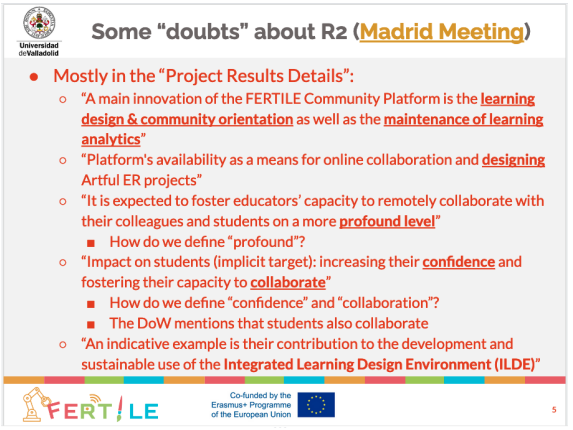
UML: Unified Modeling Language

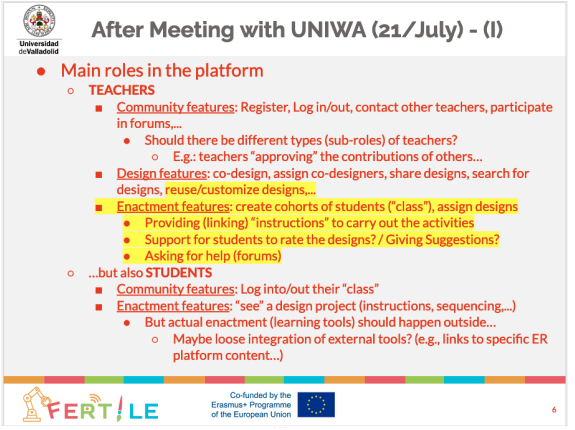
APPENDIX A. SLIDES USED FOR BRAINSTORMING ABOUT THE FERTILE CP DURING THE TPM2

The following slides were used during the Transnational Project Meeting 2 (TMP2, September 2022, Prague) for triggering a brainstorming among FERTILE partners about potential CP functional requirements (see section 3.2).









After Meeting with UNIWA (21/July) - (II)

- Learning Analytics
  - We mean: "Community Analytics"
    - And some metrics of teachers'/students' participation
- Design Features
  - Depending on how the "Design Methodology" will look like
    - Design "metadata"?
    - Phases, steps?
    - Outcomes? (document-based, graphical representations,...)
  - See material from previous meeting (Maria's ideas)
- Moving forward: parallel threads:
  - Working example of a design and the steps followed to complete it
  - Sketching the main "use cases"
    - Assessment of technical alternatives (joomla-based, ILDE-based, etc...)

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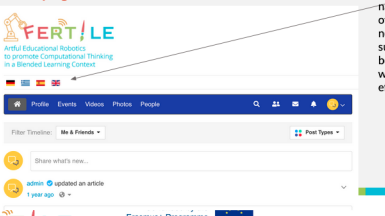
Sketching the Community Platform Use Cases (I)

- TEACHERS
  - Registration
    - Need to get a profile of the teachers?
      - Experience, educational level, ...
  - Log in/out
  - Main page with "timeline" and social features...



Let's not forget that English and all the national languages of the partners need to be supported (help will be needed here with the translation effort)

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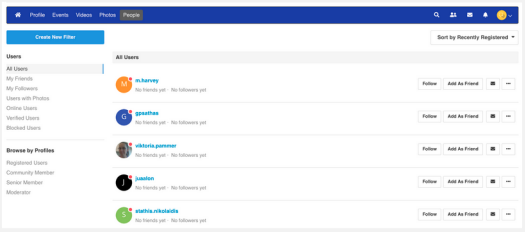
Sketching the Community Platform Use Cases (II)

- TEACHERS
  - Contacting other teachers (messaging)



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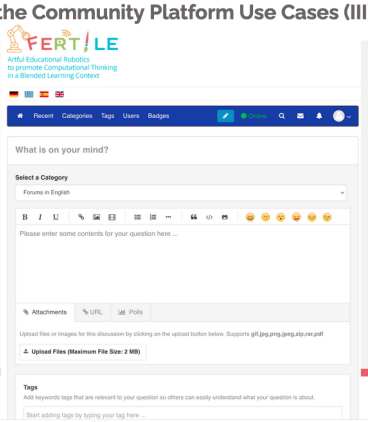
9

Sketching the Community Platform Use Cases (III)

- TEACHERS
  - Participate in forums....



10

Sketching the Community Platform Use Cases (IV)

- TEACHERS
  - Creating and editing Artful ER Designs...

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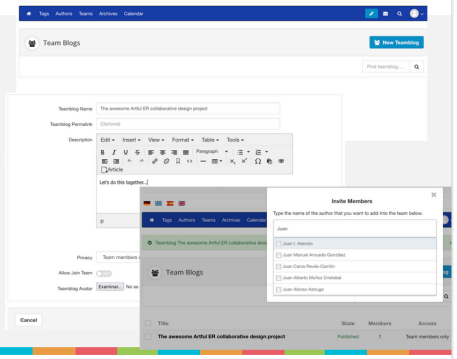
Sketching the Community Platform Use Cases (V)

- TEACHERS
  - Creating a co-design "Team"
  - All "Team" members can edit the design



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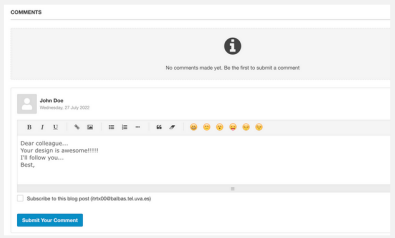
12

Sketching the Community Platform Use Cases (VI)

- TEACHERS
  - Commenting on other teachers' designs



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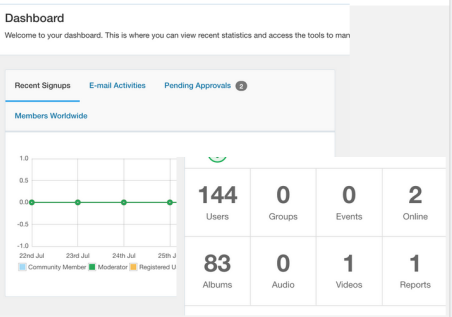
13

Sketching the Community Platform Use Cases (VII)

- Community Analytics



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Sketching the Community Platform Use Cases (VIII)

- STUDENTS
  - Registration (or not), log in/out
  - What shall they see in the platform?
    - Only the "instructions" from the design
    - Are we assuming they are using a "learning platform" somewhere else? (e.g., Moodle,...)
- Brainstorming needed... :)

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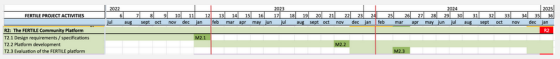
Next Steps



- Task 2.1 ("Design Requirements / specifications") - Jan 2023
  - "Vision" of the platform
  - Identification and definition of roles
  - Definition of use cases
  - Functional architecture
  - Technological alternatives and decisions

To be moved to M2.2??

Alignment with Design Methodology (but M1.3 is expected for July/23)

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APPENDIX B. FEEDBACK QUESTIONNAIRE ABOUT THE FERTILE CP REQUIREMENTS

Design Requirements for the FERTILE Community Platform: partners' opinions and ideas

Dear Fertile member:

Fertile's result R2 deals with the development of the "*FERTILE educator community platform for remote collaboration in a blended learning context*" around the topic of artful educational robotics. Task T2.1 aims at eliciting the **design requirements** for such a platform. While Fertile's description of work gives us some ideas about what the "Community Platform" (CP) should do, there are still many details we should agree upon, as we discussed during the Prague meeting. Also, the FERTILE CP needs to be **well aligned with the design methodology** to be delivered as M1.2, so the input from the participants in that task is crucial. Therefore, we agreed at Prague on gathering your ideas and suggestions about the main FERTILE CP functionalities.

That is the goal of this questionnaire: to show you our main ideas about potential CP functionalities and give you the opportunity to comment on them and/or provide more suggestions. Your feedback will be VERY VALUABLE...

The completion of this questionnaire is expected to last 1 hour approximately.

Before answering the questionnaire, remember that the slides of UVA's presentation about the CP at Prague are available at this link.

Your name *

Your answer

Your institution (UNIWA, CU, CUB, URJC, UVA) *

- ◯ UNIWA
- ◯ CU
- ◯ CUB
- ◯ URJC
- ◯ UVA
- ◯ Other:

You'd describe yourself as (multiple options are allowed)... *

- [ ] Teacher of educational robotics
- [ ] Teacher of arts
- [ ] Designer of scenarios for learning educational robotics
- [ ] Designer of scenarios for learning arts
- [ ] Researcher in educational technology
- [ ] Other: _____

Your e-mail address (we might contact you back in order to clarify or get further info about your answers) *

Your answer

What is a Communtiy Platform for you?

In this section, we would like to know your ideas/opinions about Community Platforms in general, and for FERTILE in particular. We are asking you to start from a "blank sheet" (and this is not easy!), but we would like to understand the different opinions and visions that the different partners might have about this issue.

Please, describe with your own words how you envision the Community Platform for FERTILE. It is enough to list the main ideas/functionalities... (please, don't read now the description of work... simply try to write down what comes out of your mind) *

Your answer

Why do you think a Community Platform is important for the field of artful educational robotics? *

Your answer

Do you have previous experience with other Community Platforms in other contexts? Which ones? Are they similar to what you envision for FERTILE? If you think we should pay attention to some already existing platforms, please let us know... *

Your answer

The roles in the Community Platform

In your opinions, who are the users/participants in the FERTILE Community Platform? (you can check several options and/or add further ideas) *

- [ ] Teachers interested in artful educational robotics
- [ ] Students that participate in learning scenarios about artful educational robotics
- [ ] Other: _____

According to your answer to the previous questions, do you think the Community Platform should differentiate among different types of teachers and/or students? (e.g., teachers with "read-only" rights that cannot edit designs, "moderating teachers" that can approve (or not) other teachers' editions, "lead designers" that can create and edit new designs, etc...). Please, try to justify your answer... *

Your answer

Potential functionalities for TEACHERS

We are now going to propose a set of initial functionalities for TEACHERS (even though you may have indicated before that teachers have nothing to do with the Community Platform!)... Please, let us know your opinion about these functionalities and provide as many suggestions as possible so that we can refine them. Also, do not hesitate to suggest new functionalities you think we are missing.

Do you agree (or not) with the support, by the Community Platform, of the following BASIC SOCIAL functionalities for teachers? *

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Teachers get a complete list of other teachers participating in the Community Platform	○	○	○	○	○
Teachers search, by name, for other teachers in the platform	○	○	○	○	○
Teachers search for other teachers in the platform that are interested in a same set of art-related learning topics (e.g., painting, animation, etc...)	○	○	○	○	○

Teachers search for other teachers in the platform that teach in a certain educational level (primary, secondary, etc...)	○	○	○	○	○
Teachers get a complete list of artful ER learning designs available in the platform	○	○	○	○	○
Teachers search, by name, for specific artful ER learning designs	○	○	○	○	○
Teachers search for artful ER learning designs related with specific topics (e.g., painting, animation, etc...)	○	○	○	○	○

Teachers search for artful ER learning designs aimed at specific educational levels (primary, secondary, etc...)	○	○	○	○	○
Teachers can send a message to other teachers	○	○	○	○	○
Teachers can create new threads in discussion forums	○	○	○	○	○
Teachers can participate in discussion forums	○	○	○	○	○
Teachers can get a list of their own artful ER designs	○	○	○	○	○
Teachers can create a "design team" for a specific artful ER design	○	○	○	○	○

Teachers can make a copy of an existing artful ER learning design (created by him/her or by other teachers)	○	○	○	○	○
Teachers can comment on others' designs	○	○	○	○	○

Please, add any suggestion you may have about the previous list of BASIC SOCIAL functionalities (e.g., if you don't understand them, if you would add new ones, etc...)

Your answer

As we discussed in Prague, the functionality of "DESIGNING an Artful ER learning scenario" is very much dependent of the "FERFILE design methodology". However, we may already start to envision how this might look like... Imagine you are a teacher in artful ER, you enter the Community Platform and you click, somewhere, in "Create a new design...". What would you expect from the platform? (please, indicate you level of agreement with the different ideas/alternatives) **IMPORTANT: take into account who will the users of the platform be (i.e., are the teachers you know willing and/or able to user the different ideas/alternatives?** *

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
A blank canvas in which I can freely draw and/or write my ideas about an artful ER learning design	○	○	○	○	○
One or several rigid document templates (i.e., with black spaces) that I can fill up in the order I want.	○	○	○	○	○

One or several rigid document templates (i.e., with black spaces) that need to be filled up in a specific sequence of steps.	○	○	○	○	○

Please, add any suggestion you may have about the previous list of DESIGN ideas/alternatives (e.g., if you don't understand them, if you would add new ones, etc...)

Your answer

In Prague we discussed about the possibility of allowing the teachers to use a **graphical editor** for creating the artful ER learning designs (i.e., designs expressed not only with text, but also with visual representations). Do you think this could be helpful for "regular teachers" and, in case you do, could you please give us some ideas about how this might look like? (e.g., do you know any existing graphical editor and associated type of visual representations that might be applicable for this case?) *

Your answer

Potential functionalities for STUDENTS

We are now going to propose a set of initial functionalities for STUDENTS (even though you may have indicated before that students have nothing to do with the Community Platform!)... Please, let us know your opinion about these functionalities and provide as many suggestions as possible so that we can refine them. Also, do not hesitate to suggest new functionalities you think we are missing.

Do you agree (or not) with the support, by the Community Platform, of the following BASIC SOCIAL functionalities for students? *

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Students can create new threads in discussion forums	○	○	○	○	○
Students can participate in discussion forums	○	○	○	○	○
Students can rate the artful ER learning designs they are enacting	○	○	○	○	○
Students can comment and/or ask for help in forums specifically related to the artful ER learning designs they are enacting	○	○	○	○	○

Please, add any suggestion you may have about the previous list of BASIC SOCIAL functionalities for students (e.g., if you don't understand them, if you would add new ones, etc...)

Your answer

As we discussed in Prague, the Community Platform will provide students with "instructions about the learning tasks that they are expected to carry out (these instructions should be provided by the teachers as part of their artful ER learning designs)". How do you think these instructions should look like? (e.g., a web page with a list of task descriptions and web links to the associated resources, ...). Do you know any existing ER web sites that provide this type of instructions (e.g., for lessons/tutorials) that might be applicable to the FERTILE case? *

Your answer

Community Analytics

During the Prague TPM it was agreed that the Community Platform will provide analytics about the community (Community Analytics), but not about the learning process of the students (learning analytics). For more information, see, e.g.,
Hernández-Leo, D., Martinez-Maldonado, R., Pardo, A., Muñoz-Cristóbal, J. A., & Rodríguez-Triana, M. J. (2019). Analytics for learning design: A layered framework and tools. British Journal of Educational Technology, 50(1), 139-152.

Do you agree (or not) with the support, by the Community Platform, of the following COMMUNITY ANALYTICS functionalities? *

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Providing information about the types of learning designs created in the platform (in relation to subject topic, educational level, and other metadata)	○	○	○	○	○
Providing information about the participation of teachers (number of created designs, co-editions, comments about others' designs, etc.)	○	○	○	○	○

Providing information about learning designs created using or refining another design as starting point	○	○	○	○	○
Providing information about social appraisal of a learning design within a community, typically in the form of a scale	○	○	○	○	○

Do you think the above functionalities should be available to all teachers? Only to the administrators of the platform? To students? Please, elaborate your answer... *

Your answer

Please, add any suggestion you may have about the previous list of COMMUNITY ANALYTICS functionalities (e.g., if you don't understand them, if you would add new ones, etc...)

Your answer

Final comments

Please, feel free to provide any final comment/remark you would like to make in relation with the Community Platform

Your answer