PERIODIC TECHNICAL REPORT

Deliverable 7.1

ER4STEM - Educational Robotics for STEM

The ER4STEM project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 665972

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1 EXECUTIVE SUMMARY

1.1 ROLE/PURPOSE/OBJECTIVE OF THE DELIVERABLE

The present deliverable aims to present the status of ER4STEM after the first 15 months. This is achieve reporting activities, progress and results of each one of the eight work packages present in ER4STEM.

1.2 RELATIONSHIP TO OTHER ER4STEM DELIVERABLES

This deliverable uses as input all deliverables delivered until the report period. From each deliverable is taken information that could contribute to present the status of each work package.

1.3 STRUCTURE OF THE DOCUMENT

This deliverable is organized as follows. Section 2 reports the work done in each one of the work packages, detailing the contribution of the partners. Sections 3 and 4 present updates on the exploitation and dissemination, and data management, respectively. Section 5 presents the follow-up to previous recommendations from previous reviews. Finally, section 6 presents any deviation from annex 1 and annex 2.

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2 EXPLANATION OF THE WORK CARRIED OUT BY THE BENEFICIARIES AND OVERVIEW OF THE PROGRESS

ER4STEM objective is to turn the curiosity of young children into a passion of young adults about science and technology through the use of robotics, which has been pointed out to be a field with great potential in education. Moreover, ER4STEM's consortium includes practitioners with diverse background and experience. To obtain the best results and capture all their experience, the project has been planned to have contribution of all partners in all Work Packages (WP). Likewise, each WP contributes to fulfill one or more objectives of ER4STEM. The correct coordination and dialog through bi-weekly teleconferences, face-to-face meetings and other mechanisms have allowed the project to get a better understanding of the real impact of robotics and create instruments to foster skills that are required by the industry through robotics activities. The information presented in this document corresponds to the first report period, which corresponds to the first fifteen months of the project.

During the first year several activities took place to get a better understanding of the current approaches, technologies and methodologies used in Educational Robotics. Therefore, a literature review was conducted to determine current practices in educational robotics. From this review a first idea of the framework was derived, with the idea to provide a structured method to implement best practices. To implement the framework, we use a metaphor to show the connection between the framework and the other WPs. As metaphor we created the "wood workshop spaces". Using this metaphor as a guideline and combining experiences and knowledge of each partner, we proposed a first version of the framework, which groups workshops and lessons under pedagogical activities. A "Pedagogical activity" has the following characteristics: clear learning outcomes, evidence of learning, using a specific pedagogical methodology, and a detailed description of the activity. To support the creation, implementation and evaluation of pedagogical activities, we created a process in four phases: design or adaptation, implementation, evaluation or assessment, and improvement of the activity.

To evaluate the developed activities, in the first year a total of 48 workshops were held, with a total of 1213 participants, which is about 30% of the total number planned. To have a clear picture of the status of each workshop, we created a spreadsheet that is shared via Google Drive. The spreadsheet collects data about the status of the workshop, number of participants, and dates. A workshop could be in one out of five phases: *plan*, workshop activities are in preparation phase; *in progress*, workshop activities are in execution phase; *completed*, the workshop execution is completed; *reported*, the data collected has been submitted to WP2 and WP6 leaders; and *validated*, WP2 and WP6 leaders confirmed that the data comply with the characteristics expected from it.

The workshops implemented during the first year are described using the first version of the activity template, which was designed with the purpose to be an instrument that identified critical elements of teaching and learning with robotics based on theory and practice. These descriptions were collected and analyzed. A total of 13 activities were described, which covers a wide range of technologies, students' ages and objectives. Moreover, each partner provided comments and suggestions for the activity template, which were implemented to obtain the second version and come with the idea to create activity blocks.

In the first year of the project a pre-kit was created to evaluate the workshops. It provides opportunities to collect enough data to guide developments in the project. The ethical issues associated with the data collection were considered. Therefore documents and procedures were drawn up to gain informed consent and all issues around data protection were clarified for each member. The pre-kit comprises a handling protocol, pre and post activity questionnaires, an observation protocol, and material to guide

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activities such as draw-a-scientist, forms for student reflections, artefacts of the workshops, and the informed consent documents and reporting templates. Using this pre-kit each partner collected information for the workshops offered during the first year. The information collected was then analyzed and led to the following eleven recommendations:

1. Use 21st Century skills as a unit to encompass industry skills and soft-skills.
2. Consider creativity as leading to innovation and entrepreneurship.
3. Examine critical thinking through a focus on reflective thinking.
4. Provide evidence of learning.
5. Differentiate activities.
6. Develop new entry points to approach all learners.
7. Develop approaches for the orchestration of teamwork, with particular consideration of mixed-gender groups.
8. Evaluate the impact of specific tools.
9. Change and sustain attitudes to STEM.
10. Raise awareness of pedagogic strategies and their impact.
11. Ascertain a Gender-Balance in the Draw-a-Scientist activity.

Based on partners' experiences with the pre-kit and their recommendations, modifications were done to obtain the evaluation kit.

In parallel, four activities were done. Three activities to create technologies that could foster the use of robotics in education. The first one was the improvement of the electronic platform Hedgehog. The second was the implementation of Slurtles, which is going to be used in second and third year workshops. Finally, the repository requirements were collected. From these requirements and the activity plan, it was created a first wireframes of the repository, which were discussed with all the partners. The last activity was the organization and implementation of ECER 2016, which a total of 34 teams participated in all the categories (i.e. Opent, Botball, Aerial, and Underwarter). Moreover ECER was held in parallel to the International Conference on Robotics in Education (RiE), which allowed ECER's participants to see possibilities of engagement between STEM and robotics.

To conclude the first year, all partner met for a recapitulation meeting in Malta. This meeting was mainly focused on the results obtained by the analysis of the data collected during the first year and the recommendations obtained these results. All partners committed to include these recommendations into their second year activities. It was also discussed how to improve the framework, repository, and how these two should include the recommendations. Based on these discussions, it was decided to provide a better definition of the framework, which will be provided in the second year of the project.

During this second year we started preparations for ECER 2017, which will be held in Sofia-Bulgaria. During the second year the project partners plan to conduct 43 workshops with an approximate 1349 participants. Until December of 2016, we already executed 18 workshops with 525 participants. The eleven recommendations from the first year evaluation have been included into the framework and a specific study of creativity, collaboration, critical thinking and communications is taken place to identify best practices that could be used to better foster these skills.

2.1 OBJECTIVES

Project's objectives for the first report period were:

- Educational Robotics for STEM (ER4STEM) will approach and engage children by offering multiple entry points into creative STEM (STEAM) via robotics
- ER4STEM will offer educational robotics to engage all young learners.

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- ER4STEM will study real-world societal problems as perceived by each child and relate societal challenges to existing technologies and requires innovations.
- ER4STEM sets out to create a continuous STEM schedule by leveraging on already existing European approaches of innovative science education methods and measures based on robotics within one open operational and conceptual framework.

WP 1 is developing the ER4STEM framework with the purpose of provides the conceptual tools to engage all young learners and to encourage activities related to real social challenges. During the first period the objectives for WP 1 were the following two: (1) Identify best practice and requirements to render STEM education and careers attractive to younger children with educational robotics, and (2) establish ER4STEM (Educational Robotics for STEM) Framework to implement the activities developed in the other WPs.

WP 2 is concerned with the development of workshop curricula, providing guidelines to carry out workshops, and execute workshops. During this first period the objectives for WP 2 were the following three: (1) Analyse the state of the art and propose a curriculum of educational robotic activities based on the ER4STEM framework. (2) Provide a first organizational basis for conducting workshops, and (3) conduct the first set of workshops.

WP 3 incorporates the organization of the student conference European Conference on Educational Robotics (ECER). During the reporting period, the goal was to create the full plan of conferences over the period of the project and to organize and carry out ECER 2016. Certainly, first work to prepare for ECER 2017 also had to be carried out.

WP 4 is developing an activity plan based on the pedagogical theory of constructionism and an analysis of best practices. During this first period the objectives for WP 4 was to design a set of innovative activity plans promoting: collaborative work, sharing products, and entrepreneurial robotics solutions to real problems.

WP 5 has focus on the creation of a novel repository, and the implementation of the educational robot system Andrix and Slurtles. During this first period the objectives for WP 5 were two: (1) Creation and Development of Educational Repository with easily available technology for robotics practitioners, teachers and educators. (2) Adapt existing technologies of the consortium to ER4STEM.

WP 6 has developed a set of test instruments (pre-kit) and piloted the pre-kit to evaluate ER4STEM workshops and conferences**.** During this first period the objectives for WP 6 have been: (1) to design an evaluation framework and tools for ER4STEM activities. (2) To carry out an evaluation of ER4STEM workshop and conference curricula. And (3) to feedback the evaluation results into further developments of the final project outputs

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2.2 1.2 EXPLANATION OF THE WORK CARRIED PER WP

Work Package 1: ER4STEM Framework (TUW)

In WP 1 the Tasks 1.1 “Best practice” and 1.2 “Framework development” have been started. Progress is reported below. Two deliverables report the progress in more detail, D1.1 and D1.2. Tasks 1.3 and 1.4 will start in the second period of the project.

Task 1.1: Best practice & requirements

To identify best practices and requirements, a literature review was done to determine current practices in educational robotics. This was done analysing projects, research studies, workshops and curriculum, conferences and competitions, educational technologies, industrial requirements, and resources in educational robotics. The analysis was performed by each partner. Each of them is leading a topic in which it is specialized: ESICEE was in charge of workshops and curriculum, PRIA of conferences and competitions, ACROSSLIMITS of educational technologies, CERTICON of requirements from the industry, UoA of projects, and Cardiff University of research studies.

The main role of TU Wien during this period was the coordination and identification of trends among the findings that could inform the framework (Task 1.2). While this study was done, it was decided to determine who the stakeholders are and how the framework could be beneficial for them. The final set of stakeholders was determined based on discussions done during tele-conferences and one to one meetings with all partners. The stakeholders include teachers, organisers of activities in educational robotics, educational researchers, and industry, see also D1.1.

Once all the information was collected and discussed, the next step was to start envisioning the framework and define its connection with other WPs. To create a better idea of the framework, we used the metaphor of “wood workshop spaces”. In this kind of space, having a bunch of tools does not guarantee the correct use of them, but it is necessary to have good knowledge of procedures and best practices. Similarly, the framework is a set of procedures and best practices that shall be used in specific spaces with desired tools to create educational activities with robotics. This idea is depicted in Figure 1 and further explained in D 1.1.

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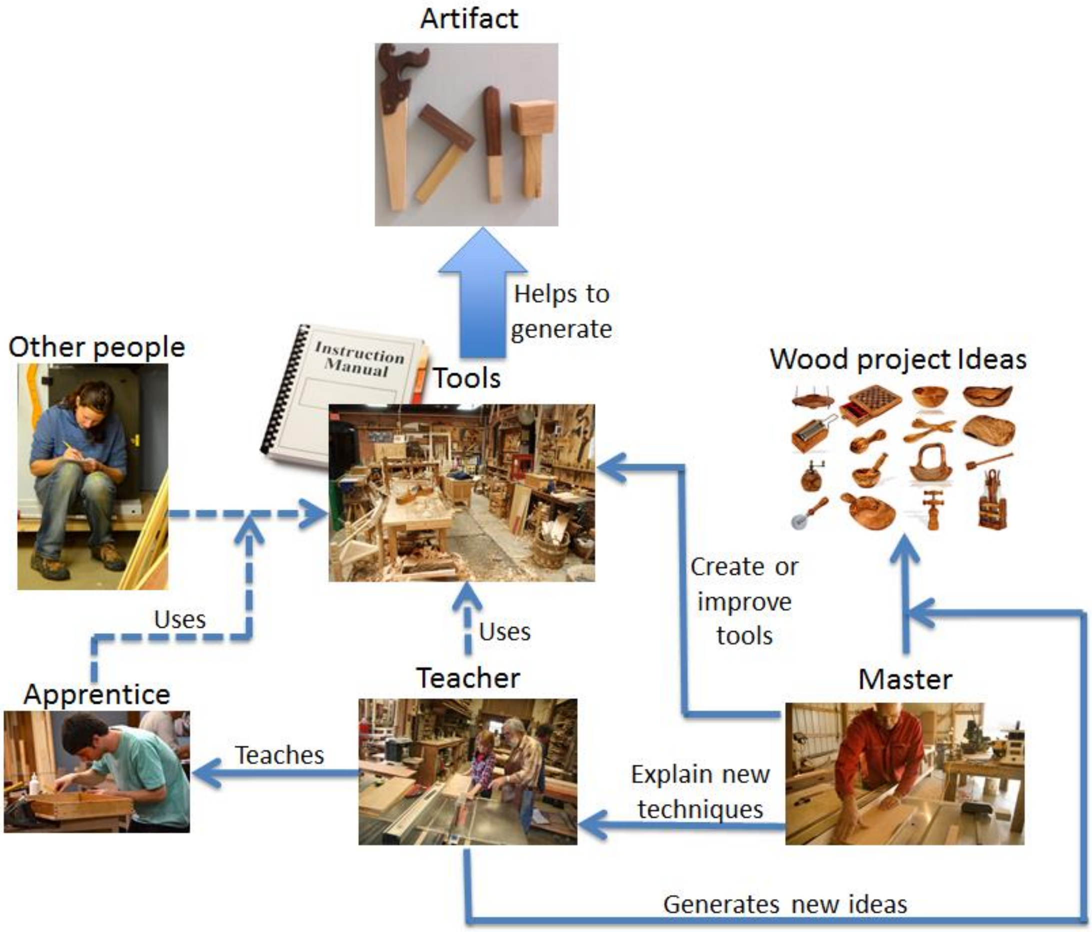

Figure 1 The Wood workshop metaphor used to explain the ER4STEM framework.

During the Prague meeting this metaphor was presented to all the partners and this led us to create a common vision of the framework. Also, we discussed other tools that could be helpful and two possible tools were determined. The first one is a glossary that defines words that are found in educational robotics. This could help people from different disciplines to understand the use of the word and solve ambiguities among the terms. For example the word platform had different meanings depending on the partner. For TU Wien, it is used as shorter for robotic platform. But for ACROSSLIMITS, it interprets software platforms. The glossary will be part of D1.3 and the present version is on the ER4STEM web-page. The second tool is a set of skills that could be taught in educational robotics activities. This set has the purpose to guide stakeholders to determine pre-requisites and independences to other skills. The set of skills is input to Task 1.2.

Task 1.2 Development of ER4STEM Framework

Before starting to determine and fix the set of skills, it was defined how the final output of these skills should look like. After different discussions and taking into account previous works, emerged the idea to make a tree representation of the skills. This idea is based on video games, specially used in RPG – Role Playing Games, in which players can select diverse skills after they achieve certain experience. Figure 2 presents an example of a skills tree used in the game "Endless Legend.

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Figure 2 Example of a skills tree[1]. This is the representation of skills used in the video game Endless Legend.

To start defining the set of skills, TU Wien analysed literature about skills that were fostered during educational robotic activities and type of activity done. Results are shown in Table 2 of D1.2. As it could be observed, skills mentioned in these works are too general to state which specific skill(s) were taught during the robotic activities. For example, some works inform that robotic activities have a positive impact in problem solving, but would this mean that these activities have a positive impact on all skills that are involved in problem solving? Or do only a sub-set of skills improve? And more important, do these activities improve the skills in the same way? In order to answer these and other questions, it was decided to determine which skills are important to have a better understanding. These skills were determined studying the expected future needs of industry. Certicon was in charge of this work. Their study revealed that six main skills are required in the industry (see also D1.2): problem solving (general ability to synthesize new solutions), high level problem solving (in context and over levels of detail), specific knowledge in robotics, creative thinking, efficiency, and flexibility. This set was refined later on, see below.

The framework is introduced with Figure 1. It gives a simple view from the point of view of future users. For example, we used the expertise of industry to define a set of relevant skills. Then researchers will design pedagogical activities that target each of these skills. The results will be activities with robots that foster one or more specific skills. The robotic platforms used could assume different roles (see below). The activities may first be designed by the researchers in the ER4STEM project. But we also foresee that other teachers or researchers could add to the pool of activities (see repository below).

[1]7 This image was taken from https://steamcommunity.com/sharedfiles/filedetails/?id=260937298

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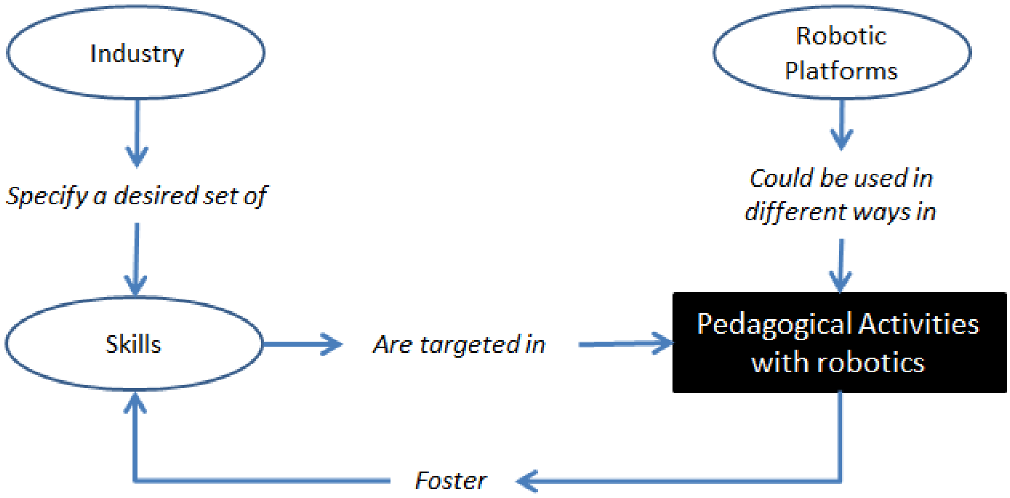

Figure 3 User point of view of the framework focusing around pedagogical activities. Users set the desired skills and given a robot platform can extract pedagogical activities. These pedagogical activities had been designed and created by researchers or by other

As mentioned, a part of the framework is the use of robotic platforms. We paid particular attention on the robotic platforms and programming languages used, the role of the robotic platforms, and the knowledge domain. Three types of roles of the robotic platform in the activity were considered during the study. These roles were suggested by Mubin et al. [1], and they are (i) as tool, when the robotic platform is used as teaching aids, where students would be building, creating and programming robots; (ii) as a peer, the robot could spontaneously collaborate with the kids or be a care receiver; (iii) as a tutor, the robot is going to support children learning, and in some cases motivating kids to continue with the activity. The works studied showed a multi-displicinarity in educational robotics activities. Moreover, this study let us to understand weaknesses and strengths of past efforts in educational robotics. All works studied are summarized in Table 1 of D1.2.

Pedagogical activities allow us to make children learn specific skills. We can extend this to also present the content learned. The typical format is a conference. Figure 4 depicts the concept and relation of pedagogical and presentation activities (or conferences). Within ER4STEM we particularly focus on Conferences as a better format to let the children not only learn but also show to other what they have learned.

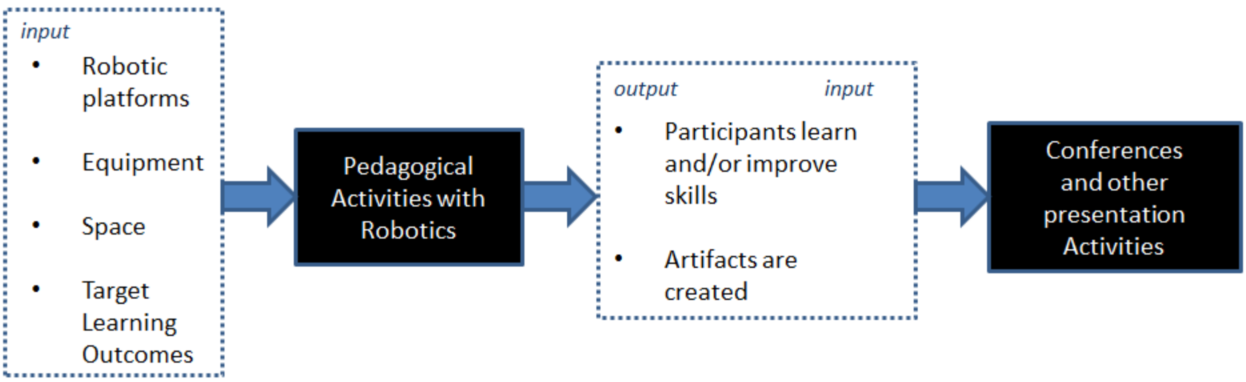

Figure 4 Specific instances of pedagogical activities to reach out to all children: conferences are a format such that students can share what they have done. Other presentation activities are competitions

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To formalize the process of developing pedagogical activities, we create the macro-process Figure 5. The macro-process is divided in four macro-phases. The macro-phases and their names were the conclusion of discussions among all partners, which were facilitated by the D1.2 draft document.

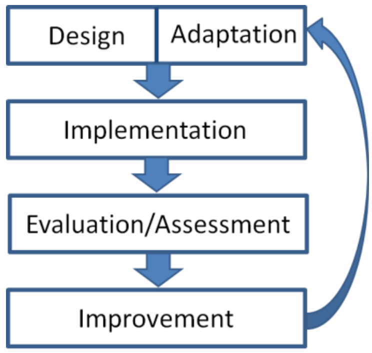

Figure 5 Framework's macro process definition

The very design process using the four phases of the macro process can be used to define pedagogical activities as well as conferences processes. In this case, conferences are events that involve schools students and that could help teachers in their organization. The conference process was developed by PRIA, who has had led the organization of ECER in Austria. The pedagogy activities process was led by TU Wien and enriched by discussions with other partners. When studying the four phases in detail, we can draw a much more elaborate diagram of the process. The individual steps for each of the phases identified for pedagogical activities are depicted in Figure 6 (for the full explanation refer to D1.2).

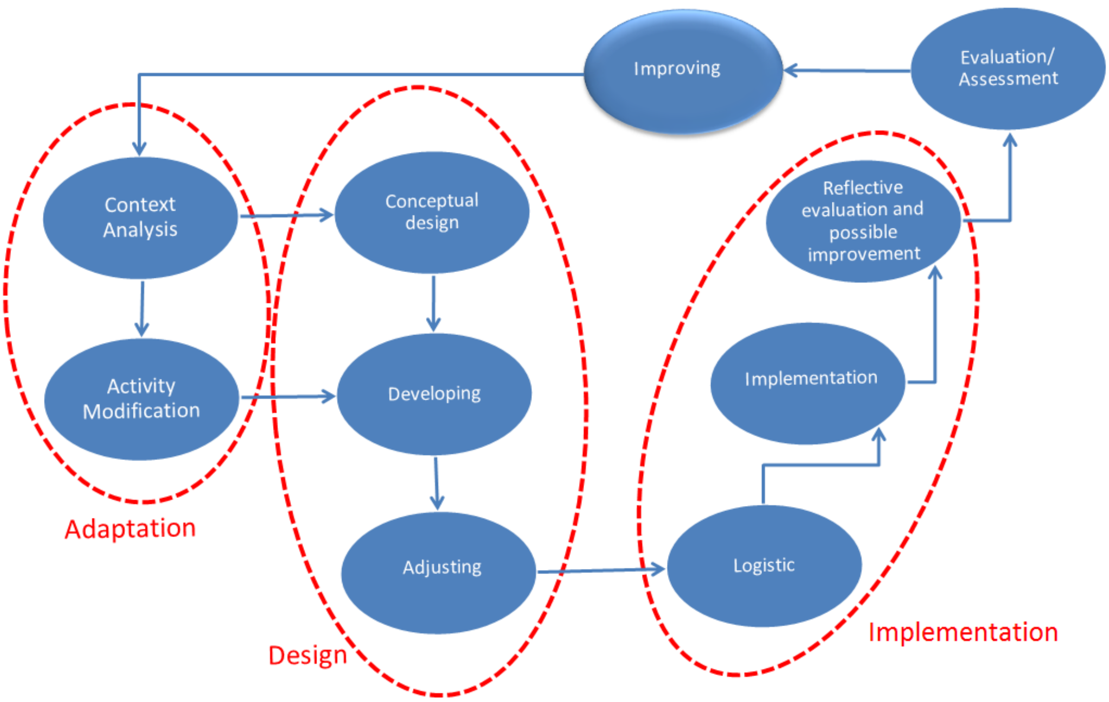

Figure 6 The block diagram of the development process for pedagogical activities. The phases implement the four phases of the macro process (Figure 5).

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During the project meeting in Malta, the results from WP 6 (evaluation) presented recommendations that should clearly be addressed in the framework. These recommendations have been extracted from a first evaluation of the workshops conducted (see WP 6). These recommendations were:

- Add communication, creativity, critical thinking and collaboration to set of skills.
- For all workshops, preferably create mixed gender teams.
- After every workshop include a measure to be able to evaluate if the participants have learned.
- Create multiple entry points to the activities.
- Use the activities to change and sustain attitudes to STEM.
- For each activity, use adequate pedagogic strategies.

As a result, it was decided that creativity, critical thinking, collaboration and communication must be clearly included in the set of skills of the framework.

The next step was the definition and development of the framework. To achieve this, the following activities were done:

- Face to face meetings among TU Wien, Cardiff University and UoA. Two meetings of one week were done to discuss about the framework, evaluation and activity plan. During the first meeting, it was done a literature review on creativity and discuss how to integrate all the suggestions in the definition of the framework. From the literature review on creativity, it was identified elements in creativity, types of creativity (e.g. little-c and big-c), requirements to foster creativity, elements in robotic activities, and evaluation methods. During the second meeting it was concluded that the components in educational robotics are fragmented. Therefore, ER4STEM framework should make evident the use of pedagogical methodologies, general knowledge (e.g. Mathematics), specific knowledge in robotics (e.g. Programming), and our set of skills (e.g. Collaboration).
- To start with the process of defining activities for specific skills, we conducted a specific literature review and description of two selected skills, collaboration and creativity. This study has let us to identify components that should be made evident (explicit) during educational activities with robots. For example, many stakeholders assume that they know what collaboration is. However, they have never had a formal training of how to collaborate. Hence, it is beneficial to make explicit what is part of and how collaboration is best done to improve the collaboration skill through one of the activities offered in ER4STEM with educational robots.

In order to get all the knowledge described in the framework and to connect it with the ER4STEM repository (WP 5), we created an ontology that describes activities in educational robotics and links them to skills, pedagogical methodologies, and robotic platforms. The ontology will allow inferences about activities that are described in the repository and give the users a better approach to select appropriate activities given specific skills that should be addressed, platforms that are available, or educational approaches that are preferred. This ontology is still under development and it still requires communication with the partners. Finally, the ontology will be described in detail in D1.3 at the end of year 2. Additional to the ontology, D1.3 will present the refinement of the framework, the set of skills, and how to foster these skills in the pedagogical activities.

Contributions of partners:

ESI CEE developed and maintained a web-based repository for collection and analysis of best practices, as well as requirements reviewing workshops and curriculums. ESI CEE collected and analysed good practices for ER workshops. Moreover, ESI CEE researched and developed a set of criteria for good practices, which were applied in order to select several case-studies of good practices which were

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presented in deliverable 1.1. Those criteria were also developed and implemented within the framework and integrated as part of the activity plans for the ERWs.

Furthermore, ESI CEE proposed descriptions of skills to be implemented within the project framework as part of the educational workshops curricula. Additionally, ESI CEE was involved in discussions about the framework, pedagogical activities process, and ontology. Lastly, the Bulgarian partners also defined words for the glossary.

PRIA contributed in best practices and requirements reviewing conferences and competitions. They contributed in D 1.2 developing and describing a process for conferences and competitions that could help teachers. They were involved in discussions about the framework, pedagogical activities process, and ontology. They defined words for the glossary.

UoA contributed in best practices and requirements reviewing projects and identifying best practices. Moreover with respect to the design and development of ER4STEM Framework of WP1, UoA has reviewed the 1st framework structure and provided input from pedagogical perspective. UoA participated in two face two face meetings (one in Athens and one in Cardiff) where the structure of the framework was discussed and was given feedback. UoA contributed with a literature review and definition of creativity in learning process, which is one of the basic elements of the framework and also provided a 21st century skills review which was used in the formation of the framework structure.

Acrosslimits contributed in best practices and requirements reviewing educational technologies. They were involved in discussions about the framework, pedagogical activities process, and ontology. They defined words for the glossary.

Cardiff University contributed to the identification and review of academic research on educational robotics activities, to identify best practices and requirements, as well as research trends and outcomes. Cardiff contributed to the completion of D.1.1 providing a detailed summary of educational robotics activities in virtual worlds. Also, it has contributed to the planning and development of the ER4STEM Framework, providing pedagogic and research informed contributions. In addition as WP6 lead, Cardiff has translated the requirements from the year 1 evaluation into essential components to be considered within the Framework.

CERTICON contributed in best practices and requirements analyzing industry requirements. They also contributed determine the skills required by the industry, which has been used on the skills study done for the development of the framework. They were involved in discussions about the framework, pedagogical activities process, and ontology. They defined words for the glossary.

Work Package 2: Educational Robotics Workshops (ESI CEE)

T.2.1 Development of generic curriculum based on ER4STEM framework

A high-level definition of the ER4STEM curricula was developed by ESI CEE with the direct contribution of UoA in “D2.1 Robotics Workshops 1st year”. Admittedly, this concept is expected to further evolve throughout the course of “D2.2 Robotics Workshops 2nd year” development and consequently, in “D2.3 Robotics Workshops 3rd year”. A definition of generic curricula will, logically be finalized during the process of developing “D2.4 ER4STEM curriculum“.

The question of “*what a curriculum is*”, in its nature is, a matter of profound philosophical discussion, as it yet revolves around the concept of knowledge and notably, of what is of importance to be learned for the individual within the context of the society in which they function [2]. Thus, the answer to this

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question has to be in alignment with theories about values, ideas and priorities. Under those circumstances, the topic of curriculum for ER further becomes even more complex, if we consider two specific characteristics of ER: a) they are in fact, innovative technology, the integration of which dictates to take into account best practices and common approaches for integrating digital technologies in education; and b) this integration has to take place in formal (school) and non-formal settings (competitions, science centres, conferences etc.)

To solve this problem we started off with the rather simplified definition of curriculum offered by Walker [2]: "A curriculum is a particular way of ordering content and purposes for teaching and learning in schools […] offering a common foundation of essential knowledge and skill" [pp.4]. In order to adapt, however, this definition to Educational Robotics (ER), we need to extend the milieu, so as to include also a non-formal learning setting (e.g. competitions, conferences, and camps). Correspondingly, when discussing curriculum for robotics, we also have to reflect on its nature as a scientific domain: Robotics could be considered a subject matter as well as a domain for contextualized learning of other subject matters, chiefly the STE(A)M related ones. The latter is also related to the approaches for integrating digital technologies in education. Specifically, Wang and Woo [3]identify three levels of ICT integration in the classroom: a) micro level where integration of ICT involves a specific lesson, aiming to support student learning in specific concepts b) meso level: where integration involves a specific topic and c) macro level where integration of ICT happens at the level of a course.

We are developing a generic curriculum in ER4STEM that covers the meso and macro levels and in addition we provide specific Educational Robotics Workshops (ERWs). Activity plans (developed in WP4) that are organized in information repository (WP5). Specifically for formal education setting, we will focus on the meso level and we will extract and generalise form the activity plans learning activities that will be topic-specific and are relevant to STE(A)M. For non-formal settings ER4STEM can provide a "curriculum" at the macro level, providing a plan for courses already piloted within ERWs focusing on robotics for STEM, which will cover the generic learning requirements of contests, scientific centres, clubs or conferences.

Curriculum development is an endeavour with many difficulties and problems. More often than not, curricula are populated with contradicting values, orientations and interests. Problems in curriculum development are often manifested in the gaps between the intended curriculum (the described curriculum), the implemented curriculum (real life in school practice) and the attained curriculum (learner experiences and outcomes) [4]. This problem in many cases could occur due to the fact the process of curriculum design follows a top down direction, thus there is a rising effort to include teachers in the design and development process.

To overcome this problem, along with the fragmentation in the domain of robotics caused by the different personal pedagogies and technologies in the field (see also [5]) we follow in ER4STEM a bottom up approach. Specifically, we create a curriculum starting from the activity plans already created by the practitioners (teachers, company trainers, etc.) in the first year workshops. Those activity plans and the process of their implementation piloted in 48 ERWs with 1213 both male and female students of age between 5-20 years old in four different countries, namely Austria, Bulgaria, Greece, and Malta provided a solid baseline for years 2 and 3 of the project when we will refine this curriculum based on the conclusions from the evaluation of the workshops and oriented towards unifying the activity plans under an overarching pedagogical approach that takes into account the affordances and the special characteristics of robotics as a scientific field and as a domain for contextualized STE(A)M learning.

We accept the general definition of curriculum being the general plan for educational activities, Adams and Adams [6] define a curriculum as everything that goes in the learners' live such as planned and not planned interaction of pupils with educational objectives, instructional content, materials and resources

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used and materials and resources not used, the sequence of courses, objective, standards and interpersonal relationships.

Following this definition, the ER4STEM project correspondingly presents the ERW curricula in three integrated components:

(a) Context is provided by the ER Framework (WP1), which defines, encompasses and analyses concepts, such as activities in educational robotics and links them to skills, pedagogical methodologies, and robotic platforms and represents them as ontology. In order to ensure such alignment within WP1, ESI CEE developed a web-based tool for the collection of good practices from literature, portals (e.g. Scientix) and projects in several fields: Workshop curricula, Conference curricula, Pedagogical design & Innovations and Educational technology. In total, 72 good practices were collected and described in the tool. From them, best practices were selected based on predefined criteria and included in the D1.1 Best Practice & Requirements. The criteria for best practices were used as a reference for the description of the ERWs curricula during the first year of the project implementation. An important factor was the reported shortage of STEM skills and professionals at industrial level. Among the reported reasons for this, which ER4STEM considered being within the project scope to address were:

1) An insufficient number of students interested or willing to pursue professional realization in this field;

2) Inconsistencies in their geographical distribution of students with interest in the STEM fields.

This industrial context was taken into account during the process of ERWs curricula development as the project consortium aimed to contribute to the motivation and the general interest of the students to consider pursuing careers in STEM. Furthermore, the project consortium is determined to execute ERWs in multiple geographical regions to stimulate the student's interest in STEM at a wider geographical range.

(b) Content - the Activity plans for the most part, structure information around the core elements of the ERWs such as objectives; competencies – target knowledge and skills, content, pedagogical approach and materials; target participants; necessary resources – experts, facilities and materials and outputs and deliverables. As the activity plans, representing the actual content of the ERWs, are an integral part of the curriculum, as defined above, a lot of effort was invested by all the partners to cooperate with UoA on constantly revising and sustainably creating high quality activity plans. It is worth mentioning that ESI CEE supported Cardiff University to identify and to comply to the legal aspects related to ethical personal information collection, data storage and processing, with the use of reliable encryption tools and methods.

Within the first cycle of ERWs, which was finalized within the period from February 2016 to August 2016, ER4STEM partners developed, adapted and executed activity plans for students aged between 5 and 20 years using various technologies, including:

- Arduino
- Botball (Link Controller and kit)
- Dash and Dot
- LEGO Mindstorms
- LEGO WeDo
- The Finch Robot by Birdbrain Technology

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- Thymio II

The programing languages used to control the robots were:

- Arduino
- C / C++
- Drag and Drop Visuals
- LEGO Mindstorms
- LEGO WeDo graphical language
- Native programming language ASEBA -& gt; Text programming
- Scratch

Due to the vast portfolio of technologies and programing languages applied by the partners and included in the activity plans, it is now possible to cater to the needs of a wide range of students, taking into account their age and/or their level of expertise in the field. For students with no prior experience and beginner level of knowledge in the field, technologies such as Lego and Scratch are possible solutions. For the students with advanced knowledge and experience Link Controller and C programming language, for example, are often applied.

During the ER4STEM Project Meeting in Malta in September 2016, the project partners decided that the next cycle of workshops to be executed within the period from October 2016 to July 2017, should put heavier focus on the use of educational robotics technologies and tools for the development of 21st century skills. Among the skills, defined as essential for the activity plans of the ERWs for the second project year are Creativity, Communication, Collaboration, Critical Thinking, Problem solving, Information literacy, Digital fluency as well as other 21st century skills in order to strengthen the competence-centric approach in the ERW curricula.

(c) Process – the ERW implementation process, which describes the sequence of activities to initiate, prepare, deliver and complete a workshop, could be considered as a step-by-step walkthrough of a successful workshop delivery. The process developed and documented in order to serve as a pillar of the ERWs implementation. This description of the ERW implementation process aimed to provide a clear picture to researchers and teachers on the key steps that were planned and executed within the first year of the project implementation. From a research perspective, the process complements the evaluation data collected from the workshops with detailed information on how this data was obtained throughout the ERWs execution.

The process description served as a baseline for the implementation of the ERWs to be executed during the remaining implementation phases of the project. Undoubtedly, the process breakdown would serve a similar purpose for any stakeholders that might be interested in the application of the Activity Plans and in a broader sense, for any stakeholders interested in delivering ERWs designed within the ER4STEM project.

The ERW process contains four phases, namely Initiation, Preparation, Execution, and Closure that are visually represented in Figure 7.

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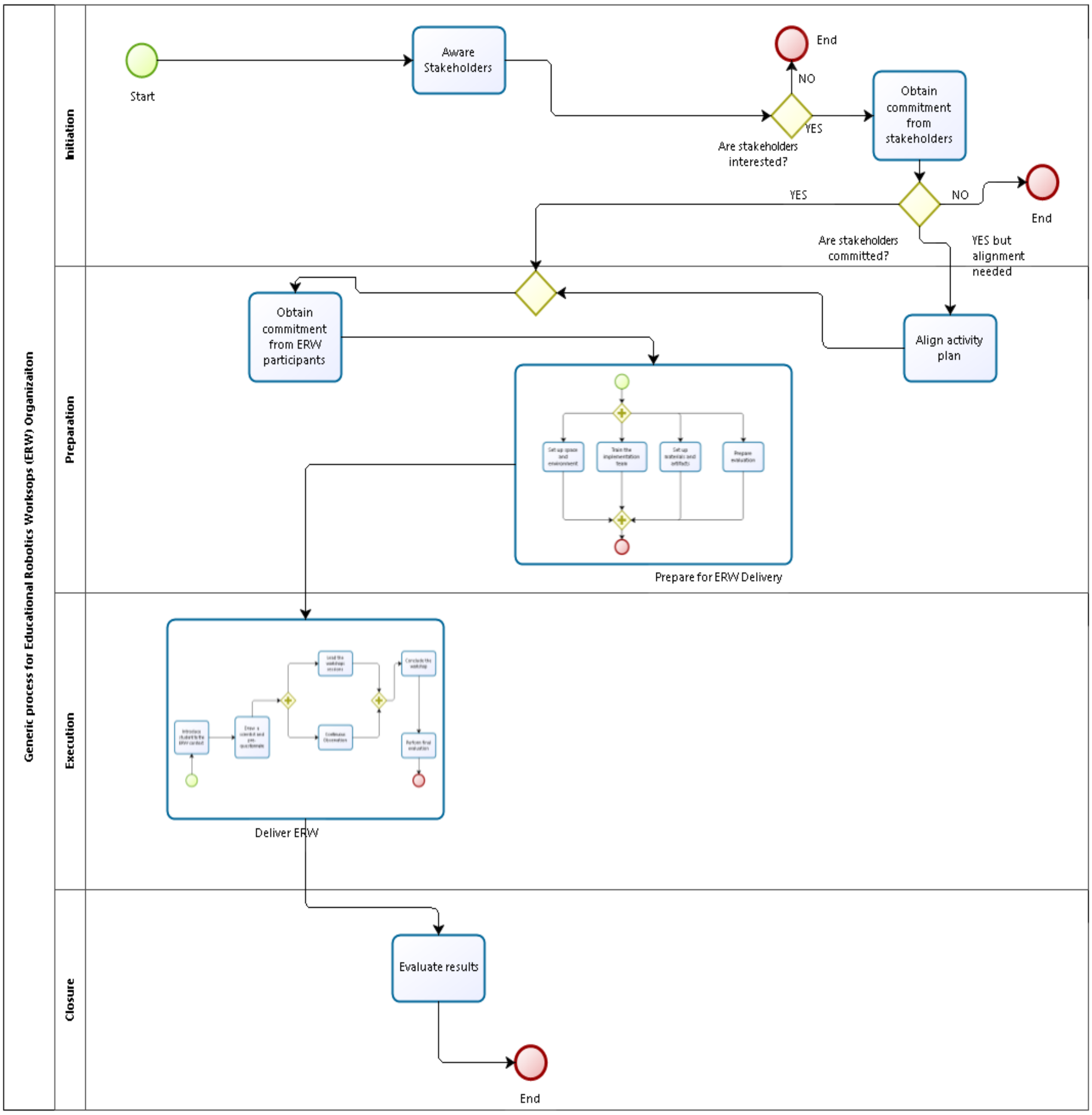

Figure 7 Educational Robotics Workshops Implementation Process

The ERWs Preparation steps and Delivery steps are visualized as sub-processes. This process was documented in details within D2.1 and is being continuously updated throughout the project implementation phases, following the first project year. Based on that process, ESI CEE established and maintained continuous monitoring, control and support mechanism for the ERW implementation by all project partners.

These three components of the curriculum namely Context, Content and Process in close alignment with the evaluation protocol were structured and continuously improved, so that they would provide all relevant stakeholders with a detailed, but yet easily understandable and visually comprehensive information about the technology used, the pedagogical approaches and methods applied, background requirements, criteria for success and more. As result, ESI CEE will be able to generalize the curricula in “D2.4 ER4STEM curriculum” at the end of the project.

T.2.2 Organize workshops (exchange of information between partners)

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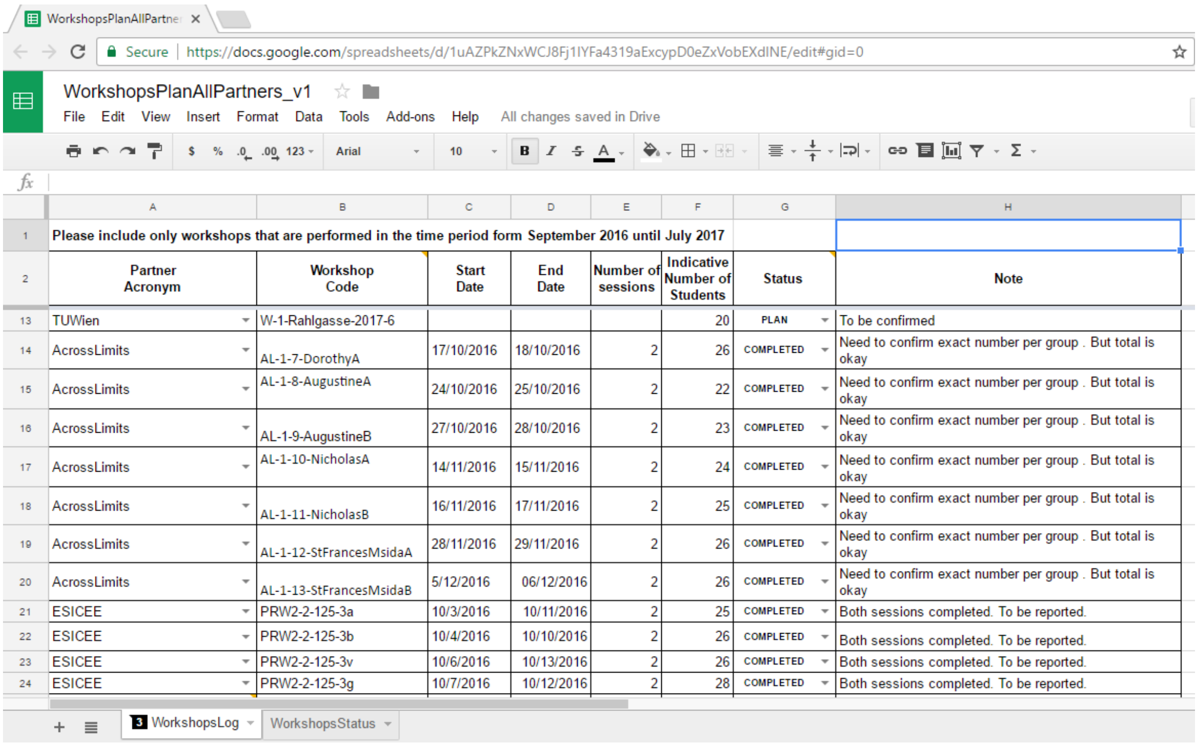
ESICEE agreed with the partners during the project meeting in Prague, January 2016 to establish and maintain an efficient process and a corresponding web-based tool for monitoring and control of the ERWs delivery. The tool developed by ESI CEE provides with the constant input of all project partners delivering workshops, updated information about all ongoing workshops by phases. Phases are:

- PLAN - ERWs activities are in preparation phase
- IN PROGRESS – ERWs activities are in execution phase
- COMPLETED - execution phase is completed
- REPORTED – Activities are in closure phase: data as required by WP2 & WP6 submitted to the relevant partners
- VALIDATED – Closure phase is completed: WP2 and WP6 leaders confirmed that data is valid and in alignment to the respective requirements.

Workshops log sheet contains data about the workshop planned and carried out by partners in all 5 phases of execution. A sample screenshot of the sheet is depicted in Figure 8.



Please include only workshops that are performed in the time period form September 2016 until July 2017

Partner Acronym	Workshop Code	Start Date	End Date	Number of sessions	Indicative Number of Students	Status	Note
TUWien	W-1-Rahlgasse-2017-6				20	PLAN	To be confirmed
AcrossLimits	AL-1-7-DorothyA	17/10/2016	18/10/2016	2	26	COMPLETED	Need to confirm exact number per group . But total is okay
AcrossLimits	AL-1-8-AugustineA	24/10/2016	25/10/2016	2	22	COMPLETED	Need to confirm exact number per group . But total is okay
AcrossLimits	AL-1-9-AugustineB	27/10/2016	28/10/2016	2	23	COMPLETED	Need to confirm exact number per group . But total is okay
AcrossLimits	AL-1-10-NicholasA	14/11/2016	15/11/2016	2	24	COMPLETED	Need to confirm exact number per group . But total is okay
AcrossLimits	AL-1-11-NicholasB	16/11/2016	17/11/2016	2	25	COMPLETED	Need to confirm exact number per group . But total is okay
AcrossLimits	AL-1-12-StFrancesMsidaA	28/11/2016	29/11/2016	2	26	COMPLETED	Need to confirm exact number per group . But total is okay
AcrossLimits	AL-1-13-StFrancesMsidaB	5/12/2016	06/12/2016	2	26	COMPLETED	Need to confirm exact number per group . But total is okay
ESICEE	PRW2-2-125-3a	10/3/2016	10/11/2016	2	25	COMPLETED	Both sessions completed. To be reported.
ESICEE	PRW2-2-125-3b	10/4/2016	10/10/2016	2	26	COMPLETED	Both sessions completed. To be reported.
ESICEE	PRW2-2-125-3v	10/6/2016	10/13/2016	2	26	COMPLETED	Both sessions completed. To be reported.
ESICEE	PRW2-2-125-3g	10/7/2016	10/12/2016	2	28	COMPLETED	Both sessions completed. To be reported.

Figure 8 Screenshot of log of the web-based tool for monitoring and control of the Educational Robotics Workshops offer in ER4STEM

The Workshops Status sheet aggregates the data per phase and project partner. A sample screenshot of the sheet is depicted in Figure 9.

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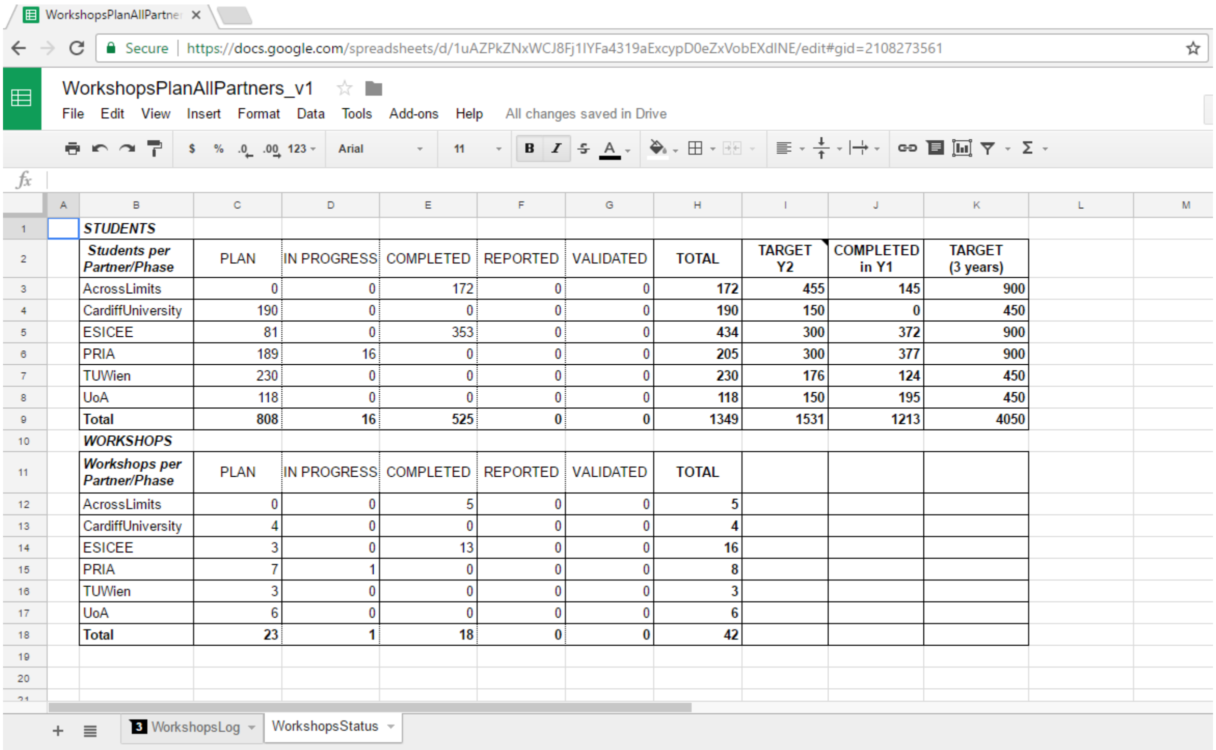

STUDENTS

Students per Partner/Phase	PLAN	IN PROGRESS	COMPLETED	REPORTED	VALIDATED	TOTAL	TARGET Y2	COMPLETED in Y1	TARGET (3 years)
AcrossLimits	0	0	172	0	0	172	455	145	900
CardiffUniversity	190	0	0	0	0	190	150	0	450
ESICEE	81	0	353	0	0	434	300	372	900
PRIA	189	16	0	0	0	205	300	377	900
TUWien	230	0	0	0	0	230	176	124	450
UoA	118	0	0	0	0	118	150	195	450
Total	808	16	525	0	0	1349	1531	1213	4050

WORKSHOPS

Workshops per Partner/Phase	PLAN	IN PROGRESS	COMPLETED	REPORTED	VALIDATED	TOTAL
AcrossLimits	0	0	5	0	0	5
CardiffUniversity	4	0	0	0	0	4
ESICEE	3	0	13	0	0	16
PRIA	7	1	0	0	0	8
TUWien	3	0	0	0	0	3
UoA	6	0	0	0	0	6
Total	23	1	18	0	0	42

Figure 9 Sample screenshot of the web-based tool for summarizing, monitoring and control of the ERWs phases and quantitative results

The tool and the current data are shared with all project partners. The workshops progress is measured against the plan and discussed on bi-weekly base during the coordination calls. During the calls, a discussion about difficulties and exchange of good practices takes place. When needed, project partners organized separate meetings or calls, dedicated to specific topics, such as:

- Process and templates how to organize the workshops - project meeting in Prague, January 2016;
- Good practices for workshops delivery and evaluation - Half-year project meeting in Vienna, April 2016;
- ERWs delivery process improvement - Project Meeting in Malta, September 2016
- Structure of the new activity plans - skype call with TUWien, Cardiff and UoA in December 2016;
- Exchange of good practices for ERWs delivery - during the course of the project implementation phases and after the bi-weekly coordination calls.

The ERWs Activity plans by each partner are uploaded in a shared folder so they are accessible to all partners.

Quarterly status, including objectives, progress and associated risks, were reported and discussed in the Quarterly progress reports for WP2.

All the activities mentioned above facilitated the effective information exchange between project partners and the smooth delivery of the ERWs.

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During the first cycle within the period from the beginning of February 2016 to the end of August 2016, project partners successfully completed 48 ERWs with 1213 participants, which is about 30 % of the planned 4000 students for the whole project implementation phase. It is also important to note that the project partners had to organize and deliver the workshops in a short period of time as the implementation period for the first year of the project started from February 2016, which coincided with the beginning of the second semester in general education schools. Considering the shortened time-period for ERWs' execution, the results from year 1 could be considered very successful. Detailed information about the workshops is provided in D2.1.

During the second cycle within the period between the beginning of September 2016 and the end of December 2016, project partners planned 43 ERWs with 1349 participants from which 18 ERWs with 525 participants were executed and were in process of evaluation. Additionally, other workshops are planned and will be executed by the end of the current academic year by July 2017.

Keeping into account that WP2 started in month 5 of the project implementation phase, the project partners had 10 months of active work. During those 10 months they planned 104 ERWs for 2597 students (65% of the target minimum of 4000 students for the whole project), from which they executed 63 ERWs with 1839 students (46% of the targeted minimum of 4000 students for the whole project). Judging by the numbers, we are able to conclude with confidence that the project will achieve and most probably even exceed its objective of 4000 students to participate in ERWs in the remaining 20 months in which the activities under WP2 have to be completed.

The overall status of the workshops delivery, as of the end of the reporting period (December 31, 2016), is presented in Table 1

Table 1 Number of Educational Robotics Workshops and students per partner and phase executed from February 1, 2016 to December 31, 2016

STUDENTS

Students per Partner/Phase	PLANNED	COMPLETED	EVALUATED
AcrossLimits	317	317	145
Cardiff University	190	0	0
ESI CEE	806	725	372
PRIA	617	478	377
TUWien	354	124	124
UoA	313	195	195
Total	**2597**	**1839**	**1213**

WORKSHOPS

Workshops per Partner/Phase	PLANNED	COMPLETED	EVALUATED
AcrossLimits	13	13	6
Cardiff University	8	0	0
ESI CEE	29	26	13
PRIA	24	21	16
TUWien	17	6	6
UoA	13	7	7
Total	**104**	**73**	**48**

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Note: the table represents cumulative numbers. The "planned" column represents all workshops that are planned, including those that are already completed and evaluated. The "completed" column represents all completed workshops including those that have already been evaluated.

In parallel with the development of the generic curricula and overall planning, monitoring and support of WP2, ESI CEE planned 29 workshops in total with 806 students from which they so far executed 26 workshops with 752 students and provided evaluation data for 13 workshops with 372 students. 13 workshops with 353 students are in process of evaluation. 3 workshops are planned and will be executed within the period February 2017 – March-2017. ESI CEE designed and developed two educational robotics workshops, one of which included the adaptation and design of an Arduino-based robotics kit, specifically tailored for work with children. The other workshop, developed by ESI CEE adapted the Finch robot by BirdBrain Technologies LLC for the execution of ERWs in alignment and of support to the national general education curricula for mathematics for the fourth grade.

Contribution of partners:

TUWien designed and developed educational robotics workshops. The organization planned 17 workshops with 354 students from which executed and evaluated 6 workshops with 124 students. TUW was providing guidelines for ERWs curricula structure related to the framework that was under development in WP1.

PRIA designed and developed educational robotics workshops. The organization planned 24 workshops with 617 students from which executed and provided evaluation data for 16 workshops with 377 students. PRIA was supporting improvement of the overall process of workshops delivery through peer review and feedback on the actual implementation. PRIA also gave support to AcrossLimits in the beginning of the project regarding educational robotics technology by performing a workshop on Malta with the staff of partner AcrossLimits.

UoA designed and developed educational robotics workshops. The organization planned 13 workshops with 313 students from which it executed and provided evaluation data for 7 workshops with 195 students. UoA contributed to the development of the ERW curricula structure and definition. UoA was providing guidelines for ERWs curricula structure related to the activity plans developed in WP4

AcrossLimits designed and developed educational robotics workshops. The organization planned and executed 13 workshops with 307 students from which it provided evaluation data for 6 workshops with 145 students. 7 workshops with 172 students were in process of evaluation. AcrossLimits was supporting the improvement of the overall process of workshops delivery through peer review and feedback on the actual implementation. AcrossLimits continuously provided guidelines for ERWs curricula structure related to the information repository, which was under development as part of the activities under WP5

Cardiff University designed and developed educational robotics workshops. The organization planned 8 workshops with 190 students. Cardiff University continuously provided guidelines for the ERWs evaluation and ethical implementation, related to the evaluation protocol developed as part of the activities under WP6. Cardiff University provided recommendations for improvement of ERWs activity plans and delivery process based on the data form the evaluation of 48 workshops with 1213 students.

Work Package 3: Educational Robotics Conference (PRIA)

T.3.1 Conference Plan

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Part of this WP is to develop a conference plan, which provides guidelines on how to organize a student conference such as ECER. While the completed plan will be delivered in project year 3, the following tasks to be done during a conference organization were already identified:

- Scope and Activities: Scope and activities of a conference or competition need to be defined at first because they influence the planning of the event. An event can be composed of one type of activity or of several types.
- Funding: Evidently, a conference or a competition requires a certain amount of budget for covering costs. Major possibilities of obtaining funding for a conference or competition are: grants, sponsoring, registration fees, and selling of objects.
- Costs: The costs depend very much on the planned activities and the available resources and environment for carrying out these activities. Possible costs are: rent of venue, administrative costs, equipment, spare parts, and travel costs.
- Staff: In order to successfully carry out a conference or competition, a certain amount of staff members is required on site for technical support, modetation, etc.
- Venue: A venue is required that is suitable for the planned activities and number of participants. Depending on the activities, the venue should offer for instance working spaces and place for presentations.
- Awareness: An awareness campaign might be needed to promote the event. Various target groups can be reached (e.g. participants, sponsors, multipliers) by various activities (e.g. website, event calendars, e-mail newsletters).

T.3.2 Organization of ECER 2016

ECER 2016 was carried out in April 2016 in Vienna, Austria. The preparation for ECER 2016 was split into two phases: Phase 1 from September to December 2015 and Phase 2 from January to April 2016.

The performed tasks in ECER 2016 Phase 1 encompassed:

- Setup of ECER Website: A website was set up within the PRIA website for informing about the conference. It also included a form for allowing the registration of participants. Later, the Call for Papers was added and a link to a paper submission tool (Open conference tool) was provided.
- Finding sponsors: As ECER itself was covered by ER4STEM, the intention was to find sponsors that would support material costs of participating teams. E.g. two teams consisting only of girls from the Austrian technical high school denoted as Technologisches Gewerbemuseum (TGM) were supported by “genderfair”, a project by the Vienna University of Technology that tackles gender issues concerning university careers. Also partner ESI CEE was able to support the Bulgarian teams in finding sponsors.
- Organisation of venue: The technical high school TGM was used as venue for hosting the ECER. It provides a large hall that was used for the tournaments as well as for the working places of the participants. Furthermore, one of the school’s lecture halls was used for the talks by the students and by researchers.
- Advertise participation: E-Mails were sent out to participants of previous issues of ECER. Also ER4STEM partners contacted their school partners to advertise for participation.

The performed tasks of ECER 2016 Phase 2 encompassed:

- Participation at Botball Instructors’ Summit at the KISS Institute of Practical Robotics (KIPR), Oklahoma, USA: Dr. Gottried Koppensteiner of PRIA participated at the Botball Instructors’ Summit to obtain information about the season’s rules as well as about the current Botball set. Furthermore, details regarding the registration process and shipment of robotic sets to the participants were clarified.

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- Delivery of Botball sets: PRIA arranged the delivery of Botball sets for all Austrian Botball teams as well as for the teams of Albania, Bulgaria and Belgium. The participating Botball teams of Egypt, Kuwait and Poland took care for their sets without support. Botball sets are required if a team wants to participate in the official Botball tournament. Each set comprises two robotics controllers, an iRobot by Create, as well as metal and Lego parts.
- Contact with participants: PRIA was in regular contact with the participants of ECER for supporting in various matters ranging from the writing of papers to technical issues with the robotics sets.
- Within WP2, one Botball workshop at PRIA was prepared and carried out. Information from the Botball Instructors' Summit was passed on to the Austrian teams. The Bulgarian teams received this information from PRIA in a separate workshop using a telepresence robot. The teams of Albania and Belgium paid the travel for a PRIA staff member for getting individual workshops.
- Planning of tournaments: Four tournaments were incorporated at ECER 2016:
  - Botball tournament: Botball is an educational robotics program that focuses on engaging middle and high school aged students in team-oriented robotics competitions. The tournament at ECER represents the official European Championship in Botball.
  - Open tournament: The Open tournament uses the same rules and game table as in the Botball tournament. However, teams with any robotics set are allowed to participate.
  - Aerial tournament: This tournament does not require a game table but a setting for using drones. Accordingly other rules apply.
  - Underwater workshop/tournament: This trial workshop/tournament used a small 3D-printed submarine developed by a student employed by PRIA.
- Organisation of material for ECER: Three game tables were planned for ECER of which one was provided by PRIA (using ER4STEM funding). The other game tables were provided by two Austrian schools participating at ECER. Name tags and printed handouts for the ECER participants were prepared. Spare parts for Botball (in case material of participants breaks) were organised. T-shirts were designed that could be obtained by the participants. EU funding was promoted and visualized in advertising and information materials
- Organisation of invited talks: ECER was carried out in accordance with this year's issue of the International Conference on Robotics in Education (RiE). The RiE is a conference for researchers being active in the field of educational robotics. The RiE was established in 2010 in the frame of the EU project Centrobot and has been organised every year since then. As RiE 2016 was carried out in parallel to ECER 2016, the high school students were able to visit the sessions of RiE. Besides, two talks by researchers were organised specifically for ECER 2016. Moreover, a few talented high school students were invited to present their interesting work on robots and drones during two talks.
- Submission and review of student papers: 21 papers were submitted by high school students with some of them having sole authors and others by groups of authors. All papers were reviewed by at least two researchers and 12 papers were selected to be presented. The best 4 of these 12 papers were chosen to be presented in a special session at RiE in order to have also the actual researchers as audience.
- Detailed planning of ECER schedule: According to the accepted papers, the invited talks and the planned tournaments, the ECER schedule was created (ECER 2016 schedule).

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Figure 10 ECER 2016 schedule

- Planning of staff: PRIA staff was planned for manning the registration desk as well as a support desk. Moreover PRIA employees acted as judges and fulfilled various other tasks during ECER.
- Preparation of invitation letters: The participants from Egypt and Kuwait needed Visa for entering Austria, which required invitation letters. Also an invitation letter was issued for the participants of Albania.

ECER 2016 was conducted from 11th to 15th April 2016. It had participants from the following countries: Albania, Austria, Belgium, Bulgaria, Egypt, Kuwait, and Poland. 21 teams participated in the Botball competition, 8 teams participated in the Open tournament, 2 teams participated in the Aerial tournament, and 3 teams participated in the Underwater tournament. Furthermore, as the International Conference on Robotics in Education (RiE) was hosted in parallel to ECER, the attendants of RiE had the chance to visit ECER. As a consequence, more than 40 international visitors were present at ECER. Besides, several classes from middle and primary schools of Vienna took the chance of visiting ECER. This allowed the young pupils to see possibilities of engagement in STEM and robotics in particular.

21 papers were submitted by the Botball teams. They were reviewed by researchers (mostly PRIA staff) and 12 papers were chosen to be presented at ECER. The best 4 papers were chosen to be presented in a special session at RiE so that the high school students had the possibility to show their work also to the international researchers attending RiE. The other 8 papers were chosen to be presented during the student paper sessions at ECER on Tuesday and Wednesday.

For the evening talk session on Tuesday, two contributions by high school students were invited. A group of 5 high school students presented their work on a drone usable for serving customers in a restaurant. The title of their talk was "Hovering Stewart – the flying waiter". Afterwards a humanoid robot was introduced by high school student Florian Kristof in his talk "RobBox 3.0".

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On Monday after the opening ceremony, Assistant Professor Dr. Pavel Petrovic of Comenius University in Bratislava gave a talk entitled “Lessons Learned from 20 years of Robotics Competitions”. On Thursday, the ECER participants had the chance of visiting the RiE sessions. Moreover, two talks by university students employed by PRIA were given in the evening talk session to show the possibilities of research during university studies. Christoph Krofitsch gave a talk entitled “Hedgehog” concerned with a low-cost robotics controller and Reinhard Grabler introduced the model used for the underwater workshop in this talk “Underwater Robotics”.

T.3.3 Organization of ECER 2017

The project time reported in this document also encompasses Phase 1 for the organization of ECER 2017. This issue of ECER is scheduled for 24th to 28th April 2017 in Sofia, Bulgaria. Therefore, the organization is carried out by partners PRIA and ESI CEE. Due to the years of experience in organizing ECER, PRIA provided organizational guidelines to partner ESI CEE. The tasks necessary to conduct ECER were distributed to the partners PRIA and ESI CEE.

The performed tasks by PRIA in ECER 2017 Phase 1 encompassed:

- Setup of ECER Website: A website was set up within the PRIA website for informing about the conference. It also included a form for allowing the registration of participants.
- Finding sponsors: As ECER itself was covered by ER4STEM, the intention was to find sponsors that would support material costs of participating teams. Likewise to the previous issue of ECER, a few sponsors could be obtained for supporting participating student teams.
- Advertise participation: E-Mails were sent out to participants of previous issues of ECER. Also ER4STEM partners contacted their school partners to advertise for participation.
- Contact with participants: In regard of organizational or technical matters, PRIA is in continuous contact with all teams.

Contribution of partners:

ESI CEE participated in the organization of ECER 2016. More specifically, ESI CEE supported PRIA to raise awareness and spread information about the conference, participated in the planning and organization of the event and attended it. Two teams of students from Bulgaria, recruited by ESI CEE, planned their participation, prepared robots and participated in the ECER 2016. ESI CEE, together with PRIA, prepared a plan to organize the ECER 2017 in Sofia, Bulgaria during the last week of April 2017. During the reported period, ESI CEE planned and initiated activities on the preparation and organization of ECER 2017 in Bulgaria including but not limited to dissemination of materials, information, ensuring the venue and preparation of teams. ESI CEE invited relevant stakeholders and conducted training workshop for 17 students on how to develop solutions for ECER 2017. ESI CEE conducts multi-layer coordination of the activities, related to the organization of the event, ensuring its successful implementation.

UoA provided the activity plan for the design of ECER 2016 conference and conference’s workshops. Moreover UoA attended the ECER 2016 conference with an article and a presentation of the activity plan template.

ACROSSLIMITS participated to ECER 2016 in Vienna to observe and gather necessary information regarding the logistics and the competition of this European Robotics event. This was done specifically to gain understanding and to pave the way for ECER 2018 which will be held in Malta.

Cardiff University collaborated with PRIA to develop a modified evaluation kit for the educational robotics conference ECER 2016. Cardiff attended ECER 2016 to support data collection activities and gain a first-hand understanding of the conference to feed into the evaluation.

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Work Package 4: Pedagogical design and Innovation for Educational Robotics

Task 4.1 ER4STEM activity plan

For the first version of activity plans, UoA-ETL developed a template aiming to provide tools to for designing activity plans for educational robotics that integrate key learning activities. The design of the activity plan template was based on the analysis of best practices in Educational Robotics from D1.1 and on ETL's experience in designing innovative activity plans for digital learning environments. The basic pedagogical theory underlying its design is constructionism, where learning is connected to powerful ideas inherent in constructions with personal meaning for the students. The template provides a generic design instrument that identifies critical elements of teaching and learning with robotics based in theory and practice and is expected to contribute to the description of effective learning and teaching with robotics. It was designed with the purpose to function as a mediating artefact between the pedagogical experts (ETL) and the ER4STEM partners interested in designing activity plans for ER.

The activity plan template was given to the participants to be used as a design tool for the workshops' activities of the first year. To further illustrate and clarify each aspect of the template, UoA – ETL provided to the workshops organizers an example of activity plan designed with the specific template. After all partners had implemented the activities they designed according to the activity plan template, the UoA reviewed the submitted activity plans in collaboration with TU-Wien. Based on the TU-Wien recommendations we refined the form of the activity plan so as to be easier used and understood by the community out of ER4STEM. All partners updated their activity plans according to the revised version of the template.

More precisely, the activity plan template addresses the following aspects:

- A brief description of the focus, set up and requirements of the activity with reference to the different domains involved, the connection to the curriculum, the different types of objectives, duration and necessary material
- Contextual information regarding space and characteristics of the participants
- Social orchestration of the activity (e.g. group or individual work, formulation of groups)
- A description of the teaching and learning procedures where the influence of the pedagogical theory is mostly demonstrated
- Expected student constructions
- Description of the sequencing and the focus of activities
- Means of evaluation and assessment procedures

For the first year there were designed 13 activity plans in total, covering a wide range of technologies, student ages settings and objectives. In Table 2 is resented briefly the activity plans created from each partner, the technologies they employ and the primary domain they cover although all activity plans are multidisciplinary with their themes and tasks belonging to STE(A)M

Table 2 Activities described by each partner using the activity plan template

No	Partner	Activity Plan	Technology	Domain - emphasis
1	AL -Malta	Introduction to Dash and Dot	Dash and Dot	Programming-mathematics

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2	ESI-CEE	Introducing Robotics with Arduino, Scratch and Mindmaps	Custom set developed by ESI CEE	Programming – Engineering – creative thinking
3	TU-Wien	Learning basics of programming with Thymio II	Thymio II	Programming
4	TU-Wien	Crazy Robots	Mattie – custom set developed by TU-Wien	Engineering – Design - Business
5	PRIA	ECER-Botball Preparation Workshop	BotBall	Programming - Engineering
6	PRIA	European Conference on Educational Robotics	BotBall and any other robotic kit	Programming - Engineering
7	UoA-ETL	Making a robot "Smart" (introducing programming structures)	LEGO –NXT kit	Programming
8	UoA-ETL	Robotic "Safe Swing" and Seesaw	LEGO WEDO	Programming - Mathematics
9	UoA-ETL	Constructing and controlling a robot painter	LEGO –NXT - G	Programming - mathematics
10	UoA-ETL	Solving the maze problem with Lego EV3	Lego EV3	Programming
11	UoA-ETL	My first Robot	Lego WeDo 2.0	Programming, Engineering
12	UoA-ETL	Robots and walking mechanisms	LEGO Mindstorms	Programming – Engineering
13	UoA-ETL	A Robotic insect	Arduino	Engineering

In order for workshop organizers to use the activity plan template to design their activity plans, UoA discussed explained and refined the dimensions of the template through a) project meetings with ER4STEM partners and b) a one day workshop with teachers (in UoA-ETL).

After the workshops and the data collection had finished we analysed from a pedagogical perspective the activity plans developed and implemented by the partners. The aim of the analysis was to identify strengths and weaknesses of the first version of the 13 activity plans and to consider future directions for the revised version in the second year. Thus, we conducted a thematic analysis of the activity plans and in collaboration with CU we compared the results of our analysis with the analysis of the data of the implemented workshops. To do this, apart from collaboration at project meetings and we also had face to face meetings about evaluation with CU and TU-Wien (Cardiff and Athens).

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Furthermore, in March 2016 ER4STEM made contact with the Scientix network and arranged an evaluation of the first draft of activity plans by five Scientix ambassadors. Scientix is a community for promoting innovative approaches in science education in Europe, thus an evaluation of ER4STEM activity plans from Scientix ambassadors was expected to provide useful criticism and interesting ideas on how to further develop and refine our activity plans so that they are appealing and useful for STEM teachers. Scientix's Evaluators were asked to answer three questions, which involved a) their interest to implement the activity plans in their classroom as they are described b) their interest to adapt the activity plans in order to implement them in their classroom and c) the clarity of the structure and the presentation of the activity plans.

The suggestions of the evaluators as long as the results of the analysis and evaluation of activity plans were used as guidelines to identify a set of recommendations for the revision of the activity plans for the second year of the project.

Task 4.2 ER4STEM activity plan

For the second year of work on activity plans, UoA is working on refining the activity plan template. The design of the second version of activity plans template is in progress with some updates that have already been implemented. The updates of the template are based on:

- 1st year evaluation of activity plans and of workshops (WP6)
- Recommendations of Scientix ambassadors
- On-going adaptations and evaluations throughout the 2nd year.

The 2nd version of activity plans template aims to support the following key features of student activity:

- A transition from individual to collaborative learning perspectives
- An identification of key skills including collaboration, argumentation, taking individual responsibility in groups, creativity and innovation, constructionism, coding/programming robot behaviours, interactions, field properties
- To foster the design of activities that focus on giving entrepreneurial robotics solutions to real problems.

Moreover with the 2nd version of the activity plan we aim to address the following issues/recommendations from the 1st year evaluation:

- Support multidisciplinarity of the activity plans
- Enrich the activity plans with digital forms of material
- Support the design and implementation of collaborative and reflective activities
- Include specific concepts of the curriculum in the activity plans

The updates have been done so far include:

- Integration of activity Blocks
- Simplification of some sections of the template

More specifically, activity blocks are structured blocks of proposed educational robotics activities that can be used in an activity plan. They include the type of the activity, a title and a description of how students will work and what are the expected outcomes of this activity. They will be categorized according to the type of activity they implement and they will be integrated in the 2nd version of the activity plans template as possible choices for the description of activities. Thus, the workshop organizer that uses the activity plan may first choose a type of activity that wants to use in the workshop and then

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select among different activity blocks of the desired category. The aim of the activity blocks is to facilitate the description of activities in the section “Sequence and Description of Activities” of the activity plans template. Moreover through the implementation of the activity blocks we aim to support the design of activities for reflection and collaboration, which have been found as important skills in the industry (D1.1). Activity blocks can be used as they are or with adjustments according to the needs of the respective activity plan. We have developed 15 activity blocks so far and we are working on more aiming to cover different type of activities. In Table 3 is presented some examples of developed activity blocks presenting the type, the title and the description of the activity of each block. Other type of activities include: ENTERING THE SCHOOL, PROTOTYPING, TEACHING FOR RESCILLIENCE and ASKING FOR HELP.

Table 3 Example of activity blocks developed

TYPE OF ACTIVITY	TITLE	DESCRIPTION
INTRODUCING	What a robot could do for you: Create a mind map	A short discussion begins in the classroom around what a robot is. A motivating question for this discussion could be to ask students if they have ever seen a robot in real life or in a movie. Collect the answers and then ask the students what are the characteristics of a robot and what it normally does. Next tutors or the teacher present students with their task: to design a mind map about what a robot could do for them as children or as grownups. Next students are provided with A3 or A4 paper and colored pens. They can work individually, or as a group. If students work as a group then the topic for their design should be an open theme addressing aspects of everyday life or of general interest like: How robots could help our society, our families; the environment; the everyday life of the impoverished etc.
GROUP FORMULATION	Creating random groups	A technique to create random groups could be the following: determine what is the number of the groups you wish to create according to the number of students. If for example you have 21 students and you need to create groups of 3 then you have 7 groups. The next step is to write the number of each group three times in separate pieces of paper (e.g. group 1, group 1, group 1, in three pieces of paper, then group 2, group 2, group 2 in another three pieces of paper and repeat the same process for all seven groups). Then fold the papers so that the written surface to be hidden and mix them. Ask from the students to choose one piece of folded paper. Then those three students who chose the 3 group3 folded papers then they belong to group 3. You can follow the same process with pieces of colored straws mixed in a bag and asking students to close their eyes while choosing one straw. Students with the same straw color belong to the same team. You need as many colors as the teams you wish to create.
EXPERIMENTING with constructions	Modifying a given example	Provide a readymade example and ask from the students to change it so that it demonstrates a slightly different behavior. After the obstacle detection, the robot will perform a U turn and will move for 4 floor plates. For example: Give students a predefined program

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		with a simple loop. The program can include one "move" block that results in the following behavior: the robot moves until it detects an object at 20 cm away. Ask from the students to modify the program so that, after the obstacle detection, the robot will perform a U turn and will move for 4 floor plates.
EXPERIMENTING with constructions	Tasks with gradual complexity	Tasks with gradual complexity can be a good method to introduce students in a complex concept or construct. The idea is to start with simple procedures or physical constructions and in consecutive steps add new elements in the process. The teacher asks students to create a program that results in moving the robot on a predefined path (a rectangular path) on the floor. The robotic vehicle is pre-assembled so students have to focus on programming and debugging their own programs. They are facing two real issues: a) How the real distance on the floor is related to distance parameter on the program b) How a robot can turn 90 degrees as it cannot understand "degrees" by default. After a successful first program, they are asked to enhance the program by repeating the movements on the floor and ensuring that the robot returns to the initial position.
REFLECTING	Video advice	Ask the group of students to create a short video with what they would consider best advice for other students who would like to construct something similar with their robot. Their video should focus on a) one tip for the construction of the robot b) one tip for the programming (if the group engages with it) and c) one tip on how it is best collaborate. The aim for this activity is for the students to reflect on the most important parts of their activity. Normally we expect here students to identify issues that were tricky and explain them so that someone else can find them useful. The video could be uploaded to a u-tube channel and be offered to younger students or students from other classes that they are engaged with the same activity. Furthermore, each video could be evaluated (likes - and comments) by students of the same class or other collaborating classrooms.
REFLECTING	Promo Video	Each group should create a promo-video for their robot or for their work as a team around their robot. Students should work on a the script of their video focusing on what makes their robot special, or showing what their robot can do in a creative way i.e. instead of saying our robot can do this or that they could create an imaginative story around their robot which demonstrates its functionalities. Another option for theme of the promo video is to focus on the collaboration of the specific students as a group. In this case the video should focus on how the group worked together, how they resolved their disagreements, the disagreements that finally promoted their work, and what is their special strength as a group. As in the advice video an evaluation of the videos is important part of the process. Each video could be evaluated (likes - and comments) by students of the same class or other collaborating classrooms. Before embarking on evaluation ask your students to

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		focus on the following criteria: how innovative and creative is the video; can the video draw other people's attention; why? Quality of the music, the graphics and the texts used; other characteristics that make the video to capture the attention of the viewer (e.g. humor). Ask your students to provide comments along with their evaluation.

Moreover some sections of the activity template will be simplified or merged in order to shorten the template and facilitate its completion from the workshop organizers. More precisely, we have made the following changes so far:

- In section "Teaching and Learning Procedures" the subsection "teacher's role", "teaching methods" and "students productions" where removed
- Change the "sequence and description of activities" section to "How to in the classroom" where the teaching and learning process are described with the help of the activity blocks

TU Wien has contributed to this work package in the use of the activity plan to describe the workshops offered during the first year. Moreover TU Wien has given feedback and offer suggestions to imporve the activity plan.

ESI CEE has contributed to the research and the development of the first version of the activity plans. More specifically, ESI CEE developed criteria for good practices in organizing educational robotics workshops that were applied to align the activity plans to the good practices in the field.

ESI CEE organization contributed to the development of the second version of the activity plan template and its alignment with the workshop curricula and the 21st century skills representation in particular. Specific activity plans, tailored form the generic plans, were documented per each of the 13 workshops completed by ESI CEE during the period from September 2016 to December 2016.

PRIA contributed to this workpackage by using the activity plan for the description of robotics workshops and consequently by providing feedback for improvements.

ACROSSLIMITS contributed to this workpackage in the development of the activity plan namely by giving its feedback and suggestions towards its content and structure so as to make the activity plan as user friendly as possible and, to keep it reasonably concise for users.

Cardiff University has acted as a critical-friend to UoA in the development of the activity plans, due to their pedagogic expertise. This includes the design and redesign of activity plan templates, as well as the analysis and evaluation of activity plans created by partners for use in their workshops to identify key areas for development.

Work Package 5: Technology for Educational Robotics

T.5.1 Creation and development of an educational repository (AL)

The main aim of this task is the creation of an educational repository where all the materials created by the project, combined with free-to-use resources on educational robotics would be stored and freely made available to stakeholders. Moreover the repository would be simple to use, with an internal powerful search engine, and sorted according to several criteria that would help teachers and educators to find the

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educational resources they need when they wish to implement robotics technology in their lessons and workshop.

Once the project kicked off, a deliverable plan was created in order to ensure that WP findings and milestones are always on time and recorded. The activity plan is constantly updated with the results and findings of each milestone assigned for this workpackage. The deliverable plan also includes a detailed gantt chart with specific milestones to help visualise each stage needed to building the ER4STEM repository. The WP also identified the different stakeholders through various brainstorming sessions. This brainstorming session took place during the Prague meeting in the first few months of the project. All the partners identified key people that have influence in changing and influencing the use of robotics in education. All the stakeholders listed have been grouped as per the list below. This exercise was important in order to ensure that no one would be left out and that the design and development of the ER4STEM repository is based for such stakeholders. The needs of the educational sector and of the stakeholders listed were then further researched. The stakeholders identified were young people, universities, schools, organizations offering educational robotics, industry, parents, policy-makers and ministry of education.

Once the stakeholders were identified, it was decided to hold a workshop to collect the teachers' requirements. This workshop was held for the "10th Scientix Projects Workshop in the Future Classroom Lab" on 28th February 2016 in Brussels. From this workshop, the main point that was brought forward was that teachers feel that there aren't enough materials available when it comes to Robotics. This information is very fruitful for the project, since it was clear that there is a need for a centralised repository which is dedicated for robotics technology and education other aspects identified were:

- There aren't specific specialised robotics teachers yet within the normal schooling environments. STEM teachers therefore need help with lesson plans. They are not the experts in robotics as they are the experts in their respective subjects. Primary school teachers are generalists; they feel like they need the experts in the classroom.
- Lesson plans are not linked to the curriculum. They should be modular, linked to topics in the curriculum and age group (or cognitive capabilities and previous knowledge). Or, there should be a new subject such as coding that can be easily linked with robots. Lesson plans or activity descriptions are too long. There is a need for quick previews, better graphical interface to access the information needed. Video tutorials would be very helpful.
- There is a need for lesson plans or what-if concepts and guidance for teachers to understand that any topic can be taught with robotics.
- Alternative materials like virtual robots that can be accessed via internet are needed.
- The need for more international projects that involve schools is missing

To further strengthen these findings, it was evident that a better understanding of stakeholders' need and requirements was required. Therefore, it was decided to do an online questionnaire, where the below questions were asked:

- Profession
- Do you already make use of robots in your school?
- If you could create a tool/portal to help you diversify your teaching approach, what would be the most important features you would include?
- Which of these features would you make use of in a portal that would be dedicated to robotics?
- Which of the following resources would you like to see?
- If you had to choose the filters by which you search resources. Which ones would you prefer? Sort from 1-7 (1 being the most important)

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This questionnaire was done in order to allow us to get a wider view of different opinions from across Europe. Although the sample is not that huge, and might not reflect the real situation in all the European countries, it gave us a real feel of what is missing and what is needed. A total of 45 answers were received. The results gave us a better picture of our stakeholders' needs and requirements. The below is a summary of the findings.

From the individuals that filled the questionnaires 61% of the users were already making use of robots in their school. This is a rather high number, however most probably the individuals that answered the questionnaire already have some interest in educational robotics. When asked about the technologies educators are using, the answers vary from BeeBot to, Lego WeDo to Lego Mindstorms and also ProBots. These technologies are mostly implemented during ICT lessons. Others also used them for Maths, Science and language lessons.

From the question related to the current portals people are using, 54% answered none, however 23% of the participants are currently using Scientix. Other portals where mentioned, and these include European Schoolnet, Lego Mindstorms, Edmondo, eTwinning, and Open Education Europea. This shows that a majority of the individuals are not resorting to using a portal, and most probably are building their own content from scratch. In the context of the project, one can speculate that existing portals are either not accessible or do not contain the information one desires.

When it comes to the features, the top 5 features requested are Videos, Tutorials, Web Application, Link to Subject/Topic and a Mobile Version. These features have been considered during the course of design. The repository will have the ability to handle videos, tutorials, will be web-based, will have a direct link to the subject and also can be used on mobile devices. On the other hand, it was clear that the resources required include, Lesson Plans and Activity Plans, Games, Workshop and Educational Technologies. When it comes to filters, on how users prefer to filter the results, their order preferences where: Age, curriculum, difficult, duration, technology, domain and language. In the questionnaire participants had to rank the filter from 1 to 7, with 1 being the most important. Figure 11 shows how each filter ranked. For instance, there were over 10 that ranked Age first. Although language has the least score, the reason behind this would be that the people answering the questionnaire were English speaking. All these filters will be made available in the final design.

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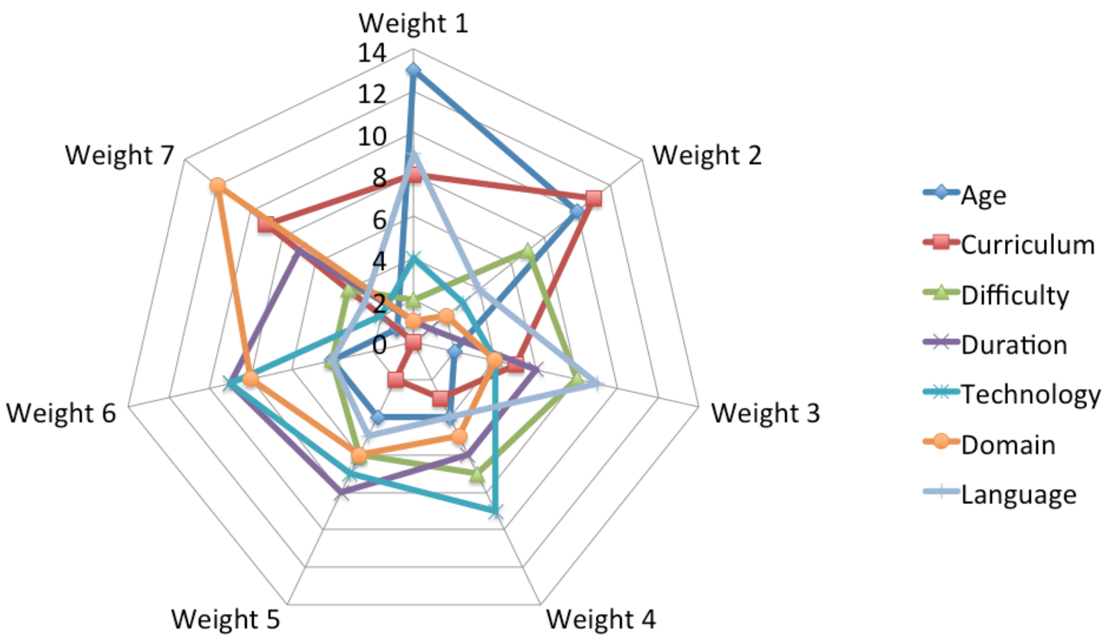

Figure 11 Result of the importance given to each filter.

Apart from defining the stakeholders and the online survey, we felt the need that a number of use cases should be generated so that we further identify the needs of all potential users. This exercise was done during the Malta meeting, where different people were assigned a "stakeholder" role and had to write what their ideal repository would contain. The following is a collection of the results of this exercise that proved to be extremely useful to help us in the design phase of the repository. The use-cases obtained from this activity are presented below:

I AM AN EDUCATOR TEACHING YOUNG STUDENTS IN PRIMARY LEVEL AND I AM LOOKING...

- To find information how to make use of the new robot the IT department gave us to use in the classroom. Not sure where to start, or how to use this. I do not have a lot of programming knowledge.
- For educational program that I can apply in my everyday work;
- For organizations that can suggest and show me ways to teach my students technology or science;
- For materials/ devices (price and store) and where I can buy them on an affordable price for teaching my class technology/ science…;
- for curricula (incl. visual materials) for activities that teach my class Team Work, Communication, Creativity;
- For matrix or guidelines how to develop some elements of educational technology, i.e. using Minecraft, hangouts, facebook…. how to set up educational goals, how to choose content, environment etc.;
- For accessible (easy to find and easy to read/ prepare) materials to make my teaching more interesting for pupils.

I AM AN EDUCATOR AND I WOULD LIKE TO:

- Compare available platforms, and to decide between the most suitable one based on my needs
- Find tutorials to explain how to use an specific platform
- Find new activities that I could use for a particular platform

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- Share my activity with others
- Comment on others activities about my experience
- Find a way to bring technology into my classroom that can be used as a tool, the kids and the activity being in the center and the tool being supporting actor
- Find a way to link my curriculum topics to educational technology (robotics) activities
- Excursions to companies in STEM fields
- Find a way to teach mathematics concepts hands-on
- Find a way to teach mathematics concepts with real cases (linked to life and not abstract)
- Find a way to introduce my curriculum concepts with real cases and hands-on approaches;
- Find organization that can show me how to teach my class technology or science in a more involving way;
- Find sample of research goals – how to follow up on my students' interest towards technology, science, engineering;
- Find materials and good practices to help me out while identifying the personal learning style of my students;
- Find instruments to help me evaluate the attitude of my students towards the subject I teach;
- Find methodologies on how to include parents in the active support of educational robotics tools in general education;

I AM A HEAD OF SCHOOL AND I AM LOOKING FOR:

- ways to get educational technology into my school (borrow it or exchange with other schools)
- training for my teachers to use educational technology

After having all the information at hand from the above mentioned activity, another brainstorming session was held to identify what the core features of the repository would be. During this session that was held in the Malta meeting, the partners were grouped in 3. Each individual had a role: One was to be the repository, the other a teacher and the other a researcher. Each group was asked to write what they would like the repository to do for them. All data has been collected and grouped to complete the ER4STEM feature list. Features of the repository will include but not limited to, easy-access, mobile compatible, search functionality, language functionality and interactive lessons plans.

In order to start concretising the requirements and portraying them in a visual manner, we chose the methodology of first building wireframes, and then once there is total sign off from all the partners and other stakeholders, these get to be built in a real rapid prototyping manner into the user interface of the repository. Wireframes are always useful in order to start a discussion with people who are not of a technical (ICT) background and cannot most of the time understand what is meant by the designers, but are able to comment once they see something visual since they are experienced users of ICT solutions.

In order to arrive to the following wireframes, we started from the activity plan that was developed in WP4. The activity plan was divided into different parts as individual pieces. We then made sure to "stick" them in a location of the user interface on a virtual monitor / display, and rearranged where needed to make sure that they are all easily understood and accessible from a variety of ways. The words and phrases used were also taken into consideration, in order to make sure that the platform is accessible even to non-academics.We also took inspiration from other online repositories that although not focusing on robotics, however provide a simple interface for teachers to find open educational materials like www.oercommons.org and www.openeducationeuropa.eu.

The first version of the wireframes has been discussed among all the partners in different occasions. During the annual meeting, the wireframes were presented and some issues were pointed out. To address these issues, a meeting within PRIA, TU Wien and AcrossLimits was held in Malta. During this meeting, the user experience and concordance with the activity plan were taken into consideration on improvement

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of the wireframes. As result of this meeting, it was generated a second version of the wireframes, which also provided suggestions on the activity plan template to improve the user experience. An example of a wireframe is presented Figure 12

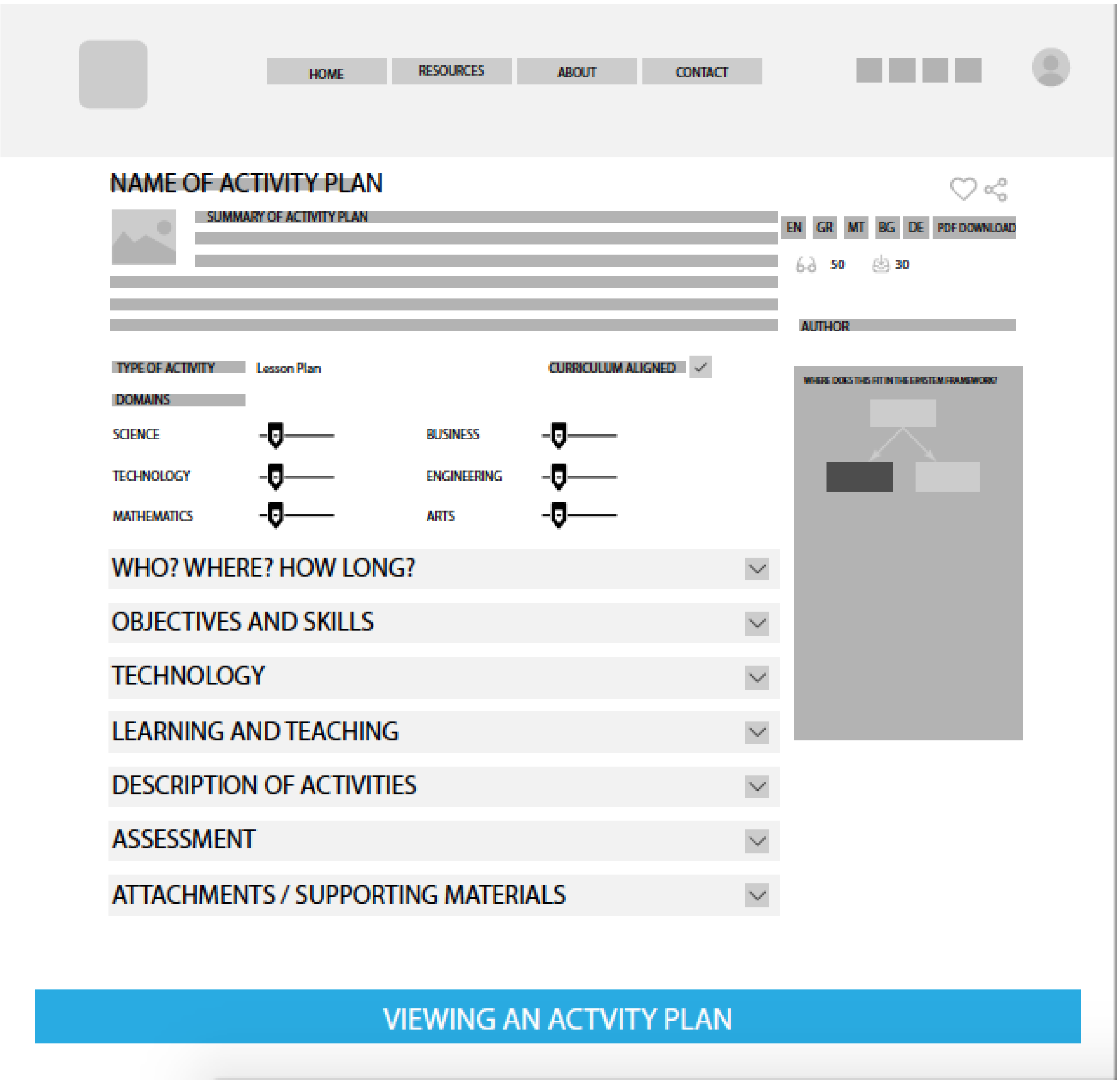

Figure 12 Example of the wireframe designed based on the activity plan

T.5.2 Further development of robot controller Andrix to use in workshops (PRIA)

The educational robotics controller Andrix, which was mainly developed during the project SCORE! (Funded by the Austrian Research Promotion Agency), was further developed in reporting period 1. It is now denoted as Hedgehog for pointing out that it is not only compatible with Android devices (which was suggested by the old name Andrix). Figure 13 shows the educational robotics controller Hedgehog.

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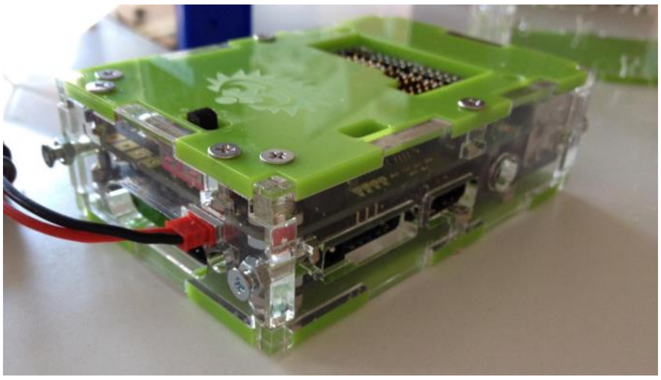

Figure 13 Final version of Hedgehog educational robotics controller

The main development within ER4STEM was concerned with Pocket Bot, a graphical programming environment for Hedgehog to be used on smartphones. The open source software app Pocket Code, which offers a graphical programming environment, was used as basis. A Pocket Code program realizes a background and different objects. Both of these can have scripts that are triggered by different events, such as the program starting, an object being tapped, or two objects colliding. Scripts are composed of sequential blocks that each accomplish a tasks. They are separated into categories such as “Control”, “Motion”, “Data”.

To develop Pocket Bot as a robot extension to Pocket Code, a new category, “Hedgehog”, was added. As described earlier, there are two main elements for bringing functionality to Pocket Code: bricks and functions. These two map cleanly to actuators and sensors. The following elements were already implemented:

- a brick for setting a motor’s power,
- a brick for setting a servo’s position,
- a brick for turning a servo off,
- a function for reading digital sensor values, and
- a function for reading analog sensor values.

Pocket Code does not provide a programming interface that would allow Pocket Bot to be developed as a third party plugin to the Pocket Code app, but it uses clean separation of concerns, which makes it possible to make the necessary changes without interfering too much with the rest of the app. However, this means that Pocket Bot cannot be used as an optional part of the app: it needs to be distributed either with the official, main Pocket Code app, or as a completely independent fork.

To demonstrate Pocket Bot’s functionality, a simple program was implemented that uses both Pocket Code and Hedgehog features: an object allows the user to interact with the program while it is executing, and the program controls a motor depending on the user’s input (see Figure 14). A variable is used to save the state between invocations of the “When tapped” event handler. Although the program is kept simple – which is in line with the complexity that is manageable as a graphical program – it shows how a seamless integration into Pocket Code was achieved. It also shows how a highly motivating use case of Pocket Bot can be achieved with minimal effort: a remote control for robots.

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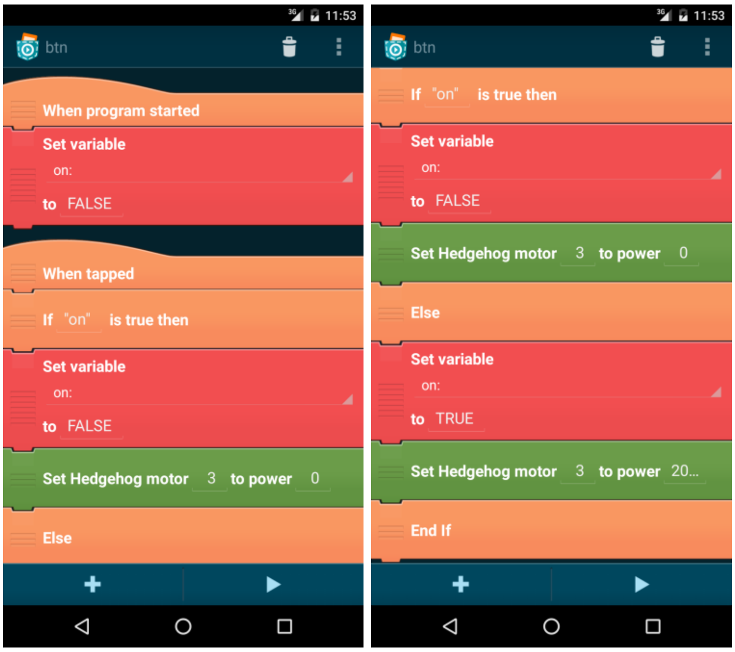

Figure 14 Pocket Bot demo programs

Pocket Bot can be used for graphically programming the controller Hedgehog. It allows the control of actuators and the reading of sensor values using according graphical blocks.

Apart from Pocket Bot, also further minor technical improvements were carried out regarding the Hedgehog controller, which should ease its usage in workshops and other robotics activities.

T.5.3 Development of Slurtles for younger children (CU)

Cardiff University redesigned and implemented a prototype of a secure virtual world environment with SLurtles for young people (T.5.3; D.5.2). To ensure stability during the implementation of the prototype within schools, the decision was to create a secured online environment, accessible only to the schools working with Cardiff University. Feedback from teachers prior to implementation has resulted in some minor updates to the environment. Since development of the prototype, infrastructure issues within some pilot schools have meant the unexpected additional development of a standalone virtual world.

Based on SLurtles in Second Life (Girvan, Tangney and Savage, 2013), the SLurtles created for ER4STEM had to be implemented in a secured virtual world that would provide a safe environment for children and young people to use the robots and interact with each other.

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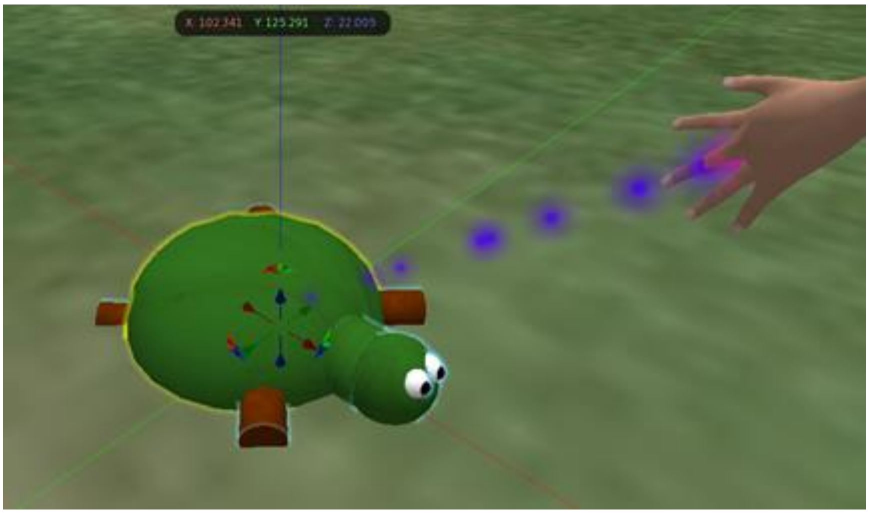

Figure 15 Avatar interacting with SLurtle for kids

Figure 15 shows the SLurtle tool created for ER4STEM. With many of the same requirements of the original SLurtle, a similar looking tool was created. The head provides a clear heading, whilst the body provides a clear indication of the position of the SLurtle. When selected (as shown in Figure 15) the precise X Y Z coordinates appear providing the precise location of the SLurtle on the grid island.

The original SLurtles were provided for users from a SLurtle collection point. This showed images of the types of objects that each SLurtle would create, from which the user could select a SLurtle. Initial user test showed that whilst it was useful to see the types of blocks created by each SLurtle, requiring the user to visit this point for each SLurtle used was inconvenient. Therefore the ER4STEM SLurtles are all provided in a user's inventory when their account is first created.

Each SLurtle contains a lineSegment (Figure 16). An instance of the lineSegment is created starting at the center of the SLurtle's body when the 'pen down' command is given. The shape, width and height of the lineSegment are predetermined. The length is determined by the distance travelled forward by the SLurtle in a single move when the 'pen down' command is used.

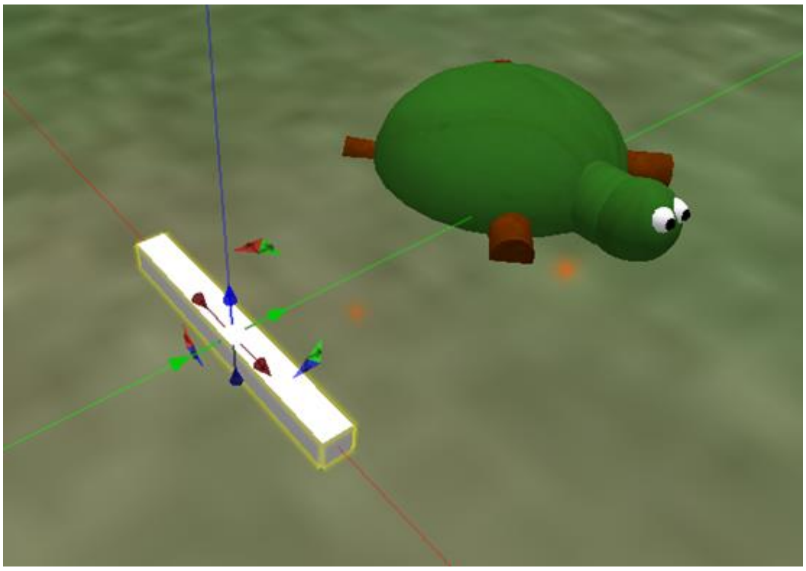

Figure 16 Instance of a 1 meter lineSegment in white

The position, colour and length of each lineSegment created is determined by a script in the SLurtle. Users have two options to achieve this. 1) Create a new script in the SLurtle and use a text editor in the virtual world to write the script. 2) Use Scratch for OpenSim (Figure 17) which provides a

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block-based programming environment which automatically generates the text-based script, which can be copied into a new script in the SLurtle. It is anticipated that most users will use Scratch4OpenSim but as they gain familiarity they may change the script in the virtual world text editor, providing teachers with an opportunity to develop lessons which support learners transitioning between block and text-based languages. The particular advantage for students who are collaborating or transitioning is that scripts in SLurtles can be copied into Scratch4OpenSim to be represented as graphical blocks.

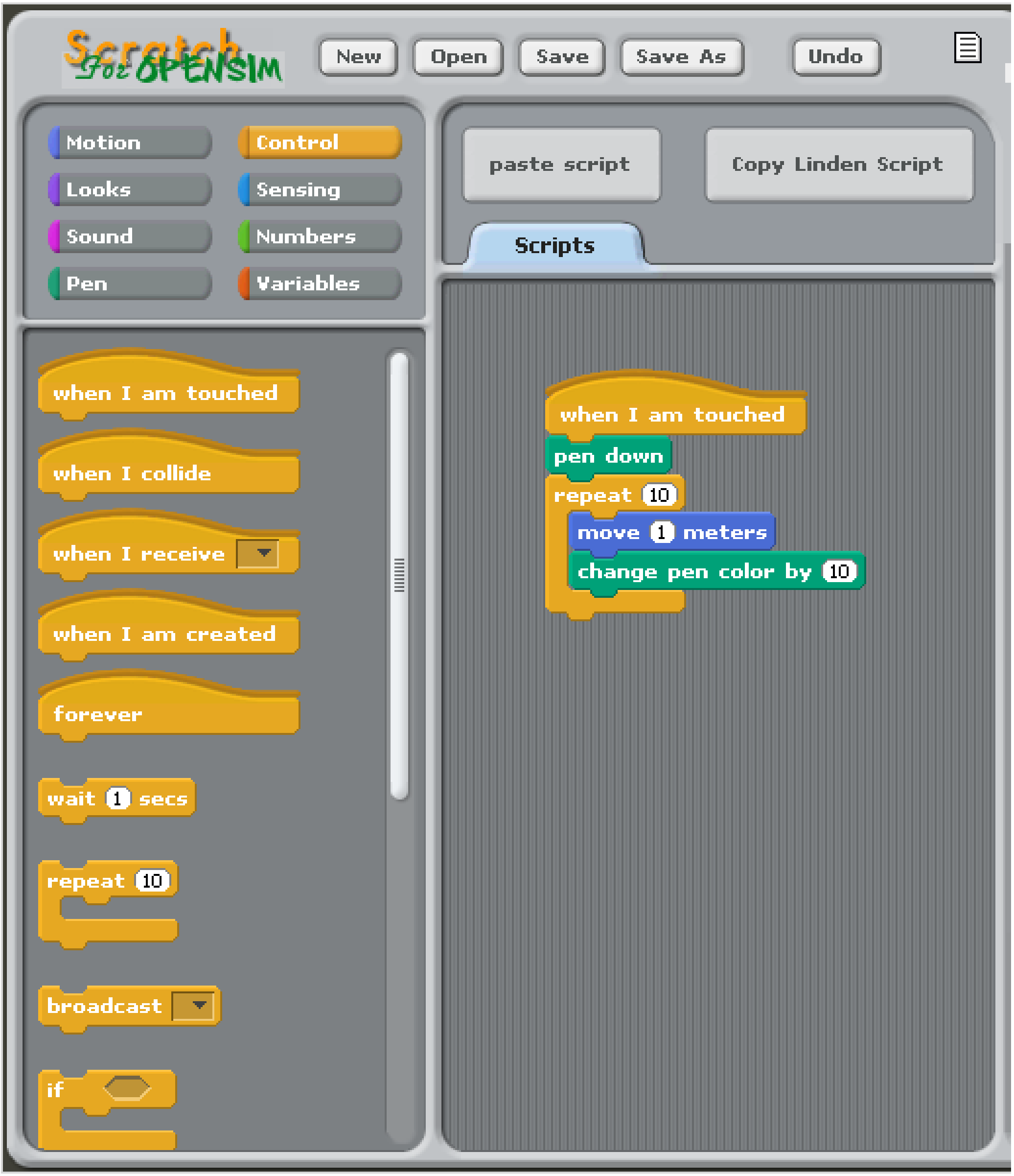

Figure 17 Scratch for OpenSim programming interface

Attributes assigned in the script placed in the SLurtle are passed to a script within each lineSegment instance. From the original SLurtles, this lineSegment script had to be adapted to operate on the OpenSim platform.

OpenSim was the virtual world platform chosen for the development of SLurtles. Minecraft was considered as a popular alternative, however in order to construct the user must first mine resources which could distract from any intended learning outcomes and needlessly extend the length of activities.

Using the OpenSim platform, SLurtle World was created as a secured environment for young people and their teachers to log into. Having created and avatar, upon first arrival into SLurtle World, the user

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appears on the heelo_world island (Figure 18). This is an orientation island for them to explore and learn how to navigate the virtual environment before going to their class island.

Figure 18 Arrival in SLurtle World

The class islands (Alpha, Beta and Zeta) are all identical and designed to be flexible spaces with a small arrival area which cannot be changed and a large open space when can be configured in any appropriate way for the learning activity. To facilitate this number of resources are available for teachers including a sandbox and sky platforms (Figure 19 & Figure 20).

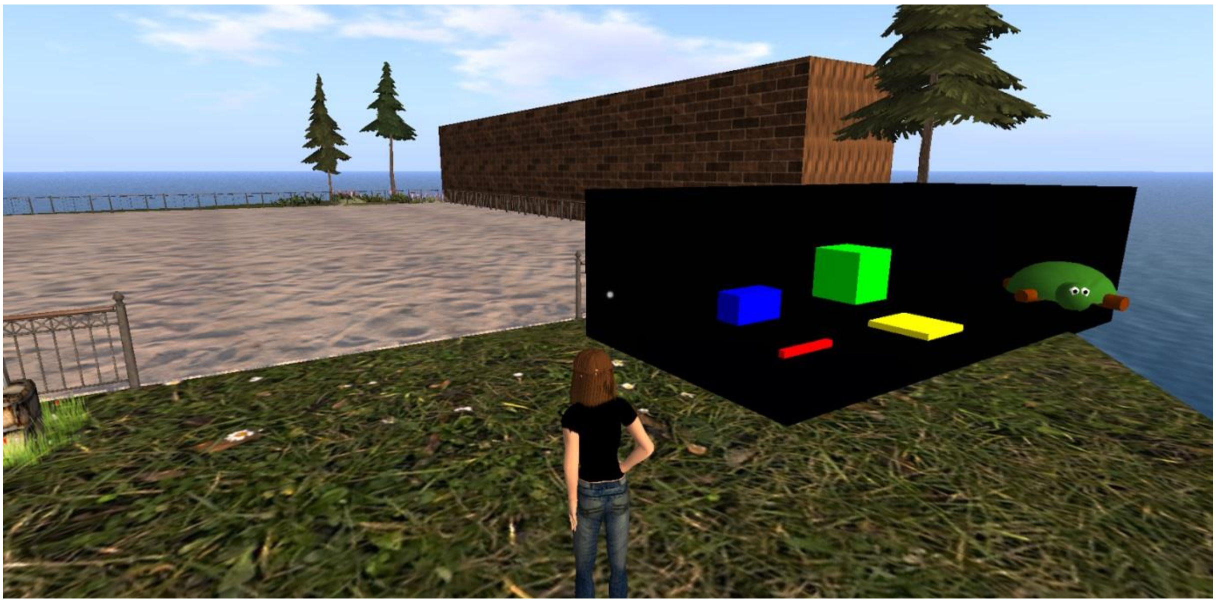

Figure 19 Sandbox with SLurtle Collection Point

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Figure 20 Open space with SLurtle Collection Point

At the SLurtle Collection Points students can choose the type of SLurtle they wish to work with and a copy of that SLurtle will go into their inventory. Each SLurtle is represented by the type of object it will create, as seen in Figure 19, four cuboids could be available. Again, within the teacher's resources there are SLurtle Collection Points for a range of shapes.

T.5.4 Workshop for Scientix ambassadors and/or Scientix National Contact Points to explain how to use the educational repository works (AL)

This task is due by August 2017; initial discussions about the structure and content of this workshop are underway. A date will be announced shortly.

TU Wien has contributed providing ideas (e.g. use cases) and being the link between framework, activity plan and repository. This has been achieved through diverse online and face to face meetings (e.g. Annual Meeting), to discuss, suggest and modify the wireframes. TU Wien also helped to disseminate the online survey among contacts to have a higher participantion.

ESI CEE contributed with peer reviews and discussions to the Andrix MOBILE ROBOT CONTROLLER PROTOTYPE development. ESI CEE contributed with requirements, design ideas, case studies, user stories, examples and review of the mark ups in the development of the concepts and initial design of the technology of educational repository.

PRIA mainly contributed in T5.2, which is concerned with further developments of the educational robotics controller Andrix/Hedgehog. Apart from that, PRIA provided feedback and ideas for the repository and its interlinking with the framework, e.g. during a meeting end of November in Malta, which was attended by two staff members of PRIA.

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UoA contributed with suggestions from a pedagogical point of view about the design of the repository, with an initial review of the features of some existing repositories and by providing some use cases for the repository.

CARDIFF has contributed in T5.3 which has conducted to D 5.2, which is the redesign and implementation of Slurtles.

Work Package 6: ER4STEM Evaluation

T.6.1. Development of pre-kit for evaluation.

In order to design an evaluation framework and tools for ER4STEM activities in the first year of project, it was necessary to consider the methodological approaches taken in existing research in the area of educational robotics and the field of educational research more widely. These were considered with reference to the explicit objectives of the ER4STEM project and questions which had emerged from partners about their specific activities/technologies. The aim was to create a pre-kit which provided opportunities to collect sufficient data to begin to answer these questions, whilst not over-loading the activities that children/students would be engaged, so as not to detract from the purpose of these activities – educational robotics in STEM. Further requirements included the need to conduct rigorous data collection across different sites by different partners with varying experience and in different languages.

These requirements were used to identify the most appropriate sources of data and the instruments that could be used. For most, multiple sources of data were identified and therefore the requirement to conduct rigorous research was balanced with the need to not overwhelm the ER4STEM activities with excessive data collection.

In tandem with the development of the pre-kit, the ethical issues associated with the project were considered. Documents and procedures were drawn up to gain informed consent and issues around data protection were clarified for each member. Informed consent is an essential part of the data collection process and so was included in D.6.1. Ethical approval was initially sought from Cardiff University's School of Social Sciences Ethics Committee for the whole project and individual organisations ensured that they gained the necessary approval from their own institutional ethics committees or state organisations.

Together with a protocol for administering the pre-kit, a draft version of the pre-kit was circulated to all project partners for feedback. Through this and subsequent meetings, the protocol, ethics documents and data collection instruments were discussed and refined.

The final pre-kit included an overall data collection and handling protocol, pre and post activity questionnaires, draw-a-scientist activity, observation protocol, interview questions and protocol, collection of planning and workshop material created by partners, student reflections and artefacts of their learning, tutor reflection, informed consent documents and reporting templates, along with a checklist for preparing workshops.

T.6.2 Development of evaluation toolkit

The development of the final evaluation toolkit to be used in project year 2 was informed by the implementation of the pre-kit, feedback from partners and an evaluation of the strengths and limitations of the toolkit in addressing the research aims identified in D.6.1.

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Table 4 presents an overview of the data collected across the 48 workshops. Using the pre-kit (D6.1), evaluation data was collected during all of the 48 workshops. As described in D2.1, of the 1228 students who participated in workshops and the conference, 1133 (92%) completed the pre-workshop questionnaire and 1052 (85%) completed the post-workshop questionnaire. This data is used to gain evidence on students' experience, attitudes and assumptions. To complement this, 1094 (89%) completed the Draw-a-Scientist task.

Table 4 Overview of data collected during the first year

	Number of workshop	Number of participants
Pre-questionnaire	48	1133 (92%)
Post-questionnaire	48	1052 (85%)
Draw-a-Scientist	48	1094 (89%)
Observations	47	n/a
Interviews	35	193 (16%)
Artifacts of Learning	47	n/a
Student Reflections	40	Varies (individual and group)
Tutor Reflections	45	Varies (all or some tutors)

The collection of data through the pre-kit was highly successfully operationalised by partners as part of their workshops. Implementation by partners with little or no previous experience of research had required additional supports from WP 6 lead, as anticipated. With time and experience, the data collection process became more efficient and effective.

The outcomes of the evaluation in year 1 (reported in D.6.3) provided clear insight into the effectiveness of the different aspects of the pre-kit, with each of the 11 recommendations from the evaluation having implications for the development of the evaluation tool kit. Partners also provided feedback on their experience throughout the first year of the project which informed the development of the evaluation kit, as reported in D.6.2. Below is a summary of the changes made.

Protocol:

- o Reporting of general workshop information via standardised spreadsheet
- o Include activity plans in workshop information
- o Partners find a time efficient approach that works for them in the distribution or recording of student numbers.
- o Follow a standardised file naming approach which does not include the name of schools or date of the workshop.

Activity Plans:

- Clearly identify which of the recommendations presented at the Malta milestone meeting have been implemented, with a brief statement on how and why.
- Clearly identify any changes from previous activity plans as part of their ongoing development, with a brief statement on how and why.

Draw-A-Scientist:

- For languages where the term 'scientist' is not gender neutral, in year 2 of the project the task will be "draw a female scientist or male scientist".
- In year 3 this will be reversed.
- Limited to 10 minutes
- For each workshop partners to create a single PDF or PPT file for data transfer

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Questionnaires:

- Modified version for younger children
- Reduce the number of open questions to reduce the need for translation
- Reduced overall length
- Change “What do you want to do after you finish school?” to “In the future, what job would you like to do?”
- Standardised spreadsheets for data input with drop-down input values.
- Remove duplicated questions
- Rephrase questions for clarity

Student reflection:

- Ongoing throughout workshops
- Integrated with workshop activities
- Needs to be flexible in form.

Artefacts of learning:

- Ongoing collection throughout workshops
- Need to demonstrate the work completed by students in a form that could allow a workshop tutor, teacher or researcher to assess the work in relation to the objectives stated in the activity plan.
- Needs to be flexible in form, with options chosen to suit the workshop activities

Observations:

- Class teachers could be asked to write observational notes if available.
- If video is recorded, observational notes only need to include key moments witnessed by tutors at the time, there is no need for tutors to review all video files.

Interview:

- Add a question to provide entry to explore the use of specific tools.
- Limited to 10-15 minutes.

Ethics and data protection:

- Informed consent is still required of parents and students but only parents are required to provide a signature.

The revised toolkit is currently in use during WP 2 activities.

T.6.3 Evaluation of the workshops

Each partner running workshops in WP2 implemented the pre-kit at each site in year 1. All required data from project year 1 was reported to WP 6 lead (translated into English) by the end of M10. Currently year 2 workshops are ongoing and reporting of data is due to start in M17.

T.6.4 Evaluation data and reporting

Throughout the first year of the ER4STEM project, workshops were implemented by 5 project partners in 4 countries. As part of each workshop the evaluation pre-kit (D6.1) was implemented in whole or part. The evaluation pre-kit had two roles: The first was to collect baseline data which would be used to evaluate the development and implementation of the ER4STEM Framework in years 2 and 3 of the project. The second was to pilot the evaluation protocol that would be used in years 2 and 3. As part of

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D6.2, the pre-kit was assessed against these targets and is reported there. In addition the pre-kit provided data to inform the development of the Framework (WP1) and Activity Plan (WP4).

To analyse the data, concurrent, mixed-method data analysis was conducted using three approaches: 1) exploratory case study analysis using constant comparative analysis to gain an emergent understanding; 2) country level analysis focusing on the evaluation criteria (primarily to ensure that the pre-kit was fit for purpose); and 3) single data-set analysis across countries. D.6.3 presents each of the analysis processes in detail.

D.6.3 reports on the evaluation and analysis of the first project year. It presents the emerging findings from the analysis of data collected using the pre-kit over 48 workshops. In addition to the workshops, a version of the evaluation pre-kit was created for the ECER conference. This report presents the results of the baseline data, the intended outcome of this report. D6.2 provides an assessment of the evaluation pre-kit as part of the report on the development of the final evaluation kit to be used in years 2 and 3 of the project. In addition, due to the breadth of data successfully collected by all partners, several in-depth case studies are presented. These provide findings which not only provides a nuanced understanding of the baseline data but also provide key recommendations for the development of the Evaluation Kit, Framework and Activity Plan:

1. Use 21st Century skills as a unit to encompass industry skills and soft-skills.
2. Consider creativity as leading to innovation and entrepreneurship
3. Examine critical thinking through a focus on reflective thinking
4. Provide evidence of learning
5. Differentiate activities
6. Develop new entry points
7. Develop approaches to the orchestration of teamwork, with particular consideration of mixed-gender groups
8. Evaluate the impact of specific tools
9. Change and sustain attitudes to STEM
10. Raise awareness of pedagogic strategies and their impact
11. Gender-balance the Draw-a-Scientist activity

In addition to the report, WP 6 lead is involved in close collaboration with WP 1 and WP4 to identify how these recommendations can be implemented. The lead organisations of WP1 and WP4 are also involved in the data analysis process, led by Cardiff. This ensures an holistic understanding of each recommendation.

TuW researched the Austrian legislation related to privacy and confidentiality of data collected by students and teachers in scientific research projects. Together with PRIA, TuW agreed protocols for ensuring confidentiality between sites and translated materials into German. TuW implemented the pre-kit and are currently implementing the evaluation kit, translating the data into English for analysis and reporting it to the WP lead. TuW is leading the quantitative data analysis.

ESI CEE researched the Bulgarian and EU legal framework related to privacy and confidentiality of data collected by students and teachers in scientific research projects. They translated all evaluation materials

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into Bulgarian and translated data i into English for analysis. ESI CEE also researched and proposed a mechanism and tools for encryption of sensitive data that was adopted and used by all project partners in order to guarantee the privacy and confidentiality of personal data collected and stored for the needs of the ER4STEM project. For project year 2 they created a reporting tool for quantitative data, which include validation mechanisms and automated statistics presentation for the data collected. The tool is used by project partners during the second cycle of workshops

PRIA collaborated on the development and implementation of the pre-kit for the purposes of conferences, identifying opportunities and constraints to data collection in this specific context. Together with TuW they researched relevant Austrian legislation and translated the pre-kit into German. TuW implemented the pre-kit and are currently implementing the evaluation kit, translating the data into English for analysis and reporting it to the WP lead.

University of Athens directly contributed to the development of the pre-kit, with methods to collect reflections and artefacts of learning. University of Athens also researched the Greek legislation related to privacy and confidentiality of data collected by students and teachers in scientific research projects. They communicated special requirements of the Greek Ministry to the WP lead and supported the development of alternative data collection approaches to meet the Ministry's requirements whilst collecting comparable data. UoA translated all evaluation materials into Greek, implemented the pre-kit and are currently implementing the evaluation kit, translating the data into English for analysis and reporting it to the WP lead. UoA works in collaboration on the qualitative data analysis with Cardiff University.

Across Limits researched the Maltese legislation related to privacy and confidentiality of data collected by students and teachers in scientific research projects. Across Limits developed a checklist for the preparation and implementation of the evaluation activities, along with the data preparation and transfer. Across Limits translated all evaluation materials into Maltese as required, implemented the pre-kit and are currently implementing the evaluation kit, translating data (as required) into English for analysis and reporting it to the WP lead.

CERTICON reviewed the data collection to identify sources of data for industrial evaluation.

Work Package 7: Project Management

Management started the project by conducting the negotiations, ensured that the consortium agreement has been signed before the project start, and that all responses are sent to start the contract. We then organised, already before the starting day, the kick-off meeting and hosted it in Vienna.

Next, we developed a project handbook. It establishes and provides guidelines for the day-to-day operation of the Project. We checked that the beneficiaries have started their RTD activities right from the beginning.

Management proceeded with the established WP teams and a clear structure for the **project coordination** (Task 7.1). The official coordinator is Markus Vincze. He has been assisted at project start by the scientific coordinator Lara Lammer. After year one, Lara left to get another position at the TU Wien. Consequently the coordination team has been adapted:

- Coordinator: Markus Vincze, overseeing the main output of the project.
- Scientific coordination: Julian Angel. He is in charge of the content of the project, supervising all work. He is also leading WP1. TUW is also in charge of chairing the meetings and sending out the reports. The results of these meetings including the minutes are then used for discussion in the Conference Calls as listed below.

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- Consultation to the project scientific development: Lara Lammer. She remains for a few hours per month available as expert to make sure the project keeps the right focus and direction.
- Additional role of Integration of scientific and practical work: Wilfried Lepuschitz of partner PRIA. Wilfried assist Julian, since along the project we found that the different background and points of view and terminology needs to be better integrated. This concerns specifically the integration of the scientific viewpoints (WP1, WP4, WP6) with the application/practical viewpoints (WP2, WP3, WP5). Since Wilfried has experience on both sides, is leading WP3 already, and has capacity to take over this function, he was assigned. TUW shifts some of the coordination budget to PRIA to fulfil this function.

Emails have been sent to the PO about these changes and have been acknowledged.

To be as efficient as possible we initiated regular **telephone conference calls** (TelCos) and email exchanges based on emailing lists. The purpose was to use the resources as efficiently as possible. All meetings are reported shortly in the following. See below a summary of the TelCos.

We also list the **project meetings** in detail below (Task 7.2).

Project management installed a procedure to ensure the quality of the work and the **deliverables**: other than the lead partner of a deliverable is checking the quality of deliverables before submission.

So far the following deliverables have been submitted (screen shot from the EU ECAS system):

Deliverables

For each Deliverable, a single file (max 52MB) can be uploaded

WP No	Del Rel.	Del N	Title	Lead Benefic	Nature	Dissemination	Est. Del. Date (ar	Receipt Date
WP1	D1.1	D1	Best Practice and Requirements	TU WIEN	Report	Public	31 Jan 2016	31 Jan 2016
WP1	D1.2	D2	ER4STEM Framework First Structure and Roadmap 2nd `	TU WIEN	Report	Public	30 Sep 2016	30 Sep 2016
WP1	D1.3	D3	ER4STEM Framework Adaptation and Roadmap 3rd Yea	TU WIEN	Report	Public	30 Sep 2017	
WP1	D1.4	D4	ER4STEM: An Operational and Conceptual Framework fc	TU WIEN	Report	Public	30 Sep 2018	
WP2	D2.1	D5	Workshop Report 1st Year	ESI CEE	Report	Public	31 Jul 2016	31 Aug 2016
WP2	D2.2	D6	Workshop Report 2nd Year	ESI CEE	Report	Public	31 Jul 2017	
WP2	D2.3	D7	Workshop Report 3rd Year	ESI CEE	Report	Public	31 Jul 2018	
WP2	D2.4	D8	ER4STEM curriculum	ESI CEE	Report	Public	31 Aug 2018	
WP3	D3.1	D9	ECER 2016 Proceedings and Report	PRIA	Report	Public	31 Aug 2016	31 Aug 2016
WP3	D3.2	D10	ECER 2017 Proceedings and Report	ESI CEE	Report	Public	31 Aug 2017	
WP3	D3.3	D11	ECER 2018 Proceedings and Report	ACROSS	Report	Public	31 Aug 2018	
WP3	D3.4	D12	ER4STEM conference plan	PRIA	Report	Public	31 Aug 2018	
WP4	D4.1	D13	irst Version of the Activity Plans	UoA	Report	Public	31 Aug 2016	31 Aug 2016
WP4	D4.2	D14	Operational Release of Activity Plans	UoA	Report	Public	31 Aug 2017	
WP4	D4.3	D30	Final Release of Activity Plans	UoA	Report	Public	31 Aug 2018	
WP5	D5.1	D15	Mobile Robot Controller Prototype	PRIA	Demonstrator	Public	31 Aug 2016	31 Aug 2016
WP5	D5.2	D16	Prototype of Slurtles for Kids	CARDI...	Demonstrator	Public	31 Aug 2016	30 Aug 2016
WP5	D5.3	D17	Report of the Repository Workshop	ACROSS	Report	Public	31 Aug 2017	
WP5	D5.4	D18	ER4STEM Repository	ACROSS	Demonstrator	Public	31 Aug 2018	
WP6	D6.1	D19	Pre-kit for Evaluation	CARDI...	Report	Public	31 Jan 2016	26 Feb 2016
WP6	D6.2	D20	Evaluation Tool Kit	CARDI...	Report	Public	31 Aug 2016	30 Sep 2016
WP6	D6.3	D21	Evaluation and Analysis of 1st Project Year	CARDI...	Report	Public	31 Aug 2016	30 Sep 2016
WP6	D6.4	D22	Evaluation and Analysis of 2nd Project Year	CARDI...	Report	Public	31 Jul 2017	
WP6	D6.5	D23	Evaluation and Analysis of 3rd Project Year	CARDI...	Report	Public	31 Aug 2018	
WP7	D7.1	D24	Report 1 for project months 1-15	TU WIEN	Report	Public	31 Jan 2017	
WP7	D7.2	D25	Report 2 for project months 16-36	TU WIEN	Report	Public	30 Sep 2018	
WP8	D8.1	D26	Data Management Plan	TU WIEN	Report	Public	31 Mar 2016	31 Mar 2016
WP8	D8.2	D27	Report on Scientific Papers	UoA	Report	Public	31 Aug 2018	
WP8	D8.3	D28	Report on Non-Scientific Dissemination	PRIA	Report	Public	31 Aug 2018	
WP8	D8.4	D29	Report on Established Links with Scientix	ACROSS	Report	Public	31 Aug 2018	
WP9	D9.1	D31	POPD - Requirement No. 4	TU WIEN	Ethics	Confidential,	31 Dec 2015	18 Apr 2016

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A few Deliverables have been delivered with a short delay (marked with a yellow triangle above). The reasons are summarised in the table below. We had informed our PO prior to the original deadline that we expect a short delay and received confirmation. The list above also indicates that other deliverables and the most recent deliverables are on time. So overall, the project is on track.

Deliverable reference	Deadline in Grant Agreement	New deadline proposed	Justification
D 2.1	M10	M11	Some partners need to use school holidays for workshops in July 2016. If we move D 2.1 one month further, from M10 to M11, we can include these workshops in the deliverable.
D 6.1	M4	M5	Delayed due to illness.
D 6.2	M11	M12	D 6.2 is directly connected to D 1.2, so it makes sense to finish both documents together.
D 6.3	M11	M12	Following the move of D 6.2, D 6.3 Evaluation Report needs to be moved a month to include workshop results from July, from M11 to M12
D 6.4	M22	M23	In order to include information from workshops done during the second year and given the situation that D2.2 is due M22 (July 2017), D6.4 needs to be moved from M22 to M23 (August 2017)
D 9.1	M3	M7	First upload on time for all partners involved in user studies. On request for reasons of completeness we added the ethics form also for the other partner. For this the PO had to reopen and the final submission was delayed.

On regular basis project management monitors the **status of the project** and the fulfilment of the consortium's contractual obligations (Task 7.3). This procedure also helps to keep track of potential risks that may occur any time during the project (Task 7.4). This was done through quarterly reports from all WP leaders. They provided the follow information: general status, quarter objectives, progress, activities, deviations, independencies, deliverables status, and outlook. This information has let us to improve effort allocation to achieve project's objectives. For example, in two consecutive quarterly reports (i.e. January-March and April-June), WP 2 was on yellow because it was not clear if we could achieve the number of participants promised. As a consequence, the status of each partner on planning workshops was monitored continuously. Once the partners PRIA, ESCIEE and UoA have planned and implemented enough workshops to cover their number of participants, it was agreed that they could execute the workshops to achieve the planned number of participants in the first year. This decision allowed us to correctly achieve the number of participants promised. In the following we present the quarterly reports for the period January to September for this example related to WP 2.

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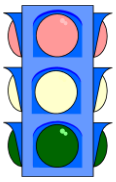
<table>
<tr><td colspan="2">ER4STEM WP 2
PROGRESS REPORT
as of 30.04.2016</td></tr>
<tr><td>
WP crisis
WP in difficulties ✓
WP according to plan</td><td>1) Overall Status:
Overall plan and process for the Educational Robotics Workshops (ERW) agreed.
Shared simplified tool for continuous monitoring and control of the ERW progress established and maintained
34 ERW with 839 students were in different stage of execution
There are note detailed plans for ERW delivery by AcrossLimits
D2.1 structure developed and shared with the partners.</td></tr>
<tr><td>WP objectives:
The objectives for the reported period were to:
ERW plan structure agreed in M4
Initial ERW plans established and maintained in M5-M6
First workshops are completed in M5-M6 and results, lessons learnt are communicated among the relevant stakeholders
D2.1 Workshops Report structure in M5</td><td rowspan="2">Activities:
Meetings and planning activities with schools and other relevant stakeholders in order to ensure access to the target groups.
Developing high level plan and tool for continuous monitoring and control of the progress
Planning the ERW in details.
ERW delivery and evaluation.
ERW activities alignment with the requirements for other WPs
Development of structure of D2.1</td></tr>
<tr><td>3) Status WP progress:
Workshops plan structure agreed as planned. Tool for continuous monitoring and control of the progress operational
Initial workshops plans established and maintained as follows:
ESICEE, PRIA and UA planned ERW in details and started delivery.
TUWien planned ERW schedule and curricula but commitment form the schools was not confirmed in the reported period
AcrossLimit did not communicate concrete plans for the ERW in the reported period.
CU postponed Y1 workshops for Y2 and Y3
At the end of the reported period totally 34 workshops with 839 students were in different stage of execution: 18 ERW with 418 students planned; 4 ERW with 76 students in progress; 11 workshops with 345 students completed and 1 workshop finished without collecting data. results, lessons learnt discussed during the bi-weekly meetings
D2.1 Workshops Report structure developed and shared with the partners in M6</td></tr>
<tr><td>4) Status WP schedule:
There is no significant deviation from the overall project plan.
The ERW detailed planning is behind the operational schedule.</td><td>Activities:
AcrossLimits plans in details the workshops
TUWien obtains commitment from the schools to deliver the workshops</td></tr>
<tr><td>5) Status WP interdependencies:
There are no specific issues related to the interdependence to other WPs</td><td>Activities:
N/A</td></tr>
</table>

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6) Status of Deliverables: ● No deliverables were planned and produced in the reported time period ● D2.1 structure developed and shared with the partners.
7) Outlook: ● Initial ERW plans established and maintained in M7-M9 ● ERW completed in M5-M6 reported and validated in M7-M9 ● ERW delivery according the plan in M7-M9 ● D2.1 Workshops report structure and plan for tis development agreed by M8 ● D2.1 Workshops report in progress in M9

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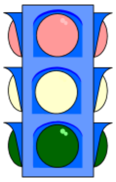
<table>
<tr><td>ER4STEM</td><td>WP 2
PROGRESS REPORT
as of 30.06.2016</td></tr>
<tr><td>
WP crisis
WP in difficulties ✓
WP according to plan</td><td>2) Overall Status:
3) Initial ERW plans established and maintained in M7-M9
4) ERW delivery according the plan in M7-M9 and all ER workshops completed
5) D2.1 Workshops report structure and plan for this development agreed
6) D2.1 Workshops report was in preparation in M(</td></tr>
<tr><td>• WP objectives:
The objectives for the reported period were to:
• Initial ERW plans established and maintained in M7-M9
• ERW completed in M5-M6 reported and validated in M7-M9
• ERW delivery according the plan in M7-M9
• D2.1 Workshops report structure and plan for this development agreed by M8
• D2.1 Workshops report in progress in M9

3) Status WP progress:
• Tool for continuous monitoring and control of the progress operational
• Workshops plans established and maintained. Activity plans template updated and content migrated to the new activity plan
• At the end of the reported period totally 51 workshops with 1162 students were completed from which 1 workshop was reported and 1 workshop was validated. Lessons learnt discussed during the bi-weekly meetings
• D2.1 Workshops Report structure developed and shared with the partners in M6</td><td>Activities:
• ERW delivery and evaluation.
• ERW activities alignment with the requirements for other WPs
• Started development of D2.1</td></tr>
<tr><td>4) Status WP schedule:
• There is no significant deviation from the overall project plan.
• The ERW reporting of evaluation results is behind the operational schedule.</td><td>Activities:
• Priority given to submission of the ERW evaluation results to WP6 leader</td></tr>
<tr><td>5) Status WP interdependencies:
• The WP6 depends on the submission of the ERW results to WP6 leader</td><td>Activities:
Priority given to submission of the ERW evaluation results to WP6 leader</td></tr>
<tr><td colspan="2">6) Status of Deliverables:
• No deliverables were planned and produced in the reported time period
• D2.1 development in progress.</td></tr>
<tr><td colspan="2">7) Outlook:</td></tr>
</table>

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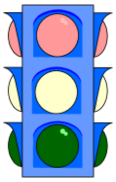
• ERW evaluation results submitted to WP6 leader in M10 • D2.1 drafted in M10 and submitted in M11 • Started planning of new ERW cycle in M12

<table>
<tr><td colspan="2">ER4STEM
WP 2
PROGRESS REPORT
as of 30.09.2016</td></tr>
<tr><td>
WP crisis
WP in difficulties
WP according to plan</td><td>Overall Status:
7) ERW cycle for the first year successfully completed
8) D2.1 submitted according to the plan
9) Started planning of new ERW cycle for the second year of project execution</td></tr>
<tr><td>• WP objectives:
The objectives for the reported period were to:
• ERW evaluation results submitted to WP6 leader in M10
• D2.1 drafted in M10 and submitted in M11
• Started planning of new ERW cycle in M12</td><td rowspan="2">Activities:
• ERW delivery and evaluation.
• Development of D2.!
• Planning of ERW for the second year of project execution</td></tr>
<tr><td>3) Status WP progress:
• Tool for continuous monitoring and control of the WP2 progress operational
• Workshops plans established and maintained. Activity plans template updated and content migrated to the new activity plan</td></tr>
<tr><td>4) Status WP schedule:
• There are no significant deviations from the overall project plan.</td><td>Activities:
n/a</td></tr>
<tr><td>5) Status WP interdependencies:
• The evaluation results submitted to WP6 o</td><td>Activities:</td></tr>
<tr><td colspan="2">6) Status of Deliverables:
• D2.1 developed peer reviewed and submitted on time.</td></tr>
<tr><td colspan="2">7) Outlook:
• Tool and process for continuous planning monitoring and control of the WP2 progress in Y2 operational
• ERW delivery in progress – estimated 500 students to participate in workshops in Q5
• Update the documented Workshop Process that is going to be used in the second year with the agreed changes in the coordination meeting in Malta.
• Propose usable and reliable list/structure/taxonomy of skills that will could be used as entry points for users within the framework
• Automated spreadsheets for reporting and evaluation of workshops based on the content and structured defined in the updated evaluation kit. The forms should be easy to be filled in in order to reduce the manual work and increase the effectiveness of the evaluation tasks and they should include data validation in order to</td></tr>
</table>

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minimize the risk of technical errors.

- A checklist with comments that will facilitate configuration management of changes in the activity plans towards their continuous improvement based on the updated framework and the corresponding recommendations from the first year of workshop planning, execution and evaluation.

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List of Project Meetings (Task 7.2)

Kick-off Meeting

Date: 23-25th October 2015

Place: partner TUW, Technical University Vienna, Vienna, Austria

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Markus Vincze (partly)	TU Wien
Julian Angel	TU Wien
Marjo Rauhala (absent due sickness)	TU Wien
Sibylle Kuster (partly)	TU Wien
Ivaylo Gueorguiev	ESICEE
Pavel Varbanov	ESICEE
Wilfried Lepuschitz (5 & 6 Oct.)	PRIA
Gottfried Koppensteiner (7 Oct.)	PRIA
Lisa Vittori (6 & 7 Oct.)	PRIA
Chronis Kynigos	UoA
Sofia Nikitopoulou	UoA
Marianthi Grizioti	UoA
Angele Giuliano	AL
Joanna Pullicino	AL
Annalise Duca	AL
Carina Girvan	CU
Pavel Vrba (5 & 6 Oct.)	CE

Topics:

No	Agenda Item	Responsible
1.	World Cafe - Meeting Project Partners	Lara Lammer
2.	Presentation of Project Partners	All
3.	Presentation of European Commission (Via video conference)	Niamh Delaney
4.	ER4STEM vision and goals	Lara Lammer
5.	Workshops, Evaluation and Ethics - Aligning project goals to work packages and partners	Lara Lammer
6.	Work packages and time line	WP leaders
7.	Organizational matters	Sibylle Kuster
8.	Final discussions	WP leaders

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Project meeting

Main Topic: Best Practice and requirements

Date: 11-13th January 2016

Place: Certicon, Prague, Czech Republic

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Ivaylo Gueorguiev	ESICEE
Pavel Varbanov	ESICEE
Wilfried Lepuschitz	PRIA
Chronis Kynigos	UoA
Sofia Nikitopoulou	UoA
Joanna Pullicino (1st and 2nd day)	AL
Annalise Duca (2nd and 3rd day)	AL
Carina Girvan	CU
Miroslav Stola (3rd day)	Certicon
Pavel Vrba	Certicon

Topics:

No	Agenda Item	Responsible
1.	ER4STEM Vision and Goals revisited	Lara Lammer
2.	WP1 Stakeholder and Requirements	Julian Angel
3.	WP1 Best Practice Research Outcome	Julian Angel
4.	WP1 ER4STEM Framework	Julian Angel
5.	WP6 Evaluation Decisions and TO DOs	Carina Girvan
6.	WP2 ER Workshops Decisions and TO Dos	Ivaylo Gueorguiev
7.	WP3 Conferences Decisions and TO DOs	Wilfried Lepuschitz
8.	WP4 Activity Plans Decisions and TO DOs	Chronis Kynigos/ Sofia Nikitopoulou
9.	WP5 Educational Technologies Decisions and TO DOs	Annalise Duca
10.	WP8 Dissemination – Data Management Plan	Lara Lammer
11.	WP8 Scientific Dissemination Decisions and TO DOs	Chronis Kynigos
12.	WP8 Non-Scientific Dissemination Decisions and TO DOs	Wilfried Lepuschitz
13.	WP7 Project Management Decisions and TO DOs	Lara Lammer
14.	MS2 Milestone Best Practices and Requirements	Lara Lammer
15.	Group Sessions	All

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Half year project meeting

Date: 13th April 2016

Place: PRIA, Vienna, Austria

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Ivaylo Gueorguiev	ESICEE
Pavel Varbanov	ESICEE
Christina Todorova	ESICEE
George Sharkov	ESICEE
Wilfried Lepuschitz	PRIA
Lisa Vittori (Partly)	PRIA
Sofia Nikitopoulou	UoA
Joanna Pullicino	AL
Angele Giuliano	AL
Carina Girvan	CU

Topics:

No	Agenda Item	Responsible
1.	Welcome	Lara Lammer & Wilfried Lepuchitz
2.	WP1 Status	Julian Angel
3.	WP1 Framework Session	Julian Angel
4.	WP2 Status	Ivaylo Gueorguiev
5.	WP2 Workshop Curricula Session	Ivaylo Gueorguiev
6.	WP4 Status	Sofia Nikitopoulou
7.	WP4 Pedagogical Design and Innovation Session	Sofia Nikitopoulou
8.	WP5 Status	Angele Giuliano
9.	WP5 Technology	Wilfried Lepuschitz, Angele Giuliano and Carina Girvan
10.	WP6 Status	Carina Girvan
11.	WP6 Evaluation Session	Carina Girvan
12.	WP3 Conference Status	Wilfried Lepuschitz
13.	Data Management Plan	Lara Lammer
14.	MS3 Status	Lara Lammer
15.	Planning of next tasks and mini-meetings	Julian Angel

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Project Meeting

Date: 26-29th September 2016

Place: Partner ACROSS, Malta

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Markus Vincze	TU Wien
Ivaylo Gueorguiev	ESICEE
Pavel Varbanov	ESICEE
Christina Todorova	ESICEE
Wilfried Lepuschitz	PRIA
Lisa Vittori	PRIA
Nikoleta Yiannoutsou	UoA
Marianthi Grizioti	UoA
Joanna Pullicino	AL
Angele Giuliano	AL
Annalise Duca	AL
Carina Girvan	CU
Martin Klima	Certicon
Mirov Stola	Certicon

Topics:

No	Agenda Item	Responsible
1.	Coordination board introduction	Markus Vincze, Julian Angel, Lara Lammer, and Wilfried Lepuschitz
2.	Review Preparation Questions and Answers	Markus Vincze
3.	WP presentations of work done and next steps of every partners	WP Leaders
4.	Repository and Framework	Annalise Duca and Julian Angel
5.	Evaluation Process and Results	Carina Girvan and Nikoleta Yiannoutsou
6.	Key Findings and Recommendations	Carina Girvan
7.	New Evaluation Kit	Carina Girvan
8.	Planning for Year 2	Carina Girvan and Nikoleta Yiannoutsou
9.	Implications for Framework and Repository	Julian Angel, Carina Girvan and Nikoleta Yiannoutsou
10.	Wrap up of last two days	Lara Lammer
11.	Presentation Patrick Camilleri and Suzanne Gatt	
12.	Framework Discussion	Julian Angel
13.	Time Line	Julian Angel

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TelCo's - Conference Calls

Conference Call no. 1

Date: 27th October 2015, Time: 10:30-12:00

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Ivaylo Gueorguiev	ESI CEE
Pavel Varbanov	ESI CEE
Wilfried Lepuschitz	PRIA
Sofia Nikotopoulou	UoA
Marianthi Grizioti	UoA
Joanna Pullicino	AL
Annalise Duca	AL
Carina Girvan	CU
Pavel Vrba	CE

Topics:

Agenda Item	Responsible/ Date
Ethical and Data protection Approvals	Lara
Review of activities	Lara
Activity Plan	Sofia
Structure and guidelines of research to be conducted for D1.1	Julian

Conference Call no. 2

Date: 9th November 2015, Time: 10:30-12:00

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Ivaylo Gueorguiev	ESI CEE
Pavel Varbanov	ESI CEE
Wilfried Lepuschitz	PRIA
Sofia Nikotopoulou	UoA
Marianthi Grizioti	UoA
Joanna Pullicino	AL

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Carina Girvan	CU

Topics:

Agenda Item	Responsible/ Date
Confirmation of your data protection officer/Ethics approval process	Lara
Review of activities	Lara
Research for D1.1: Forms, best practices criteria, …	Julian
Access Strategies, Workshop formats: Evaluation	Lara

Conference Call no. 3

Date: 24th November 2015, Time: 10:30-12:00

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Sibylle Kuster	TU Wien
Ivaylo Gueorguiev	ESI CEE
Pavel Varbanov	ESI CEE
Wilfried Lepuschitz	PRIA
Marianthi Grizioti	UoA
Joanna Pullicino	AL
Carina Girvan	CU

Topics:

Agenda Item	Responsible/ Date
Review of activities	Lara
Access strategy for workshops	All
Any plans already on scientific dissemination beside Julian's abstract to CDIO?	Julian
WP2: Your workshop plans for this school year	Ivo
Video for website and to explain the research to parents	Lara + All
Repository research by Annalise	All
WP Progress report to be send before 11.1.2016	Lara
Deliverables 1.1 and 6.1	Julian, Carina, and Lara
Deliverable Length	Lara
Prague Meeting	Lara + All

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Conference Call no. 4

Date: 11th December 2015, Time: 10:30-12:00

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Ivaylo Gueorguiev	ESI CEE
Pavel Varbanov	ESI CEE
Wilfried Lepuschitz	PRIA
Marianthi Grizioti	UoA
Sofia Nikitopoulou	UoA
Annalise Duca	AL
Carina Girvan	CU
Pavel Vrba	Certicon

Topics:

Agenda Item	Responsible/ Date
Review of activities	Lara
WP2 Feedback and TO DOs until Prague	Ivo
WP3 Feedback and TO DOs until Prague	Wilfried
WP4 Feedback and TO DOs until Prague	Sofia
WP5 Feedback and TO DOs until Prague	Annalise
WP6 Feedback and TO DOs until Prague	Carina
WP1 Feedback and TO DOs until Prague	Julian
Prague Meeting	Lara + All

Conference Call no. 5

Date: 19th January 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Ivaylo Gueorguiev	ESI CEE
Pavel Varbanov	ESI CEE
Wilfried Lepuschitz	PRIA

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Marianthi Grizioti	UoA
Sofia Nikitopoulou	UoA
Annalise Duca	AcrossLimits
Carina Girvan	CU
Pavel Vrba	Certicon
Joanna Pullicino	AcrossLimits

Topics:

Agenda Item	Responsible/ Date
Review of activities	Lara
WP8 Website	Annalise
WP1 D1.1	Julian
WP8 Scientix	Lara
WP8 Scientific Disseminations	Lara (Chronis)
WP7 Malta Meeting	Lara
WP1 Feedback and TO DOs until Prague	Julian

Conference Call no. 5

Date: 16th February 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Ivaylo Gueorguiev (first ½ hour)	ESI CEE
Pavel Varbanov (first ½ hour)	ESI CEE
Wilfried Lepuschitz	PRIA
Sofia Nikitopoulou	UoA
Joanna Pullicino	AcrossLimits
Carina Girvan	CU

Topics:

Agenda Item	Responsible/ Date
Review of activities	Lara
WP8 Paper submissions to RIE 2016	All
WP1 D1.1	Julian
WP6 D6.1	Carina
WP2 Workshops	Ivo

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WP3 ECER	Wilfried
WP4 Activity Plans	Sofia
WP5 Repository Development	Annalise

Conference Call no. 6

Date: 1st March 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Julian Angel	TU Wien
Ivaylo Gueorguiev (First Hour)	ESI CEE
Pavel Varbanov (First Hour)	ESI CEE
Wilfried Lepuschitz	PRIA
Marianthi Grizioti	UoA
Sofia Nikitopoulou	UoA
Annalise Duca	AcrossLimits
Carina Girvan	CU
Mirek	Certicon
Joanna Pullicino	AcrossLimits

Topics:

Agenda Item	Responsible/ Date
Ivo explained his insights about the evaluation kit used during the workshops	Ivo, Carina, Annalise
Wilfried explained briefly the work done during the scientix event	Wilfried
Review Activities	Julian

Conference Call no. 7

Date: 15th March 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Ivaylo Gueorguiev (First Hour)	ESI CEE
Pavel Varbanov (First Hour)	ESI CEE
Wilfried Lepuschitz	PRIA
Marianthi Grizioti	UoA
Sofia Nikitopoulou (First Hour)	UoA
Carina Girvan	CU

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Topics:

Agenda Item	Responsible/ Date
A report WP1, including work done with WP4 and WP6	Julian
A report WP2, including work done with WP6	Ivo
A report WP3, including work done with WP6	Wilfried
A report WP5	Annalise
Review of Activities	Julian

Conference Call no. 8

Date: 29th March 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Ivaylo Gueorguiev	ESI CEE
Pavel Varbanov	ESI CEE
Wilfried Lepuschitz	PRIA
Sofia Nikitopoulou	UoA
Carina Girvan	CU
Annalise Duca	AcrossLimits
Joanna Pullicino	AcrossLimits

Topics:

Agenda Item	Responsible/ Date
A report WP2	Sofia
A report WP3	Wilfried
A report WP4	Sofia
A Report WP5	Annalise
A Report WP6	Carina
Data management	Lara
Review of Activities	Julian

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Conference Call no. 9

Date: 26th April 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Ivaylo Gueorguiev	ESI CEE
Pavel Varbanov	ESI CEE
Wilfried Lepuschitz	PRIA
Nikoleta Yiannoustsou	UoA
Carina Girvan	CU
Annalise Duca	AcrossLimits
Joanna Pullicino	AcrossLimits

Topics:

Agenda Item	Responsible/ Date
Glossary	Nikoleta
ECER Results	Wilfried
Finishing Minutes	Lara
Updating TO DOs	Lara
Review of Activities	Julian

Conference Call no. 10

Date: 10th May 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Christina Todorova	ESI CEE
Pavel Varbanov	ESI CEE
Sofia Nikitopoulou	UoA
Nikoleta Yiannoustsou	UoA
Carina Girvan	CU

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Topics:

Agenda Item	Responsible/ Date
First Framework Draft	Julian
Non-Scientific Dissemination	Lara
Industry requirements	Carina
Review of Activities	Julian

Conference Call no. 11

Date: 24th May 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Lara Lammer	TU Wien
Julian Angel	TU Wien
Annalise Duca	AcrossLimits
Joanna Pullicino	AcrossLimits
Nikoleta Yiannoustsou	UoA
Carina Girvan	CU
Wilfried Lepuschitz	PRIA
Markus Vincze	TU Wien
Ivaylo Gueorguiev	ESI CEE

Topics:

Agenda Item	Responsible/ Date
Organization	Lara
Evaluation	Carina
New Activity Plan	Nikoleta
Review of activities	Julian

Conference Call no. 12

Date: 7th June 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Julian Angel	TU Wien
Nikoleta Yiannoustsou	UoA
Carina Girvan	CU
Wilfried Lepuschitz	PRIA
Pavel	ESI CEE
Miroslav Stola	Certicon

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Topics:

Agenda Item	Responsible/ Date
Scientix comments summary	Nikoleta
Industrial Skills	Miro
Data Transfer Solution	Carina
Code Week	Carina
Meeting with Richard Balog	Julian
Review of activities	Julian

Conference Call no. 13

Date: 21th June 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Markus Vincze	TU Wien
Julian Angel	TU Wien
Marianti Grizioti	UoA
Wilfried Lepuschitz	PRIA
Ivo Gueorguiev	ESI CEE
Christina Todorova	ESI CEE
Pavel Varbanov	ESI CEE
Miroslav Stola	Certicon

Topics:

Agenda Item	Responsible/ Date
Conference and competition	Wilfried
Industrial Skills	Miro
Summary meeting with Richard Bahlog	Julian
Review of activities	Julian

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Conference Call no. 14

Date: 5th July 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Annalise Duca	AL
Joanna Pullicino	AL
Nikoleta Yiannoutsou	UoA
Marianthi Grizioti	UoA
Wilfried Lepuschitz	PRIA
Tina	ESI CEE
Ivo Gueorguiev	ESI CEE

Topics:

Agenda Item	Responsible/ Date
Scientix Comments Evaluation	Nikoleta
Workshops	Ivo
Hedgehog Prototype	Wilfried
Review of activities	Wilfried

Conference Call no. 15

Date: 19th July 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Markus Vincze	TU Wien
Julian Angel	TU Wien
Nikoleta Yiannoutsou	UoA
Lisa Vittori	PRIA
Wilfried Lepuschitz	PRIA
Ivo Gueorguiev	ESI CEE
Pavel Varbanov	ESI CEE
Annalise Duca	AcrossLimits
Joanna Pullicino	AcrossLimits
Carina Girvan	CU
Miroslav Stola	Certicon

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Topics:

Agenda Item	Responsible/ Date
Evaluation	Carina
Skills Tree	Julian
Review of activities	Julian

Conference Call no. 16

Date: 2nd August 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Julian Angel	TU Wien
Marianthi Grizioti	UoA
Wilfried Lepuschitz	PRIA
Ivo Gueorguiev	ESI CEE
Pavel Varbanov	ESI CEE
Cristina Todorova	ESI CEE
Annalise Duca (First half hour)	AcrossLimits
Joanna Pullicino	AcrossLimits
Carina Girvan	CU
Miroslav Stola	Certicon

Topics:

Agenda Item	Responsible/ Date
Repository-Framework Connection	Julian + All
EU Code Week	Miro
WP Progress Report	WP leaders
Review of activities	Julian

Conference Call no. 17

Date: 16th August 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Nikoleta Yiannoutsou	UoA
Cristina Todorova	ESI CEE
Carina Girvan	CU
Miroslav Stola	Certicon

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Topics:

Agenda Item	Responsible/ Date
WP Report	All
Deliverable Update	WP leaders
Review of activities	Carina

Conference Call no. 18

Date: 30th August 2016, Time: 10:30-12:00

Participants:

Name	Affiliation
Julian Angel	TU Wien
Nikoleta Yiannoutsou	UoA
Marianthi Grizioti	UoA
Wilfried Lepuschitz	PRIA
Ivo Gueorguiev	ESI CEE
Pavel Varbanov	ESI CEE
Cristina Todorova	ESI CEE
Annalise Duca	AcrossLimits
Joanna Pullicino	AcrossLimits
Carina Girvan	CU

Topics:

Agenda Item	Responsible/ Date
Update of each deliverable that is due end this month	All
Conference last week that Carina attended	Carina
Review of activities	Carina

Conference Call no. 19

Date: 11th October 2016, Time: 10:30-11:30

Participants:

Name	Affiliation
Julian Angel	TU Wien
Nikoleta Yiannoutsou	UoA
Wilfried Lepuschitz	PRIA
Cristina Todorova	ESI CEE
Annalise Duca	AcrossLimits
Joanna Pullicino	AcrossLimits
Carina Girvan	CU

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Topics:

Agenda Item	Responsible/ Date
Summary of the meeting with Drokoo robotics	Julian
SciChallenge Horizont Project Analysis	Wilfried
Review of activities	Julian

Conference Call no. 20

Date: 25th October 2016, Time: 10:30-11:30

Participants:

Name	Affiliation
Julian Angel	TU Wien
Markus Vincze	TU Wien
Marianti Grizioti	UoA
Wilfried Lepuschitz	PRIA
Cristina Todorova	ESICEE
Ivo Gueorguiev	ESICEE
Pavel Varbanov	ESICEE
Miroslav Stola	Certicon
Carina Girvan	CU

Topics:

Agenda Item	Responsible/ Date
Review Dates	Julian
Webpage	Julian
Workshop Review	Ivo
RIE 2016 and 2017	Wilfried
Review of activities	Julian

Conference Call no. 21

Date: 8th November 2016, Time: 10:30-11:30

Participants:

Name	Affiliation
Julian Angel	TU Wien
Marianti Grizioti	UoA
Wilfried Lepuschitz	PRIA
Annalise Duca (First 20 minutes)	AcrossLimits
Joanna Pullicino	AcrossLimits
Carina Girvan	CU

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Topics:

Agenda Item	Responsible/ Date
Repository – List of features	Annalise
EU Code Week	Miro
Review of activities	Julian

Conference Call no. 22

Date: 22sd November 2016, Time: 10:30-11:30

Participants:

Name	Affiliation
Julian Angel	TU Wien
Cristina Todorova	ESICEE
Ivo Gueorguiev	ESICEE
Pavel Varbanov	ESICEE
Wilfried Lepuschitz	PRIA
Annalise Duca	AcrossLimits
Carina Girvan	CU

Topics:

Agenda Item	Responsible/ Date
Website menu	Julian
ECER 2017 status	Wilfried
Creativity and Collaboration Research Status	Julian
Skills	Ivo
Workshops Review	Ivo
Review of activities	Julian

Conference Call no. 23

Date: 22sd November 2016, Time: 10:30-11:30

Participants:

Name	Affiliation
Julian Angel	TU Wien
Ivo Gueorguiev	ESICEE
Cristina Todorova	ESICEE
Mariathi Grizioti	UoA
Miroslav Stola	Certicon
Carina Girvan	CU

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Wilfried Lepuschitz	PRIA
Annalise Duca	AcrossLimits

Topics:

Agenda Item	Responsible/ Date
Summary Greece Meeting	Julian
Wireframes	Annalise
Workshops Review	Ivo
Review of activities	Julian

Work Package 8: Dissemination

Dissemination started with creating the project web-page, see http://er4stem.acin.tuwien.ac.at.

The web-page serves as link to the wider public as well as scientists, Tasks 8.2 and 8.3. Further details on these tasks and the other task follow.

Task 8.1 Formulate Data Management Plan

Cardiff University worked closely with TuW to formulate the data management plan (D.8.1), to ensure it met EU and national data management regulations and ethical review for social science research. Cardiff University has been involved in scientific dissemination through the development of research articles and has led the presentation of the ER4STEM project at European Conference on Educational Research in 2016. Further abstracts have been submitted to the European Conference on Educational Research 2017 and British Educational Research Association 2017 Conference. There has been substantial dissemination towards society through networking with STEM organisations and schools.

Task 8.2 Scientific dissemination

Several publications have been submitted and accepted to diverse conferences. These are included in the website. The following are the publications accepted:

- Lara Lammer, Wilfried Lepuschitz, Chronis Kynigos, Angele Giuliano and Carina Girvan: “ER4STEM – Educational Robotics for Science, Technology, Engineering, and Mathematics” Accepted in 7th International Conference on Robotics in Education (RIE), 2016.
- Nikoleta Yiannoutsou, Sofia Nikitopoulou, Chronis Kynigos, Ivaylo Guerorguiev and Julian Angel-Fernandez: “Activity Plan Template: a Mediating Tool for Supporting Learning Design with Robotics” Accepted in 7th International Conference on Robotics in Education (RIE), 2016.
- Wilfried Lepuschitz, Gottfried Koppensteiner and Munir Merdan: “Offering Multiple Entry-Points into STEM for Young People” Accepted in 7th International Conference on Robotics in Education (RIE), 2016.
- Clemens Koza, Wilfried Lepuschitz, Martin Wolff, Daniel Frank, and Gottfried Koppensteiner: “Hedgehog Light – A Versatile, White Box Educational Robotics Controller” Accepted in Edurobotics conference, 2016.
- Lisa Vittori, Lisamarie Schuster, Nicole Weinert, Gottfried Koppensteiner, Wilfried Lepuschitz: “Overview and Interim Evaluation of the Project ROBIN: Robotics for Integration” Accepted in 8th IEEE International Conference on Engineering Education

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(ICEED), 2016.

Website: it was kept up to date with new items added continuously. Publications, deliverables and collaboration with schools are documented.

Task 8.3 Dissemination towards society

The project has been promoted with diverse events and activities. The following are the activities done:

- Workshop and robotics activities for participants of Researchers' night 2016 in Vienna.
- A one hour workshop during Maker Faire Wien 2016.
- ER4STEM stickers have been printed. They were distributed to participants through all events.
- Participation to the "10th Scientix Projects' Networking Event" and "10th Science project workshop in the future classroom Lab" in Brussels, 2016
- Mention of the project in diverse events, such as INDEED 2015, Digitale Kompetenzen 4.0, and training with teachers.
- Offer of activities during the EU Code week 2016 in Sofia and Prague
- Advert in Sunday Times of Malta on February 14th,the expression of interest to participate to the workshops
- Discussions with National STEM Learning Centre (UK), TechnoCamps (Wales), Education Workforce Council Wales
- Presentation on the **technical conference INDEED WE CAN of Microsoft**, 20-21 October 2015 in Sofia, Bulgaria about the ER4STEM project activities, with a focus on educational robotics workshops held in Bulgaria, as well as ECER.
- Presentation of ER4STEM and the ECER Conference in April 2016 in Sofia, Bulgaria at the Technical School "Electronic Systems", 10 December 2015.
- Presentation of ER4STE and demonstration of esI,tank educational robotics technology and workshops at "I the Engineer" event in Sofia, Bulgaria. 11 March 2016.
- Public lecture about ER4STEM project and Nao robot demonstrations at Varna Open University in Varna, Bulgaria. 12-14 March 2016.
- During the European Researchers' Night, ESI CEE participated with a presentation on why educational robotics is important as well as demonstrations with the humanoid robot NAO and the robot for educational purposes Finch. As the event was attended by school representatives, ER4STEM was promoted during the presentation as a great opportunity for schools to get more involved in educational robotics, followed by other presentations on curious applications of robotics. 30 September 2016
- An educational robotics workshop was held in a public school in Sofia, Bulgaria, as part of the European Code Week initiative. 19-26 October 2016
- Presentation of ER4STEM and the ECER Conference in April 2017 in Sofia, Bulgaria at the TUES Inspiration Talks. The event was followed up by a formation of a school team for the BotBall competition and so far, two team meetings on which ESI CEE team was present. 18 November 2016
- A series of four educational robotics workshops, conducted in two 4-hour sessions, which were held in a public school in Sofia, Bulgaria, as part of the European Robotics Week initiative. 21 November 2016 - 2 December 2016
- Veda Private Deutsche Schule visit at the Cybersecurity Lab of Sofia Tech Park, Sofia, Bulgaria aiming to engage children's interest in robotics by demonstrations and information about different applications of robotics in everyday life. 16 December 2016.
- Presentation of ER4STEM project and workshop for interested schools / teachers in Malta, 17th March 2016.

The project is also disseminated through various web pages and social media:

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- PRIA website: https://pria.at/education/#er4stem-projhttps://pria.at/education/ - er4stem-proj
- PRIA Facebook page: https://www.facebook.com/PRIArobotics/https://www.facebook.com/PRIArobotics/
- AcrossLimits website: http://acrosslimits.com/index.php/all-projects-list/8-projects/137-er4stemhttp://acrosslimits.com/index.php/all-projects-list/8-projects/137-er4stem
- AcrossLimits newsletter edition 39: http://us9.campaign-archive1.com/?u=64faef28956805c079b27da13&id=774925957fhttp://us9.campaign-archive1.com/?u=64faef28956805c079b27da13&id=774925957f
- AcrossLimits Facebook page: https://www.facebook.com/acrosslimitshttps://www.facebook.com/acrosslimits/
- TrainingMalta Facebook page: https://www.facebook.com/TrainingInMaltahttps://www.facebook.com/TrainingInMalta
- Educational Technology Lab web page: https://www.facebook.com/educationaltechnologylab/?fref=tshttps://www.facebook.com/educationaltechnologylab/?fref=ts
- Videos of workshops (7th High School of Trikala): https://www.youtube.com/watch?v=QICjSkR55YEhttps://www.youtube.com/watch?v=QICjSkR55YE
- ESI CEE robotics web page: http://esirobot.org/http://esirobot.org/
- ESI CEE Facebook page: https://www.facebook.com/esicenter.bg/https://www.facebook.com/esicenter.bg/

https://www.facebook.com/esicenter.bg/

https://www.facebook.com/esicenter.bg/

Task 8.4 Scientix

TU Wien and PRIA participated at the "10th Scientix Projects' Networking Event" and "10th Science project workshop in the future classroom Lab" in Brussels, 2016

In the reported period ESI CEE popularized the activities under ER4STEM project through 3 main channels - external organized events (conferences, workshops, workgroups etc.), web/ social/ traditional media, face-to-face meetings with partners and clients. More specifically ESI CEE delivered a presentation in the technical conference INDEED WE CAN of Microsoft and ESI CEE organized ER4STEM related demonstrations at "European Researchers' Night", "European Code Week" and EU Robot Week" and others . The organization conducted a number of presentations to students in schools and organized direct meetings with the management of nine Bulgarian schools to present the project.

ESI CEE regularly uploads and maintaisn information about the ER4STEM project on the web page http://esirobot.org/. The team of ESI CEE published on ESI CEE's Facebook profile information, pictures and videos about activities performed within ER4STEM project: https://www.facebook.com/esicenter.bg/. An ESI CEE team member is a co-author of an article that presented ER4STEM experience in 7th International Conference "Robotics in Education", Vienna, Austria: "Activity Plan Template: a mediating tool for supporting learning design with robotics.

AcrossLimits prepared the questions to be asked during the workshop and later processed the inputs.

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2.3 IMPACT

Short Temp

- Activity template and activity blocks were created to help introducing creativity element in to activities with robots.
- Until December of 2016, 1839 participants have participated in the workshops offered by ER4STEM.
- The ECER conference has gathered more than 40 teams from more than 6 different countries.
- ER4STEM has cover over 450 female participants in the workshops.

Medium Temp

- It was done a study on industrial needs to detect skills that must be foster in ER4STEM workshops.
- The project was contacted by the start-up DROKOO and a school teacher from Italy. DROKOO contacted to know how they can produce better activities to promote their robotic kits. On the other hand, the Italian teacher contacted to know considerations in activities with robotics, because she and her colleagues are going to present a project for Erasmus+.
- ESICEE has been contacted to lead new projects on educational robotics in Bulgaria.

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3 UPDATE OF THE PLAN FOR EXPLOITATION AND DISSEMINATION OF RESULT

There is not a new update in the dissemination plan.

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4 UPDATE OF THE DATA MANAGEMENT PLAN

There is not any change in the data management plan.

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5 FOLLOW-UP OF RECOMMENDATIONS AND COMMENTS FROM PREVIOUS REVIEW(S)

Not applicable.

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6 DEVIATIONS FROM ANNEX 1 AND ANNEX 2

Explain the reasons for deviations from the DoA, the consequences and the proposed corrective actions.

TUW: give short summary of changes here

6.1 TASKS

From the diverse teleconferences, meetings and quarter reports, it has been established that there is not any critical task.

6.2 USE OF RESOURCES

Although not explicitly budgeted in the "resources to be committed" section of Annex I, TU Wien has spent 1.489,50 € for the organization of project meetings (Kick-off-meeting, MS3 meeting) and workshops. These costs have been declared in the cost category "other goods and services".

Lara Lammer, who until September of 2016 worked as Project Coordinator, had the role of making sure the partners understand each other. In ER4STEM the work packages are intertwined together in a way that every partner has to work with every partner regularly. We put this up to avoid a common EU project mistake where partners work on their WPs for months and then try to fit them together. Given 5 points by 5 in the proposal, this project management approach needs more effort by the coordinator. The partners are from different EU countries, however with experience in European projects, so this is one side. The more difficult part is the difference in their approaches and thinking, half coming from research and half from industry. There is an important effort from the coordinator necessary to mediate between these two "different languages and thinking styles". This is most visible in WP1, where the core framework of ER4STEM is developed. Lara has done that in her coordinator role and part of WP1 work. Now, we see Wilfried as the best person to continue this together with Julian developing the framework in WP1, coordinating tasks like bi-weekly Telco's and bilateral meetings (partly on Skype, partly on place). This is also so that both have enough resources to continue working as leaders of their respective work packages. Consequently, partners TUW and PRIA agreed on shifting according budget from TUW to partner PRIA for financing Wilfried Lepuschitz' employment for 7 hours/week from December 2016 until the end of the project in the role of integration support.

Data explaining the calculation:

- Salary: Wilfried Lepuschitz is currently employed 27 h/week with a monthly gross salary of € 2798,50 (meaning € 3990,00 in case of a full-time employment of 38,5h/week)
- Monthly costs of 7 h/week (including projected salary increase for 2017 and 2018): € 1150,00
- Duration: 22 months until the end of the project
- Personnel costs for 22 months: € 25.300,00
- Total sum including 25% overhead: € 31.625,00
- PM: 7h/month over 22 months correspond to 4 PM

In April 2016, ESI CEE informed the project coordinator that ESI CEE would need more person-months compared to the initially estimated efforts in the project proposal and within the project contract, **while keeping the budget for direct personnel cost within the already planned amount**. This change became necessary during the implementation of the project, based on the actual data until March 2016. It became clear that ESI CEE would need more efforts for data collection, coordination, execution and,

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especially, for the collection, evaluation and data analyses of the educational robotics workshops and organization of educational conference related to all work packages. Furthermore, when ESI CEE did the initial plans, they used 2013 as a base for estimation of the hourly rates and it estimated that mostly senior personnel will take part in the project. In reality, those activities ended up being performed mainly by junior members of the team instead of the senior project personnel that was in charge of scientific and managerial work. In this case ESICEE spent more person-months on a lower rate instead of less person-months for senior experts.

Through the ER4STEM Project Coordinator, ESI CEE acquainted REA with the situation. During the course of an e-mail correspondence, the Coordinator supported ESI CEE's request. **On May 23, ESI CEE received confirmation from the Coordinator that REA representatives stated that an amendment would not be required, given that:(i) there is no impact on the estimated personnel costs as a result of the change and (ii) that the project targets will still be achieved.**

In continuation of that, as the average rate per month of ESI CEE personnel was lower than the initially planned, ESI CEE personnel worked more person-months than planned within the contracted budget.

As a result, ESI CEE was able to ensure achieving and even exceeding the project objectives for the period related to the number of workshops and students to participate in the educational robotics workshops and the quality of the design, execution and evaluation process of those workshops.

Until December 31, 2016 ESI CEE planned 29 workshops in total with 806 students from which they so far executed 26 workshops with 752 students and provided evaluation data for 13 workshops with 372 students. 13 workshops with 353 students are in process of evaluation and another 3 workshops are planned and will be executed within the period between February 2017 and March 2017. The students covered by ESICEE by December 31, 2016 were 725 that exceeded 600 students, which was a target for ESICEE to be achieved by July 2017.

On a work package (WP2) level, as of December 31, 2016 the total number of students, planned to participate in workshops within WP2, the work package led by ESI CEE, is estimated to reach 2597 students or 65% of the target minimum of 4000 students for the whole project period. We expect even more students to be covered with the workshops planned and organized until the end of July 2017.

As of December 31, 2016, the updated estimation from April 2016, for efforts measured in person-months, proved to be realistic and to correctly reflect the actual progress of the project implementation. As expected, the changed structure of the labor distribution and the corresponding increase in person months will not affect in any way the allocated budget for ESI CEE, which will remain the same as what was initially planned. A summary of the pe person moths per WP is provided in the table below:

Table 5 Number of person months per WP for ESI CEE

	ESICEE person-months per WP for ER4STEM									Personnel cost
	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	Total	EUR
Initially planned and contracted (M1-M36)	7	14	5	5	2	4		3	40	€ 140,940.00

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Replanning as of April 2016 (M1-M36)	11	25	8	8	3	8		5	68	€ 140,940.00
Actual (M1-M15)	5.1	10.8	3.0	3.5	1.0	3.1		2.0	28.5	€ 59,118.64

ESI CEE is continuously monitoring and controlling the costs and targets in order to ensure their compliance against the re-planned efforts levels communicated in April 2016.

Acrosslimits spent 1806 Euros to advertise, print canvas, magnets (giveaway), printing (flyers, etc.), covers for the tables, and translation of the evaluation and animation software.

CertiCon a.s. has just reached planned amount of PMs in WP1 (actually 3,51 PMs). This overspending was caused by higher effort needed. Mostly in connection with identification of a set of skills that could be taught in educational robotic activities, literature learning, survey and mapping of the best practices for industry etc. We expect the further activities in WP1 for the second part of the project period. The amount of personnel costs remain the same.

6.3 UNFORESEEN SUBCONTRACTING

No applicable

6.4 UNFORESEEN USE OF IN KIND CONTRIBUTION FROM THIRD PARTY AGAINST PAYMENT OR FREE OF CHARGES

No applicable

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7 GLOSSARY / ABBREVIATIONS

EC	European Commission
ER4STEM	Educational Robotics for STEM
REA	Research Executive Agency
STEM	Science, Technology, Engineering, and Mathematics
STEAM	Science, Technology, Engineering, Arts, and Mathematics
ERW	Educational Robotics Workshops
ETL	Pedagogical Experts
CU	Cardiff University
UoA	University of Athens

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