Ark of Inquiry: Inquiry Activities for Youth over Europe

Deliverable D6.2

Implementation Activities

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Beneficiary number	Beneficiary name	Beneficiary short name	Country
1	TARTU ÜLIKOOL	UT	Estonia
2	ELLINOGERMANIKI AGOGI SCHOLI PANAGEA SAVVA AE	EA	Greece
3	TURUN YLIOPISTO	UTU	Finland
4	UNIVERSITY OF CYPRUS	UCY	Cyprus
5	UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION (UNESCO) REGIONAL BUREAU FOR SCIENCE AND CULTURE IN EUROPE, VENICE	UNESCO	Italy
6	STICHTING HOGESCHOOL VAN ARNHEM ENNIJMEGEN HAN	HAN	The Netherlands
7	BUNDESMINISTERIUM FÜR BILDUNG	BMB	Austria
8	HUMBOLDT-UNIVERSITÄT ZU BERLIN	UBER	Germany
9	BAHCESEHIR EGITIM KURUMLARI ANONIM SIRKETI	BEKAS	Turkey
10	L'ECOLE DE L'ADN ASSOCIATION	EADN	France
11	UNIVERSITY COLLEGES LEUVEN-LIMBURG (previously KATHOLIEKE HOGESCHOOL LIMBURG VZW)	UCLL (previously KHLim)	Belgium
12	KUTATO TANAROK ORSZAGOS SZOVETSEGE	HRTA	Hungary
13	SIHTASUTUS TEADUSKESKUS AHHAA	AHHAA	Estonia

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Summary

The Ark of Inquiry project focuses on two closely related concepts: Responsible Research and Innovation (RRI) and Inquiry-Based Science Education (IBSE). Ark of Inquiry aims at raising youth awareness to RRI and, at the same time, building a scientifically literate and responsible society through IBSE practices. In other words, the project's ambition is to translate and demonstrate the abstract term "RRI" into everyday real life inquiry activities and put it into practice in formal and informal learning environments.

The implementation of the Ark of Inquiry project into school practice takes place in 2 phases with the aim to overlap with 3 consecutive school years. The first phase with a duration of six months, the piloting, started in September 2015 and lasted until February 2016. During this period, 85 in-service science teachers – 23 in primary education and 62 in secondary education – along with 80 pre-service teachers or science students participated from 7 countries. In the large-scale implementation phase, which started in March 2016 and will last 24 months (until February 2018), a large number of teachers and schools from all 12 countries will be included in the network of the project. In the first 12 months of the large-scale implementation, 685 in-service science teachers, 6412 pupils and 279 stakeholders (teachers' trainers, scientists, headmasters, school counsellors, ministry advisors, etc.) participated in the events implemented by the consortium.

This report documents the implementation activities of Ark of Inquiry undertaken at local, national and international level throughout the implementation period of the project (second phase) that took place from 1/3/2016 to 28/2/2017. This deliverable is best read in conjunction with Appendix 1 that accompanies it and lists all implementation activities per country. In this report we describe the general framework of implementation and afterward focus on the first year of the large-scale implementation phase. The main implementation activities are reported per country.

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1. General introduction

The Ark of Inquiry project centres around two closely related concepts: Responsible Research and Innovation (RRI) and Inquiry-Based Science Education (IBSE). Ark of Inquiry aims at raising youth awareness to RRI and, at the same time, building a scientifically literate and responsible society through IBSE practices.

According to the Science with and for Society action of the European Union's Seventh Framework Programme, Responsible Research and Innovation (RRI) is an approach to research and innovation which helps societal actors and innovators to work together during the research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of European society. In practice, this approach involves a) ensuring gender equality, b) taking the ethical implications of research into account, c) promoting science education, d) engaging society more broadly in the research process and e) increasing access to scientific results. (The EU's official articles and policy documents on Science with and for Society and Responsible Research and Innovation can be found at http://ec.europa.eu/programmes/horizon2020/en/h2020-section/science-and-society).

To achieve this aim, the Ark of Inquiry project sets the following clear objectives:

- Developing a pedagogical framework for identifying inquiry activities that promote pupils' awareness of RRI.
- Collecting RRI-related inquiry activities and environments.
- Building a large supportive community including research institutions, science centres and museums.
- Training primary and secondary school teachers.
- Developing the Ark of Inquiry platform integrated with the evaluation and award system.
- Making the inquiry activities available across Europe through the Ark of Inquiry platform.
- Disseminating the approach in schools, universities, science centres and museums and society in general.

In this context the Ark of Inquiry project not only aims to build a scientifically literate and responsible society through Inquiry-Based Science Education but also to raise young people's awareness of Responsible Research and Innovation by providing them with a collection of engaging inquiry activities in the STEM domain (science, technology, engineering and mathematics). In other words, the project's ambition is to translate and demonstrate the abstract term "RRI" into everyday real life inquiry activities and put it into practice in formal and informal learning environments.

Within this scope the main goal of the project is to implement the aforementioned initiative and approach on a large scale in Europe, namely at about 1000 schools involving at least 20000 pupils and 1000 teachers from 12 countries (Estonia, Greece, Finland, Cyprus, Italy, the Netherlands, Austria, Germany, France, Belgium, Turkey, Hungary), in two phases – the piloting and the large-scale implementation phase.

This report documents the implementation activities of Ark of Inquiry undertaken at local, national and international level throughout the implementation period of the project (second phase) that took place from 1/3/2016 to 28/2/2017. This deliverable is best read in conjunction with Appendix 1 that accompanies it and lists all implementation activities per country as reported by each partner.

2. Objectives

The aim of Work Package 6 of the Ark of Inquiry is to implement the pedagogical approach and the related inquiry classroom activities, developed in Work Package 1, on a large scale in schools in Europe. The project will be implemented in two phases, the piloting phase, which has duration of 6 months, and the large-scale implementation phase, lasting 24 months. The goal is to recruit at least 20000 pupils and 1000 teachers from 12 countries, or equivalently, a total of 1000 schools from the participating countries. This is a very challenging task that can only be realized with a well-planned, coordinated and collaborative effort along clear and systematic guidelines detailed in a general implementation plan consisting of national plans. These implementation plans were developed for each participating country and were included in D6.1 in the form of reports that a) described the methodology of organizing implementation activities and involving schools b) defined the key partners responsible for the management of the implementation in each country c) described the reporting procedure per implementation phase.

In the first year of the large-scale implementation these objectives or procedures were followed according to the initial plan. Some minor adjustments were made by the partners (e.g. exploring new channels for approaching schools) that reflect on the experience gained as the project advances and help the project implementation excel.

3. Implementation activities

In general, an implementation activity intends to bring into the classroom practice the pedagogical and methodological approach of the Ark of Inquiry project and related resources in an innovative, user friendly and engaging way so that both teachers and pupils have a stimulating experience in STEM education. A series of support activities (such as introductory presentation seminars and training workshops) are organized for teachers in order for them to become familiarized with the relevant platform and support materials, gain confidence and be able to adopt it in their everyday school practice.
All in-school activities with pupils and preparation or support actions, such as training for teachers, both referred to in the following as implementation activities, events or actions, are centrally coordinated by the Work Package 6 Leader and the Work Package 4 Leader with respect to training, but also managed locally by one partner in each country who acts as the National Coordinator and is responsible for the local management and localization of the project resources and activities. These roles and duties of the National Coordinators were reported last year in D6.1 in a section that dedicated in describing their responsibilities and tasks.

Bellow we present the list of National Coordinators. It contains the acronym of the institutions that will resume the role and the name of the person in charge.

Table 1. The National Coordinators of the Ark of Inquiry project

Country	National Coordinator	Name
Estonia	UT	Marianne Lind
Greece	EA	Aliki Giannakopoulou
Finland	UTU	Tomi Jaakkola
Cyprus	UCY	Marios Papaevripidou
Italy	UNESCO	Lauren Bohatka
Netherlands	HAN	Bregje de Vries
Austria	BMBF	Monika Moises
Germany	UBER	Amany Annaggar
Turkey	BEKAS	Bulent Cavas
France	EADN	Christian Siatka
Belgium	KHLim	Erica Andreotti
Hungary	HRTA	Szilvia Toth

4. Distribution of teachers and schools per country

The implementation of the Ark of Inquiry project takes place in 2 phases with the aim to overlap with 3 consecutive school years. In the first phase, with a duration of six months, the piloting, 35 schools or about 100 teachers have been recruited from 7 participating countries. In the large-scale implementation phase, with a duration of 24 months, a large number of teachers and schools from all 12 countries will be included in the network. The distribution of the total number of 1000 teachers and corresponding schools is shown in the following tables. The distribution shown in the tables below was presented, discussed and agreed during the project kick-off meeting and the first consortium meeting.

Table 2. Distribution of the indicative number of teachers across the participating countries and for the lifetime of the project

Countries	**Number of teachers**
Greece, Italy, Germany, Turkey, France	100 * 5
Estonia, Finland, The Netherlands, Hungary	80 * 4
Cyprus, Austria, Belgium	60 * 3
Total	**1000**

Additionally to the above, about 100 science and teacher education students will be engaged to participate in the Ark of Inquiry.

Table 3. Distribution of the indicative number of schools across the participating countries and for the two main implementation phases

Country	**Pilot Implementation Phase (6 months)**	**Large-scale Implementation Phase (24 months)**
Estonia	5	32
Greece	5	40
Finland	5	32
Cyprus	5	24
Italy	5	40
Netherlands	5	32
Austria	5	24
Germany		40
Turkey		40
France		40
Belgium		24
Hungary		32
Total	**35**	**400**

5. Reporting of implementation activities

An integral part of the implementation plan is the reporting actions and procedures that should accompany the piloting and the large-scale implementation phases across the 12 countries. Proper and up-to-date reporting is vital to monitor the project's implementation development, to have a smooth bookkeeping of activities per country, to determine overall progress and identify countries or regions where this may not be at a satisfactory level, and to ensure the implementation quality. The reports form the basis of the project's official deliverables, to be submitted at the end of each implementation phase, as is the case with this deliverable D6.1 (end of February 2016), due in M24, and similarly with D6.2 (end of February 2017), and D6.3 (end of February 2018), General reports of large-scale implementation, due in M36 and M48, respectively.

According to the plan for each implementation event or series of activities the partner or partners involved is expected to produce a report. This should be sent to the Work Package Leader and uploaded to a repository/common workspace of the project. The reports document basic information about the activity such as date/period held, location, number of participants, target group and type of activity along with a brief and comprehensive description of the implementation activities and learning outcomes reached or expected. Also, any materials in printed or electronic format that are related to the implementation reporting are to be used in this report (e.g., drawings, photos, presentation slides etc.). As indicated in Appendix 1 (columns L, M, N) many materials are available per activity either presented online or as files that document the activity and are available upon request.

The implementation activity reports compose a key part of the overall public image of the project. Material included in them will also be used in dissemination actions and documents. Furthermore, the information contained in the reports will be assessed and integrated in the validation and evaluation work in order to develop a concrete picture of the integration of Ark of Inquiry in inquiry activities and identify the impact level in terms of the effectiveness and efficiency to the teacher communities.

The reporting of the implementation activities is periodically reviewed to measure progress and provide creative and constructive feedback to and from the National Coordinators and the partners specifically involved in the collection and organization of proposed inquiry activities. The goals and scope of the reporting procedure will not change over the lifetime of the project, but specific improvements and revisions or complementary actions might be added over time if needed.

6. Large-scale implementation phase (first 12 months)

The large-scale implementation phase lasts 24 months and involves all partners from 12 countries. It started in March 2016, M25 of the project, and will last until the end of the project. The goal is to engage in Ark of Inquiry 23000 pupils and 1100 teachers or about 400 schools in total. Each partner, following last year's guidelines was requested to reach a number of schools in their country and engage as many teachers as possible in order to approach the aforementioned indicators.

During this period a series of implementation activities were performed in all 12 countries. Each partner kept record of their activities and reported specific details per activity in an excel (Appendix 1) file. In the Appendix all implementation activities are organized per country (different sheet) and include details regarding not only the number of schools, teachers and pupils involved but also the type of activity, the connection to the Ark of Inquiry platform, useful links, the person responsible from the Ark of Inquiry consortium monitoring/reporting the activity etc. Within the Appendix one can see all areas where the information of each activity I distributed. A part of Appendix columns of this file that provide info about the activity itself in depicted below.

Table 4. Partial representation of the Appendix columns to be filled by National Coordinators as part of their monitoring/reporting of each implementation activity

Date	Location (city, area)	Participating School Name(s)	# of Teachers	# of Pupils	# of other Participants	Inquiry Activity	Activity link(s) available on the Ark of Inquiry platform

The activities implemented by partners covered a wide range of experiments available on the Ark of Inquiry platform. These include numerous activities in various thematic areas, an indication of which is presented below:

- Coding and Computer Science (Experiments with Raspberry Pi) – Austria
- Nanotechnology (Quantum Spinoff) - Belgium
- High energy Physics (Science, research and technology at CERN) – Greece
- Electricity / Electronics (Electric Circuits) – Cyprus
- Biology / Light (Photosynthesis, Light Diffraction) – Estonia
- Biology (DNA from saliva) - Finland
- Genetics (A common genome) – France
- Chemistry (Water quality) – Germany
- Bioinformatics (Building a phylogenetic tree) - Hungary

- Environmental Sciences (Arctic and Antarctica) – Italy
- Physics / Engineering (Wind car) – The Netherlands
- Physics / Engineering (Construction of doors that provide heat insulation) – Turkey

Overall, the first 12-month period of the large-scale implementation phase was successfully completed by the project partners across the participating countries – a total of 685 in-service science teachers, 6412 pupils and 279 stakeholders were engaged and provided feedback on various aspects of the project.

Table 5. Detailed presentation of the number of teachers, pupils and educational authorities participated in the first 12 month period of the large-scale implementation

Country	**Partner**	**Teachers**	**Pupils**	**Other**
Austria	BMB	119	957	3
Belgium	UCLL	112	272	66
Cyprus	UCY	22	321	25
Estonia	UT/ AHHAA	196	374	113
Finland	UTU	53	910	5
France	EADN	31	495	0
Germany	UBER	19	475	0
Greece	EA	22	201	7
Hungary	HRTA	6	127	0
Italy	UNESCO	84	1808	57
Netherlands	HAN	8	172	0
Turkey	BEKAS	13	300	3
	Total	**685**	**6412**	**279**

The distribution of the number of participants per country (extracted from the detailed excel file in Appendix 1) is shown in the table above. The column "Other" represents educational authorities such as school counsellors, teacher trainers, ministry advisors, scientists, university staff etc.). A detailed list of their professional identity is provided in column H of the Appendix that accompanies this report.

As mentioned in last year's report the schools and teachers that got involved in the large-scale implementation phase (and are expected to continue using the Ark of Inquiry approach and participate in more activities next year as well) were selected based on

- (for schools) their ability to involve more than one teacher in the Ark of Inquiry project and their capability of using schools computer labs to run their activities.
- (for teachers) their ability to communicate in English; their ICT skills; their interest in performing Ark of Inquiry activities with their pupils.

Overall, the number of teachers (685 teachers from around 250 schools) that were involved in implementation activities during this phase indicates that the selection of schools was performed according to the plan and consortium's expectations.

The number of pupils involved in all 12 countries in the carefully documented activities was 5912. Teachers involved their pupils following the instructions and by using extensively the Ark of Inquiry platform.

The summary of all the implementation activities performed per country are given in the following section.

6.1. Estonia

In the second year of the implementation and in the 1st phase of large-scale implementation phase, both Estonian partners UT and AHHAA, followed the implementation plan in engaging teachers and other educators in trainings and other Ark of Inquiry events.

An overview of the stakeholders involved in their activities is presented in the table below.

Table 6. Detailed presentation of the number of teachers, pupils, educational authorities, schools and implementation events performed in the period March 2016 – February 2017

Country	Partner	Teachers	Pupils	Other	Schools	Impl. Events
Estonia	UT	11	358	0	11	10
Estonia	AHHAA	185	16	113	30+	11
	Total	**196**	**374**	**113**	**41+**	**21**

a) University of Tartu (UT)

UT conducted several Ark of Inquiry workshops in spring 2016 and from autumn 2016 onwards they have been involved in Ark of Inquiry teacher trainings which will be held in 4 groups (2 groups have already completed all 3 phases of training). All trained teachers have received formal certifications and 2 ECTS. Main obstacles have been lack of time (training should last longer than 3 days), poor inquiry and ICT skills of teachers and lack of proper ICT equipment/WiFi in schools.

More than **34 schools**, more than **20 science centres and museums**, 2 vocational schools and universities have taken part in UT's implementation phase so far. They have trained more than **67 teachers** and reached more than **367 pupils** (however, only 11 teachers reported pupil numbers and are listed in the table above). Pupils were ~ 13 years old.

Pupils were involved in two main ways:

- as learners (64%);
- as content creators of Inquiry Learning Spaces (one teacher, 46% of all pupils, all in Viljandi Gümnaasium).

As part of the teacher trainings, the participants created or modified an existing inquiry activity, used it in his/her classroom with pupils. Most of the teachers involved in the trainings created their own Inquiry Learning Spaces (ILS) in Graasp using apps and tools developed in the Go-Lab project and used it with their pupils (pupils as learners 64%). Moreover, in some activities pupils were taught how to create their own ILS-s for younger pupils (pupils as content creators 46% of pupils). Therefore, there was a limit in the number of inquiry activities used from the Ark of Inquiry platform as teachers preferred using their own ILS-s in their classroom.

All activities were conducted from October 2016 – January 2017. A detailed list of all ILS examples created is provided in Appendix 1. Below we present a few examples of the ILS-s created within the aforementioned time period.

Prevention of skin cancer: Pupils learned how to recognize early signs of possible skin cancer and how to protect oneself from skin cancer by following the 5 phases of inquiry cycle.

Photosynthesis: Pupils learned about photosynthesis works and what factors influence photosynthesis by following the 5 phases of inquiry cycle.

Pine seeds: Pupils learned about the lifecycle of pine trees by following the 5 phases of inquiry cycle.

Figure 1 & 2. Pupils from Neeme School perform their investigation on pine trees activity following the inquiry cycle.

An additional group of teachers from Jõgevamaa Gümnaasium engaged with a small group of pupils on the Ark of Inquiry platform with the following activities:

- The inquiry activity ''Electricity: an alternative approach to Ohm's Law'' which deals with the topic of electricity, electric current and types of circuits.
- The “Which soap is best” activity that explores the effectiveness of different soaps for cleaning. This set of activities allows you to consider the factors which can be involved in determining the best soap to use.

Other activities that were performed, as illustrated in the pictures below included the “Virtual Moon Atlas” and the “Sinking and Floating” learning activity.

Future plans, in order to get more teachers and pupils involved, include the continuation of training activities for teachers on the Ark of Inquiry approach and methodology; the dissemination and promotion of the existing learning activities; and the support of teachers willing to design their own IBSE learning paths. Furthermore, UT plans to focus on reaching out to pupils in order to involve many more in using the Ark of Inquiry platform.

Figure 3 & 4. Pupils (left) from Tartu Tähetorn perform the Virtual Moon Atlas activity while those (right) from Tartu Nature School work on the Sinking and floating inquiry activity.

b) AHHAA Science Center

AHHAA has conducted a series of implementations activities from May 2016 up to January 2017. Overall, 11 activities were organized involving more than **30 schools** and **185 teachers**, **16 pupils** and **113 educational stakeholders**. The main effort in the implementation was focused on teachers and in introducing AHHAA’s inquiry activities and ways to introduce them to their pupils via the Ark of Inquiry platform.

Activities uploaded on the platform include AHHAA’s learning programmes in the fields of: Astronomy – The programme helps pupils understand space weather phenomena. A number of tests are performed to prove the scientific literature while by visiting the spherical planetarium pupils can get a good visual overview of the sky.

Ecology – The programme introduces to pupils habitats conditions and biota. A water study is performed and pupils explore the Red Sea Aquarium and its inhabitants. Moreover, a

discussion follows on liquid density and on the production of coloured liquids of different densities. Finally, through laboratory work pupils study the internal and external structure of the fish in relation to their environment.

6.2. Austria

The Ministry of Education of Austria performed 9 major implementation activities involving **119 teachers** and **957 pupils** (as shown in Table 4). The specific implementation activities were different from the originally planned ones. However, the selection of schools and teachers has met all the criteria according to the Ark of Inquiry project's requirements. The modification of the initial plan was necessary since there was a decline in teacher's interest (in secondary schools) in IBSE training activities last year, mainly due to the nation-wide introduction of the centralized final school exams (centralized high-school diploma). The latter approach requires for standardization instead of individualization of teaching. As a consequence BMB adapted their implementation plan and focused on a) activities that can be easily implemented in class and b) on very specific activities in combination with new technologies (the Raspberry Pi).

In detail, the total number of schools that took part in the large-scale implementation phase (and estimate of teachers, pupils involved):

- around 75 teachers (plus around 44 from the national Ark of Inquiry training programme);
- around 57 secondary school pupils directly reached;
- around 500 secondary school pupils indirectly reached through teachers;
- around 400 primary school pupils reached in the course of the implementation of the training sessions;
- schools can only be roughly estimated, since we don't have the information from all our participants. A reasonable figure would be 35-40 primary and secondary schools.

An overview of 2 exemplary activities and workshops performed in the framework of this period's implementation is presented in detail below.

A) RRI-activity with PlayDecide (digital lives for pupils aged 12-14 years): PlayDecide is a discussion game, which enables a discourse on controversial science topics. Pupils learn how to form arguments and how to critically reflect on new technologies. This this training activity was implemented in two secondary schools, with three school classes.

The first session took place in April 2016 in Vienna with 24 pupils (aged 12) and 6 secondary school teachers (training facilitators). The second workshop was organized in January 2017 in the province of Burgenland at a secondary school with two classes (33 pupils aged 14, and

4 teachers). In total **57 pupils and 7 teachers** participated in this implementation activity. The duration of the activity is two teaching lesson hours for the conduction of the activity in class, and one school lesson hour for reflection. Optional, the topic of social media can be introduced to the pupils in one informatics lesson.

Figure 5 & 6. Pupils participating in the PlayDecide activity

BMB has collected data from this activity that can be viewed on its national Ark of Inquiry-Moodle at http://www2.lernplattform.schule.at/vis/course/view.php?id=51 (login as a guest) while the corresponding activity on the Ark of Inquiry platform can be found under the title: Digitale Leben playDecide (in German), http://arkportal.ut.ee/api/inq-activity/digitale-leben-playdecide/

B) Ark of Inquiry Workshop: Experiments with the Raspberry Pi:

Four Raspberry Pi Implementation Workshops were organized between March and December 2016. The participants were introduced to the Raspberry Pi, a powerful, but affordable minicomputer, which was developed specifically for educational purposes by the Raspberry Pi Foundation, a non-profit organization from the UK. The main aim of the training sessions was to demonstrate how engaging inquiry experiments can be conducted in science class, facilitated with an innovative, technological device. The main aims of this Ark of Inquiry training workshops were

- to demonstrate the Raspberry Pi concept and its application capabilities in class;
- to introduce the diverse components of the Raspberry Pi computer;
- to try out simple exercises: switching LEDs, using motors, sensors, radio receivers and touch screens, smartphone remote controls;
- create a didactic guide for use of the Raspberry Pi in class;

to familiarize the participants with the Ark of Inquiry cycle and its RRI-concept;

Figure 7, 8 & 9. Teachers participating in the Raspberry Pi activity

During the hands-on-sessions teachers tested the “REPi prototype (Renewable Energy on a Raspberry Pi)" for measuring and analysing data in regards to power efficiency in class and tried out simple exercises. During the training sessions we reached **47 participants (43 secondary school teachers, 4 education stakeholders)**. During the ongoing implementation **around 500 pupils** were reached through the teachers.

The documentation of the Raspberry Pi WS can be viewed (login as a guest) on BMB’s national Ark of Inquiry-Moodle at http://www2.lernplattform.schule.at/vis/course/view.php?id=51.

The aforementioned inquiry activities will continue to be implemented by BMB in the months to come. According to next year’s planning the following implementation events are expected to take place:

- On the 24th of March 2017 a one-day workshop at the WELIOS Science Center in Wels, Upper Austria will be organized. Inquiry cycle model (Pedaste et al., 2015) will be introduced to the secondary school teachers and discuss how to implement Ark of Inquiry-activities in school. The pupils (two school classes) will participate in a LEIS-Ark of Inquiry workshop, where they will learn how to build a solar car with LEGO.
- In April 2017 BMB will hold its 3rd PlayDecide Workshop at a secondary school with two school classes. At least 32 pupils are expected to participate.

Between April and May 2017 BMB will organize its next Raspberry Pi Workshop for secondary school teachers.

6.3. Belgium

During this period UCLL organized some activities in schools, involving in the organization some teacher students. It organized activities with pupils and teachers in several institutions: UCLL, Antwerp University, Cosmodrome Genk, Belgian research institutes and companies. This all was possible thanks to the experience and the contacts the group had in the past, thanks to other EU and local projects (for example Quantum SpinOff). These experiences and projects have been suited to the Ark of Inquiry philosophy and run under the framework of this project.

Moreover UCLL performed activities in schools or out of school with pupils involving **8 schools** in total. Furthermore, many more schools were reached through UCLL's teacher training (lowest estimation: about **50 schools**).

The total number of teachers reached through these activities was **1**12. The majority was reached via teacher trainings. The total number of pupils reached directly with these activities was **272**. More pupils are expected to be reached by teachers who participated in the teacher trainings acting as Ark of Inquiry agents. Moreover, **UCLL teacher students** were involved in the organization of the implementation activities.

UCLL has promoted its inquiry activities through the creation of different communities within the Ark of Inquiry platform in which the activities are grouped with respect to their thematic area. The list of communities used for disseminating and implementing UCLL's activities (most of them in Dutch) were:

- België
- Kwantumfysica - België
- Quantum physics
- Menu van de schoolcafetaria - Agnetendal Peer
- English-Activities-Belgium

The main activities that were performed during the reporting period are presented in detail and in chronological order below:

09/03/2016 – activity in a school: Teacher students from UCLL institution conducted a lesson to 2 classes of pupils in the school Agnetendal Peer. The lesson is part of the inquiry activity "Menu van de schoolcafetaria" uploaded on the Ark of Inquiry platform and it lasted 2 hours. The pupils worked in groups with the material that was offered to them by UCLL and successfully completed the activity. The pupils created their own 'menu' for the school canteen based on scientific considerations and taking into account healthy factors (such as daily energy need, energy contained in food, etc.).

17, 19 and 20/05/2016 – activity in a school: Teacher students from UCLL gave a lesson to several classes of pupils (22) in the Provinciale Middenschool in Diepenbeek and Agnetendal Peer. This lesson occurs in the inquiry activity from the Ark of Inquiry platform (in Dutch) "Kleurmenging onderzoeken met een RGB-LED gestuurd met een Arduino" and it lasted 2 didactic hours. The pupils worked in groups with the material (arduino, laptops, leds, etc.) brought to them by UCLL and managed to successfully complete their given tasks. The pupils were very enthusiastic as well as the teachers and the school director (who came for some time to have a look during the lesson). In this activity the pupils investigated how to mix colors using LED's by programming them with Arduinos.

30/05/2016 – Teacher training activity for STEM teachers: This activity included presentation of RRI and inquiry learning; activity about RRI focused on the role of STEM disciplines in enterprises; time to create account on the platform. The implemented Inquiry activities were:

- Koffiezet science and technology, also present on the platform with titles *'koffiezetapparaat vanuit techniek'* and '*koffiezetapparaat wetenschappelijk gezien'.* These activities involve the investigation of the functioning of the safeties in a coffee maker from the points of view of respectively technology and science.
- Adapted version of the activity: *Quantum SpinOff - Een tijdslijn 'onderzoek van het onderzoek'*, present on the platform. This is an activity with a strong RRI component. The pupils are free to investigate the development in time of a certain scientific subject, by e.g. investigating researchers and entrepreneurs. At the end they create their 'Timeline' in which they show the connections between scientific discoveries, technological applications, spinoff companies and RRI.

14/06/2016 – teacher training & info session 'Quantum SpinOff trajectory' 2016-2017: This was a teacher training event in which we presented to the interested teachers the 'Quantum SpinOff trajectory' 2016-2017 and how it can be implemented in their school. Quantum SpinOff is an initiative that is organized by UCLL over the last 5 years. It started as first as a national project and became a European project involving schools from 4 countries (project Quantum Spinoff implemented in Belgium, Greece, Estonia and Switzerland). Recently it has been modified by UCLL to follow the Ark of Inquiry approach and methodology. During this session UCLL presented the framework of Ark of Inquiry and the platform. The teachers created an account. Finally the teachers performed the activity: *Quantum SpinOff - Een tijdslijn 'onderzoek van het onderzoek'.*

15 and 16/09/2016 - Start day Quantum SpinOff: During this event groups of pupils from 5 different Flemish secondary schools had the opportunity to do inquiry activities at the University of Antwerp. These activities are included in the Inquiry Platform and are part of the 'Quantum SpinOff' activities. The pupils that were involved in this activity will also participate in the Quantum Spinoff trajectory this school year via the Ark of Inquiry platform.

Thus, they will work on the platform's advanced activities and, compete in the Quantum Spinoff contacting researchers in the fields of quantum technology and nanotechnology. RRI plays a major role in the process of the competition. The activities performed and proposed to the teachers in order to prepare their pupils for the contest are:

- *Quantum SpinOff - Een tijdslijn 'onderzoek van het onderzoek' (see above): an example was given!* and
- *Quantum SpinOff Hands-on activities that include:*

- Discrete emission lines of chemical elements: with this inquiry activity you will learn how to measure the emission lines of He, or of any other chemical element.
- Measuring Planck's Constant with LED's: the aim of this activity is to measure the Planck's constant in a very simple way and with simple material. At the same time pupils will learn more about LEDs.
- Diffraction of light at a hair: The aim of this activity is to measure the thickness of a hair using light diffraction.
- Electron diffraction at carbon crystal: this activity allows pupils to compare the predicted wavelength of the electron - following from de Broglie's hypothesis – with the experimental value measured from the electron diffraction pattern**.**

In general, the pupils of the **5 secondary schools** that take part in the Quantum Spinoff contest have participated in the implementation of the activity Quantum SpinOff - Een tijdslijn 'onderzoek van het onderzoek' in their schools. As part of the contest, the pupils visited research labs and will visit companies in order to develop develop 'Timeline' on a specific assigned subject within High-tech and quantum physics. The contest has started in September 2016 and will conclude in May 2017. The classes participating in the Quantum SpinOff trajectory 2016-2017 will present their final work to a jury of experts on 31/5/2017 (day of the final).

Figure 10. A UCLL teacher student explains the hands-on activity to Pupils on 27/10/2016 - Vlaams Wetenschapsweek

27/10/2016 - Vlaams Wetenschapsweek: Each school year in Flanders several universities and research institutes participate in the 'week of science': pupils and their teachers can visit the institutes and perform organized inquiry activities which they cannot do in their schools. Our institute participated this time with 4 different inquiry activities, in which 5 teacher trainers and about 40 of our teacher students guided about 75 secondary school pupils. The activity performed: *Quantum SpinOff Hands-on activities (see above).* Others not on the platform: *atomic models (chemistry), several aspects of science through the 'science carousel'.*

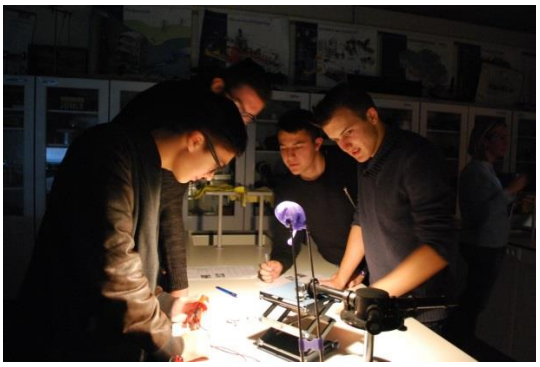

Figure 11 & 12. Pupils during a hands-on activities (27/10/2016 – Vlaams Wetenschapsweek)

21/11/2016 – Teacher training activity for STEM teachers at Cosmodrome Genk: Teachers as part of their training participated in the implementation of the following two STEM inquiry activities uploaded on the Ark of Inquiry platform:

- '*Astronomie - wat is de omtrek van de aarde*?': measuring the circumference of the Earth using the method of *Eratosthenes;*
- '*Astronomie – de rotatie van de maan*': investigation about the gravitational force and how this force can affect the rotation of the moon around the Earth.

This training was organized in collaboration with 'Cosmodrome Genk' (host institution). Cosmodrome Genk is a museum and astronomical observatory which routinely organizes interactive activities for visitors (individually or school groups).

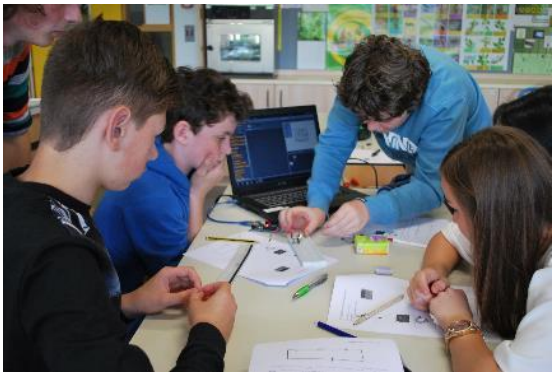

Figure 13. Pupils of Provinciale Middenschool in Diepenbeek doing the activity "Kleurmenging onderzoeken met een RGB-LED gestuurd met een Arduino"

6.4. Cyprus

In the framework of organizing its implementation activities, OCY has contacted several science teachers where the Ark of Inquiry approach was presented or information material was provided. Many training sessions were organiozed by UCY with regard to Inquiry, RRI, Evaluation and Award system and reflection on teachers' inquiry practices. It seems that during this phase teachers seemed to be sceptical and requires extra effort to have them motivated to adopt, adapt and implement non-traditional teaching methods and practices (such as inquiry) because the education system as is neither encourages them nor acknowledges their extra effort needed. Despite the difficulties encountered, UCY held within a year (March 216- January 2017) 18 implementation activities, involving 13 schools, 22 teachers, 321 pupils and 25 educational stakeholders.

During these activities various educational scenarios have been implemented covering different fields such as Biology, Physics, Chemistry, Engineering etc. A list of the most popular activities implemented is presented below.

Hydrostatic presure (3 teachers, 36 pupils): Pupils investigate how pressure changes as you change fluids, gravity, container shapes, and volume.

Electric circuits (6 teachers, 105 pupils, 9 stakeholders): This inquiry activity presents an alternative way to introduce the Ohm's law, by having the pupils manipulate the variables of voltage (V) and resistance (R), in order to investigate how the electric current (I) is influenced.

Figure 14. Pupils in Cyprus participating in implementation activity organized by UCY

Other activities performed included "The mystery of disappearing dinosaurs", "Mushroom cultivation", "Olive Oil Soap - Oil to clean water from renewable resources" and more.

6.5. Finland

In Finland, the implementation has proceeded according the localized implementation plan that was developed last year. UTU has contacted teachers and other educational authorities, both through formal conferences and informal local meetings, to inform about the Ark of Inquiry project and to invite them to participate in national training sessions and to use and disseminate project resources in general.

Major implementation focus for period March 2016 – February 2017 has been on teacher training. Up until today, UTU has trained 113 teachers in Finland, which is more than initially planned (80). Trainings sessions have taken place between September 2016 and January 2017, and have involved elementary school teachers, subject teachers (secondary school), and special education teachers. Teachers that have participated in to the trainings are from 8 different schools, and 5 different cities. The fact that the trainings were organized in different cities had been particularly important, because this ensures wider dissemination across the whole country. The trainings have been well received by schools and teachers, because the project's aims are well aligned with the new national curriculum (active since fall 2016) that emphasizes on inquiry learning, multidisciplinary areas, collaboration (both among teacher and pupils), and ICT, to name a few.

One requirement of teacher training has been that teachers should implement inquiry learning in their classrooms. It is estimated (it is difficult to present the exact numbers), part of this activity about 2300 pupils have used inquiry activities. They have used inquiry activities from the Ark of Inquiry platform (for Finnish pupils, Finnish, Swedish, and English language inquiry activities are relevant), or activities created by teachers (teachers designed their own inquiry lesson according the inquiry principles of the project). *Figure 1* and *Figure 2* show an example of an inquiry activity from the platform that has been used by pupils. Many teachers also reported that pupils were extremely engaged during the inquiry activities. Overall, four main implementation activities were performed (where the number of participants was accurately monitored) involving **53 teachers** and **910 pupils** (see Table 4).

Some main implementation activities that outline the Ark of Inquiry approach are reported below.

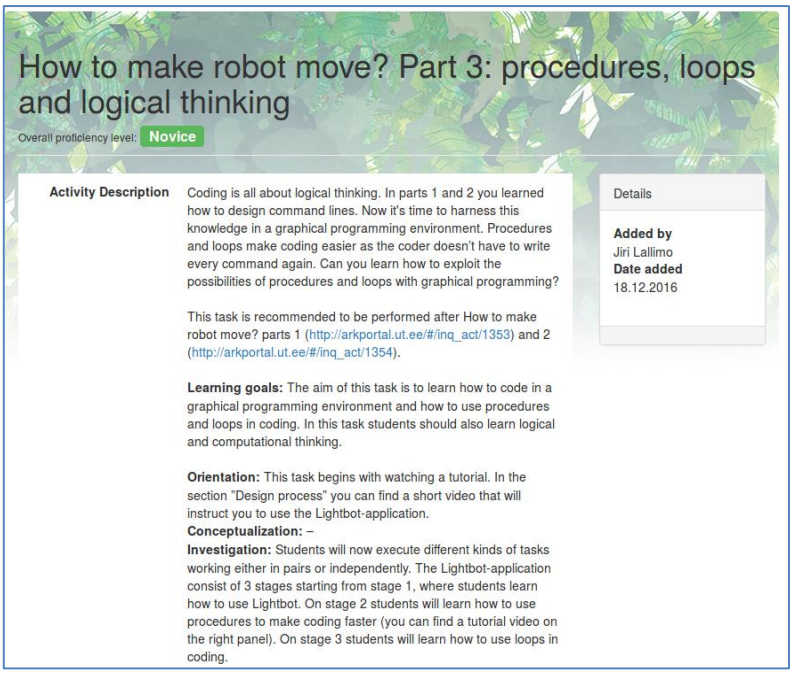

Figure 15. Partial description of an inquiry activity on Coding (screenshot from Ark of Inquiry platform)

May 2016: a joint science fair and training exhibition was held in Heureka Science Centre in Vantaa, Finland. The event was organized in collaboration by UTU, AHHAA, UT, and Heureka science center. 8 teachers and 1o pupils took part in this hands-on inquiry activity, where they examined authentic pig's heart and lungs. Furthermore, the participants also investigated the properties of DNA from saliva. Pupils and teachers were extremely interested because they got the opportunity to examine real lungs and heart (see Figure 2). Especially, blowing air to the lungs via a straw provided an extremely powerful mean to discover how the lungs work.

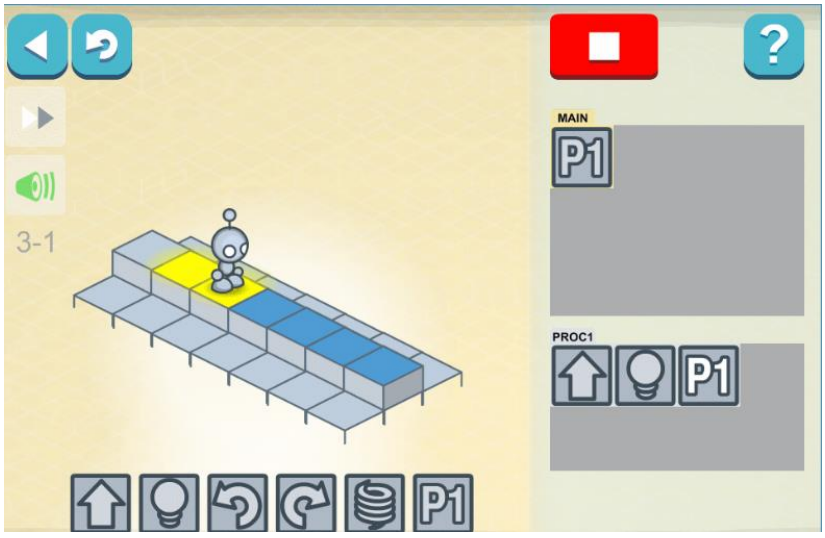

Figure 16. Lightbot, a simple graphical game to learn Coding (activity described in Figure 15)

March 2016 – January 2017: uploading of inquiry activities to the Ark of Inquiry platform. By January 2017, we have uploaded 112 Finnish and 5 Swedish language inquiry activities to the platform. In addition, there are approximately 140 inquiry activities in English, which are also relevant for Finnish pupils. Some of these activities were used in the implementation phase performed in the primary schools of Kevätkumpu and Roihuvuor where **36 teachers** and **720 pupils** were involved.

Figure 17. A pupil investigating pig's lungs in a training exhibition that took place in science centre Heureka, in Finland

Regarding future actions, UTU plans to train 29 teachers from a new special nationwide in-service teacher training programme in order for them to advice expert teachers on the educational use of ICT in schools. Since these participants are from all over the country, they can provide a nationwide dissemination channel of the project. Furthermore, UTU plans to engage other science centres in Finland, using the successful Heureka example.

6.6. France

EADN has performed various implementation activities in France in collaboration with the following museums and science centres:

a) Museum of Natural History in Nîmes, www.nimes.fr/?id=284;
b) Tous chercheur, in Marseille, http://touschercheurs.com/index.php?page=63;
c) Arche des Metiers, www.arche-des-metiers.com/;
d) Terre des Sciences, www.terre-des-sciences.fr/ecole-de-ladn/formations-ateliers-proposes.

In total, 18 implementation activities were performed in various locations in collaboration with the aforementioned institutes. These involved **31 teachers** and **495 pupils.** Specifically, in collaborating with the network of French DNa Learning Center, three activities were performed in the following locations and by implementing a different inquiry activity:
a) At Paris the "Genetic diagnosis" activity with 9 teachers and 165 pupils;
b) At Angers the "A common genome" activity with 1 teacher and 37 pupils;
c) At Pointers the "DNA fingerprint" activity with 6 teachers and 102 pupils.


Figure 18 & 19. Pupils participating in activities organized in collaboration with the French DNA Learning Center Network.

Moreover, a training session was conducted at Genopolys in Montpellier involving 3 teachers and 32 pupils. In addition to that at the same location a training session for PhD students on «How to elaborate and perfom a scientific lesson for young pupils» was implemented by Gilles Guillon.

Figure 20. Genopolys in Montpellier

6.7. Germany

The main activities for implementation of the Ark of Inquiry project in this second year in Germany were focusing on two learning environments of the Ark of Inquiry platform, “Acids and Bases” and “Water quality”. Following the implementation plan of UBER, both learning environments were introduced to a group of science teacher students, which nearly end their studies at Humboldt University and will be practicing teaching chemistry in schools in Berlin for 4months. Each student went to one school, supported by an experienced teacher in every day teaching issues. Additionally, the students were visited by an UBER representative to evaluate the implementation of Ark of Inquiry learning environment in their science classes.

Before going to schools, the science teacher students were trained in a seminar on how to organize science lessons in principle, implementing experiments and aspects of scientific reasoning in their lesson plans and how to take specific characteristics of science lessons into account. They had already gathered teaching experience in one school training session during their studies, but that one focused on general aspects of teaching and learning. This new preparation seminar emphasized the implementation of the topics “Acids and Bases” and “Water quality” through the Ark of Inquiry platform. Based on the expected age groups, both topics were estimated by UBER as highly valuable for the science teacher students.

In total, **19 schools** with **19 teachers** and **475 pupils** took part in the implementation of the two aforementioned activities. In the learning environment “Acids and Bases” pupils have to identify characteristics of both substance groups. They start with a kind of association method and capture the attributes at the beginning, and later on in the teaching and learning sequence, the results, in an illustrative way. At the end, their illustration can look like in Figure 3 for example.

Figure 21. Attributes of acids and bases

Moreover, the pupils carry out a series of real experiments, combining them with aspects of the history and philosophy of chemistry (science), and complete their knowledge with virtual experiments, e.g., the titration of blood (Figure 5). By using this virtual lab, the pupils get an impression about the pH value of everyday substances and that titration in real experiments is often complex.

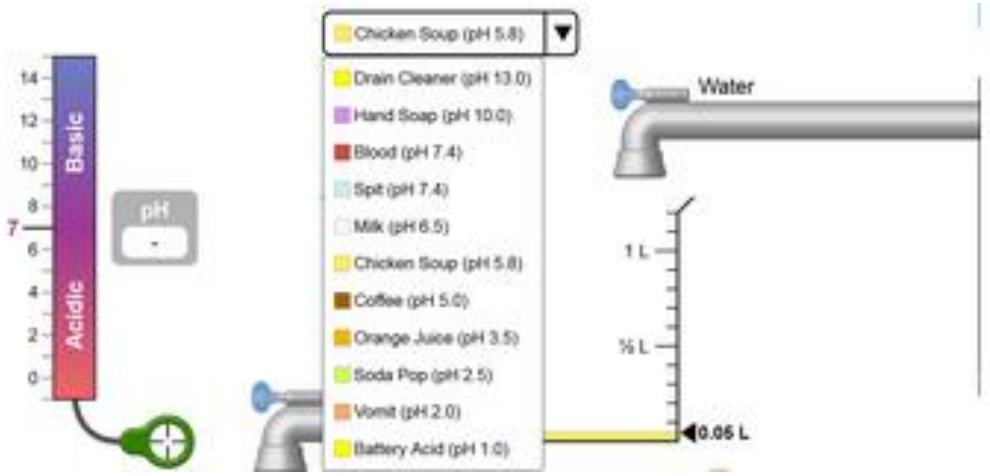

Figure 22. Virtual Titration of usual substances

The second learning environment focused on the topic of water quality. It starts with the question, whether or not the quality of water is sufficient for swimming. The pupils learn about the quality criteria, how to measure the necessary values, and which factors influencing the quality of water. But also how to interpret the data and how to put the data into a larger context is important. So they have to compare data from the Netherlands and from Spain. The aim for the pupils is to develop an advice for a local touristic office about the water quality. They have to refer to the experiments they conducted and have to make a scientific argumentation.

Figure 23. "Blue Flag", a symbol for quality standards at a beach

Beside scientific reasoning and knowledge acquisition pupils become familiar with the guidelines of the EU for swimming water quality (Picture 17. “Blue flag”). They experienced with this example the necessity of equal standards within a partnership of different countries. This is also a good example of so called socio scientific issues, because the pupils have to bring together different perspectives. The blue flag does not only refer to the water quality, but also to standards about public communication and information.

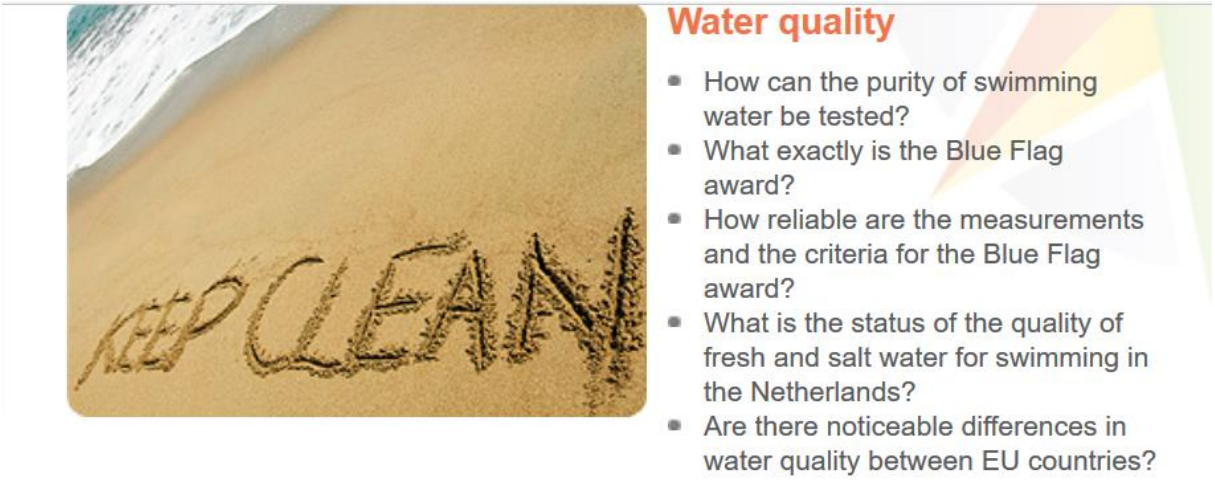

Figure 24. Questions for pupils related to Water Quality

The science teacher students were introduced in both implementation activities. Based on the situation they were at least faced at school, mainly “Acid and Bases” was carried out. Each science teacher student had an average of 25 pupils in his class (some were teaching in more than one class), and they often taught together with mentor teacher.

This implementation activity was running from September 2016 to February 2017. The implementation of these activities is expected to continue in summer 2017 with approximately 30 science teacher students.

6.8. Greece

EA has implemented two main activities (four in total) in Greek schools over the last year. These main activities were related to Earthquakes and Frontier research performed in the field of High energy physics at CERN. It total 8 implementation activities were performed involving **22 teachers** and **201 pupils**. The short description of these main activities follows below.

Earthquakes: time and epicentre (10 teachers, 20 pupils): In this educational activity, pupils will learn about earthquakes, the fundamentals of physics and geology behind the phenomenon, and will apply techniques using real data to locate the epicentre of

earthquakes. Real data of an earthquake from three seismological stations is provided to the pupils and they have to interpret the data, make the appropriate calculations and locate the epicentre of the earthquake.

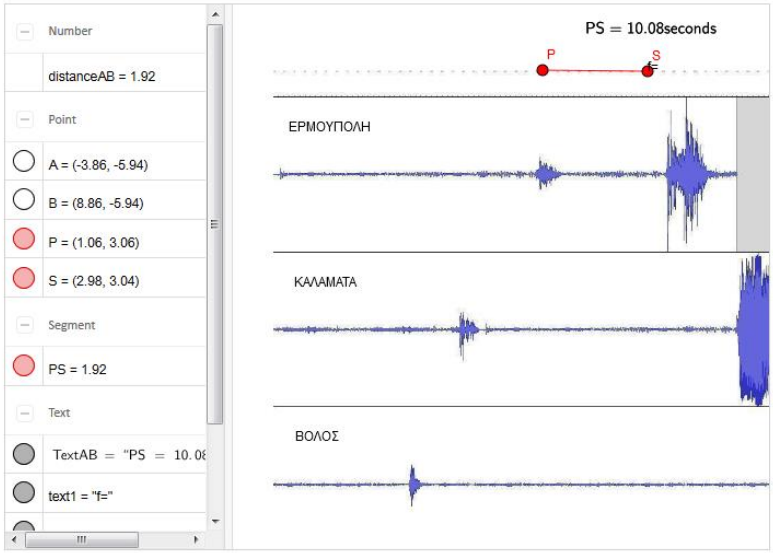

Figure 25. Screenshot of the Earthquake activity where a Geogebra app is used for measuring earthquake parameters

Science, research and technology at CERN (12 teachers, 118 pupils): In this activity pupils learn about fundamental particles, the research that takes place, the experiments performed and the technology that is used at CERN. Pupils analyse real data from the CMS experiment by using real scientific data analysis tools.

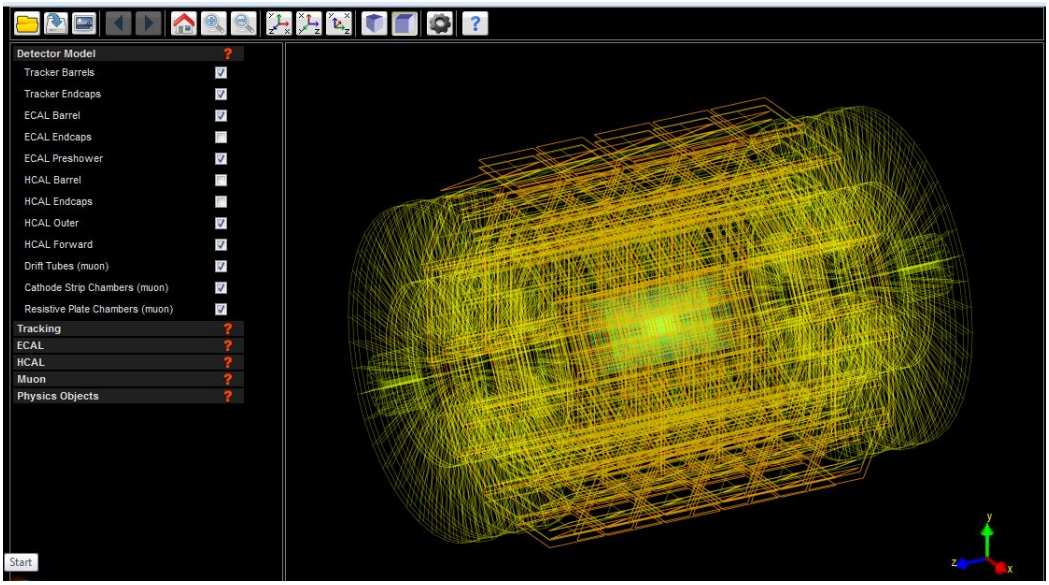

Figure 26. The CMS event display tool used in the illustration of the CMS detector and the analysis of real experimental data from CERN

Since September 2016, EA has modified its implementation plan in order to maximize the dissemination and implementation of the Ark of Inquiry approach via various communication channels. Thus, as depicted in the illustration below, EA has initiated three different channels leading to the implementation of the project that reaches the pupils in schools.

The first two channels make use of

a) EA's established network of schools and Official School System: This includes schools that have participated in previous actions that promoted IBSE in primary and secondary schools. More than 300 schools are part of this network and have been approached to participate in various activities and contests such as the Eratosthenes experiment, the Water experiment and activities promoting Coding.

For the Eratosthenes experiment EA has launched a site namely the http://eratosthenes.ea.gr and up to February 23rd, 2017 more than **110 schools have registered** to participate to the measurement of the circumference of Earth. The event will take place in March 21st, 2017 and is supported by UNESCO Venice Office (partner in Ark of Inquiry).

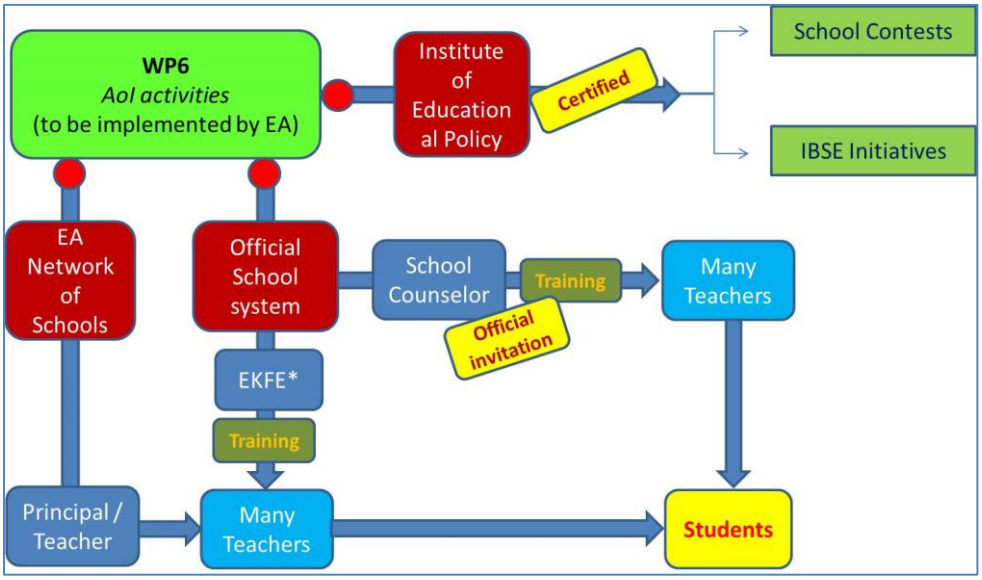

Figure 27. EA's Communication channels promoting Ark of Inquiry initiatives through contests and collaboration with formal educational authorities

For the Water experiment 50 schools will be selected from EA's network of schools and perform a set of activities concerning the chemistry of water. Each school (one classroom) will perform at least one of the two proposed activities. The activities were firstly developed by IUPAC and UNESCO in 2011 in the framework of the international year of chemistry but have been modified by EA to follow the IBSE pedagogy. The first activity focuses on the use of the chemistry kit that has been distributed to the participant schools, in order to measure the pH of a natural water supply. Pupils will learn about acids, alkali, acid strength and pH

measurement in a hands-on approach using both hands on and virtual experimentation. In the second activity, by using the same chemistry kit pupils measure the salinity of fresh seawater. They will work on basic chemical procedures and measurements in a hands-on approach using both hands on and virtual experimentation. In addition to the hands-on experimentation, the teachers (that have been trained by EA during Ark of Inquiry workshops) enrich their activities by adding RRI components. So far **20 schools** have pre-registered as shown in the figure below.

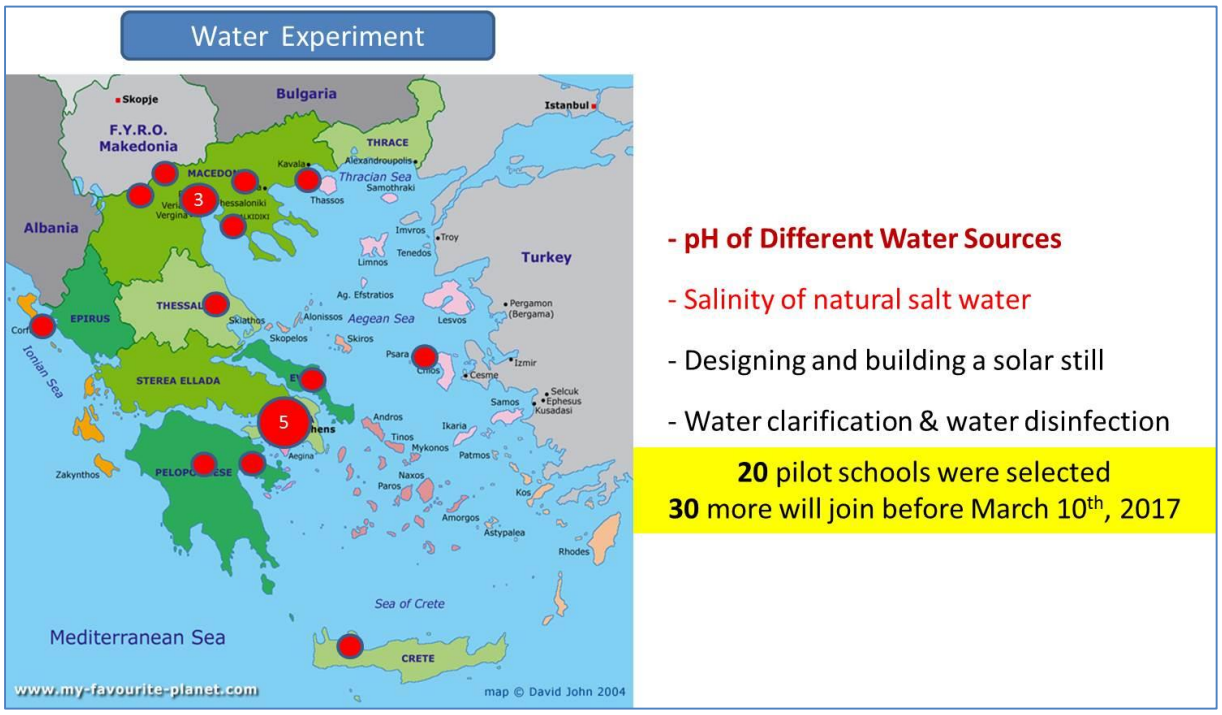

Figure 28. 20 Greek schools have preregistered to participate in the Water experiment that will be performed in March-April 2017

b) the Institute of Educational Policy (part of the Ministry of Education): through this collaboration two National contests supported by the Ministry of education will be launched from March to May 2017.

The first one named "My School Garden" will encourage Schools to create school gardens and teachers to submit inquiry activities that follow IBSE and are connected to RRI. A committee will select 10 schools and their teachers will participate in a summer school for teachers in Rethymno where they will be trained extensively on the Ark of Inquiry platform and approach. 40 schools are expected to participate.

The second thematic educational contest "Intro to Earthquakes" will be for high school pupils (ages 13-18) and related to the aforementioned Ark of Inquiry Earthquake educational activity. Around 20 schools and 40 teachers around Greece are expected to participate.

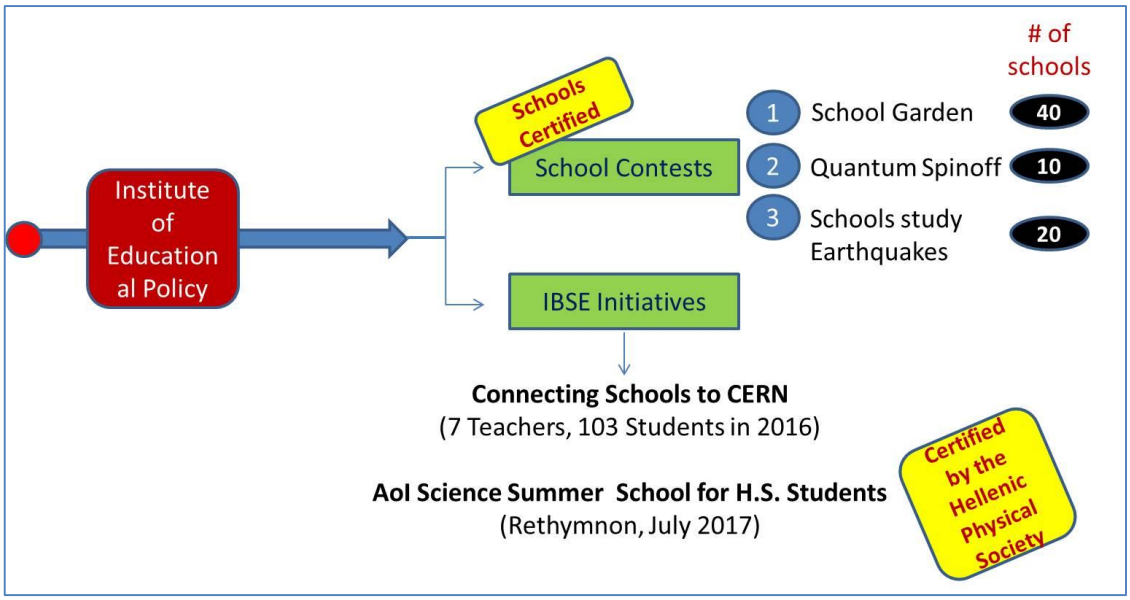

Figure 29. Implementation of Ark of Inquiry in Greece supported by the Institute of educational Policy (part of the Ministry of Education)

Moreover, the implementation of the existing Ark of Inquiry activities will continue while new ones are also expected to be developed.

Figures 30 & 31. A seismometer (left) at EA used for pupils (right) to collect experimental data and perform the Ark of Inquiry Earthquake activity

6.9. Hungary

In the second year of the implementation in Hungary, basically the original plan was followed. However, political changes affected the whole structural background of public education in Hungary, bringing about even more centralization and less room for teachers' creativity and school autonomy, which was a clear drawback to implementation as planned. Recent changes also meant that some of HRTA's strategical partners have no longer influence on educational processes (for example those ministry's background institutes or university faculties that have recently – and for May, suddenly – been closed down). These obstacles meant that HRTA had to adapt the plan. Therefore focus was on peer support cluster communities rather. This means that HRTA chose a leading school in 5 regions of Hungary with an experienced teacher (who has previous knowledge and practice in inquiry learning and who had also been involved in teacher-training projects of professional development or mentoring activities before). These teachers will help others in their geographically closer region to implement Ark of Inquiry. However, there is still a clear obstacle with the very low number of science lessons (in Chemistry, in year 7 or 9, it is 1 per week!) and the proposed changes in the national core curriculum, which in general make it very difficult to motivate teachers to experiment with the platform.

In the first wave, the implementation was closely linked to schools hosting teacher training sessions. In this wave, 4 schools participated, with 6 schools, 6 teachers and about 140 pupils involved. The second wave is still in process: it involves 80 teachers who participated in the teacher-training sessions, as part of the training (in phase 3: teachers as reflective practitioners) was to try one activity from the platform and then re-design it according to pedagogical scenarios. This phase involves an additional number of 21 schools with about 250 pupils.

In general, feedback from implementation was promising: teachers as well as pupils enjoyed experimenting with the activities.

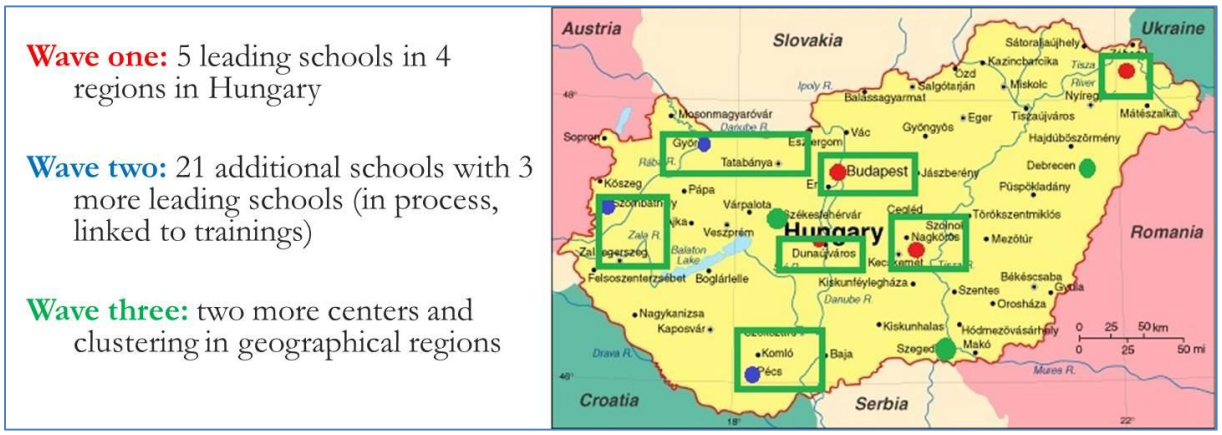

Figure 32. The three-wave implementation performed in Hungary

The activities piloted within the first phase were:

From Hungarian-language materials uploaded on the platform the teachers who participated in the training and were involved in the implementation chose activities based on their interest, connected to their subject and suitable for their group's profile. When uploading the Hungarian-language activities on the platform we tried to choose diverse activities connected with almost all the science subjects so that every school age group can find materials. So as to understand and follow it easily, we linked even the English-language webpage of these activities in the chart of summary (see Appendix 1), the implementation were carried out in Hungarian.

In Városmajor Gimnázium (Budapest) during the activity 'Bioinformatics with pen and paper: building a phylogenetic tree' the pupils with Biology specialisation worked with the help of homologue DNA-sequence of 5 primates.

In Bessenyei Gimnázium (Kisvárda) the pupils with Biology and Chemistry specialisation during the activity 'Can you spot a cancer mutation?' used real genomics data to search for mutations in KRAS-gene that can lead to the development of cancer (see also photos).

The pupils in Feketeerdői Általános Iskola (Helvécia) worked on the activity 'How can the bear's nose be switched on?' and they made themselves familiar with lighting, the basic principles of the batteries and the light bulb.

In Dunaújváros, in the economic secondary school, the pupils examined the colours of white light in a Physics lesson within the activity 'A fresh look at light: build your own spectrometer'. They did this with the help of simple tools and materials that can be found even in the households (e.g. CD, cereal-box).

Within the 'Microscale chemistry: experiments for schools' activity, the musicians of Bartók Music secondary school (Budapest) in their Chemistry lesson – with the help of materials and tools found even in the households – the acidity, alkalinity or neutrality of different substances.

Not only science teachers took part in the trainings but even an English-teacher who also found on the platform a teaching material meeting his interests: in Aszód, the pupils of Evangélikus Gimnázium got closer to natural sciences within their activity 'Using news in the science classroom'.

Future plans include involving more schools in the geographical surroundings of the 25 schools participating in the trainings.

6.10. Italy

Following the completion of the pilot phase of the Ark of Inquiry project in Italy in March 2016, allowing time for proper planning and availability of training resources in Italian, the implementation phase began in June 2016 with the hiring of a local consultant to administer the trainings in Italian. At this time, UNESCO also contracted with the National Association of Natural Sciences Teachers (ANISN) in Italy to help administer the trainings through the use of their network and their members' facilities to host the trainings. With the help of the local consultant, Ms. Anna Pascucci, the training plan was adapted and tailored to better fit the Italian situation while still remaining faithful to the overall implementation plan agreed to amongst the partners.

Implementation initiated in September 2016, with the identification of training locations and teachers (members of ANISN) approached to participate in the trainings. Three locations in Italy were identified:

- Napoli (southern Italy)
- Rosa (northern Italy)
- Foligno (central Italy)

A tailored training plan was then created in response to the unique specificities of the teachers in each location. After receiving the relevant level of training, teachers participating in the trainings were each then asked to choose and implement at least one inquiry activity from the Ark of Inquiry platform in their classroom. UNESCO was not present at any of the inquiry activities implemented in Italy. Of the 104 teachers who participated in the trainings, 74 of them returned activity reports on the implementation of activities in their classrooms. Reporting was not required of the teachers in Italy.


Figure 33 & 34. Approaching science learning through Ark of Inquiry activities

In general, the implementation plan that was developed at the end of Y2 was followed. Only in-service teachers were targeted in Italy, and efforts were made on a regional level (3

regions, to be specific). Activities in English from the Ark of Inquiry platform were translation into Italian as planned (5 were translated instead of the original 3 planned upon the suggestion of the teachers in the pilot phase). The main differentiation from the implementation plan was that no online course for teachers was developed and all trainings were delivered via in-person trainers, complemented by the resources of the ANISN teacher community. Thus, a total of eight (8) in-person trainings were help for the participating teachers.

Implementation of activities in schools: The 104 teachers that were trained came from 60 different schools: 3 kindergarten schools, 18 primary schools, and 39 secondary schools (both lower and high levels). The teachers in these schools selected their own activities to implement in their classrooms. Considering the information retrieved from the 74 activity reports voluntarily received, of the 18 activities available in Italian to them (17 on the platform and one offline version), teachers selected 16 different activities. All implementation activities are listed in great detail in the attached Appendix.

Of the activities listed, the two most popular activities selected by teachers were two activities that were introduced to the Ark of Inquiry platform by the ANISN network. These activities were:

- **The Clementine Test**

An activity designed to teach pupils how to focus their observations. Pupils are asked to pick a clementine from the pile and draw it in 2 minutes. They then compare their drawings and have discussions on how to identify “their” clementine from the others’ and on the importance of focused observations in inquiry.

- **Paper Napkins**

The activity is designed to have pupils test different kinds of paper napkins to determine which has the best absorption rate and thus will be the best option for a birthday party. In small groups, pupils must first identify the different possible criteria and how the testing can be done. The activity also helps pupils learn to make informed choices in life.

Figure 35 & 36. Pupils exploring Paper Napkins

More information on both activities can be found on the Ark of Inquiry platform at the hyperlinks above.

For the future, while the official implementation phase of the Ark of Inquiry project in Italy can be considered "concluded" as of end-February 2017, at least as far as trainings are concerned, the support provided by both the UNESCO Venice Office and the ANISN network will continue. New teachers will be encouraged to sign up for the Ark of Inquiry platform and currently the project team in Italy is working to identify ways that some of the training resources in Italian can be made available for new teachers who would like to join. However, it should be pointed out that one of the main lessons learned in the Italian context is that teachers cannot just simply be offered the platform, activities, and other resources and be expected to make sense of them, regardless of the language. There needs to be an interlocutor to "interpret" how best to utilize and apply these resources in the classroom so that teachers can take full advantage of this unique opportunity presented to them.

6.11. The Netherlands

HAN has performed 5 implementation activities with **8 teachers** and **172 pupils**. These activities took place in 3 different locations. During autumn 2016, **7 teachers** received the in-service training while future plans include several training in the following year:

- Spring 2017; 20 teachers (HAN area & Amsterdam)
- Spring 2017; 10 teachers, vocational education (HAN area)
- Autumn 2017; 10 to 20 teachers (HAN area & Amsterdam)

HAN has been in contact with Dutch science centres in focusing in the promotion of the Ark of Inquiry educational activities and supporting the sustainability of the project via training sessions for teachers. Moreover, HAN has collaborated with existing networks for science education (WKRU, platform Beta) in trying to have Ark of Inquiry training part of a professional development programme.

6.12. Turkey

The implementation in the large-scale implementation phase (first 12 months) was performed as planned. The pupils of the Bahcesehir Schools registered to the Ark of Inquiry platform with the “short” help, guidance and explanation of their teachers.

The pupils were motivated to enter to the Ark of Inquiry platform without extra notice.

The teachers are arranging assessment sheets for each of the pupils about their inquiry activities conducted on the Ark of Inquiry platform. It was, however, difficult to form teacher groups in assisting the pupils. As a final remark from pupils and their teachers, it was very easy to register and to find an inquiry activity from Ark of Inquiry platform.

Total number of schools that took part in the implementation phase (and estimate of teachers, pupils involved):

- Approximately 250 Turkish pupils have already registered to the Ark of Inquiry platform after their teachers’ notice. More than 20 teachers already registered to the Ark of Inquiry platform.
- At this starting phase of large-scale implementation, only 3 schools from Izmir and their teachers and pupils registered in the Ark of Inquiry platform. The activities on the platform are extensively implemented in these 3 schools. So far **13 teachers** and **300 pupils** have participated in the projects implementation. About 30 more schools are expected to join the project within the next few weeks.

Regarding the registered users, pupils in the system have started to implement inquiry activities from Ark of Inquiry platform. The science curriculum in Turkey changed recently so teachers are now revising the inquiry activities again to see their relation to the curriculum. This means that new activities will be designed and implemented to fit the teachers’ needs.

In year two of the large-scale implementation, new schools, teachers and pupils will be added to the Ark of Inquiry platform. Bahcesehir schools are a part of chain schools system. More than 120 schools are located in different locations in Turkey and are expected to be reached in order to involve as many educators in the Ark of Inquiry approach.

Appendix 1: Implementation activities per country

Detailed overview of implementation activities can be found in Google Drive at http://bit.ly/implementationARK