Ark of Inquiry: Inquiry Activities for Youth over Europe

Deliverable D2.3

Population of the Ark of Inquiry platform for piloting

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The Ark of Inquiry Consortium

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Legal Notices

Summary

The Ark of Inquiry project aims to build a scientifically literate and responsible society through inquiry-based science education. The project seeks to expand young people's awareness of Responsible Research and Innovation (RRI) by disseminating across Europe engaging inquiry activities in Science, Technology, Engineering and Mathematics (STEM) domains.

The focus of this deliverable is on the initial set of inquiry activities, which aim to provide a comprehensive selection of inquiry activities that are in accordance with the main goals of the Ark of Inquiry project for piloting. The current deliverable describes the methodology and process behind the initial selection of activities, presents an overview of the selected activities from the perspective of the selection criteria and coverage of core elements, describes how inquiry activities are represented within the Ark of Inquiry platform, and offers an initial set of inquiry activities that aim to help teachers (and others) across Europe to implement, adapt and reuse inquiry activities in their classrooms in the context of the Ark of Inquiry project.

The overview, which is the main focus of this document, revealed that the activities as a whole represent a good coverage of the central components of the project and thus provide a fruitful baseline for the piloting phase. Though the overall picture is clearly positive, the overview revealed some areas that might need attention in the future (activities for the youngest learner group, on the advanced proficiency level, and in some partner language areas). As the project evolves, and based on experiences during piloting, this initial selection of activities will be continuously revised and amended, and a final updated list of activities, with broader coverage of all aspects that guided the selection of this initial set, will be presented in M36 (Deliverable D2.5 Complete population of the Ark of Inquiry platform).

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1. Introduction

The Ark of Inquiry project aims to build a scientifically literate and responsible society through inquiry-based science education. The project seeks to expand young people's awareness of Responsible Research and Innovation (RRI) by selecting engaging inquiry activities in Science, Technology, Engineering and Mathematics (STEM) domains and to make these learning resources available to European learners, teachers and schools through the Ark of Inquiry platform.

The focus of this deliverable is on the initial set of inquiry activities, which aim to provide a comprehensive selection of inquiry activities that are in accordance with the main goals of the Ark of Inquiry project for piloting. The current deliverable describes the methodology and process behind the initial selection of activities, presents an overview of the selected activities from the perspective of the selection criteria and coverage of core elements, describes how inquiry activities are represented within the Ark of Inquiry platform, and offers an initial set of inquiry activities that aim to help teachers (and others) across Europe to implement, adapt and reuse inquiry activities in their classrooms in the context of the Ark of Inquiry project.

The methodology for selecting the activities finds its origins in the Description of Work (DoW) and Deliverable D1.1 (Description of inquiry approach that fosters societal responsibility) and their translation into the set of selection criteria that was specified in Deliverable D2.1 (Criteria for selection of inquiry activities including societal and gender dimensions). The selection criteria are based both on a theoretical rationale and on contemporary research evidence and consist of seven mandatory elements (Existing activity, Targeted age range 7–18, Focus on STEM domain, Support for inquiry type of learning, Coverage of at least one inquiry phase, Targeted for a specific inquiry proficiency level, Evidence on the success of the activity) and two recommended elements (Support for societal responsibility and Integration between learning content and inquiry skills).

Based on these criteria, a template with guidelines for selecting and instructions for describing potential activities was developed and distributed among the partners of the project in November 2014. In January 2015 a preliminary set of activities that were provided by each of the partners was reviewed against the criteria and the general aims of the Ark of Inquiry project. This initial review process and the following discussions led to some modifications to the original template. The most notable changes were that the activities should include a part that is directly targeted at learners and the change of the descriptors for the proficiency levels from Basic-Advanced-Expert to Novice-Basic-Advanced. The set of preliminary activities from the partners also identified some valuable sources of activities that have a high level of correspondence with several central ideas behind the Ark of Inquiry. Activities from the Go-Lab project (http://www.go-lab-project.eu), for instance, use, to a large extent, the same inquiry model (Pedaste et al., 2015) for their inquiry spaces; activities

from the Compass project (http://compass-project.eu) greatly emphasise Responsible Research and Innovation related topics, while activities from the Katholieke Hogeschool Limburg (KHLim) aim to build a perception of relevance of physics for both boys and girls by showcasing connections between the concept of quantum mechanics and everyday life phenomena. A more elaborate review of all activities proposed by the partners during the month of February and the beginning of March 2015 was translated into a more detailed feedback to the individual partners related to their preliminary proposed activity descriptions. This included, for instance, advice on certain aspects of the descriptions in order to make them clearly aligned with the general framework of the Ark of Inquiry, requests to separate the teacher and learner parts in activities that were described in an intermixed format, and, on some occasions, to describe additional activities from resources that seemed well-aligned with the Ark of Inquiry project goals. The finalised revised versions of the descriptions were then collected by the University of Turku during the latter half of April and the beginning of May, and this resulted in a collection of 68 activities for piloting the Ark of Inquiry.

It is important to recognise that the range within each element of the selection criteria is so wide as a whole that a single activity that passes the criteria can (and shall) cover only part of the range (e.g., basic proficiency level physics activity for 13–15-year-olds). In order to accommodate various learners and teachers, coverage should therefore come from the collection of all activities. The next section will review the initial set of inquiry activities as a whole against the coverage of the full criteria and in relation to the goals of the Ark of Inquiry in order to get a better perspective on the current status and the future needs for additional activities in the Ark of Inquiry.

2. Overview of selected activities

Inquiry phases

Inquiry learning is a process that is often complicated for learners (e.g., Veermans, van Joolingen & de Jong, 2006), and dividing the process into phases can make it easier to be explained and understood, especially when learners are not yet very proficient. In the Ark of Inquiry the inquiry process is divided into five distinct phases (Orientation, Conceptualisation, Investigation, Conclusion, and Discussion) according to Pedaste et al. (2015) inquiry model (see Deliverables D1.1. and D2.2. for more details on the inquiry phases). According to the selection criteria (Deliverable D2.1.), an activity needs to cover, at the minimum, one of the five inquiry phases. This relatively loose criterion stems from the fact that existing inquiry activities that were not designed with these particular phases in mind will not necessarily comply with all phases of the Pedaste et al. inquiry model. Another reason is that an activity that covers only one (or two) inquiry phases may cover/address that phase particularly well and setting a stricter criterion would mean exclusion of these activities from the Ark of Inquiry. In general, though, activities covering multiple phases are highly recommended and desired, because multiple phases can ensure that learners get a good and comprehensive learning experience in a process that a) resembles scientific inquiry, b) helps to improve their inquiry skills and proficiency (i.e. the ability to generate and evaluate and discuss scientific evidence and explanations), and c) promotes their understanding of the process of conducting science in a better and more responsible manner. Regarding the latter point, the Orientation phase and the Discussion phase are considered particularly important in the context of Ark of Inquiry, because it is in those phases that the RRI aspects can be thoroughly addressed most naturally.

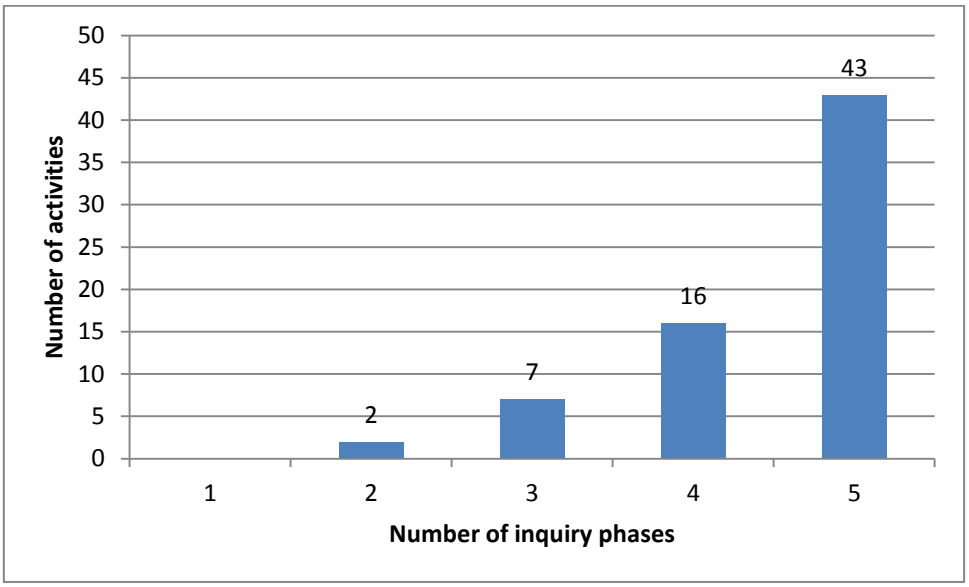

Figure 1. An overview of the number of inquiry phases covered in individual activities

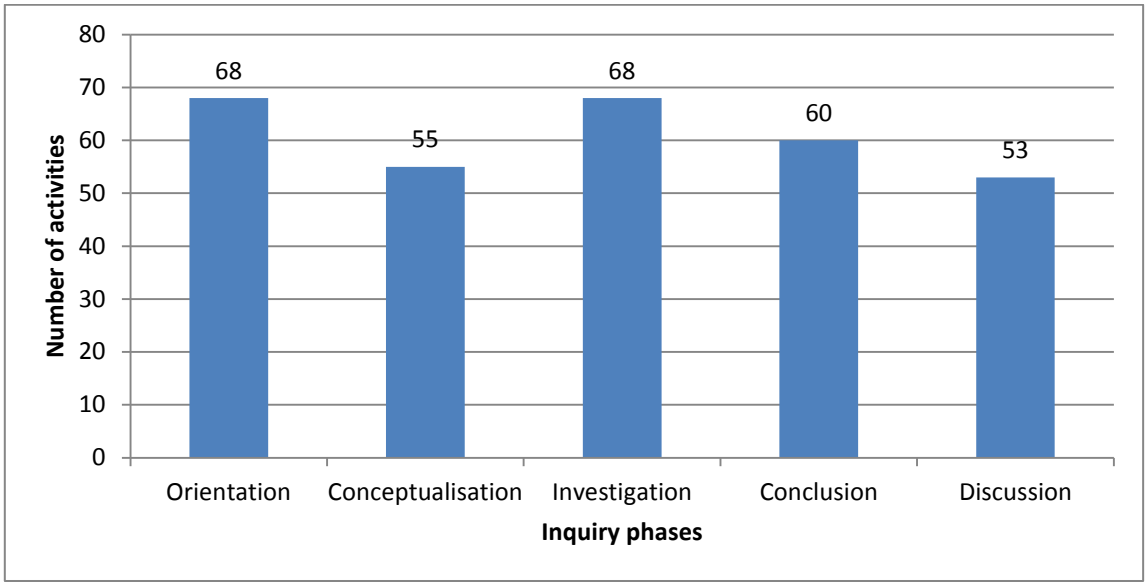

Figure 2. Number of times that an inquiry phase is included in an activity

As shown in Figure 1, most of the inquiry activities consist of four or five inquiry phases and single-phase activities are completely absent, which can be considered as an excellent outcome and a good baseline for piloting. As shown in Figure 2, the Orientation, Conceptualisation, Investigation, and Conclusion phases are present in virtually all activities, and only the inclusion of the Discussion phase is slightly less frequent.

Proficiency levels

In order to make inquiry learning engaging and productive, it is important to match the learner's level of inquiry proficiency with suitably challenging inquiry activities. In the context of Ark of Inquiry this is supported by distinguishing levels of inquiry proficiency. Inquiry proficiency, one of the central concepts in the Ark of Inquiry project's inquiry framework, refers to pupils' experience, skills and capacity regarding inquiry learning, and in the context of Ark of Inquiry, inquiry activities are divided into the following three proficiency levels: A – Novice, B – Basic, and C – Advanced.

The main distinctive features between the inquiry proficiency levels are the problem-solving type (well- vs ill-defined problem space), learner autonomy (from teacher-led to pupil-led), and RRI awareness (gradually expanding the amount and scope of interaction/discussion). At the lowest level, Novice level (A), the activities aim mainly at engaging learners in and introducing them to structured inquiry activities. At the Basic level (B) the inquiry activities become semi-structured and guide learners towards independency related to knowing how to inquire and reflect on and discuss issues related to the activity. At the Advanced level (C)

learners can already shape their own inquiry activities and reflect and discuss outcomes in collaboration with various stakeholders.

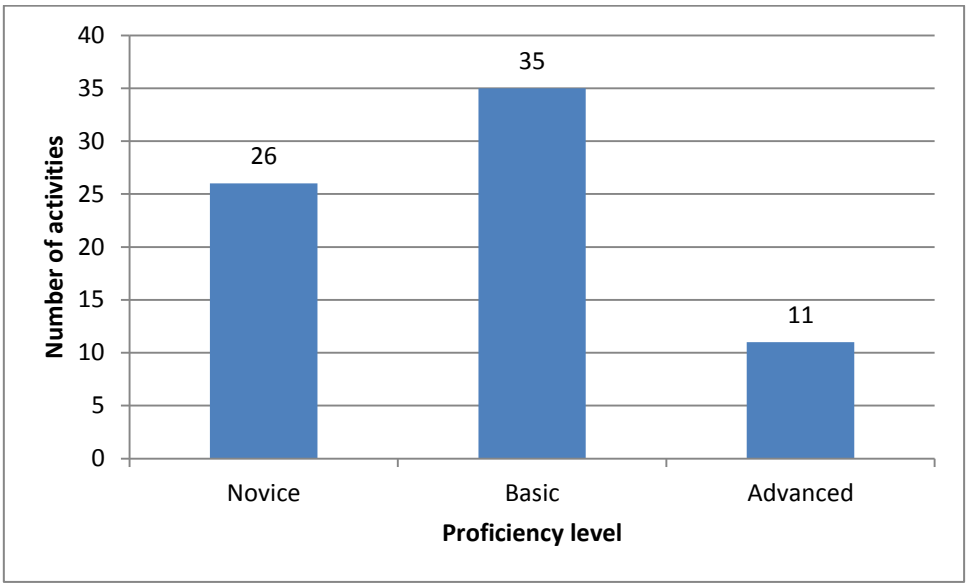

Figure 3. Number of inquiry activities on each proficiency level across the whole age range

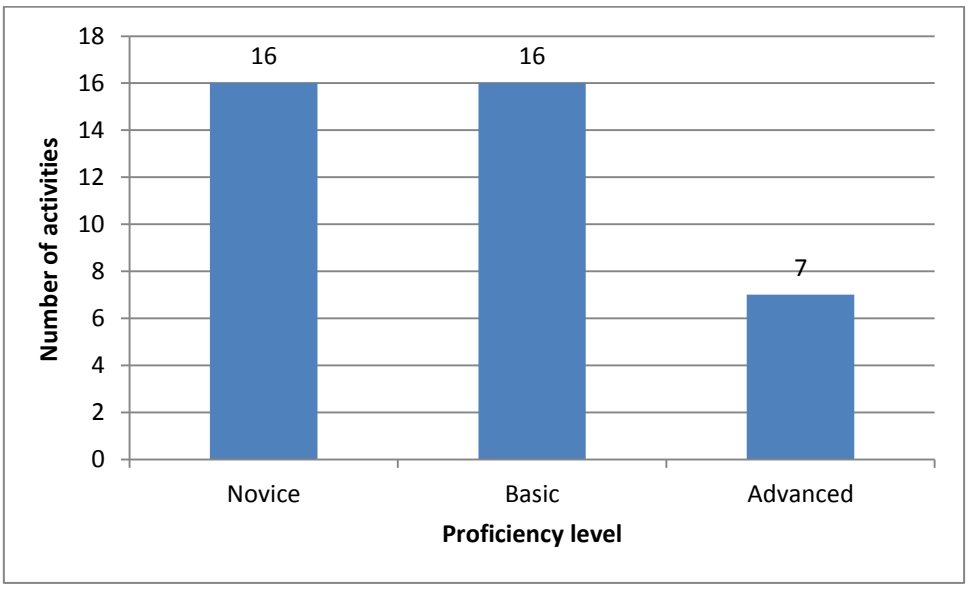

Figure 4. Number of inquiry activities on each proficiency level on elementary school level

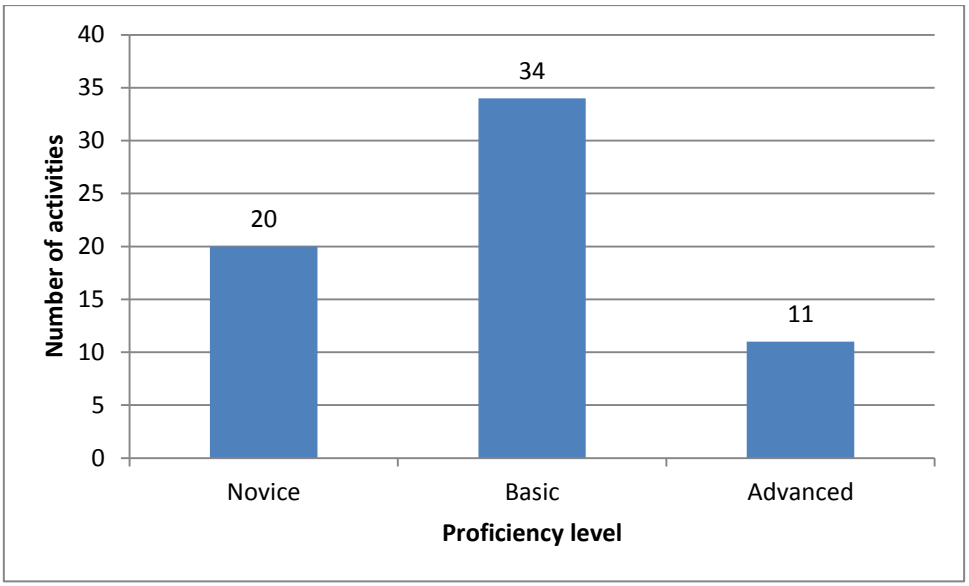

Figure 5. Number of inquiry activities on each proficiency level on secondary school level

As shown in Figure 3, a majority of the current activities are on the A-level (36%) and B-level (49%), whereas there are only a limited number of activities on the C-level (15%). As can be seen from Figures 4 and 5, A- and B-level activities are more or less in balance on elementary school level (ages 7 to 12), whereas on secondary school level (ages 13 to 18), the balance shifts more towards B-level activities, while C-level activities are less frequent. The lower number of C-level activities does not necessary pose a problem for piloting since the majority of the pupils are not expected to be that experienced or advanced as investigators at the beginning of the project, but it nevertheless highlights the need for identifying and selecting C-level activities in the future.

Table 1. Coverage of the five inquiry phases on each of the three inquiry proficiency levels

	Orientation	**Conceptualisation**	**Investigation**	**Conclusion**	**Discussion**
Novice	26	21	26	24	21
Basic	35	35	35	34	26
Advanced	11	3	11	6	10

The combination of proficiency and phases provides a view of the coverage of phases on the different proficiency levels. Table 1 displays this through the cross tabulation of inquiry phases and inquiry proficiency levels as it was defined in the Framework for Inquiry Proficiency in Deliverable D1.1 and highlights a good coverage of the core aspects of the Ark of Inquiry framework within the activities, on both the A and B levels.

Responsible Research and Innovation (RRI)

In the section on inquiry phases it was already argued that besides the general nature of inquiry (e.g., focus on environmentally and societally relevant topics), the Orientation and Discussion phases where identified as phases that would be the most appropriate for implementing dimensions of RRI into the inquiry activities. Therefore, devoting specific attention to reviewing if these dimensions are addressed in the activity has been recommended. This entails identifying how and what kind of a context is provided in the Orientation phase. Furthermore, it entails identifying if the Discussion phase connects the context to the inquiry process. In the inquiry section it was already shown that as a result of the selection criteria, many of the selected activities include both the Orientation and Discussion phase, making these activities likely to be able to contribute to the RRI goals of the project. It is also positive to see that quite many of the initial activities do focus on environmental (e.g., pollution, CO_2 emission, Sea pH levels) and societal contexts (e.g., greenhouse effect, transportation, solar energy, alternative energy), especially because activities in these contexts can also contribute to another goal of the Ark of Inquiry project, namely increasing girls' interest in STEM domains.

Gender

One of the specific goals of the Ark of Inquiry project is to attract more girls to science and science careers. Negative views and low self-efficacy of STEM are often associated with characteristics of the learning environment that do not motivate and engage girls. Therefore, in order to engage more girls in STEM, motivational and emotional processes should be taken into consideration as well. The first way that this is done in the Ark of Inquiry is through emphasis on inquiry activities that are engaging by nature. Another way in which the Ark of Inquiry activities provide affordances in that direction and hence empower girls in science is by providing active learner-centred learning in environments that connect to environmental, societal and everyday-life contexts. Though both ways are believed to help to address girls, they will, of course, also have an impact on boys with similar engagement motivational profiles. As such it is positive to see that the activities that support RRI through their focus on environmental (e.g., pollution, CO_2 emission, sea pH levels) and societal (e.g., greenhouse effect, transportation, solar energy, alternative energy) contexts also provide affordances for empowering girls, in addition to activities in everyday-life contexts (e.g., food, diet, bulbs, soap, digital imaging) in the selection that can fulfil a similar role.

Age range

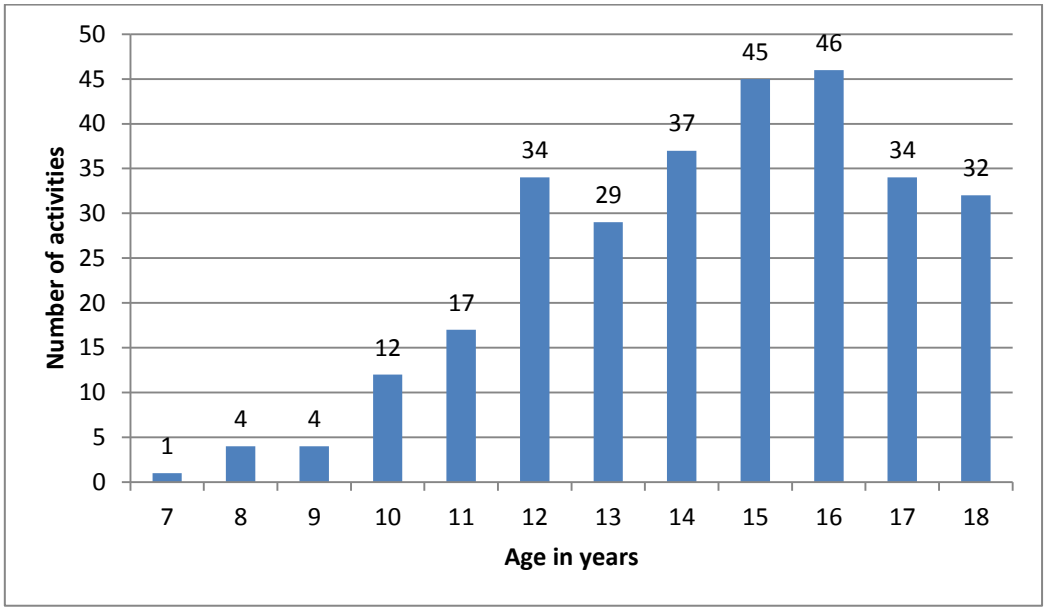

Figure 6. Number of inquiry activities available in each age within the targeted age range of the Ark of Inquiry.

Though proficiency might be a more important indicator than age in a European project (proficiencies might vary across age over different countries), age indications nevertheless provide an alternative view on the coverage of the activities. Figure 6 shows that the distribution of activities across the targeted age range (7–18) is relatively good, but there seems to be room for improvement with regard to activities for the youngest age groups (between 7 and 9 years of age). While this suggests that more activities are needed for the youngest learners, the age level should be considered more as a (rough) indicator and recommendation for a targeted user group (and always in combination with the proficiency level), and piloting should reveal to what extent activities are lacking in this respect.

Domains

Since the Ark of Inquiry targets inquiry activities in STEM domains, it is also interesting to see the coverage of domains among the selected activities. The majority (82%) of the activities focus on one or two domains (Figure 7), while activities covering as many as five domains are also available. Most of the activities focus on the domain of Physics (Figure 8). Chemistry, Biology and Mathematics are the three other major domains covered by the activities. All in all, a rather diverse range of domains is covered, with both single disciplinary and cross disciplinary activities.

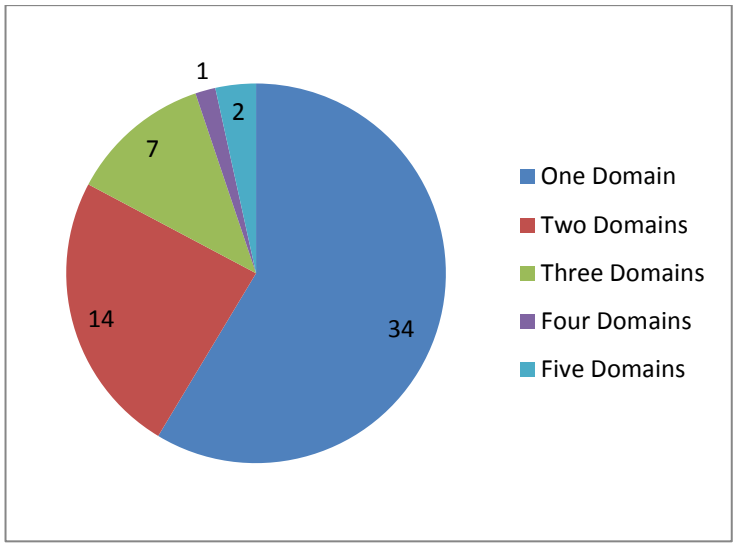

Figure 7. Number of domains covered within individual inquiry activities

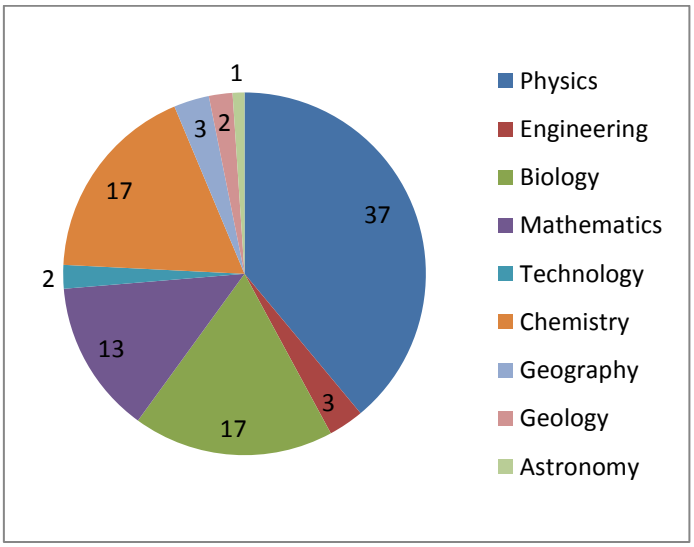

Figure 8. Frequency of individual domains being covered by the inquiry activities

Language and language dependency

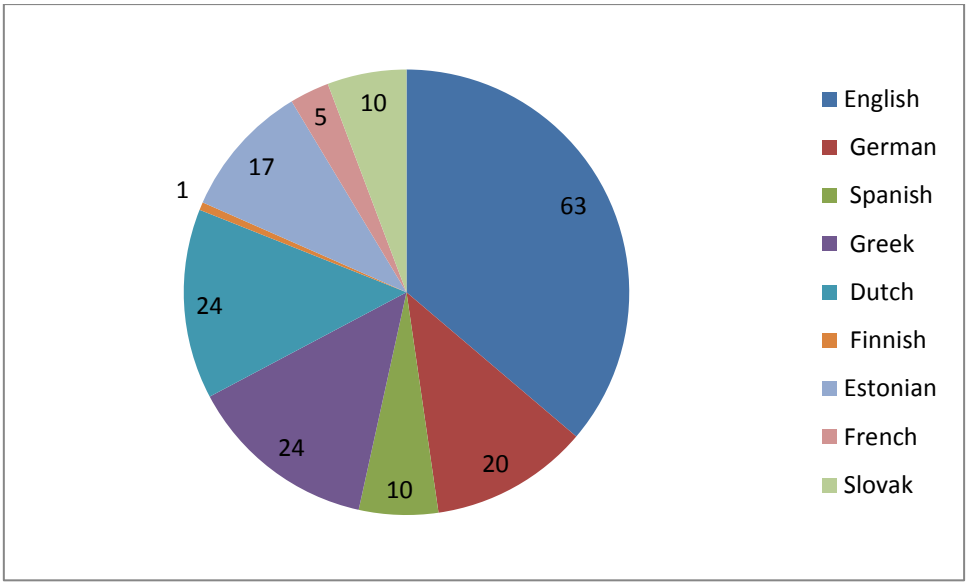

Figure 9. Availability of inquiry activities in different European languages

Figure 9 shows that activities are available in 9 different languages (English, German, Spanish, Greek, Dutch, Finnish, Estonian, Latvian, Slovak). More than half of the activities (thirty-five) are available in multiple languages: eight are available in two different languages, one in four, ten in five, and five in a total of six different languages. Most of the activities (sixty-three) are available in English. Coverage of Dutch, Greek, Spanish, German, Estonian, and Slovak languages is good (Dutch, Greek and German language activities can also be used in multiple countries). In terms of languages spoken in the countries of the project partners, Finnish, French and Hungarian are the languages that need more attention in the future.

Activities in a foreign language do not render them useless. First of all, there is great variation in language dependency between activities, that is, some activities can be used with little effort in a foreign language whereas others require some or a high level of adaptation. Secondly, language dependency is in many cases subjective and teachers and schools might actually seize different language activities as an opportunity to integrate content and second language learning (see Deliverable D2.2. for more details on the language issue in general and some potential solutions). These are the reasons why activities in the Ark of Inquiry are also classified according to their language dependency level. Three levels of language dependency are distinguished (low, medium, and high), and, broadly, these can be understood as low, meaning there is fairly little language understanding needed in the activity (e.g., concepts and words in a simulation interface that is self-directing through the design), medium as having more language involved, but the amount and the way it is incorporated in the activity allows relatively easy adaptation or work around (e.g., an accompanying sheet of paper or machine translation), and high, meaning that these

strategies do not work and that it would require a fairly good understanding of the language and/or real effort to make it available in another language.

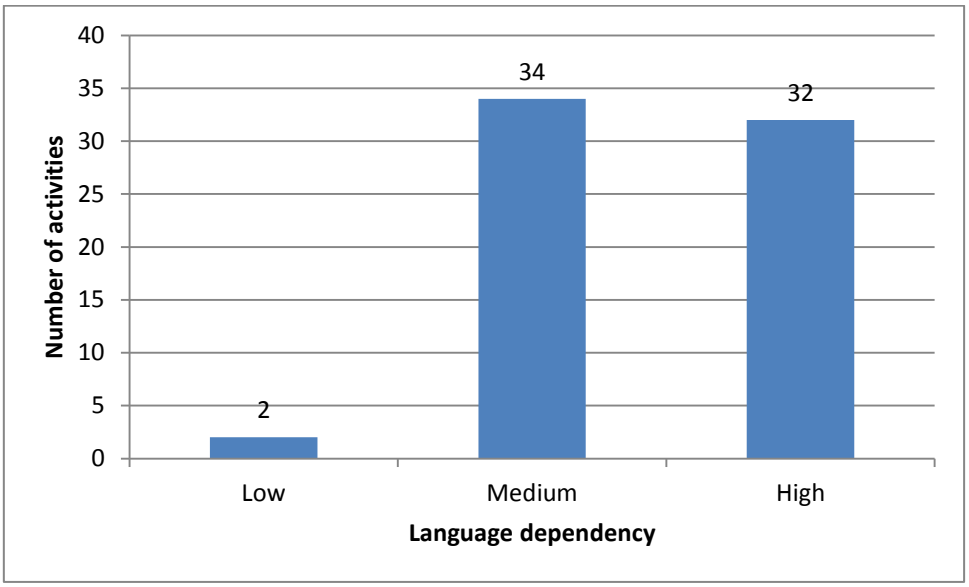

Figure 10. Level of language dependency of the inquiry activities

As shown in Figure 10, thus far there are only two activities that have a low language dependency (both are on elementary level), but for approximately half of the activities the level of language dependency is medium, suggesting that these activities can be used by non-native speakers, at least on the secondary school level.

Empirical evidence

In the process of selecting activities (either for uptake in the Ark of Inquiry or for use as a learner) it serves as a requirement that there is some kind of evidence which makes it more likely that the activity will be suitable for achieving intended learning outcomes. Within the framework of the Ark of Inquiry, sources of evidence can be research, theory and/or practice. Viewed from the evidence perspective it is positive that many of the activity descriptions report theoretical evidence (theoretically informed design, e.g., covering and/or supporting all inquiry phases) and/or ecological evidence (use in daily school practices). Research evidence, however, seems to be mostly lacking at this point, but this will likely change in the future as quite many of the activities are relatively new.

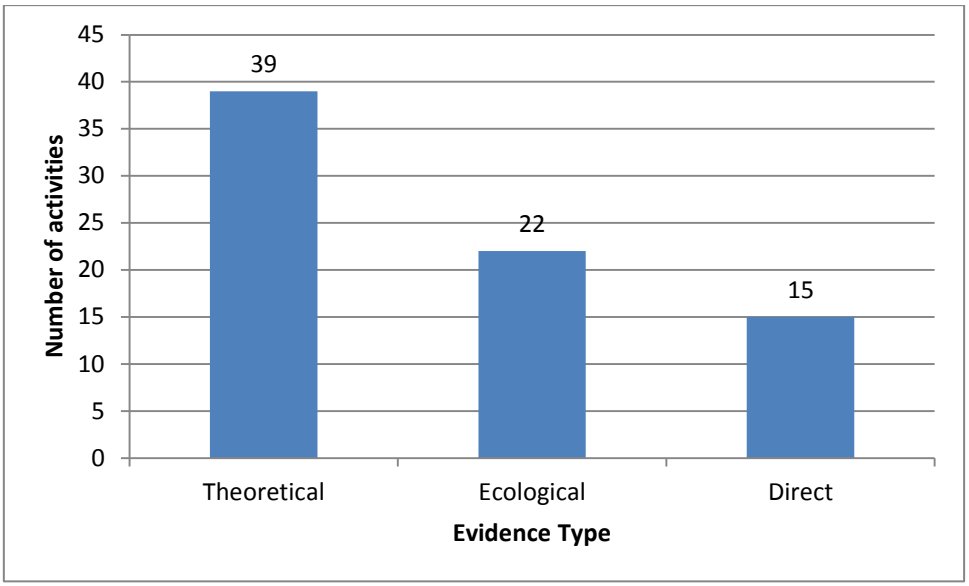

Figure 11. Different types of evidence related to the design and use of the inquiry activities

Learning Time

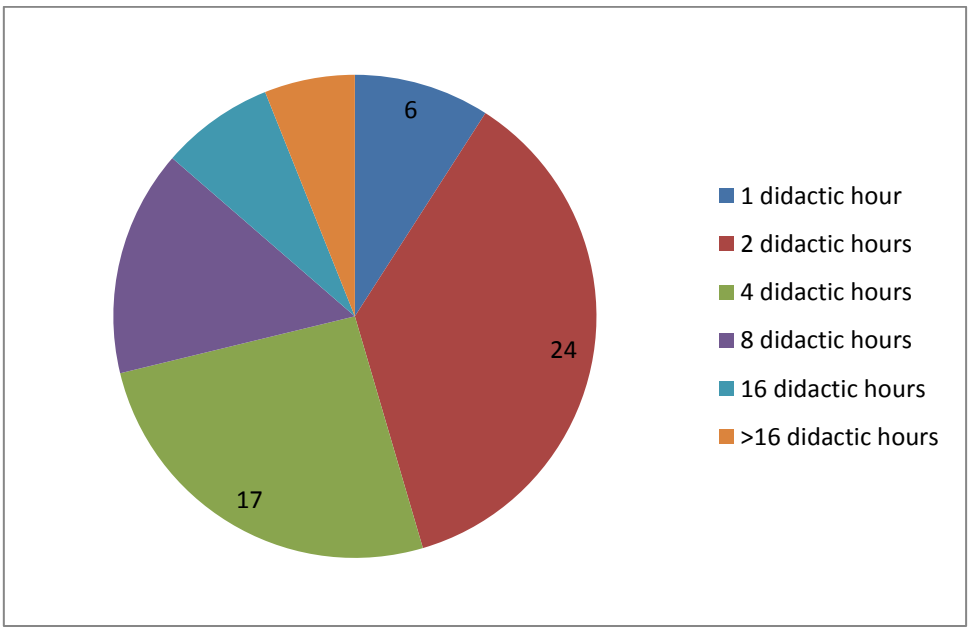

Figure 12. Distribution of inquiry activities by learning time

Though it was not an explicit part of the selection criteria, the estimated learning time of an activity will likely be a factor for teachers and learners in deciding whether to engage with a certain activity. The estimated median duration of inquiry activities is 110 minutes. However, there is great variation in the learning time among the activities, the shortest lasting only one didactic hour (45 minutes) and the longest 155 didactic hours (7000 minutes) (see Figure

12 for more details). Activities with a longer learning time might enable the pupils to learn more about the inquiry process than the shorter ones. The longer ones might also better address RRI (though that naturally depends on the content), but in any case, the variance in range provides an option for teachers and learners to engage in projects with different durations based on the available resources, time, and goals.

3. Representation of inquiry activities within the Ark of Inquiry platform

Within the Ark of Inquiry platform the inquiry activities are presented as a library of activities, allowing potential users to either scroll through the list of activities, search for activities using a search function or to select an activity based on keywords attributed to the activity from a word cloud.

The characteristics of the inquiry activities that were specified in D2.1 (Criteria for selection of inquiry activities including societal and gender dimensions) and discussed in the previous part of the present deliverable (2. Overview of selected activities) will be used within the platform to describe the activities in detail in order for users of the Ark of Inquiry to make informed choices when selecting activities. The information on each activity that will be available for the Ark of Inquiry users includes the following: title of the activity, description, location (web-based or physical location), domain or domains, topic or topics, language or languages, proficiency level of the activity (evaluated as a whole or by inquiry phases covered), inquiry phases covered, age range, learning time, materials needed for the activity, evidence on the success of the activity, evidence description (which objects are needed for the pupil to prove he or she has completed the activity), copyright information and other restrictions, and keywords.

3.1 Activity list

In the activity list (Figure 13), the user is presented with inquiry activities, which are listed starting from the activity added to the platform most recently. This order aims to guide users to discover new activities. When looking through a list of activities, the users can see the names, the first paragraphs of the description and the locations of the activities. Full information about the activity is revealed upon selecting the activity (Figure 14).

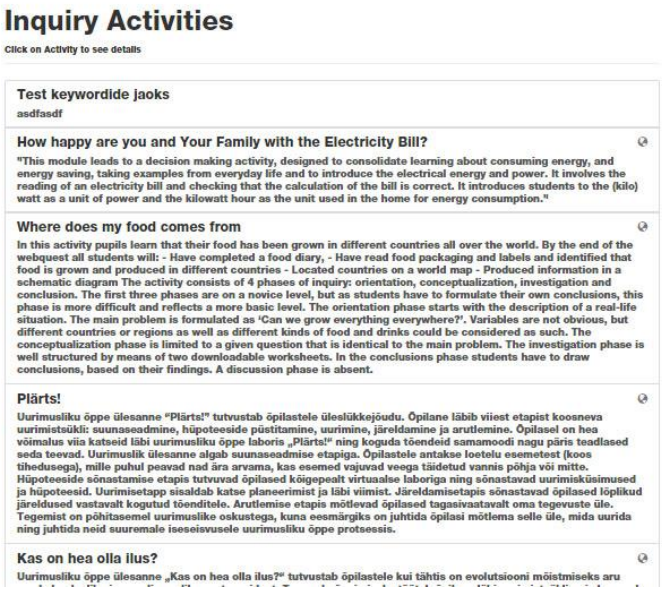

Figure 13. Example of the activity list from the initial platform prototype with no design applied

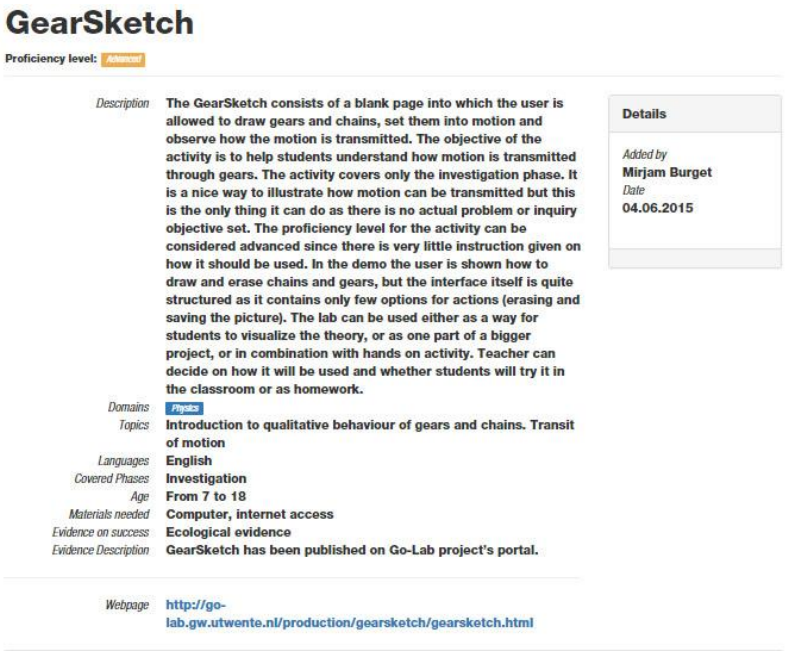

Figure 14. Example of the activity form from the initial platform prototype with no design applied

3.2 Search function

Within the search function (Figure 15), setting limiting parameters to several of the characteristics allows filtering the complete list of activities to find the ones most suitable for the current needs of the user. In addition to searching for specific text or keywords, the user can set parameters for the following characteristics: location (either web-based or in a location in the country of the user), domains, languages, proficiency level, age range and learning time. The user can also search for activities containing a strong RRI component.

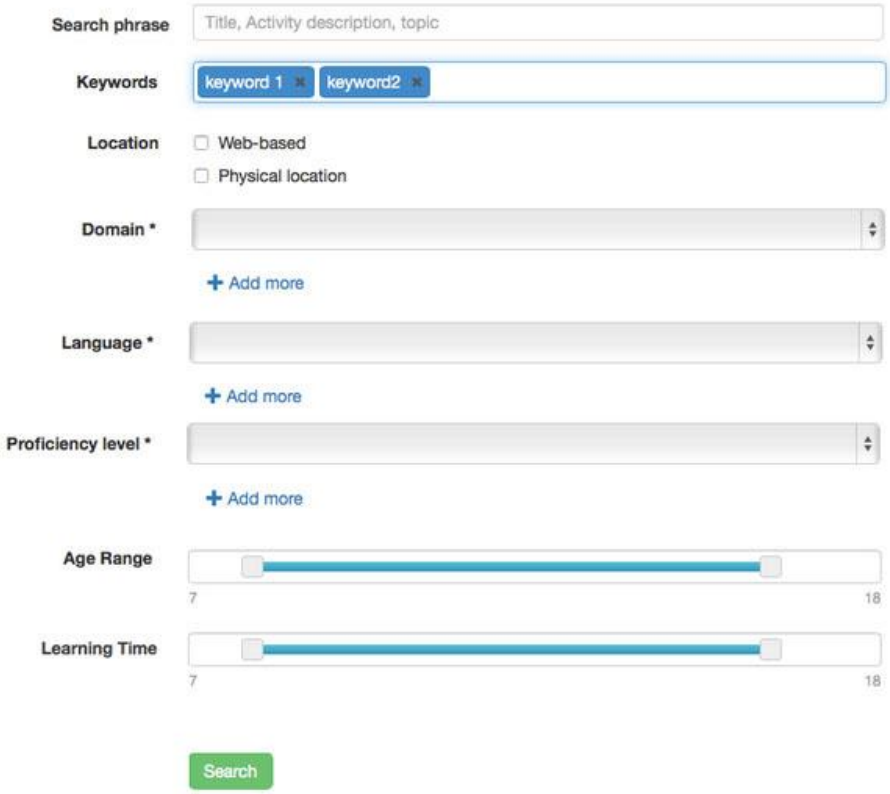

Figure 15. Example of the search form from the initial platform prototype with no design applied

3.3 Word cloud

A word cloud (Figure 16) consisting of the most commonly used keywords or -phrases associated with inquiry activities provides another way to filter inquiry activities by displaying all activities related to specific keywords or -phrases. Keywords used most often are displayed bigger than the ones mentioned less frequently. For example, clicking on the phrase “solar system” within the word cloud guides the user to a list of activities dealing with topics related to the solar system regardless of the actual domain or other characteristics of the inquiry activity. The advantage of this alternative is that it does not require ‘pre-knowledge’ on adequate filtering terms or keywords, since they are displayed on the screen. This allows the user to be more exploratory than with the search function, while at the same time being more directed than with going through the list.

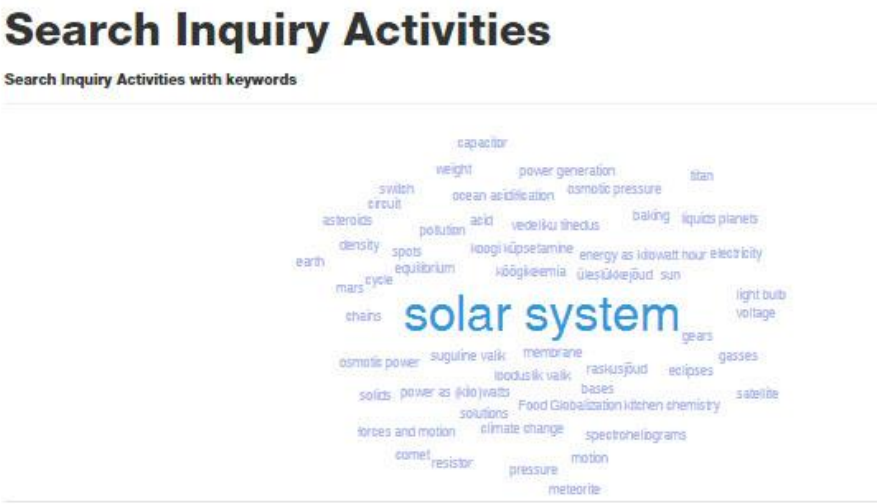

Figure 16. Example of the word cloud form from the initial platform prototype with no design applied

In addition to finding activities using the aforementioned options, the Ark of Inquiry platform allows teachers and other users with similar roles to recommend certain activities to pupils within their pupil groups, and activities can be recommended on the main page of the platform as highlighted activities. Activities that prove engaging and interesting to pupils will also be promoted in the social media (for example, on the Ark of Inquiry Facebook community page: https://www.facebook.com/ArkofInquiry) as an activity focus feature.

4. Discussion

The current deliverable describes the methodology and process behind the initial selection of inquiry activities in the context of the Ark of Inquiry project, presents an overview of the 68 selected activities from the perspective of the selection criteria and coverage of core elements of the Ark of Inquiry project, describes how those inquiry activities are represented within the Ark of Inquiry platform and lists the initial set of inquiry activities published in the Ark of Inquiry platform that aim to help teachers (and others) across Europe to implement, adapt and reuse inquiry activities in their classrooms in the context of the Ark of Inquiry project. The overview, which was the main focus of the document, revealed that the activities as a whole represent a good coverage of the central components of the project and thus provide a fruitful baseline for the piloting. Though the overall picture is clearly positive, the overview revealed a potential shortage of activities among the youngest learner group (seven to nine years old), on the advanced proficiency level, and some partner language areas (Finnish, French, and Hungarian). Though these shortcomings are not considered critical for piloting, these issues might need to be addressed in the future (on a positive note some Finnish, French, and Hungarian activities are already in a queue, waiting for a review and approval). Despite a formally strong list of activities for piloting, it is important during the next stages of the project that activities are used during the piloting in order to evaluate the value of the activities in real Ark of Inquiry contexts. The feedback from piloting will determine future directions regarding activities and the support mechanism around them. From this moment onwards, the list of inquiry activities that is available for teachers and learners across Europe will be constantly updated until the finalised set of inquiry activities in the context of Ark of Inquiry is published in month 36 (Deliverable D2.5 Complete population of the Ark of Inquiry platform).

5. References

Pedaste, M., Mäeots, M., Siiman L. A., de Jong, T., van Riesen, S. A. N., Kamp, E. T., Manoli, C. C., Zacharia, Z. C. & Tsourlidaki, E. (2015). Phases of inquiry-based learning: definitions and the inquiry cycle. Educational Research Review, 14, 47-61. doi:10.1016/j.edurev.2015.02.003

Veermans, K. H., van Joolingen, W. R., & de Jong, T. (2006). Using heuristics to facilitate scientific discovery learning in a simulation learning environment in a physics domain. International Journal of Science Education, 28, 341-361.

Appendix 1: The full list of inquiry activities

Splash Buoyancy Lab

Electricity: an alternative approach to Ohm's Law

Sinking and Floating

How are the light fixtures in a house connected

GearUp

pH scale

Build an atom

Is it Good to be Beautiful - Understanding Evolution through Natural and Sexual Selection

The color of the light

In the shadows

Craters on Earth and Other Planets

Conservation of momentum in particle collisions

Dangerous Cold

Desertec

Water Shortage

Car Pollution

Water Quality

Biodiversity

Solar car

Light bulbs

Food

Dangerous rain

Galaxy crash

Ionic concentrations of acids and bases in a workbench simulation

Temperature in the air: molecule movements in the gases

Can we learn from the past?

Carbon detective in transport

How do people travel when they go on holiday?

What does our home produce?

Where does my food come from?

Idea for the research from Ice Age Centre

Inquiry-based learning in Ice Age Centre

Investigate and Discover

Oil pollution in water

Our daily bread

Biological values of my homeplace water body

Patties for snowboarders

Learning station I: Inexplicable phenomena?

Learning station II: What is light?

Learning station III: Light as a wave: which waves are these?

Learning station IV: Wave Particle Duality – Quanta of Quantum Fields

Learning station V: Predicting the hydrogen emission lines with a quantum model

Learning Station VI - From photo-electric effect to digital imaging

Learning station VII: Semiconductors

Hands on: Discrete emission lines of chemical elements

Hands on: Measuring Planck's Constant with LED's

Hands on: Diffraction of light at a hair

"How to make perfect hard boiled eggs that are easy to peel?"

A Healthy pizza

Design a CO2-friendly house

ECO mission

Forensic laboratory

Should Zero Emission Cars Be Made Compulsory - Is It Feasible?

Should Vegetable Oils be used as a Fuel?

Which Soap is Best?

Traffic Accident: who is to blame?

How can we create a car which goes on the beach using air power?

How happy are you and Your Family with the Electricity Bill?

How to perform a GMO - BACTERIAL TRANSGENESIS

Forensic science: DNA fingerprint

Enzyme catalysis

genetic engineering: RECOMBINANT PROTEIN PRODUCTION

Molecular phylogenetics

Activity 1.1 - Estimating the density of an endangered plant species in a named ecosystem

Activity 1.2 - Plant adaptations and the effects of global warming on endangered and/or farmed species

Activity 1.3 - The science of taxonomy

Activity 1.4 - Flowering plant reproduction

Activity 1.5 - Plant extracts and antibiotics

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

How can we create a car which goes on the beach using air power?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.profiles-deu.net/wp-content/uploads/2015/05/ICASE-DEU_studentactivity.pdf

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

force and motion

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

force and motion

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-14

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

4 Lessons

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This module leads to a decision making activity, designed to consolidate learning about Design and technology; Using mechanisms – gearing down, Assembling components, Combining materials, Renewable energy, Measuring area, Measuring distance, Measuring time, Forces, Friction, Air resistance, Pressure, Scientific investigation, taking examples from everyday life and to introduce the friction, energy and power.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[X] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the 3-stage model by Jack Holbrook and tested in PROFILES and PARSEL Project implementation process

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

This uniqueness of this activity is specifically exhibited by:
1. a society related and issue-based title (supported in the student guide by a scenario);
2. student-centred emphasis on scientific problem solving, encompassing the learning of a range of educational and scientific goals;
3. including socio-scientific decision making to relate the science acquired to societal needs for

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, lab equipments, Lego Kit, ruler, stick, masking tape, fan

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[x] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Bulent Cavas, Selin Nur Sayar and Duygu Seyman

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Should Zero Emission Cars Be Made Compulsory – Is It Feasible?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://icaseonline.net/parsel/www.parsel.uni-kiel.de/cms/fileadmin/parsel/Material/Hatfield/pdf/Fuel_cell_-_student_activities.pdf

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Hydrogen, fuel cells

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Chemistry

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Hydrogen and Fuel Cells

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-14, 14-16

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

7 Lessons

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This set of activities allows students to consider factors which need to be considered if a car is to give zero emission (or the emission of water vapour only). The module is planned so that students suggest the scientific learning they need to understand about hydrogen and how fuel cells have a potential advantage over hydrogen itself, once the technology has been developed. The discussion centres around the feasibility of a zero emission car given the many social factors involved and the properties of hydrogen.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the 3-stage model by Jack Holbrook

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[x] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Developer: Ingo Eilks, Spyros Evlogimenos, Charitos Olympios and Nicos Valanides; Edited by: Jack Holbrook

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

How happy are you and Your Family with the Electricity Bill?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.profiles-deu.net/wp-content/uploads/2015/05/ICASE-Electricity-bill_student_activity.pdf

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

power as (kilo)watts, energy as kilowatt hour

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

power as (kilo)watts, energy as kilowatt hour

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-14

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

4 Lessons

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This module leads to a decision making activity, designed to consolidate learning about consuming energy, and energy saving, taking examples from everyday life and to introduce the electrical energy and power. It involves the reading of an electricity bill and checking that the calculation of the bill is correct. It introduces students to the (kilo) watt as a unit of power and the kilowatt hour as the unit used in the home for energy consumption.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[X] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the 3-stage model by Jack Holbrook and tested in PROFILES and PARSEL Project implementation process

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

This uniqueness of this activity is specifically exhibited by:
1. a society related and issue-based title (supported in the student guide by a scenario);
2. student-centred emphasis on scientific problem solving, encompassing the learning of a range of educational and scientific goals;
3. including socio-scientific decision making to relate the science acquired to societal needs for

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[x] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

This module has been adapted from that developed under the PARSEL project (www.parsel.eu) as part of an EC FP6 funded project (SAS6-CT-2006-042922-PARSEL) on Popularity and Relevance of Science

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Which Soap is Best ?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://icaseonline.net/parsel/www.parsel.uni-kiel.de/cms/fileadmin/parsel/Material/Hatfield/pdf/Best_Soap_-_Student_Activities.pdf

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Saponification (consolidation of concept); Soaps (consolidation of its preparation) and their cleaning action.

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Chemistry

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Devising factors affecting 'best'; planning and carrying out tests on the cleansing ability of soap. Comparing soaps by cost.

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-14, 14-16

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

4 Lessons

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This set of activities allows students to consider factors which can be involved in determining the best soap to use. The activities also allow students to devise tests for determining the effectiveness of the soaps as cleaning agents. Finally the activity reinforces the meaning of a soap and an understanding of its cleaning action

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[X] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the 3-stage model by Jack Holbrook and tested in PROFILES and PARSEL Project implementation process

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

This uniqueness of this activity is specifically exhibited by:
1. a society related and issue-based title (supported in the student guide by a scenario);
2. student-centred emphasis on scientific problem solving, encompassing the learning of a range of educational and scientific goals;
3. including socio-scientific decision making to relate the science acquired to societal needs for

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, lab equipments

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[x] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Jack Holbrook

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Traffic Accident: who is to blame?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://icaseonline.net/parsel/www.parsel.uni-kiel.de/cms/fileadmin/parsel/Material/Hatfield/pdf/Traffic_Accident_-_student_activities.pdf

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Saponification (consolidation of concept); Soaps (consolidation of its preparation) and their cleaning action.

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Coefficient of Friction and Skidding , Friction

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-14, 14-16

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

4 Lessons

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

A boy was knocked down by a van on a pedestrian crossing linked with traffic-lights. The boy was slightly injured. A reconstruction of the accident was undertaken in an attempt to determine blame. This series of lesson assumes that the students are familiar with the laws of motion, but explores the possibility of introducing the idea of friction by an examination of skid marks related to an actual traffic accident. The students are thus introduced to the coefficient of friction through trying to solve an actual societal problem.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[X] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the 3-stage model by Jack Holbrook and tested in PROFILES and PARSEL Project implementation process

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

This uniqueness of this activity is specifically exhibited by:
1. a society related and issue-based title (supported in the student guide by a scenario);
2. student-centred emphasis on scientific problem solving, encompassing the learning of a range of educational and scientific goals;
3. including socio-scientific decision making to relate the science acquired to societal needs for

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, lab equipments

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[x] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Jack Holbrook (adapted from Physics of Road Traffic Accidents by P.K.Tao: Hong Kong, Oxford University Press, 1987)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Should Vegetable Oils be used as a Fuel?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://icaseonline.net/parsel/www.parsel.uni-kiel.de/cms/fileadmin/parsel/Material/Hatfield/pdf/Vegetable_Oil_-_student_activities.pdf

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Biodiesel, Fuel

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Chemistry

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

making and testing Biodiesel as a Fuel

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-14, 14-16

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

5 Lessons

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This module explores the ethical dilemma in using edible substances as fuels. In this aspect the problem did not arise because vegetable oils were too viscous to be used in standard engines. But by a process of exchanging the ester components the oils are mad in a substance resembling diesel and have less polluting properties. This module explores the making of biodiesel and its suitability as a fuel before trying to decide whether it is appropriate in this day and age of high costs of diesel to use vegetable oils as a source of fuels.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[X] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the 3-stage model by Jack Holbrook and tested in PROFILES and PARSEL Project implementation process

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

This uniqueness of this activity is specifically exhibited by:
1. a society related and issue-based title (supported in the student guide by a scenario);
2. student-centred emphasis on scientific problem solving, encompassing the learning of a range of educational and scientific goals;
3. including socio-scientific decision making to relate the science acquired to societal needs for

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, lab equipments

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[x] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Jack Holbrook (based on Supplementary Teaching Materials (eds) Jack Holbrook and Miia Rannikmae, ICASE, 1997)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Forensic science: DNA fingerprint

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.ecole-adn.fr/uploads/2015/05/AOI-activity-3-WB.pdf

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Forensic, genetic, DNA, law,

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

forensic science

LANGUAGE(S) (M)
Language(s) in which the activity is available

french, english

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

14-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

minimum 120 min - max 240 min

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[ ] Basic	[x] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[ ] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The Restriction Fragment Length Polymorphisms (RFLP) technique has been used for 20 years in inquiry activities in order to analyse molecular variations in DNA. Applications are various, RFLP can be used for genetic mapping in disease, for polymorphic markers analysis or phylogenesis. The RFLP technique explores all DNA sequences (codant or not) as opposed to genetic linkage mapping which identifies mutations with phenotypic effects.
Widely used genetic marker of this type depends on the way small differences in DNA sequence can alter restriction enzyme cutting patterns. The RFLP technique is used for genetic linkage analysis and identifing parental DNA inherited copies.
The inquiry activitiy gives the possibility to applied the RFLP technique in DNA fingerprint applied with an aim of solving crimes.
The results are analysed by electrophoresis on agarose gel; two methods for staining are proposed using methylene blue or Ethidium bromide.This inquiry activity provides an important technical approach for students according to quality methods and safety procedures used in a laboratory.
The methodology combined with technique in this activity, shows exactly the needs in undergraduate studies. Moreover, it contributes to enhance scientific studies in biology. This activity offer for the learner the various phases of inquiry: orientation, conceptualization, investigation, conclusion, discussion. In the beginning of the orientation phase it is important to discover the problem of a scene crime at this step it is important to define the various évidence available. The conceptualization phase starts when the learner find a biological evidence. The next phase, investigation, consists on defining a method to analyse these vidence, (extract DNA, find the various possibilities to analyse et and define a singul strategy to analyse it). They are also asked to define a protocol with all the information given by the teacher. After this investigation phase, the learners are ready to perform the protocol. In the conclusion phase the learners are asked to compare their results

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[X] Direct	[ ] Indirect	[ ] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The results are directly observed on agarose gel of electrophoresis. See the results on the document on line

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The aim of this inquiry activity permit to give the informations concerning the regulationfor the use of DNA fingerprints. The questions are for both girls and boys.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

A biology Lab with:• Micropipettes
• Mini centrifuge
• Water Bath, electrophoresis set to observe DNA fragments

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights: These activity must complain with all the safaty regulations concerning the use of reagents in a baloratory
Restrictions:

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Enzyme catalysis

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.ecole-adn.fr/uploads/2015/05/AOI-activity-4-WB.pdf

KEYWORD(S) (R)

Free keywords that capture the essence of the activity

enzyme, haemostasis, biochemistry, protein

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

biology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

haemostasis, physiology

LANGUAGE(S) (M)
Language(s) in which the activity is available

french, english

LANGUAGE DEPENDENCY (R)

The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[x] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15-18

INTERACTION LEVEL (R)

The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)

Indicate the overall time that is needed for the activity to be completed

90 min to 120 min

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[x] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[x] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

Enzymes are proteins with biochemical characteristics; the study of their mechanism is a specific discipline called enzymology.
All physiological phenomenons involve strong enzymological mechanisms. Blood Coagulation and Fibrinolysis are undoubtedly the major mechanisms in haemostasis. Haemostasis is the physiologic process which results in the cessation of bleeding in most animals with a closed circulatory system.
This inquiry avtivity allows the study of the enzymatic activity from Factor Xa, a specific protein involved in haemostasis. This protein hydrolyzes prothrombine into thrombin. The Factor Xa enzymatic activity is analysed by spectrophotometry using a chromogenic peptide as substrate. Peptide hydrolysis by factor Xa releases chromogenic compound, there is a direct relationship between chromogenic compound and factor Xa activity.
The provided protocols allows several enzymatic kinetics for an inquiry activity. The experiment for the inquiry activity illustrates enzymes catalytic functions and their specificity. It may also introduce structure function relationships whith catalytic proteins. This inquiry activity provides an important technical approach for students according to quality methods and safety procedures used in a laboratory.
The methodology combined with technique in this activity, shows exactly the needs in undergraduate studies. Moreover, it contributes to enhance scientific studies in biology. This activity offer for the learner the various phases of inquiry: orientation, conceptualization, investigation, conclusion, discussion. In the beginning of the orientation phase it is important to discover the haemostasis problem. The conceptualization phase starts when the learner try to find the physiological problem concerning haemostasis. So the learner can define various differents protocols with the teacher to explore the various hypotesis. They are also asked to define a protocol with all the information given by the teacher. After this investigation phase, the learners are ready to perform the protocol, the conclusion consistes, t define the most important

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[x] Direct	[ ] Indirect	[x] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

We can obersve along the experiments the various color changes, of the different reactions.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

A biology Lab with:• Micropipettes
- spectophotometer if available
- Water Bath,

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights: These activity must complain with all the safaty regulations concerning the use of reagents in a baloratory
Restrictions:

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

How to perform a GMO - BACTERIAL TRANSGENESIS

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.ecole-adn.fr/uploads/2015/05/AOI-activity-1-WB.pdf

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

GMO, bacterial transgenesis, biotechnology, genetic

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

biology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

genetic

LANGUAGE(S) (M)
Language(s) in which the activity is available

french, english

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

min 90 min, max 120 min

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The aim of this inquiry activity consists on discovering the transgenesis by practical training and many more other similar concepts such as gene, genotype, and phenotype. Using this inquiry activity you can also discuss the interest of recombinant protein in drug discovery, GMOs technologies, antibiotics, etc...
The aim of this inquiry avtivity consists in introducing plasmid pUC18 carrying a gene against ampicillin to Escherichia coli bacteria. The method commonly used for bacterial transformation is heat shock.
This is practical training with an important technical approach for students according to quality methods and safety procedures used in a laboratory.
The methodology combined with technique in this inquiry activity, shows exactly the needs in undergraduate studies. Moreover, it contributes to enhance scientific studies in biology.
Plasmid vectors used for gene cloning are small circular molecules of double strand DNA derived from larger plasmids that occurs naturally in bacteria cells. This DNA molecule replicates independently from genome and it is commonly transferred by bacterial conjugation. There are several genes in plasmids specially gene giving resistance against antibiotics.
These molecules are most commonly used as cloning vectors. The purified plasmids DNA are cuted with restriction nucleases and joined in vitro with foreign DNA, carrying a specific gene. The resulting recombinant plasmids are then used to transform bacteria. In this way we obtain therapeutic recombinant proteins like insulin or growth hormone.

In this inquiry activity bacteria are transformed using a plasmid with a gene against ampicillin, genotype modification provides a new phenotype

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[x] Direct	[ ] Indirect	[x] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The pupils after the work can observe the growth of bateria. In culture dishes with ampicillin, transfected bacteria with pUC18 can form colonies and non tranfected bacteria provide no colony.
In dishes without ampicillin transfected or not transfected bacteria form large confluent colonies (large display).

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The aim of this inquiry consists on having critical knowledge on GMO and their use in society. The questions are for both girls and boys;

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

A biology Lab micropipettes with:• Micropipettes
• Mini centrifuge
• Water Bath

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:This experiment should complain with European legislation regarding GMO uses; the recipients are required to comply with local GMO regulations.
Restrictions::This experiment should complain with European legislation regarding GMO uses; the recipients are required to comply with local GMO regulations.

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Molecular phylogenetics

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.ecole-adn.fr/uploads/2015/05/AOI-activity-2-WB.pdf

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

DNA, genetic , molecular phylogeny

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

biology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

genetic

LANGUAGE(S) (M)
Language(s) in which the activity is available

french, english

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [x] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

16-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [ ] Medium [X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

minimum 120 min - max 240 min

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice [ ] Basic [x] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[ ] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

Modern biology, assisted by its tools, helps to study molecular similarities which can attest to morphological or anatomical similarities. At the molecular level, it is possible de construct a phylogenetic tree on the same principles of those established at the morpho-anatomical level. This is done by studying genetic sequences where the position and organization of nucleotides are attributed to a phenotype. Today, it is common to establish comparison based on nucleotide sequences. The technique of restriction fragment length polymorphism (RFLP) is used by the students to construct a phylogenetic tree. Phylogenetics is a representation of the history of life, showing the ancestral relationships among species. Two species chosen by hazard always have a common ancestor. The DNA molecule, the common denominator of living organisms, possesses sequences which attest to our origins. We are going to analyze, by use of molecular tools (restriction enzymes), the absence or presence of specific genetic markers. This analysis will be done on DNA samples from primates.
The DNA samples (which are plasmids) will be hydrolyzed by combinations of various restriction enzymes. The restriction profiles will be studied by agarose gel electrophoresis. This inquiry activity of genetic engineering based on molecular biology is for a wide-ranging public, from novices to specialists. It is particularly relevant for last-year high school students, higher education students and for professional training.
The presentations and rhetoric of the instructor should be adapted to the particular audiences. The class or training course is given by the teacher. IIt is someone who has been trained to run this training activit and train to analyse results in molecular phylogeny.The methodology combined with technique in this activity, shows exactly the needs in undergraduate studies. Moreover, it contributes to enhance scientific studies in biology. This activity offer for the learner the various phases of inquiry: orientation, conceptualization, investigation, conclusion, discussion. In the beginning of the orientation phase it is important to discover the problem phylogeny of mamalian. The conceptualization phase starts when the learner find a strategy to analyse the genes. The next phase, investigation, consists on defining a method to analysethe

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[x] Direct	[x] Indirect	[x] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The restriction profiles will be studied by agarose gel electrophoresis.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The aim of this inquiry activity permit to give the informations the human diversity: we are all equal. The questions are for both girls and boys.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

A biology Lab with:• Micropipettes
• Mini centrifuge
• Water Bath, electrophoresis set to observe DNA fragments

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☐ Medium	☒ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights: These activity must complain with all the safaty regulations concerning the use of reagents in a baloratory
Restrictions: These activity must complain with all the safaty regulations concerning the use of reagents in a baloratory

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

genetic engineering: RECOMBINANT PROTEIN PRODUCTION

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.ecole-adn.fr/uploads/2015/05/AOI-activity-2-WB.pdf

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

protein,bacteria, genetic engineering,

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

biology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

gentic

LANGUAGE(S) (M)
Language(s) in which the activity is available

french, english

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

16-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

min 90 min, max 120 min

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[ ] Basic	[x] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[ ] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The aim of this inquiry activity consists in showing the molecular genetic function and the phenotypic expression from various alleles. Green fluorescent protein (GFP) gene inserted in a plasmidic vector is transfected in bacteria and expresses an apparent special green genotype.
This recombinant DNA molecule containing foreign DNA inserts, describes strategy for generating recombinant proteins that are commonly used in pharmaceutical process; In this way we obtain therapeutic recombinant molecules like insulin or the growth hormone.
The methodology consists in injecting in Escherichia coli bacteria a plasmid carrying a GFP gene extracted from jellyfish Aequorea victoria. The method commonly used for bacterial transformation is heat shock. Once transfected the bacteria are selected in a culture dish containing kanamycin. The GFP gene is activated by Isopropyl beta galactoside (IPTG), you can observe a green fluorescent colour in the colonies
This is an inquiry activity with an important technical approach for students according to quality methods and safety procedures used in a laboratory.
The methodology combined with technique in this this Inquiry Activity, shows exactly the needs in undergraduate studies. The inquiry activity can be performed by the teacher, the students or by both. Moreover, it contributes to enhance scientific studies in biology. All the various phases of inquiry are ued in this activity.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

In culture dishes with kanamycin, transfected bacteria with pGFP can form green colonies and non tranfected bacteria provide no colony. The green color can be observable upon UV light
In dishes without kanamycin transfected or not transfected bacteria form large confluent colonies (large display). It is possible to observe green

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The aim of this inquiry consists on having critical knowledge on GMO and the their use in society. The questions are for both girls and boys;

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

A biology Lab micropipettes with:• Micropipettes
• Mini centrifuge
• Water Bath

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:This experiment should complain with European legislation regarding GMO uses; the recipients are required to comply with local GMO regulations.

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Galaxy crash

WEB ADDRESS (M)
Link to the activity or site of the activity

http://graasp.eu/ils/547314ace9934012b7c65fed?lang=en

KEYWORD(S) (R)

Free keywords that capture the essence of the activity

galaxy, stars, gravity, universe

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Gravity, galaxy formation and evolution

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)

The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [X] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-18

INTERACTION LEVEL (R)

The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [ ] Medium [X] High

TYPICAL LEARNING TIME IN MINUTES (R)

Indicate the overall time that is needed for the activity to be completed

minimum 1 didactic hour, maximum about 90min (=2 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice [X] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The activity aims to introduce to students the concept of galaxies, how they are formed and evolve, which is the force that governs their varying morphologies, what is the scale/size of these objects and what is the timescale of their formation and evolution. Students start by looking in detail at images of numerous galaxies and then they are asked to attempt to classify them in different categories according to their shape. They compare and discuss their results and the classification scheme they developed by themselves. Then they compare their classifications with a standard scheme that astronomers/scientists use such as the Hubble Classification Scheme. In the next phase of the activity the students split into teams and will try to investigate the origin of the shapes of the galaxies and what are the interactions that govern their formation and evolution. In this way they are introduced in the gravitational force and the fact that it is the same force that governs the rotation of planets around the sun, the motion of an object in free fall and the formation and interaction of galaxies. The students then with the help of a simulation applet they investigate the interaction of galaxies. By changing various control parameters, like relative distance, relative mass or size, number of stars etc. they try to reproduce the shape of galaxies they have in their list of photos. Through this inquiry cycle they conclude that certain morphologies of galaxies are taking longer to form.

In this activity there are mainly two separate inquiry cycles, one on the classification task and the other for the simulation/investigation task. Guidance and support is needed during the discussion of the results or conclusions so that students do actually acquire the conceptual understanding that the gravitational force is universal and governs these phenomena. A possible risk of the latter inquiry activity is the fact that students may not realize or have difficulty to understand the timescale of the interaction of galaxies and their massive size. Usually a question that arises by the students during this phase is how a phenomenon or process that may take millions of years to develop can be simulated in

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, java plugin for internet browser

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

Low	[X] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[x] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

E.Tsourlidaki, Ellinogermaniki Agogi, Greece

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Hands on: Diffraction of light at a hair

WEB ADDRESS (M)
Link to the activity or site of the activity

http://qs-project.ea.gr/en/content/learning-stations + http://qs-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Quantum physics, diffraction, light

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Experimental activity to measure the width of a hair using light diffraction

LANGUAGE(S) (M)
Language(s) in which the activity is available

English (coming soon: Dutch, German, Greek, Estonian)

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15 to 18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[X] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

60 minutes (1 didactic hour)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice	[ ] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[ ] Conceptualization	[X] Investigation	[X] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The objective of the Hands-on activity is to give the opportunity to pupils to "experience" in real experiments the concepts of quantum physics they have previously learned about (for example in the Learning Stations). The aim of this activity is to show the students how to measure the thickness of a hair using light diffraction. The activity starts with a theoretical introduction followed by the explanation of the experiment. This activity is of novice proficiency level as the inquiry path is predefined. In the activity there is an orientation phase which corresponds with the introduction, where the curiosity is stimulated. This phase is followed by the experiment in which the students collects data and process them (investigation phase); at the end they formulate a short conclusion and reflect about the results. For the activity to be carried out, laboratory material is needed: therefore this should be present in the school or other facilities should be contacted. This Hands-on starts with a theoretical introduction about how waves interfere and about light diffraction. It is shown that small objects give rise to a wide diffraction pattern and therefore, because the width of the pattern depends of the dimensions of the slit or the obstacle, diffraction gives us a method to determine the size of small object like a hair. The formula to determine the size of the object from the measured distance between the minima in the diffraction pattern is derived. Finally the material and the experiment methodology are described.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The Quantum SpinOff Hands-on activities are being used by teachers participating in the European Quanum SpinOff project 2014-2015 in four countries: Belgium, Switzerland, Estonia, Greece. The activities are being used since a longer time in Belgium, where the students can make use of the experimental facilities of KHLim and of the Unversity of Antwerp under request.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The Hands-on activity is addressed to all students, without any differentiation of sort. It is to be underlindes that the subjects are treated with reference to the world of the students and that the students are invited to actively learn by making experiments. This element is of great help to inhance the interest of the pupils for the subjects and to understand that quantum physics is not something abstract and distant from us. On the contrary it is something which we experience in our daily life and that can be "experienced" via simple experiments. This fact can particularly encourage girls which, according to studies (for example the report of The Institute of Physics) experience school physics as too

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

The worksheets and the experimental material as specified inside the Hands-on activities: Sample holder; Laser (wavelength = 632.8nm); Screen (use a sheet of paper as a screen); Tape measure; Ruler; Pencil.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other: the activities can be carried out with the required experimental material; this can be available in the schools; in case it is not, other facilities should be contacted.

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions: Attribution Non-Commercial Share Alike // cc by-nc-sa // http://creativecommons.org/licenses/by-nc-sa/4.0

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Hands on: Discrete emission lines of chemical elements

WEB ADDRESS (M)
Link to the activity or site of the activity

http://qs-project.ea.gr/en/content/learning-stations + http://qs-project.ea.gr/sites/default/files/3_Hands_OnActivity_EmissionSpectrum.docx

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Quantum physics, emission lines, chemical elements

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Experimental activity to measure the spectral emission lines of Helium

LANGUAGE(S) (M)
Language(s) in which the activity is available

English (coming soon: Dutch, German, Greek, Estonian)

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15 to 18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

60 minutes (1 didactic hour)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice	[ ] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[ ] Conceptualization	[X] Investigation	[ ] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The objective of the Hands-on activity is to give the opportunity to pupils to "experience" in real experiments the concepts of quantum physics they have previously learned (for example in the Quantum SpinOff Learning Stations). This activity explaines how to measure the emission lines of He, but it can be used to measure the emission lines of any other element. The activity starts with a theoretical introduction, followed by the explanation of the experiment. The activity is of novice proficiency level as the inquiry path is predefined. In this activity there is an orientation phase which corresponds with the introduction, where the curiosity is stimulated. This phase is followed by the experiment in which the students collects data and process them (investigation phase). For the activity to be carried out, laboratory material is needed: therefore this should be present in the school or other facilities/labs should be contacted. This hands on activity starts with the introduction to Maxwell's equations and its prediction of light as a transversal electromagnetic wave. It proceeds to the presentation of the electromagnetic spectrum and the visible part of it. After that the characteristic light of the elements is described as well as the possibility to separate the emitted light into its constituent colors with a prism. Finally the discrete emission lines are explained with the quantum atomc model and the relation between energy of the electromagnetic wave and the frequency via the Planck's constant is introduced. After the theoretical introduction, the experiment is explained: a spectrometer (using a prism) is used to separate the light beam into its constituent colors which are read on a calibrated scale in nanometers. Therefore the student can make an immediate link between colour and wavelenght. The element, He in this case, is contained in a tube maintained at high voltage. Once switched on it starts emitting light whose components can then be observed with the spectrometer and the corresponding values of wavelenght read and written in a table.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The Quantum SpinOff Hands-on activities are being used by teachers participating in the European Quanum SpinOff project 2014-2015 in four countries: Belgium, Switzerland, Estonia, Greece. The activities are being used since a longer time in Belgium, where the students can make use of the experimental facilities of KHLim and of the Unversity of Antwerp under request.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The Hands-on activity is addressed to all students, without any differentiation of sort. It is to be underlindes that the subjects are treated with reference to the world of the students and that the students are invited to actively learn by making experiments. This element is of great help to inhance the interest of the pupils for the subjects and to understand that quantum physics is not something abstract and distant from us. On the contrary it is something which we experience in our daily life and that can be "experienced" via simple experiments. This fact can particularly encourage girls which, according to studies (for example the report of The Institute of Physics) experience school physics as too

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

The worksheets and the experimental material as specified inside the Hands-on activity: calibrated prism-spectrometer; spectral lamps with source.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other: the activities can be carried out with the required experimental material; this can be available in the schools; in case it is not, other facilities should be contacted.

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions: Attribution Non-Commercial Share Alike // cc by-nc-sa // http://creativecommons.org/licenses/by-nc-sa/4.0

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Learning station I: Inexplicable phenomena?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://qs-project.ea.gr/sites/default/files/1_Quantum_SpinOff_LearningStation1_InexplicablePhenomena_def.docx

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Quantum physics, particle-wave duality, emission spectra, discrete spectral lines

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Quantum physics - basic concepts

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Dutch, German, Greek, Estonian

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15 to 18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[X] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90 (2 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[ ] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The objective of the activity is to introduce the students to Quantum physics concepts. This is done in an interactive manner and by analogy with classical physical phenomena which are already known by the students. These known phenomena are related to classical physics studied or to everyday life events. The objectives consist in introducing the pupils to the world of quantum physics and letting them recognize that quantum physics is present in our daily life. In this sense the learning station includes RRI aspects. The students are guided through this process by interactive questions and exercises: these present clear instructions, but in some cases students have more freedom to explore. The proficiency level can therefore be considered as basic. Several questions are formulated so that the students should first formulate their own hypothesis based on some preliminary information given, often based on daily life situations: in this case the pupils' curiosity is stimulated (orientation and conceptualization phase). Following questions requires that the pupils make some small experiments or look at experiments/videos to investigate and collect empirical data; based on these they can then formulate an answer to the questions (investigation phase). In short, the first three inquiry phases are covered within this Learning Station.
More specifically these are the subjects covered by Learning station I-Inexplicable phenomena? : Starting from the classical idea of trajectory and the Newton's laws, the pupils are guided to discover that the concepts of exact position and trajectory are not valid in quantum physics. They also discover the concept of particle-wave duality through the description of the Double slit experiment: here the students have to formulate hypothesis and compare them to experimental results presented in the learning station. The students are stimulated to carry out small experiments to understand the discrete emission spectra of atoms. As a conclusion the quantum atomic model is introduced. The introduction to quantum physics concepts is done in parallel with the description of the hystorical events which brought to the development of the quantum theories. The students are also stimulated to look for related informations about the physicists involved in such development

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The Quantum SpinOff learning station I-Inexplicable phenomena? is being used by teachers participating in the European Quanum SpinOff project 2014-2015 in four countries: Belgium, Switzerland, Estonia, Greece. The Dutch version have been used during the Belgian predecessor SpinOff during the school year 2013-2014. The Learning Stations were awarded the 1st Scientix Resources Award Category 2, STEM teaching

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

This Learning Station is addressed to all students, without any differentiation of sort. It is to be underlinded that the subjects are treated with reference to everyday life and to the world of the students. This element is of great help to inhance the interest of the pupils for the subjects and to understand that quantum physics is not something abstract and far from us. On the contrary it is something which we experience in our daily life. This fact can particularly encourage girls which, according to studies (for example the report of The Institute of Physics) experience school physics as too abstract, but they become more interested if they see societal implications and impact and if they can understand that

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

The Learning Station, computer and internet access to use online tools as specified within the Learning Station; for certain activities some simple experimental material as specified inside the Learning Station.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

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OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Learning station II: What is light?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://qs-project.ea.gr/en/content/learning-stations + http://qs-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Quantum physics, light, reflection, diffraction, Huygens

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Quantum physics - particle and wave properties of light

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Dutch, German, Greek, Estonian

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15 to 18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[X] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90 (2 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The objective of the activity is to introduce the students to Quantum physics concepts, more specifically to the nature (particle-wave) of light. This is done in an interactive manner and by analogy with classical physical phenomena which are already known by the students. These known phenomena are related to classical physics studied or to everyday life events. The objectives consist in introducing the pupils to the world of quantum physics and letting them recognize that quantum physics is present in our daily life. In this sense the learning station includes RRI aspects. The students are guided through this process by interactive questions and exercises: these present clear instructions, but in some cases students have more freedom to explore. The proficiency level can therefore be considered as basic. Several questions are formulated so that the students should first formulate their own hypothesis based on some preliminary information given, often based on daily life situations: in this case the pupils' curiosity is stimulated (orientation and conceptualization phase). Following questions requires that the pupils make some small experiments or look at experiments/videos to investigate and collect empirical data; based on these they can then formulate an answer to the questions (investigation phase). In some cases after this stage the pupils can formulate the answers also by giving a clear explanation for it (conclusion). In short, the first four inquiry phases are covered within this Learning Station.
More specifically these are the subjects covered by II-What is light? In this station the pupils discover why light can be interpreted as a wave through several theoretical questions (based on their previous knowledge) and through virtual experiments by using video's on the web. The activity starts with Newton's particle theory of light and the students are stimulated to think which properties of light (according to their experience) can be explained by the particle theory of light. Then reflection of light is considered and it is shown how Newton explained this property with the particla theory as well. After this the wave theory of Huygens is introduced and the students are invited to understand constructive and destructive interference through interactive activities and applets. The properties of light as a wave, wavelenght, frequency

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The Quantum SpinOff learning station II-What is light? is being used by teachers participating in the European Quanum SpinOff project 2014-2015 in four countries: Belgium, Switzerland, Estonia, Greece. The Dutch version have been used during the Belgian predecessor SpinOff during the school year 2013-2014. The Learning Stations were awarded the 1st Scientix Resources Award Category 2, STEM teaching material

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

This Learning Station is addressed to all students, without any differentiation of sort. It is to be underlinded that the subjects are treated with reference to everyday life and to the world of the students. This element is of great help to inhance the interest of the pupils for the subjects and to understand that quantum physics is not something abstract and far from us. On the contrary it is something which we experience in our daily life. This fact can particularly encourage girls which, according to studies (for example the report of The Institute of Physics) experience school physics as too abstract, but they become more interested if they see societal implications and impact and if they can understand that

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

The Learning Station, computer and internet access to use online tools as specified within the Learning Station; for certain activities some simple experimental material as specified inside the Learning Station.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

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OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Learning station III: Light as a wave: which waves are these?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://qs-project.ea.gr/en/content/learning-stations + http://qs-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Quantum physics, light, waves, fields, electromagnetic waves

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Quantum physics - light as an electromagnetic wave

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Dutch, German, Greek, Estonian

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15 to 18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[X] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90 (2 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The objective of the activity is to introduce the students to Quantum physics concepts. More specifically the students are stimulated to compare the wave nature of light to other types of waves they know (mechanical waves). This is done in an interactive manner and by analogy with classical physical phenomena which are already known by the students. These known phenomena are related to classical physics studied or to everyday life events. The objectives consist in introducing the pupils to the world of quantum physics and letting them recognize that quantum physics is present in our daily life. In this sense the learning station includes RRI aspects. The students are guided through this process by interactive questions and exercises: these present clear instructions, but in some cases students have more freedom to explore. The proficiency level can therefore be considered as basic. Several questions are formulated so that the students should first formulate their own hypothesis based on some preliminary information given, often based on daily life situations: in this case the pupils' curiosity is stimulated (orientation and conceptualization phase). Following questions requires that the pupils make some small experiments or look at experiments/videos to investigate and collect empirical data; based on these they can then formulate an answer to the questions (investigation phase). In some cases after this stage the pupils can formulate the answers also by giving a clear explanation for it (conclusion). In short, the first four inquiry phases are covered within this Learning Station.
More specifically these are the subjects covered by Learning station III- Light as a wave: which waves are these?: in this station the students are guided to discover that light is an electromagnetic wave, starting from concepts of mechanical waves. They also discover interactively the concept of "field". The learning station starts with an introduction to mechanical waves, which are known by students from everyday life. Through interactive activities and questions the student is guided to "discover" that this kind of waves needs a medium to propagate. Sound is also a mechanical wave. After some experiments related to sound waves, the student is guided to think about what is that "shakes" in the case

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The Quantum SpinOff learning station III-Light as a wave: which waves are these? is being used by teachers participating in the European Quanum SpinOff project 2014-2015 in four countries: Belgium, Switzerland, Estonia, Greece. The Dutch version have been used during the Belgian predecessor SpinOff during the school year 2013-2014. The Learning Stations were awarded the 1st Scientix Resources Award Category

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

This Learning Station is addressed to all students, without any differentiation of sort. It is to be underlinded that the subjects are treated with reference to everyday life and to the world of the students. This element is of great help to inhance the interest of the pupils for the subjects and to understand that quantum physics is not something abstract and far from us. On the contrary it is something which we experience in our daily life. This fact can particularly encourage girls which, according to studies (for example the report of The Institute of Physics) experience school physics as too abstract, but they become more interested if they see societal implications and impact and if they can understand that

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

The Learning Station, computer and internet access to use online tools as specified within the Learning Station; in particular the program Visual Analyser that can be downloaded from the internet as explained in the learning station; for certain activities some simple experimental material as specified inside the Learning Station.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

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OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Learning station IV: Wave Particle Duality– Quanta of Quantum Fields

WEB ADDRESS (M)
Link to the activity or site of the activity

http://qs-project.ea.gr/en/content/learning-stations + http://qs-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Quantum physics, wave particle duality, energy quanta, quantum fields

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Quantum physics - matter waves and quanta

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Dutch, German, Greek, Estonian

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15 to 18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[X] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

60 (1 didactic hour)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The objective of the activity is to introduce the students to Quantum physics concepts. More specifically the quantization of light and matter are introduced. This is done in an interactive manner and by analogy with classical physical phenomena which are already known by the students. These known phenomena are related to classical physics studied or to everyday life events. The objectives consist in introducing the pupils to the world of quantum physics and letting them recognize that quantum physics is present in our daily life. In this sense the learning station includes RRI aspects. The students are guided through this process by interactive questions and exercises: these present clear instructions, but in some cases students have more freedom to explore. The proficiency level can therefore be considered as basic. Several questions are formulated so that the students should first formulate their own hypothesis based on some preliminary information given, often based on daily life situations: in this case the pupils' curiosity is stimulated (orientation and conceptualization phase). Following questions requires that the pupils make some small experiments or look at experiments/videos to investigate and collect empirical data; based on these they can then formulate an answer to the questions; the students also learn how to calculate the energy of light quanta knowing the frequency and the De Broglie wave lenght of particles knowing their momentum (investigation phase). In some cases after this stage the pupils can formulate the answers also by giving a clear explanation for it (conclusion). In short, the first four inquiry phases are covered within this Learning Station.
More specifically these are the subjects covered by Learning station IV - Wave Particle Duality– Quanta of Quantum Fields: starting from the concepts learned in Learning station II, the pupils discover that light has also properties which are characteristics for particles. This is done through interactive activities in which the students have to compare experimental results of the "double slit experiment" with light and with particles. At the end of this learning station the pupils will have learned the double nature of light and matter; they will have calculated the

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The Quantum SpinOff learning station IV-Wave Particle Duality– Quanta of Quantum Fields is being used by teachers participating in the European Quanum SpinOff project 2014-2015 in four countries: Belgium, Switzerland, Estonia, Greece. The Dutch version have been used during the Belgian predecessor SpinOff during the school year 2013-2014. The Learning Stations were awarded the 1st Scientix Resources

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

This Learning Station is addressed to all students, without any differentiation of sort. It is to be underlinded that the subjects are treated with reference to everyday life and to the world of the students. This element is of great help to inhance the interest of the pupils for the subjects and to understand that quantum physics is not something abstract and far from us. On the contrary it is something which we experience in our daily life. This fact can particularly encourage girls which, according to studies (for example the report of The Institute of Physics) experience school physics as too abstract, but they become more interested if they see societal implications and impact and if they can understand that

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

The Learning Station, computer and internet access to use online tools as specified within the Learning Station; calculator.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

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OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Learning station V: Predicting the hydrogen emission lines with a quantum model

WEB ADDRESS (M)
Link to the activity or site of the activity

http://qs-project.ea.gr/en/content/learning-stations + http://qs-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Quantum physics, emission lines, Balmer formula, hudrogen atom

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Quantum physics - quantum atomic model and emission lines

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Dutch, German, Greek, Estonian

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15 to 18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[X] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90 (2 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The objective of the activity is to introduce the students to the Quantum atomic model and how to predict and calculate the emission spectra of atoms. This is done in an interactive manner and by analogy with classical physical phenomena which are already known by the students. These known phenomena are related to classical physics studied or to everyday life events. The objectives consist in introducing the pupils to the world of quantum physics and letting them recognize that quantum physics is present in our daily life. In this sense the learning station includes RRI aspects. The students are guided through this process by interactive questions and exercises: these present clear instructions, but in some cases students have more freedom to explore. The proficiency level can therefore be considered as basic. Several questions are formulated so that the students should first formulate their own hypothesis based on some preliminary information given, often based on daily life situations: in this case the pupils' curiosity is stimulated (orientation and conceptualization phase). Following questions requires that the pupils make some small experiments or look at experiments/videos to investigate and collect empirical data; based on these they can then formulate an answer to the questions (investigation phase). In some cases after this stage the pupils can formulate the answers also by giving a clear explanation for it (conclusion). In short, the first four inquiry phases are covered within this Learning Station.
More specifically these are the subjects covered by Learning station V - Predicting the hydrogen emission lines with a quantum model: in this station the pupils learn how to calculate the quantised energy levels of a simple atom (hydrogen) and the energy of the photon emitted during an electron energy transition. This learning stations starts from the concepts introduced in the previous learning stations, like quantum fields and matter-wave duality. At first the quantum atomic model of Bohr and De Broglie are introduced and the central question is stated: is it possible to predict the emission spectra of hydrogen starting from the De Broglie atomic model? I.e. by considering the electron in the atom as a wave and using the De Broglie wavelenght? Then the formula of Balmer is introduced and some excercises are proposed to the sudent for the

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)
There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)
Describe in detail the evidence on the success of the activity

The Quantum SpinOff learning station V-Predicting the hydrogen emission lines with a quantum model is being used by teachers participating in the European Quanum SpinOff project 2014-2015 in four countries: Belgium, Switzerland, Estonia, Greece. The Dutch version have been used during the Belgian predecessor SpinOff during the school year 2013-2014. The Learning Stations were awarded the 1st Scientix Resources

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)
Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

This Learning Station is addressed to all students, without any differentiation of sort. It is to be underlinded that the subjects are treated with reference to everyday life and to the world of the students. This element is of great help to inhance the interest of the pupils for the subjects and to understand that quantum physics is not something abstract and far from us. On the contrary it is something which we experience in our daily life. This fact can particularly encourage girls which, according to studies (for example the report of The Institute of Physics) experience school physics as too abstract, but they become more interested if they see societal implications and impact and if they can understand that

REQUIREMENTS FOR THE ACTIVITY (M)
Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

The Learning Station, computer and internet access to use online tools as specified within the Learning Station; calculator.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions: The Learning Station, computer and internet access to use online tools as specified within the Learning Station; calculator.

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Learning Station VI - From photo-electric effect to digital imaging

WEB ADDRESS (M)
Link to the activity or site of the activity

http://qs-project.ea.gr/en/content/learning-stations + http://qs-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Quantum physics, photoelectric effect, digital imaging

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Quantum physics - photoelectric effect and explanation of digital imaging

LANGUAGE(S) (M)
Language(s) in which the activity is available

English (coming soon: Dutch, German, Greek, Estonian)

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15 to 18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[X] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90 (2 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The objective of the activity is to introduce the students to other Quantum physics concepts and to bridge the gap between these concepts and the technological applications. Similarly to the Learning Stations I to V, this is done in an interactive way and by using analogy with physical phenomena which are already known by the students. These known phenomena could be related to classical physics or to events from everyday life. The am is to build up knowledge starting from the first 5 Learning Stations: the pupils further explore the world of quantum physics and its applications, so that they recognize that quantum physics is present in our daily life. The students are guided through this process by interactive questions and exercises, with rather clear instructions, so that the proficiency level can be considered as basic. Several questions are formulated so that the students should first formulate their own hypothesis based on some preliminary information given, often based on daily life situations or on preliminary knowledge: with these questions the pupils' curiosity is stimulated (orientation and conceptualization phase). Following questions requires that the pupils make some small experiments or look at experiments/videos to investigate and collect empirical data; based on these they can then formulate an answer to the questions (investigation phase). After this stage the pupils can formulate the answers also by giving a clear explanation for it (conclusion). In short, the first four inquiry phases are covered with the various types of questions. In certain cases the activities the pupils are invited to find solutions to clearly stated problems, but to do this they need to reason about the problem and find out by themselves which concepts they have to use.
More specifically these are the subjects covered by this Learning Station: starting from the functioning of a digital camera the pupils are invited to reflect about its working principles; this leads to understanding the photoelectric effect; real and virtual (via applets) experiments related to the photoelectric effect are proposed; based on the results the pupils come to theoretical conclusions and afterwards they are invited to think about their implementation in technological applications

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The learning station VI of Quantum SpinOff is being used by teachers participating in the European Quanum SpinOff project 2014-2015 in four countries: Belgium, Switzerland, Estonia, Greece.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The Learning Station VI is addressed to all students, without any differentiation of sort. It is to be underlindes that the subjects are treated with reference to everyday life and to the world of the students. Furthermore applications are included. This element is of great help to inhance the interest of the pupils for the subjects and to understand that quantum physics is not something abstract and distant from us. On the contrary it is something which we experience in our daily life. This fact can particularly encourage girls which, according to studies (for example the report of The Institute of Physics) experience school physics as too abstract, but they become more interested if they see societal implications and

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

The Learning Stations, computer and internet access to use online tools and applets as specified within the Learning Stations.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

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OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Learning station VII: Semiconductors

WEB ADDRESS (M)
Link to the activity or site of the activity

http://qs-project.ea.gr/en/content/learning-stations + http://qs-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Quantum physics, semiconductors

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Quantum physics - semiconductors and their applications

LANGUAGE(S) (M)
Language(s) in which the activity is available

English (coming soon: Dutch, German, Greek, Estonian)

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15 - 18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[X] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90 (2 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The objective of the activity is to introduce the students to other Quantum physics concepts and to bridge the gap between these concepts and the technological applications. Similarly to the Learning Stations I to V, this is done in an interactive way and by using analogy with physical phenomena which are already known by the students. These known phenomena could be related to classical physics or to events from everyday life. The am is to build up knowledge starting from the first 5 Learning Stations: the pupils further explore the world of quantum physics and its applications, so that they recognize that quantum physics is present in our daily life. The students are guided through this process by interactive questions and exercises, with rather clear instructions, so that the proficiency level can be considered as basic. Several questions are formulated so that the students should first formulate their own hypothesis based on some preliminary information given, often based on daily life situations or on preliminary knowledge: with these questions the pupils' curiosity is stimulated (orientation and conceptualization phase). Following questions requires that the pupils make some small experiments or look at experiments/videos to investigate and collect empirical data; based on these they can then formulate an answer to the questions (investigation phase). After this stage the pupils can formulate the answers also by giving a clear explanation for it (conclusion). In short, the first four inquiry phases are covered with the various types of questions. In certain cases the activities the pupils are invited to find solutions to clearly stated problems, but to do this they need to reason about the problem and find out by themselves which concepts they have to use.
More specifically these are the subjects covered by this Learning Station: starting from the energy levels in the atoms (studied in part learning stations I - V) the pupils think about the energy levels in solids and the formation of bands and band gaps; this learning station let then the students think about the properties of semiconductors compared to those of conductors and insulators. The students learn then about the ways semiconductors can be used for technological applications. The doping process is described and the development of a diode and a

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The learning station VII of Quantum SpinOff is being used by teachers participating in the European Quanum SpinOff project 2014-2015 in four countries: Belgium, Switzerland, Estonia, Greece.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The Learning Station VII is addressed to all students, without any differentiation of sort. It is to be underlindes that the subjects are treated with reference to everyday life and to the world of the students. Furthermore applications are included. This element is of great help to inhance the interest of the pupils for the subjects and to understand that quantum physics is not something abstract and distant from us. On the contrary it is something which we experience in our daily life. This fact can particularly encourage girls which, according to studies (for example the report of The Institute of Physics) experience school physics as too abstract, but they become more interested if they see societal implications and

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

The Learning Stations, computer and internet access to use online tools and applets as specified within the Learning Stations.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

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OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Hands on: Measuring Planck's Constant with LED's

WEB ADDRESS (M)
Link to the activity or site of the activity

http://qs-project.ea.gr/en/content/learning-stations + http://qs-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Quantum physics, Planck's constant, LEDs

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Experimental activity to measure Planck's constant

LANGUAGE(S) (M)
Language(s) in which the activity is available

English (coming soon: Dutch, German, Greek, Estonian)

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [ ] Medium [X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15 to 18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [ ] Medium [X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

60 minutes (1 didactic hour)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice [ ] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[ ] Conceptualization	[X] Investigation	[X] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The objective of the Hands-on activity is to give the opportunity to pupils to "experience" in real experiments the concepts of quantum physics they have previously learned about (for example in the Learning Stations). The aim of this activity is to show the students how the Planck's constant can be measured in a very simple way and with simple material. At the same time the students learn more about the functioning of LEDs. The activity starts with a theoretical introduction followed by the explanation of the experiment. This activity is of novice proficiency level as the inquiry path is predefined. In the activity there is an orientation phase which corresponds with the introduction, where the curiosity is stimulated. This phase is followed by the experiment in which the students collects data and process them (investigation phase); at the end they formulate a short conclusion and reflect about the results (conclusion phase). For the activity to be carried out, laboratory material is needed: therefore this should be present in the school or other facilities should be contacted. This Hands-on starts with the theoretical introduction about the Planck's constant, its importance and the origine of its postulation. An explanation about the functioning of LEDs follows.The introduction is afterwards used to show how it is possible to experimentally measure the Planck's constant. The experimental set-up and the various steps of the experiment are then described. Finally the results can be written in a table and the students are invited to formulate a short conclusion and reflection.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The Quantum SpinOff Hands-on activities are being used by teachers participating in the European Quanum SpinOff project 2014-2015 in four countries: Belgium, Switzerland, Estonia, Greece. The activities are being used since a longer time in Belgium, where the students can make use of the experimental facilities of KHLim and of the Unversity of Antwerp under request.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The Hands-on activity is addressed to all students, without any differentiation of sort. It is to be underlindes that the subjects are treated with reference to the world of the students and that the students are invited to actively learn by making experiments. This element is of great help to inhance the interest of the pupils for the subjects and to understand that quantum physics is not something abstract and distant from us. On the contrary it is something which we experience in our daily life and that can be "experienced" via simple experiments. This fact can particularly encourage girls which, according to studies (for example the report of The Institute of Physics) experience school physics as too

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

The worksheets and the experimental material as specified inside the Hands-on activity: 4 colored LED-lights; Spectroscope; Voltage Source; Volt meter; LED-holder.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other: the activities can be carried out with the required experimental material; this can be available in the schools; in case it is not, other facilities should be contacted.

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

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OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Can we learn from the past?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.migaproject.eu/index.php?option=com_content&view=article&id=249%3Acan-we-learn-from-the-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Consumption; Food preservation

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Historical food conservation techniques

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Dutch

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [ ] Medium [X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

11-12

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[X] Low [ ] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

100

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice [ ] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

In 'Can we learn from the past' pupils learn how people preserved food in the past and how food is preserved nowadays. They also learn how to preserve their own food.
By the end of this activity pupils will be able to:
- name the different preservation methods
- have prepared and carried out an interview
- have followed a recipe or written instructions
During the activity pupils work in groups of 3 or 4 pupils.
The activity consists of the 5 phases of inquiry: orientation, conceptualisation, investigation, conclusion and discussion.
For the orientation phase pupils read a problem statement (in the introduction). The problem statement is about fresh vegetables: if you buy fresh vegetable, you need to eat it fast otherwise it won't last.
The conceptualisation phase consists of a couple of research questions presented to the pupils to help them focus on the topic. The research questions are about preserving. In this first activity (activity 1) pupils answer questions about preserving with the help of internet. These questions are for example: What happens to food if you do not preserve it? How did people preserve food in the past?
The investigation phase consists of 3 activities:
Activity 2. During the second activity pupils interview someone who didn't have a fridge in the past about how preserving foods during that days went. First, they have to think about a life without a fridge (conceptualisation phase – formulate hypothesis). Second, pupils have to create questions for the interview and analyse the results. This activity of the investigation phase can be considered as basic because of the freedom

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

This activity is described as a webquest. Webquests have been widely used in schools and hence have been found ecologically valid formats for education. This however is no proof of evidence for the specific activity at hand.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

Pupils learn that food can be preserved and food preservation prevents food-spill. The activity raises pupils' awareness about ancient and modern preserving techniques, and their costs and benefits. And the activity can give rise to discussion about pupils' own food preservation and/or spilling behaviour at home. Extended discussion can be raised about the relationship between globalization and food preservation.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Veldwerk Nederland

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Carbon detective in transport

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.migaproject.eu/index.php?option=com_content&view=article&id=161%3Acarbon-detective-in-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Transportation; Carbondioxide

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Chemistry, Mathematics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Sustainable mobility

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

8-12

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[X] Low	[ ] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice	[ ] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

In 'Carbon detective in transport' pupils explore how we contribute to CO^2 emission as we travel to school. This raises pupils awareness of drawbacks of travelling in general and in relation to their own travelling behaviour.
By the end of this activity pupils will be able to:
- understand that different forms of transport have different CO^2 emission
- recognise the connection between transportation and climate change
The activity consists of the 5 phases of inquiry: orientation, conceptualisation, investigation, conclusion and discussion.
For the orientation phase pupils read a short introduction about a real life situation. The introduction is about different ways to go to school: walking, by car or school bus.
The conceptualisation phase consists of a research question (Introduction) that helps pupils focus on the topic. The research question is given and is about which form of transport is the most environmentally friendly. During the investigation phase pupils try to find answers to these questions.
The investigation phase is the largest part and consist of 3 activities.
Activity 1. In the first activity pupils fill in a table about how they go to school, and work out the distance from home to school.
Activity 2. During the second activity pupils ask at least 10 classmates how they go to school and note this in a table.
Activity 3. In the third activity pupils investigate how big their CO^2 emission is when going to school. Pupils can do this with the website stated in the activity, therefore login codes are needed. As teacher you can register your pupils at forehand. It is also possible to print the needed information from the website. If you do that, registering pupils and login codes are not needed.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

This activity is described as a webquest. Webquests have been widely used in schools and hence have been found ecologically valid formats for education. This however is no proof of evidence for the specific activity at hand.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

Sustainable mobility is the topic of this webquest. Pupils learn about CO2 emmission and forms of transport that are environmentally friendly. The activity raises their awareness of the costs of daily travelling in general and stimulates discussion about their own and pther people's travelling habits.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, printed worksheets

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Veldwerk Nederland

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

How do people travel when they go on holiday?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.migaproject.eu/index.php?option=com_content&view=article&id=154%3Ahow-do-i-people-travel-when-they-go-on-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

transportation

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Technology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Which choices in transport can be made in traveling

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Dutch

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[X] Low [ ] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

8-12

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[X] Low [ ] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

120

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice [ ] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

In 'How do people travel when they go on holiday?' pupils are asked to think about the impact of several kinds of transportation on the environment. This raises pupils' awareness of the impact of their choices on the environment and can give rise to discussions about mobility issues in society, benefits and drawbacks of forms of transportations, and possible solutions. By the end of the quest students will be able to:
- Write down arguments which support a decision
- Understand a CO2 emission diagram
- Prepare and carry out an interview
- Select information from different sources
- Design an eco friendly holiday

The activity entails all 5 inquiry phases.
The orientation phase is a short introduction about choices that can be made in transportation when going on holiday. The problem is simplified to environmental friendly and other ways of transportation. In the conceptualization phase the question is raised which travel option is the best for the environment. During the investigation phase pupils try to find an answer to this question.
In the investigation phase the pupils collect data on environmental friendly travelling based on a prescribed procedure, using fixed instruments.
In the conclusion phase pupils have to write down arguments about which would be the best form of transport based on the collected data on CO2 emission.
In the discussion phase pupils are asked to design a four-days environmental friendly holiday. Pupils have to make choices in what they find

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

This activity is described as a webquest. Webquests have been widely used in schools and hence have been found ecologically valid formats for education. This however is no proof of evidence for the specific activity at hand.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

Pupils develop awareness of responsible use of transportation and how they can travel environmentally friendly. The activity raises general questions about mobility demands in modern society, because pupils become aware of the environmental drawbacks of travelling. They develop evidence-informed solutions for travelling environmentally friendly, that gives rise to discussions about what kinds of mobility are and aren't acceptable in light of their costs.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Veldwerk Nederland

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

What does our home produce?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.migaproject.eu/index.php?option=com_content&view=article&id=163%3Awhat-does-our-home-produce&catid=36%3Abuildings-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

energy-use; water-use

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Technology, Mathematics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

How can we reduce our energy and water usage?

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Dutch

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

8-12

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[X] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

150

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice	[ ] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[ ] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

In 'What does our home produce' pupils learn how they can reduce their use of water and energy at home. By the end of this activity pupils have considered how they can reduce their water and energy usage and what can be produced at home. This raises pupils' awareness of use of limited resources and possible solutions at home.
The activity consists of 4 phases of inquiry: orientation, conceptualization, investigation and discussion.
The investigation phase is on a basic level, the other phases on a novice level.
During this activity pupils work in groups of 3 or 4.
The orientation phase starts with a short story in which the importance of electricity and gas is introduced. In the conceptualisation phase research questions about a 'self-sufficient' homeare are presented that help pupils focus on the topic. During the investigation phase pupils try to find answers to these questions.
The investigation phase consists of three ill-structured activities. In the first activity pupils need to think about why it is good to have a 'self-sufficient' home and if they already know anyone who lives in a 'self-sufficient' home. The second activity is about how much energy pupils use at the moment at home and in school and about ideas for saving energy. The third activity is about how much water pupils use at the moment at home and in school and about ideas for saving water. Because pupils need to think about a 'self-sufficient' home and how to reduce the use of energy and water they raise their awareness of RRI.
The discussion phase consists of a presentation of the ideas about a 'self-sufficient' home and saving energy and water to the rest of the class.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

This activity is described as a webquest. Webquests have been widely used in schools and hence have been found ecologically valid formats for education. This however is no proof of evidence for the specific activity at hand.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

Pupils develop awareness of responsible use of water and energy. The activity gives rise to classroom discussions about using limited resources, and invites pupils to think of possible solutions in their homes and usage patterns.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Veldwerk Nederland

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Where does my food come from?

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.migaproject.eu/index.php?option=com_content&view=article&id=248%3Awhere-does-my-food-come-from&catid=34%3Afood-

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Food industry, globalization

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Globalisation of food production

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Dutch

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [ ] Medium [X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

10-12

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[X] Low [ ] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

120

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice [ ] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

In 'Where does my food come from?' pupils learn that their food grows in different countries all over the world. This raises their awareness of globalization in relation to food production and food consumption.
By the end of the webquest all students:
- Have completed a food diary
- Have read food packaging and labels and identified that food is grown and produced in different countries
- Located countries on a world map
- Produced information in a schematic diagram
The activity consists of 4 phases of inquiry: orientation, conceptualization, investigation and conclusion. The first three phases are on a novice level, but as students have to formulate their own conclusions, this phase is more difficult and reflects a more basic level.
The orientation phase starts with the description of a real-life situation through which pupils learn to see that there are different choices in what to eat for breakfast, lunch, snack and dinner. The main problem is formulated as 'Can we grow everything everywhere?'.
In the conceptualization phase a research question about where our food comes from is presented to the pupils to help them focus on the topic. During the investigation phase pupils try to find an answer to this question.
The investigation phase is well structured by means of three downloadable worksheets. The first worksheet is a food diary to record pupils what pupils eat during the day. On the second worksheet pupils have to mark where the food they ate comes from, to see which continent most of their food comes from. The third worksheet is about costs, time of transport and CO2 emission.
In the conclusions phase, students have to draw conclusions, based on their findings

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[X] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

This activity is described as a webquest. Webquests have been widely used in schools and hence have been found ecologically valid formats for education. This however is no proof of evidence for the specific activity at hand.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

Pupils develop awareness of globalisation of food production and food consumption. This can give rise to reflections on their own and other people's behaviors and raise discussions about the benefits and drawbacks of global food production and food consumption.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Veldwerk Nederland

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Ionic concentrations of acids and bases in a workbench simulation

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.chemcollective.org/vlab/vlab.php

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

pH-value, acid, base, neutralizing, concentration

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Chemistry

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

connection and influence of acids and bases on the pH-value

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-15

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[X] Low	[ ] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

approximately 90 minutes

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Basic	[X] Advanced	[X] Expert

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The students can test the connection and influence of acids and bases on the pH-value, the concentration and the temperature of solving and neutralizing chemical compounds in aqueous solution. The definition of acid , base and storng/weak acids or base should be clear for each student. The students have to face the problem of the creation of some liquids of distinct pH-values for pharmaceutical purposes. Exact pH-values, temperatures and buffer-functions must be understood and used in the process. using the eLearning tool for possible simulations will enable students can repeat their proposed solution for the given problem with real chemicals. *The teacher's role is crucial in breaking a student's routine. For example, teachers can use simple and alluring techniques; such as pH papers (why it changes color according to the concentration of acid and bases) and describe the chemistry behind this phenomenon. Also, the teacher can provide important but simple examples of how pH differs within the our own human body -such as the stomach has a pH that is highly acidic and in the intestine has a pH that is nearly neutral. Following this illustration, the teacher can then explain the importance of acid-base homeostasis using supportive photos and videos, which would be awesome.* For the simulation portion of the lesson, students can learn on web based pH simulators. For example, this website (http://www.rsc.org/learn-chemistry/resource/res00001458/ph-scale-advanced-simulation), where students can experience several examples of different pHs of substances in their every day lives such as; blood, coffee, milk, etc. This could be followed be a real life activity which can be considered the lab portion of the lesson for not just more visual understanding, but active learning, processing, and reinforcement as well ... Homework would be for the to take several strips of pH paper home and test the pH of different drinks that they have available in their house. They would record this in their lab notebook which will therefore reinforce the simulation section that was taught in the lesson that day. and can share their experience with classmate later.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[X] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

An empirical study conducted in Cyprus revealed that learners completed the activity sequence successfully.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The problem stated at the orientation phase has the potential to attract the interest of both boys and girls to the same extent.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, A computer, 1 for every student or at least one for every group

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Temperature in the air: molecule movements in the gases

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.sctg.eu/miniature1.asp

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Heating and cooling gas , weak attraction between molecules , motion in gases

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics, Chemistry

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

the gas

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [X] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

10 -15

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [X] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

more than 120 minutes

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Basic [ ] Advanced [ ] Expert

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[ ] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

the activity starts with a broad definition of the gas. Students should examine how the effect of gas on wight and size. Students also should examine how the effect of heating and colling on motion of molecules of gas. several activities can be held like inflated ball, sealed bottle (using thin layer of paraflam), hot and cold water (or Ice cubes), compressed air can and a balance. student then should examine if deflated ball is lighter or heavier after we inflate it which is tricky for student as it feels lighter (after inflate it) in hands of student but in fact it is heavier in balance. Then students have to examine size of gas if seales bottle immersed in hot water and ice cube or cold water for time. the wight of compressed air can before and after releasing gas with a question placed why in their opinion gas released.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Experimental set-ups: - A bottle sealed with a thin layer of parafilm. - Hot, ice cubes and cold water -ball - can of compressed air - a balance

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Activity 1.1 - Estimating the density of an endangered plant species in a named ecosystem

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.establish-fp7.eu/resources/units/ecobiology

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

ecosystem, habitat, abiotic factor, species, population, community, density, endemic organism, adaptation

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology, physics, technology,maths

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Ecosystem

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

80-100 minutes

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[ ] Basic	[x] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[ ] Conceptualization	[x] Investigation	[ ] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

In the orientation phase, students are informed about the problem. The problem is related to the endangered plant species.Also, students are prompted to fill in the blanks of the sentences with the appropriate ecological terms. This activity is used to assess the students' pre-existing knowledge of the ecological terminology.

In the investigation phase, students investigate a local ecosystem (e.g. school garden, forest) and select an endangered plant species for their field study. Specifically, students are encouraged to estimate the density of the endangered plant species that exist in the selected ecosystem in relation to an abiotic factor. Firstly, they identify an environmental abiotic factor and the instrument needed to measure it. Then they select data by getting random samples through the methodology of random sampling. After that, students record and present their data in a table. Once they analyze the data, they will plot them using the bar chart for their representation.

In the discussion phase, they examine the limitation of their field study and reflect on safety and ethical issues.

(Phanis&Valanides, 2013)

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[x] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The development of this activity was based on the inquiry based approach.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

calculator, tape measures, thermometer, hydrometer, ph meter, light meter, quadrants (1 m2 or 0.25 m2)

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):The activity takes place in the field (for example in the pond, school garden, forest, estuary and grassland)
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Establish project

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Design a CO2-friendly house

WEB ADDRESS (M)
Link to the activity or site of the activity

www.SCY-net.eu

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

thermodynamics, electricity and energy

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics,Biology,Mathematics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

reducing domestic CO2 emissions

LANGUAGE(S) (M)
Language(s) in which the activity is available

English,Greek

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15-17

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

20 hours

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The overall goal is to design a CO2-friendly house. In particular, students attempt to find out factors influencing CO2 emission from houses. By taking in account the house design and energy supply, students make a list of specifications for their house. Finally, they produce a report displays drawings of a CO2 friendly house. The particular mission is a meaningful and constructive experience that allows students to grasp challenging science concepts (thermodynamics, electricity and energy) and develop inquiry skills (i.e. write hypothesis, research questions etc.). The mission includes all five phases of inquiry: orientation, conceptualization, investigation, conclusion, discussion. "In the orientation phase students ask questions, discuss content and explore how to structure the work. Students collect what they already know about the topic, identify learning goals, and plan the learning process. In the next phase, Conceptualization, students try to identify the different concepts involved in the mission building a concept map. Also, they formulate research questions and hypotheses that they could investigate. In the following phase, investigation, students write an experimental procedure, make real or virtual experiments and collect data. They can design a real experiment by writing an experimental procedure before executing it. In the conclusion phase students evaluate the data collected against their hypotheses and use the outcomes of this comparison to refine their conceptual models and artefacts. The discussion phase includes students' reflection on their learning process and discussion what they would have done differently. Also, students write a report and prepare a presentation to the class and the teacher.'' (Geraedts et al.,2011, pp.8-9)

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[X] Direct	[ ] Indirect	[ ] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

An empirical study revealed that students completed the activity sequence successfully, which approved to be vital for their learning.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Computer

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:Server availability

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

SCY Lab project

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

ECO mission

WEB ADDRESS (M)
Link to the activity or site of the activity

www.SCY-net.eu

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

abiotic and biotic factors, photosynthesis, respiration, population size, trophic levels, propagation of light, temperature, pH

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics, Biology, Chemistry

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

ecosystem

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Greek

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

16-19

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

15 hours

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The ECO mission contains 4 issues: 1) influence of abiotic ecological factors on the size of a population, ii), influence of light on the photosynthesis, iii) relations between trophic levels in an ecosystem, and iv) the concept of pH and the changes of pH in water bodies. Students have the opportunity to enroll in one topic or in all topics of the mission. The product of this mission is a general concept map regarding to relations in an ecosystem. Initially, they develop it based on their preexisting knowledge and then they improve it when they finished each topic.
In the orientation phase ''students read a story in which a problem is embedded, they analyze this problem situation, indentify a goal state of the problem, identify their learning goals, and means – select devices, tools, and strategies to approach this particular problem. Next, students collect additional information. They have to browse resources for topic specific information. Then, in the conceptualization phase, they formulate research questions and hypotheses. In the investigation phase, they plan an experiment, conduct it either using mobile measurement devices or the SCYDynamics modelling tool and analyse collected data. In the conclusion phase they make inferences on the basis of the collected data and they can be used for solving the initial problem. Also, students have to relate data with hypotheses in order to answer research questions''. (Geraedts et al.,2011, pp.8-9) In the discussion phase, ''students are asked to make a video report that illustrates the inquiry processes that they have applied. In other words, in this video report students will explain to their audience what they have done and what the results are''. (Geraedts et al.,2011, pp.27)

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[X] Direct	[ ] Indirect	[ ] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

An empirical study revealed that students completed the activity sequence successfully, which approved to be vital for their learning.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

computer, mobile devices like those provided by Vernier (see http://www.vernier.com/)

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:Server availability

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

SCY Lab project

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Forensic laboratory

WEB ADDRESS (M)
Link to the activity or site of the activity

www.SCY-net.eu

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

DNA, chromosome, gene, allele, genotype, base pairing, double helix

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Chemistry, Mathematics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

DNA

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15-17 years

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

15 hours

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

In the mission, students will work in an unconventional learning environment simulating a forensic institute laboratory. Once they reopen a controversial case, they will conduct a biological DNA-analysis and a chemistry analysis. Then, they will prepare a court report illustrating the main conclusions. This report is especially important for the outcome of the court case.
Specifically, ''in the orientation phase students identify the means and goal of their investigation. Also, students get familiar with the phenomena they have to investigate from text and video. In the conceptualization phase, they generate their research questions and their hypothesis. In the investigation phase students design their experimental procedure and use it to conduct experiments. In the conclusion phase, students analyse their data, draw inferences, and relate these to their hypotheses. At the end, in the discussion phase students write a report as described above. '' (Furberg et al.,2011, pp.8-9)

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[X] Direct	[ ] Indirect	[ ] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

An empirical study revealed that students completed the activity sequence successfully, which approved to be vital for their learning.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

computer

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:Server availability

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

SCY lab project

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Activity 1.2 - Plant adaptations and the effects of global warming on endangered and/or farmed species

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.establish-fp7.eu/resources/units/ecobiology

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

xerophytes, hydrophytes, mesophytes, halophytes, and plant adaptations mechanisms

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology, Physics, Technology,Chemistry

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Plant adaptations

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[x] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

80-100 minutes

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[ ] Basic	[x] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[ ] Conceptualization	[x] Investigation	[ ] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

In the orientation phase, students have to conduct a research in order to collect information about the adaptations of a plant growing in their local ecosystem. Next, students present the adaptations of their plant to their peers. Then, students study a relevant text and fill in the blanks with the most appropriate word. This activity is used to assess the students' pre-existing knowledge of the adaptations of xerophytes.

In the investigation phase, students, design and conduct an experiment in order to investigate the effect of an abiotic factor on the development of seeds of a selected plant or its seedlings that can be found in the ecosystem under investigation. Specifically, students have to write by themselves the methodology that they can follow to investigate the effect of an abiotic factor, on the development of a plant that grows in their selected local ecosystem. During the performing of their experiment, students have the opportunity to make multiple observations and collect enough data. In addition, the experiment can be conducted in a greenhouse. During the experiment, students should consider the depended variables and how they will be measured, the controlled variables and how they can be monitored as well as the independent variables.

In the discussion phase, students share their ideas on several greenhouses-related issues. At the end, students are prompted to discuss why keeping constant specific variables during the experimental is important.

(Phanis&Valanides, 2013)

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[x] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The development of this activity was based on the inquiry based approach.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

A photo and keys of a known/named plant that grows in the local ecosystem, Calculator, Ruler, Thermometer, Hygrometer, pH meter, Light meter, Soil, Water,Minerals

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Establish project

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

"How to make perfect hard boiled eggs that are ease to peel?"

WEB ADDRESS (M)
Link to the activity or site of the activity

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

boiling, heat and temperature, egg protein denaturation

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics, Chemistry, Biology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

heat and temperature, state of matter (emphasis in boiling), protein biology (egg protein denaturation)

LANGUAGE(S) (M)
Language(s) in which the activity is available

Greek

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

approximately 1800 minutes

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[v] Basic	[v] Advanced	[v] Expert

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

v Orientation	v Conceptualization	v Investigation	v Conclusion	v Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

Orientation phase: The learners are provided with a scenario that relates to a chef's daily task about boiling and peeling eggs for the customers of his restaurant. Because of the difficulties he encounters during performing this task (e.g., quite often the eggs are not hard boiled enough and thus they are neither easily peeled nor are uniformly peeled), learners are prompted to find solutions to the chef's problem by answering the following driving question: "How one can make perfect hard boiled eggs that are easy to peel?" They define the problem that merits solution, identify the variables that might affect the boiling and peeling of eggs, perform some reading and study from internet resources to get familiar with the context of the problem, and collect information about the processes that take place during the boiling of eggs (e.g., protein denaturation).

Conceptualization phase: This phase begins by asking learners to formulate investigative questions. First, they are prompted to fill in the blanks in given investigative questions that the independent and depended variables are omitted. An example would be "Does the…… affect the …….? After learners have correctly completed the blanks with the variables that they need to test later, they are asked to identify themselves the syntax of an investigative question. At this point they are informed that any investigative question follows the same format and it always entails two variables (the one that will be varied (independent variable) and the one that will be measured (dependent variable) during the experiment) that are connected through the verb "affect". Then, they formulate new investigative questions themselves, without providing their syntax. In this way, the scaffolding of formulating an investigative question is fainting out.

Next, the learners are supported in developing hypotheses that derive from their investigative questions. In doing so, they are prompted to

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

X Direct	Indirect	X Theoretical	Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

An empirical study conducted in Cyprus revealed that learners completed the activity sequence successfully.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The problem stated at the orientation phase has the potential to attract the interest of both boys and girls to the same extent.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

eggs, hotplates, electronic kitchen scale, glass beakers, thermometer, chronometer, computer,pen and paper

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

A Healthy pizza

WEB ADDRESS (M)
Link to the activity or site of the activity

www.SCY-net.eu

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

nutrients, nutritional value, food pyramidbasic energy requirements (BER), digestive system

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology-Chemistry

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Nutrients and the relation between energy use and intake food.

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Greek

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

Approximately 20 didactic hours

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Basic	[ ] Advanced	[ ] Expert

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The main goal of the mission is to help learners study about the several nutrients and the nutritional value of prepared food, using the pizza as an example. At the end of the mission learners should propose a healthier pizza recipe. Through the mission activities learners study about the unhealthy food, the nutrients, the nutritional value, the food pyramid, the nutritional needs, the basic energy requirements (BER) and the digestive system. The skills gained are related to the inquiry skills (identify problem, formulate hypotheses, plan-design-perform experiments, analyze-interpret data, communicate the results, reflect on the process followed).

At the beginning of the mission learners are informed about the problem by watching a video and reading a text (Orientation phase). Afterwards, they build a conceptual model trying to identify all the related concepts (Orientation and/or Conceptualization phase). In the next step they state hypotheses to be tested (Conceptualization phase) through experimentation (Investigation phase). The data collected are organized and analyzed in order to confirm or reject the hypotheses (Investigation phase). At the end of the mission learners communicate their results and reflect on the process followed (Discussion phase).

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[X] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

An empirical study conducted in Cyprus revealed that students completed the activity sequence successfully, which approved to be vital for their learning.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The problem stated at the beginning of the mission concerns healthy problems as a result of consuming unhealthy prepared food at schools canteens. This problem is obviously gender independent, thus both boys and girls are involved in the inquiry process. All the information about body measures and diabetic habits are carefully managed in respect of the every student's personality.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Computer and mobile phones for data collection

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:Server availability

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Activity 1.5 - Plant extracts and antibiotics

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.establish-fp7.eu/resources/units/ecobiology

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

plant extract, antibiotics, bacteria

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology, Technology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

medicine

LANGUAGE(S) (M)
Language(s) in which the activity is available

english

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[x] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

80 minutes

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[ ] Basic	[x] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[ ] Conceptualization	[x] Investigation	[ ] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

In the orientation phase, students conduct a research on how to prepare safely plant extracts from a plant that they have found in their local ecosystem. In the next activity, the students test the effects of different kinds of plant extract which they have produced from plants selected from their local ecosystem, on bacteria.

During the investigation phase, students perform an experiment, in order to investigate the effects of different kinds of plant extracts on bacteria. They decide which variable is the dependent variable and how it can be measured. They collect data and then write a report of their findings, comparing the different antibiotics, and the effects on the bacteria.

In the discussion phase, they evaluate their experimental design.

(Phanis&Valanides, 2013)

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[x] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The development of this activity was based on the inquiry based approach.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Plant, Agar plate seeded with known bacteria, Sterile Pasteur pipette, Bunsen burner, Beaker of disinfectant,Virkon or equivalent
Bench spray of disinfectant, Virkon or equivalent, Bactericidal soap, Paper towels, Marker pen, Forceps, Plant extract/ antibiotic/ impregnated paper discs, Adhesive tape, Incubator set at 30 °C

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

establish project

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Activity 1.4 - Flowering plant reproduction

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.establish-fp7.eu/resources/units/ecobiology

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

flower, reproduction,pollination, fertilization

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology, Chemistry, Technology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

reproduction

LANGUAGE(S) (M)
Language(s) in which the activity is available

english

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[x] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

80-100 minutes

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[ ] Basic	[x] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[ ] Conceptualization	[x] Investigation	[ ] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

In the orientation phase students draw a biological diagram using a flower from their local ecosystem and label the parts of the flower. Next, students collect pollen grains from flowers and make observations using the microscope.
In the next activities students have to read a text and answer several questions. Students conduct a research related to the life cycle of an insect and its role in pollination and the effects of Global warming in seasonal flowering, pollination and seed biology.

In the investigation phase, students design and perform an experiment to investigate the time that they can store selected seeds without loss in the germination rate.

(Phanis&Valanides, 2013)

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[x] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The development of this activity was based on the inquiry based approach.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Hand lens, Pencil, Ruler, Flowers, Seeds, Pollen grains, Microscopes, Stereoscopes, Camera

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

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Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

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Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Activity 1.3 - The science of taxonomy

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.establish-fp7.eu/resources/units/ecobiology

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

taxonomy, organisms

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology, Chemistry, Physics, Technology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Scientific classification of organisms

LANGUAGE(S) (M)
Language(s) in which the activity is available

english

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[x] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

80-100 minutes

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[ ] Basic	[x] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[ ] Conceptualization	[x] Investigation	[ ] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

In the orientation phase, students make observations on the environment around them. The students use a field notebook to i) draw the organisms that they discover, ii) take notes on their features ii) report the time and place they found the organism iv) other information. After that, students classify the organism they found in one of the five given categories. The description of each category is given. Following, teachers ask their students a few questions regarding their organism. In the next activity, students have to create a dichotomous key device in order to help anyone who wants to identify an unknown organism.

In the investigation phase, students surf the internet to collect information about the organism's role in the ecosystem. They collect data and prepare a poster presentation in order to present them to the other groups.

In the discussion phase, the activity is related to a visit in a genetic institute. In the institute, students investigate how DNA analysis can provide evidence in a taxonomic study. At the end, they discuss the theory of evolution based on DNA homologies.

(Phanis&Valanides, 2013)

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[x] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The development of this activity was based on the inquiry based approach.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Beating Stick and Net, Aspirator, Killing Tube, Light Trap, Keys, Camera, Container, Dissecting Microscope, Compound Microscope, Scanning Electron Microscope, DNA Sequencing homologies

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

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Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

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Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Biological values of my homeplace water body

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.keskkonnaamet.ee/public/Keskkonnaharidus/veeprojekt/VEEKOGU_BIOLOOGILISED_VAARTUSED_juhend.pdf (biological values of

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Biological values of water body; biota of water body, description of water body

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology, chemistry, mathematics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Biological values of water body

LANGUAGE(S) (M)
Language(s) in which the activity is available

Estonian

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[x] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

14-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

estimably 7000-8000

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[ ] Basic	[x] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[x] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The aim of the activity is to investigate the state of a water body (river, lake) by the school using various methods and to develop socially active, responsible and environmentally friendly citizens who care and protect the nature and value sustainability. Expected outcome is a research work completed by a pupil or group of pupils. In the end of the research pupils know better their home place and its natural values. The results of observations can be used to promote the inter-subject integration and to enhance cooperation between the schools. The concrete theme and the extent of the inquiry can be selected by a pupil or a group of pupils in cooperation with a teacher. The inquiry activity includes all five phases of inquiry: orientation, conceptualization, investigation, conclusion, and discussion. The activity starts with the orientation phase: pupils get acquainted to the background material of biological values of water body and choose the suitable topic. In conceptualization phase after deciding the focus they need to pose the research questions or state the hypotheses. In investigation phase they can use a variety of materials: pupils can decide which worksheets and what extent they need to fill in for their research or which additional materials are suitable for their research. There are provided manuals for biological values of water body, flora investigation and Winkler test for dissolved oxygen, worksheets for flora investigation and description of water body, identification guides for flora and invertebrates in water. The worksheets are quite well structured, but provide at the same time option about what extent they can be used. Investigation part (observating plants) can be completed in late spring, summer or ealry autumn. After the investigation pupils have to draw a conclusion based on the data. The discussion phase comprises all the activities completed and overall reflection of the process. The last phase is mainly guided by a teacher. The inquiry proficiency level is the Expert as there is ill-defined problem in a complex societal context. The activity is suitable for secondary school pupils who are more familiar with inquiry-based learning. A teacher is guiding the whole process or scaffolding if needed. The activity is particularly valuable as it is closely connected to everyday life providing pupils knowledge and skills to work in STEM fields in future. The additional materials are created

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[x] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is based on a project and was carried on February 2011- April 2012. Altogether 43 schools participated.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

Inquiry activity engages girls in the activity to the same level as the boys. Discussion phase can be provided by the teacher in all stages. The inquiry process includes various actors in society (e.g. executives of companies, farmers, local people). The aim is to develop socially active, responsible and environmentally friendly citizens. The activity has a high value because it is closely connected to everyday life providing students knowledge and skills to work in STEM field in future.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Scoopnet, metal sieve, cup magnifiers, Petri dish, Secchi disc, dissolved oxygen test, pH indicator paper, tweezers, (swimming) water thermometer, white bowl, writing pad, stopwatch (e.g. in mobile phone), apple or orange, pen, identification guide, photo camera (not compulsory), gumboots, plastic box for keeping the tools, beaker.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☐ Medium	☒ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights: The teaching material is for free for educational objectives. No license. Reference for the author is needed
Restrictions:

OWNER OF THE ACTIVITY(M)

The Environmental Board www.keskkonnaamet.ee

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Inquiry-based learning in Ice Age Centre

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.jaaaeg.ee/failid/dokumendid/keskkonnaharidus/jaaajakeskuseoppematerjalid/loomingulised_voi_uurimuslikud_tood_jaaaja_kesku

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Ice age, nature, human settlement, climate change

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics, chemistry, biology, (geology, geography)

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Ice age and ice in our era, traces of ice age on the Estonian territory, meteorological observations, climate changes, ecological footprint etc.

LANGUAGE(S) (M)
Language(s) in which the activity is available

Estonian

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[x] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

500- ...

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[x] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[x] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The objective of the activity is to conduct a research based on the information gathered from Ice Age Centre. The learning outcome: pupils know how to plan the experiment, formulate the research questions, carry on the experiment, make conclusions and participate in a discussion. As for content knowledge they get to know the exposition in Ice Age Centre. The activity can be implemented with a group of pupils.
The inquiry activity leads pupils through five phases of inquiry: orientation, conceptualization, investigation, conclusion, and discussion. The activity starts with orientation phase where pupils get to know the whole inquiry cycle, they have to choose the topic and the role (e.g. archeologist, biologist). In conceptualization phase pupils have to write down research questions. In next - investigation phase - they are asked to write down research objects and tools, make a research plan, plan exercises for the group members and add supplementary materials. In next phase pupils have to write down outcomes of the research and answer to the questions e.g. why did you choose this topic and the role or what tools did you choose to collect the data? After that pupils make a conclusion. The evaluation part is helpful for discussion (see the worksheet for evaluation). Pupils have to write down what went well and what they should have done differently.
The inquiry proficiency level is basic. Although the worksheet is well structured, the activity leaves freedom for pupils in their inquiry path. Pupils are partly guided at the beginning of the activity (instructions), during the activity and in discussion phase if needed.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[x] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is effectively implemented in Ice Age Centre.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

Societal responsibility: students can share their ideas in discussion phase and communicate to experts. Gender equality: both boys and girls are engaged to the same level.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Worksheets:
http://www.jaaaeg.ee/failid/dokumendid/keskkonnaharidus/jaaajakeskuseoppematerjalid/loomingulised_voi_uurimuslikud_tood_jaaaja_keskuses/lisa_4_uurimus.pdf

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[x] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[x] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools): Tu- Su 11-18
Remote lab availability:
Booking Requirements (y/n): yes
Activity Location/place (country, address, ZIP, google map): Saadjärve 20, Äksi village, 60543, Tartu county, Estonia
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum): www.jaaaeg.ee, info@jaaaeg.ee, (+372) 5911 3318
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[x] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights: The material is for free for educational objectives. No license. Reference for the author is needed.
Restrictions:

OWNER OF THE ACTIVITY(M)

Ice Age Centre www.jaaaeg.ee

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Idea for the research from Ice Age Centre

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.jaaaeg.ee/failid/dokumendid/keskkonnaharidus/jaaajakeskuseoppematerjalid/opilasuurimuse_voi_praktilise_too_idee_jaaaja_kes

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Ice age, nature, human settlement, climate change

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics, chemistry, biology, (geology, geography)

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Ice age and ice in our era, traces of ice age on the Estonian territory, meteorological observations, climate changes, ecological footprint etc.

LANGUAGE(S) (M)
Language(s) in which the activity is available

Estonian

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[x] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

500- ...

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[x] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[x] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The objective of the activity is to introduce the pupils Ice Age Centre where pupils get an idea for their research or practical work. The activity guides the learner to acquire knowledge on the topic through five inquiry phases: orientation, conceptualization, investigation, conclusion, and discussion. The activity starts with the orientation phase where pupils` task is to choose the character - a researcher or a specialist - whose point of view the inquiry activity can be described. In this phase pupils need to fill in a first part of worksheet (which professions have played an important role for creating the Ice Age Centre?) Then the activity continues with the conceptualization phase. In this phase pupils need to fill in the second part of the worksheet: they need to find three interesting themes from each floor in Ice Age Centre and write research questions and ideas for each chosen theme. After completing the task pupils need to find out the research theme for further investigation. The investigation phase can be completed in Ice Age Centre or outside it, depending on a theme. After completing the investigation phase pupils need to write a report which is a basis for the presentation in discussion phase. All videos, photos, tables, interviews etc collected during the investigation phase should be added to the report. The graphic solutions will be used to complete the inquiry (e.g. Prezi, Power Point presentation, poster etc). If the inquiry is completed pupils are presenting the results to others. A role of a teacher is to guide pupils during the inquiry if needed and initiate a discussion. The learning outcome: pupils know how to formulate research questions, to compare the ideas for research, write a report, present and discuss the results. As for content knowledge they get to know the exposition in Ice Age Centre. Please note that it is possible to fill in the worksheet only. In this case the orientation and conceptualization phases are covered.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[x] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is effectively implemented in Ice Age Centre.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

Societal responsibility: students can share their ideas in discussion phase. Gender equality: both boys and girls are engaged to the same level. There is a recommendation to involve various specialists to the inquiry process.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Worksheets:
http://www.jaaaeg.ee/failid/dokumendid/keskkonnaharidus/jaaajakeskuseoppematerjalid/opilasuurimuse_voi_praktilise_too_idee_jaaaja_keskusest/uurimuse_teema_tooleht.pdf

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[x] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[x] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools): Tu- Su 11-18
Remote lab availability:
Booking Requirements (y/n): yes
Activity Location/place (country, address, ZIP, google map): Saadjärve 20, Äksi village, 60543, Tartu county, Estonia
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum): www.jaaaeg.ee, info@jaaaeg.ee, (+372) 5911 3318
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[x] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights: The material is for free for educational objectives. No license. Reference for the author is needed.
Restrictions:

OWNER OF THE ACTIVITY(M)

Ice Age Centre www.jaaaeg.ee

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Investigate and Discover

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.tartuloodusmaja.ee/ET/oppematerjalid_programmid/koolidele/uurime-ja-avastame-ii-meri/

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Sea, organisms, human impact, human senses

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Children get to know different organisms connected to the sea and relationships between them

LANGUAGE(S) (M)
Language(s) in which the activity is available

Estonian, English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [ ] Medium [x] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

7-8 (9-10)

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [ ] Medium [x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[x] Novice [ ] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[x] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

Objective of the study programme is learn how to recognize, describe and classify different objects connected to the sea. When children get to know things connected to the sea, they learn and think about what the sea gives to us and how we influence the sea. Children get to know the connections and relations between different organisms. Children experience the opportunities and limits of the human senses and feel the need for cooperation between their senses; they develop group work, cooperation and communication skills.
The inquiry activity consists of five different inquiry phases: orientation, conceptualization, investigation, conclusion, and discussion. In orientation phase pupils are divided into the groups and each group is assigned a prepared desk. A supervisor starts the inquiry process with saying that pupils are sciece workgroups in different parts of the world. They pose a question: what kind of pairs can be made of different objects connected to the sea? The Investigation phase consists of two different games: “Find the Pairs” and “Game of the Senses”. In the activity „Find the Pairs“ pupils are divided into the group of 4-5 and seated around desks. Each group is given a bucket and asked to look the things inside. They have to take the objects out, find the pairs and give an explanation for forming the pairs. Pupils are given free time for the discussion. When the pairs are made pupils have to introduce the pairs that they found to others. After that a supervisor shows other possible pairs for pupils. The next activity is called „Game of the Senses“. At the beginning a supervisor explains that we perceive the world mainly through five different senses: sight, hearing, touch, smell and taste. Then pupils play a game of senses. They have to describe the information they got using as many adjectives as they could. After that pupils are introduced different objects connected to the sea and they have to guess which objects these are using different senses. In conclusion part pupils have to stand in a circle. A supervisor presents the statements during the game and pupils have to decide whether they agree or not with the statement stepping back or forward. After the last game pupils present their results in a mini-conference. Discussion is provided in all phases of inquiry.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[x] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The learning program has been effectively used for 15 years at Tartu Environmental Education Centre

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

Children develop group work, communication and cooperation skills. Activities engage boys and girls at the same level.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[x] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[x] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools): Mon- Fri 9- 18
Remote lab availability:
Booking Requirements (y/n): yes
Activity Location/place (country, address, ZIP, google map): Lille 10, 51010 Tartu, Estonia
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum): www.tartuloodusmaja.ee, helle.kont@teec.ee, (+372) 736 1693
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[x] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights: The material is for free for educational objectives. No license. Reference for the author is needed.
Restrictions:

OWNER OF THE ACTIVITY(M)

Tartu Environmental Education Centre www.tartuloodusmaja.ee (Annelie Ehlvest and Helle Kont)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Oil pollution in water

WEB ADDRESS (M)
Link to the activity or site of the activity

https://www.dropbox.com/s/tr1s9gfcu68uou0/Oil%20pollution%20and%20marine%20organisms.pdf?dl=0

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

sea pollution, oil spill, marine biota

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Oil pollution, options to liquidate oil pollution, impact of oil pollution on marine organisms

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Estonian

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[x] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

11-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

60-90

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[x] Novice	[ ] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[ ] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The aim of the activity is to introduce oil pollution and its effects on marine organisms. This activity is intended for 6th to 9th graders as it relates to subjects and thematic areas of the comprehensive school curriculum, though it can be used by younger pupils and is suitable for the secondary school level too. The pupils work alone or in small three- or four-member groups.
The activity guides the learner to acquire knowledge through the inquiry path using four different inquiry phases: orientation, investigation, conclusion, and discussion. The activity starts with an introduction where pupils need to read the additional material "Oil pollution in water" and answer to the questions e.g. from where oil can get into water or what are the basic properties of oil and most oil products? The investigation part consist of three exercises: "Modelling an oil spill" and "Liquidating an oil spill" in first part of the exercise and "Effect of oil on a bird weather" on a second part of exercise. During the investigation phase pupils have to answer the questions or fill in tables according to the data that they get from the experiment. In conclusion part pupils draw a conclusion answering to the questions of experiment. The discussion part can be initiated during the whole inquiry cycle. In every phase there are helpful questions for discussion.
The role of a teacher is to observe the course of work and, where necessary, help the pupils in their work and also, where relevant, ask questions or give explanations and encourage discussion. Expected outcome: pupils can compare different tools to get rid of oil spill and learn how the oil spills can influence the marine organisms. The inquiry proficiency level is novice, because the learning path and outcomes are predefined, questions in worksheets are helpful for students to orientate well in inquiry process. Inquiry proficiency level can be turned to basic making the process more complex e.g. giving pupils an opportunity to pose the questions or state the hypotheses.
In Estonian version answers to the questions can be found from the additional material "Manual on Marine Pollution Abatement" (the book is in Estonian "Merereostustõrje käsiraamat"). In English version pupils need to use the internet to find the answers to the questions. The activity

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[x] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The learning program has been effectively used for 15 years at Tartu Environmental Education Centre

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

Engages the girls at the same level as the boys.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

"Merereostustõrje käsiraamat" ('Manual on Marine Pollution Abatement'), can be printed out at http://www.elfond.ee/et/teemad/meri/laeaenemere-kaitse/naftareostus/merereostustorje-kaesiraamat. "Oil pollution in water", additional material No. 1 (p. 35). Experiment tools for the first experiment. Dishes: a small shallow dish such as a coffee cup to mix the "mazut"; two

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☐ Medium	☒ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

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Restrictions:

OWNER OF THE ACTIVITY(M)

Tartu Environmental Education Centre www.tartuloodusmaja.ee (Külli Kalamees-Pani and Annelie Ehlvest)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Our daily bread

WEB ADDRESS (M)
Link to the activity or site of the activity

https://www.dropbox.com/s/ul7f30zu44ugl8v/Our%20daily%20bread%20research.pdf?dl=0

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Contaminants in food, healthy food, diet

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology, chemistry

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Conducting a research on bread

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, Estonian, Finnish, Latvian

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[x] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

14-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[x] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[x] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

Objective of the activity is to create an inquiry-based research on our daily bread. This activity is suitable for the 8th grade, but can be used, either in part or as a whole, by older pupils. If pupils would have any difficulties they can find links referring to the additional materials at http://foodweb.ut.ee.
The inquiry activity guides the pupils through five phases of inquiry: orientation, conceptualization, investigation, conclusion, and discussion. Before pupils will start the inquiry they can fill in the sheets getting to know more about bread, but they can also start the inquiry process with possible topics that are offered in a study material. In conceptualization phase pupils need to pose the questions or state the hypotheses. Next - in investigation phase - pupils start their inquiry by making an inquiry plan (they have to write down the activity, time and add notes if necessary). As for the conclusion pupils have to write down brief summary of activities, main results and conclusions of the study. The discussion phase comprises helpful questions for reflection e.g. did anything go against your plans or how satisfied are you with your work and results?
Guidance by a teacher is depending on the inquiry proficiency level of a pupil. The inquiry proficiency level is basic, because the activity is in pre-defined problem space and the process is partly scaffolded. The inquiry activity in general needs previous inquiry skills. Expected outcomes: pupil knows how to plan and carry out the experiment, evaluate, analyze and communicate the results.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[x] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The inquiry-based material has been effectively used in daily school practice for one year.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

Boys and girls are engaged to the activity at the same level.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Worksheets, other tools/materials are depending on what topic a pupil will choose

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights: The teaching material is for free for educational objectives. No license. Reference for the author is needed.
Restrictions:

OWNER OF THE ACTIVITY(M)

University of Tartu Natural History Museum http://www.natmuseum.ut.ee/ (Külli Relve)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Patties for snowboaders

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.biodigi.edu.ee/_/wp-content/uploads/4-P%C3%A4rmirakkude-paljunemine.pdf

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

yeast reproduction, aerobic clycolysis, anaerobic glycolysis

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology, mathematics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

yeast reproduction

LANGUAGE(S) (M)
Language(s) in which the activity is available

Estonian

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[x] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

16-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[x] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[x] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[x] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The aim of the activity is to teach the aerobic and anaerobic glycolysis by an example of yeast reproduction. The activity guides the learner to acquire knowledge on the topic through five inquiry phases: orientation, conceptualization, investigation, conclusion, and discussion. The activity starts with the orientation phase: pupils need to find a problem from a story of snowboarders. After reading the story they need to read a text of glycolysis and state the problem. Then the process goes on with posing the questions and generating the hypotheses. Finally - in conceptualization phase - the question "How the speed of dough bubbling is depending on the amount of sugar?" will be stated. In investigation phase pupils need four different straws (they need to mark them with numbers 0, 1, 2, 3, numbers are depending on the amount of sugar in the experiment (teaspoons)). Pupils need to put flour and yeast into the bowl, stir and add some water. Then they have to add the straws into the bowl with the number 0 (the dough has to rise 5 cm in a straw). Then pupils need to close the under part with clothespin and mark the height of dough on a straw. After that 1 teaspoon of sugar need to be added and the straw with number 1 need to be placed into the bowl continuing the process like they did with a straw 0, then 2 teaspoons of sugar etc. Pupils have to observe the speed of dough bubbling after 5, 10 and 15 minutes, to fill in the table and draw a diagram. After the experiment - in a discussion phase - pupils need to answer to the questions e.g. did the dough with sugar rose or not? Compare the speed of dough bubbling in different experiments and give causes for the differences. In conclusion part pupils have to remember the research question and answer it. They are also asked to think about the stories at the beginning and the experiment in order to find the solution to the problem. Learning outcome: pupils know and explain the cycle of the yeast reproduction. The activity has predefined inquiry bath and is suitable for pupils who have not so familiar with inquiry-based learning. A teacher can offer the guidance and reflection in every phase if needed. The proficiency level of the activities can be considered as basic: although all the inquiry path is well predefined there is still room for certain amount of independence e.g. posing the questions or stating hypotheses

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[ ] Theoretical	[x] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is based on a Biodigi project and is tested in various schools.

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

Inquiry process itself is interesting both for boys and girls. The orientation process in more interesting for boys because the key actors are boys and the competitive moment is included. Discussion phase can be provided by a teacher in all stages.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Drinking straws, clothespegs, rulers, thermometers, markers, little bowls, stopwatches, sugar, yeast, containers for water.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☒ Yes	☐ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions: Creative Commons: Attribution-ShareAlike CC BY-SA

OWNER OF THE ACTIVITY(M)

University of Tartu www.ut.ee

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Biodiversity

WEB ADDRESS (M)
Link to the activity or site of the activity

http://compass-project.eu/resources_detail.php?UG_hodnota_id=1

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

biodiversity, water birds, functions and graphs, modelling , probability

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

biology, mathematics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Biodiversity of water birds in Europe

LANGUAGE(S) (M)
Language(s) in which the activity is available

German, Dutch, Greek, Spanish, English, Slovak

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [X] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

16-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [X] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

270 min

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice [ ] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This activity aims to familiarize learners with the concept of biodiversity, what does it mean, how it can be described mathematically and what are its advantages and limitations. The activity concentrates on populations of different species of water birds especially the greylag goose. In this activity learners will explore the evolution of a population of geese in the Netherlands. Students will learn both about the meaning of biodiversity and how it can be measured. As a final product learners will write a report to the bird counters of the Sovon organisation in which they explain their findings and offer advice.

The Biodiversity activity offers material for the teacher to orientate the learners by providing guiding questions and proposals for real-life activities outside the classroom and worksheets for the learnerss in which they are given tasks related to biodiversity of water birds. The learners are introduced to the idea of different species competing of the same resources in a habitat and why the increasing number of certain species could become a threat to the others' existence. An over-arching question is posed which states the scope of the whole activity and works as a conceptualization phase. They are asked first to identify different trends in bird populations and then gradually direct their reasoning to a more mathematical approach on the subject. Through the worksheet tasks the learners are introduced to the investigation and conclusion phases. The activity also includes an applet which can be used to illustrate the trends in bird populations and help to conceptualize the mathematical formulas that are used to measure biodiversity in an ecosystem.In the discussion phase learners are asked to write a report to the ornithologists of Sovon explaining their position, describing the methods they used and the proposals they would suggest to protect the biological diversity of water birds, and report their findings and end results to bird watching organizations.
The activity follows a well-structured and predefined inquiry path and can be regarded as being novice proficiency level

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity can be mapped on the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles and promotes societal responsibility.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

503635-LLP-1-2009-1-DE-COMENIUS-CMP

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Build an atom

WEB ADDRESS (M)
Link to the activity or site of the activity

http://graasp.eu/ils/54731a86e9934012b7c660e1?lang=en

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

atoms, protons, neutrons, electrons, structure, chemical elments, periodic table

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Particle physics

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [X] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-15

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [ ] Medium [X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

45 minutes (1 didactic hour)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice [X] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

Build an atom activity is an Inquiry Learning Space (ILS) designed to introduce learners in the world of atoms and their 'building blocks': protons, neutrons, and electrons. Learners will be guided to build atoms and use the knowledge acquired in the ILS to identify an element and its position in the periodic table.

Orientation: The orientation phase constitutes a short introduction on the concepts of atoms, protons, neutrons and electrons.

Conceptualization: In this phase the basic elements that structure the atom are presented (namely Atomic number, Mass number, and Charge of atom) and the learners receive all the needed information in order to be able to state their hypothesis into the hypothesis scratchpad and proceed with their experiments in the next phase.

Investigation: At this point, the learners are given two main tasks followed by critical thinking questions that they have to answer after the completion of them. The purpose is that the learners will gain a good understanding of the basic structure of an atom and its particles and the idea behind the position of each chemical element in the periodic table.

Conclusion: During the conclusion stage the learners are encouraged to test their knowledge through a ''Game'' Activity to see how well they understood the content of the ILS, rethink their initial hypothesis and evaluate whether it was stated right or they would like to change/rephrase it. This phase also involves writing down the final conclusions obtained from the experiments and tasks

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[X] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights: Creative Commons Attribution (CC BY)
Restrictions:

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Car Pollution

WEB ADDRESS (M)
Link to the activity or site of the activity

http://compass-project.eu/resources_detail.php?UG_hodnota_id=10

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

car pollution, CO2 emission, photosynthesis, ecosystems, carbon sink land plants

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics, Engineering

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

CO2 emission/car pollution

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, German, Spanish, Dutch, Greek, Slovak

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [ ] Medium [X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

13-16

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [X] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

360-540 minutes (8-12 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice [ ] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This learning unit aims to familiarize the learners with the topic of car pollution and how the CO2 emission by cars can be reduced by plants. They are presented an advertisement of a car manufacturer to trigger the initial conversations, critically analyse the information offered on the website and produce a report based on calculations and scientific facts. Throughout the activity, students will carry out basic calculations (optionally, using Excel), determine statistical measures, explore the process of photosynthesis and factors influencing it, analyse and interpret graphs qualitatively, and optionally, estimate surfaces and volumes. The activity involves all five inquiry phases and targets both to teach content knowledge about the different phenomena (photosynthesis, emission of CO2, carbon sink species plants, ecosystems etc.) and scientific skills in order to reach evidence-based conclusions.

More specifically, in the orientation phase the advertisement given to the learners is followed by a range of questions which aim to trigger the interest of the learners and to connect the content to be learned with the broader societal and environmental context. In the conceptualization phase, the learners are asked to develop a mathematical model to quantify the amount of CO2 emitted by cars and to carry out an experiment in order to understand more about the land plants and processes such as photosynthesis. Before using the applet available for the investigation phase, the learners should first try to answer few questions that aim to activate prior knowledge on the topic. After using the applet, they have to qualitatively analyze the graphs derived from their experiments. Moreover, they have to think about the different kinds of plants that could be used for fixing the CO2 emission taking into consideration the soil and climate of different regions, and thus, the capacity of different plants to grow in each place. Moreover, in order to reach more precise and accurate conclusions from their calculations, the learners are provided with a table that shows the maximum amount of CO2 that different plants can fix per square meter of leaves and per second

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity can be mapped on the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The learning unit promotes research and societal responsibility

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

503635-LLP-1-2009-1-DE-COMENIUS-CMP

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Craters on Earth and Other Planets

WEB ADDRESS (M)
Link to the activity or site of the activity

http://graasp.eu/ils/54b7cb3d51830bd46a6668fd?lang=en

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

crater, comet, asteroid, Earth, planets

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Astronomy-Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Comets on Earth and other planets

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [X] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

10-14

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [X] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90 minutes (2 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice [ ] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This Inquiry Learning Space (ILS) aims to introduce to students the concept of craters on Earth, on the moon and other planets, how they are formed, what governs their varying morphologies and what is the scale/size of these objects. It also aims to familiarize the learners with the parameters that influence the effect of this phenomenon on the Earth surface. Students use the Impact Calculator lab/simulation to investigate what happens when a comet hits the Earth and through an inquiry learning path they get acquainted with the gravitational potential energy while they also practice using mathematical formulas and making graphs. Thus, together with the acquired content knowledge, the learners are also expected to gain methodology skills.

Orientation: In the beginning, an introductory video on the subject is shown; the real case of Chelyabinsk meteor is also presented in order to compare it with what was shown in the previous video and realize the phenomenon of asteroids and comets hitting Earth in its real dimensions.

Conceptualization: In the conceptualization phase learners start formulating a concept map of what they already know or want to investigate, and try to propose parameters that should take into consideration when investigating asteroid collisions.

The next phase, investigation, consists of two steps, the exploration and the experimentation.
Exploration: At this point learners are introduced to the a applet/lab Down2Earth Impact Calculator. They are asked to investigate/explore the different parameters, variables, of the simulation and make observations. After taking notes of their observations, they can proceed with the second part of Investigation, the Experimentation section

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[X] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights: Creative Commons Attribution-NonCommercial-NoDerivs (CC BY-NC-ND)
Restrictions:

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Dangerous Cold

WEB ADDRESS (M)
Link to the activity or site of the activity

http://compass-project.eu/resources_detail.php?UG_hodnota_id=7

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

hypothermia, heat flow, energy, temperature, equilibrium

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Mathematics and Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Heat and energy flow, temperature and hypothermia

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, German, Spanish, Dutch, Greek, Slovak

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

11-14

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[X] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

150 minutes (a bit more than 3 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice	[ ] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The activity deals with the phenomenon of energy flow, water and heat flow in the natural environment, in a house or in humans' body and the problem of hypothermia. It includes a set of tasks that familiarize the learners with the idea of 'flow' into and out of a system to help explain what thermal equilibrium means. In a series of maths and science tasks, pupils use applets and simple experiments to build their knowledge and understanding of these key concepts. These ideas are then applied to the prevention of hypothermia in a case study. The activity also familiarizes the learners with the research methodology principles and promotes critical thinking and societal responsibility.

More specifically, through an inquiry learning path pupils get to understand that keeping warm and maintaining temperature is an important principle both in the natural world and in the built environment. They are also shown that maintaining the temperature of our living spaces at the lowest possible cost, and emitting the lowest amount of carbon dioxide is important not only for our own personal economics, but also to conserve the world's available fuels and reduce the impact of burning fuels on our environment. The final product that students should reach is a convincing demonstration, using a simple apparatus, which will help people to recognise the risk of hypothermia, and learn how to reduce it; they will do this after having completed a series of tasks that can be found in the worksheets provided for this purpose. The activity includes an applet, the worksheets for immediate use by the learners and teacher guides with all necessary information, tips and guidelines about each of the tasks.

The learning unit covers all inquiry phases apart from the discussion phase. The eight different tasks (8 in total) in this unit cover either only one phase (e.g.: 1st task aims to activate prior knowledge; 2nd and 3rd task cover the conceptualization phase) or more than one phases. Thus

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the White & Frederiksen's Inquiry Cycle and can be mapped on the Pedaste et al. (2015) model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Dangerous rain

WEB ADDRESS (M)
Link to the activity or site of the activity

http://compass-project.eu/resources_detail.php?UG_hodnota_id=6

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Flow, rate of flow, conservation of volume, soil structure

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Mathematics, physics, geography

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Flooding

LANGUAGE(S) (M)
Language(s) in which the activity is available

German, Dutch, Greek, Spanish, English, Slovak

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[x] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

11-14

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[x] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

300 (5 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[x] Novice	[ ] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[x] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This activity aims to familiarize learners with the scientific and mathematical explanations of flooding through theoretical and practical investigation. The learning unit deals with the topic of increased amounts of rainfall that some parts of Europe have experienced during the last decades while in other regions the amount of overall rain has decreased. This has caused some parts of the continent to suffer from floods and others from droughts. The concept of flow and the physical parameters that affect its' rate are investigated using two applets and through a case study which examines flooding in a river valley.

The activity is guided by three questions dealing with rainwater, the flow of rainwater and how to prevent flooding. These questions are examined throughout the activity so that as a final product learners will be able to act as a scientific committee giving advice to farmers, engineers and residents of the flood affected area. Teachers are also encouraged to link the activity to a real life situation by choosing a flooding case study that is directly relevant to their own situation. Because of the well-structured problem space and pre-determined inquiry path this activity can be viewed as being novice level.

In the orientation and conceptualization phases students are introduced to flooding through a case sample from the UK. They are asked to reflect why certain areas are particularly badly affected by heavy rainfall. They also familiarize themselves with the concept of flow by reflecting different types of flows in traffic, human blood circulation etc.

In the investigation phase learners are asked to engage two electronic research environments provided by the activity to conduct theoretical

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity can be mapped on the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

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Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Desertec

WEB ADDRESS (M)
Link to the activity or site of the activity

http://compass-project.eu/resources_detail.php?UG_hodnota_id=8

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

solar power, sun, energy, desert, power generation, Europe

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Mathematics and Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

solar power plants

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, German, Spanish, Dutch, Greek, Slovak

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[ ] Medium	[X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

15-16

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[X] Low	[ ] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

360-450 mins (8-10 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice	[ ] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The activity deals with the construction of solar power plants as one possible solution for future energy supply problems following an inquiry learning path. Questions such as how can electrical power be generated, which type of mirror is suitable for solar power plants, how many power plants are necessary in order to meet Europe's energy demand, and how can this energy be brought to Europe are few of the main topics to be presented. While dealing with these questions, students will be exploring mathematical and physical principles and problems concerning solar power plants in the desert. At the end of the teaching unit the students write an article or a report in which they outline their findings and list the pros & cons of solar power stations in the desert. In doing so, they learn to use their knowledge of physics and mathematics to make decisions regarding a political issue. They learn that political discussions are partly based on knowledge and insight but also that decisions always imply subjective/irrational aspects.

The orientation begins by providing learners with information on how "Desertec" project could contribute to Europe's energy needs. At that point learners are introduced to the concept of energy and the different forms of it and they are encouraged to think of examples on the different energy types in daily life. Moreover, the way that certain types of power plants function is described and the advantages or disadvantages of the different types of power plants serve as a topic for a brief discussion with peers.

The learners are requested to create energy flow diagrams in order to test the knowledge acquired at the previous steps. In a next step, the learners proceed with modelling the form of parabolic troughs using geometric function. They also become acquainted with the differences between types of mirrors (concave and parabolic mirrors) and what does this mean for solar power plants. Part of their investigation is also to

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity can be mapped on the five inquiry phases of Pedaste et al. 2015 model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity promotes societal responsibility and critical thinking.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

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Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Electricity: an alternative approach to Ohm's Law

WEB ADDRESS (M)
Link to the activity or site of the activity

http://graasp.eu/ils/54ad280351830bd46a66658a?lang=en

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

electricity, voltage, resistance, electric circuits

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Electricity and magnetism, Electric current

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

14-16

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90 minutes (2 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The inquiry space "Electricity: an alternative approach to Ohm's Law" deals with the topic of electricity, electric current and types of circuits. The learning environment is divided into inquiry phases with the aim of familiarizing the learner with Ohm's Law and basic methodological principles. The inquiry space combines theory and practice while allowing the learner to manipulate variables and explore the relationship between electric current, resistance and voltage.

Orientation: In the beginning of this phase the learners are asked to brainstorm with their peers and teacher looking for keywords that are related to electricity. The task is followed by videos that learners are asked to watch in order to get familiar with the electric circuits, and the parallel and in series setups. Afterwards, the learners should use the ‘‘Tools’’ bar at the bottom of the phase to keep notes of the important concepts and keywords that are related to the term electric circuits.

Hypothesis: In this phase the learner is asked to use the concept map tool and the keywords she/he wrote down in order to discuss with othera and explore how these concepts relate to each other. There is also a number of questions available to guide the discussion around the topic.The learners are asked to form groups and formulate their hypotheses; Information on what makes a good hypothesis and what are the different types of variables are provided also.

In this activity the Investigation phase is divided into two subphases; the Experimentation and Data Interpretation phases.
In the experimentation stage, the learners are asked to form expert groups of investigation. Expert groups should be formed by members who

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity has been designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The learners are introduced to the basic methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[X] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights: Creative Commons Attribution (CC BY)
Restrictions:

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Food

WEB ADDRESS (M)
Link to the activity or site of the activity

http://compass-project.eu/resources_detail.php?UG_hodnota_id=5

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Energy in food, energy flow, calories, carbohydrates, fats, proteins, balanced diet, proportionality, percentages, fractions, ratios

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology, chemistry, physics, mathematics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Healthy diet

LANGUAGE(S) (M)
Language(s) in which the activity is available

German, Dutch, Greek, Spanish, English, Slovak

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [x] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

14-16

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [x] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

450

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice [x] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[x] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

Today there is much concern that young people are becoming obese at an early age because of what they eat. For this reason many countries in Europe are now controlling what types of foods are served for meals and snacks in schools. This activity aims to familiarize learners with the flow of energy in a human body and allow them to explore the food they consume and energy that they use every day. The activity aims to provide the learners information on how to adopt a more balanced and healthy diet and how to adjust the amount of exercise they do. The activity has a predefined problem space in which the learners operate but only partly scaffolded learning process and the findings of the investigation can be communicated in a semi-structured way. For these reasons the inquiry level of this activity can be viewed as basic.

In the orientation phase learners are introduced to the nutritional information of various foods and they are also given material to reflect on typical meals across different countries. Using example cases they calculate how much energy different people use in a typical day.

In the conceptualization phase learners are introduced to the method of measuring how much chemical energy is stored in different types of food. A Food Energy Applet is used to simulate an experiment where different types of food items are burned and the released heat is captured. This will familiarize learners with the concept of calories.

In the investigation phase students are first asked to complete tasks which map their pre-existing knowledge about healthy eating and the scientific terms related to the topic. Group work and worksheets are then used to deliver them information on different constituents of food, such as carbohydrates, proteins and fats. They then summarize new knowledge and analyze their own eating habits by keeping food diaries and

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity can be mapped on the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

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Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

GearUp

WEB ADDRESS (M)
Link to the activity or site of the activity

http://graasp.eu/ils/5491435fe9934012b7c66967?lang=en

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

gears, rotation

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Engineering

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

gears and motion

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

10-12

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

less than 45 minutes (less than 1 didactic hour)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The GearUp is an Inquiry Learning Space (ILS) that introduces basic notions about gear sizes and rotation. In the ILS learners can get a first idea of what are the gears and how the motion is transmitted through them.

Orientation: In the orientation phase, learners are shown examples of gears in everyday life and a video about the mechanical principles.

Theory/Conceptualization: During the theory part, learners are shown how two types of gears- the drivers and the followers-function, and how the motion is transmitted through them. Then they have to make their own prediction with the help of a question posed to them.

Investigation phase: In this phase the learners can test the hypothesis they stated in the previous phase by drawing gears and observing how they work.

Conclusion: At this phase the learners are encouraged to summarize their findings in a poster and upload the resources to be shared with others.

Discussion: For the purpose of the Discussion, a specific online environment has been created where the learners can share their thoughts and rate or even answer other users' thoughts also.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices, room number for the discussion phase in order to join the speak up

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[X] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:Creative Commons Attribution (CC BY)
Restrictions:

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Light bulbs

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.compass-project.eu/resources_detail.php?UG_hodnota_id=4

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Efficiency, Production of light, Light spectrum, Proportionality, Working with variables, Modelling, Linear equations, Simultaneous equations

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics, mathematics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Energy saving light bulbs

LANGUAGE(S) (M)
Language(s) in which the activity is available

German, Dutch, Greek, Spanish, English, Slovak

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [x] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

14-15

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [x] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

270

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[x] Novice [ ] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[x] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This activity aims to familiarize learners with the reasons behind the decision to abolish traditional light bulbs in the EU. Learners are introduced to various tasks in which they compare conventional and energy saving light bulbs and learn how individuals can contribute towards the needs of society. The activity aims to provide learners with opportunities to discover why the EU introduced this change whilst exploring relevant mathematical and scientific content. Due to the predefined inquiry path and questions that guide the interpretation of the activities the activity can be viewed as novice proficiency level.

The activity is guided by five guiding questions which concern the differences between light bulbs and energy-saving bulbs from a physical point of view and efficiency issues amongst other things. At the end of the teaching unit learners will carry out a debate about the pros and cons of abolishing traditional light bulbs. Through this process they will learn how to use the physical and mathematical knowledge they have gained through the activity to make a decision on a political issue.

In the orientation phase learners are introduced to the topic by three short newspaper articles dealing with different aspects related to the change from traditional light bulbs to energy saving ones in Germany in the year 2009. After reading the articles the learners are asked to reflect shortly on the information the articles provided and also make use of their prior knowledge about energy efficiency.

In the conceptualization phase learners are introduced to the differences between light bulbs and energy-saving bulbs from a physical point of view. They learn that energy-saving bulbs contain highly toxic mercury, providing an argument against the ban of conventional bulbs. They are

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity can be mapped on the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

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Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Is it Good to be Beautiful - Understanding Evolution through Natural and Sexual Selection

WEB ADDRESS (M)
Link to the activity or site of the activity

http://graasp.eu/ils/547be131e9934012b7c662a3?lang=en

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

natural and sexual selection, evolution,

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Natural and sexual selection

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [X] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-16

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [ ] Medium [X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90 minutes (2 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice [X] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This Inquiry Learning Space (ILS) deals with the topic of evolution through natural and sexual selection processes. To study these topics learners will work through an inquiry cycle model and acquire scientific investigative skills that actual biologists and other scientists apply when making discoveries and investigating new phenomena. Thus, apart from learning about biology, they will also acquire important skills for conducting scientific inquiry.

Orientation: The orientation phase begins with some information about the terms natural and sexual selection and a vide of introduction to these concepts. The learners should engage in classroom discussion (or in critical thinking, in case the activity is conducted on one's own) about beauty and the importance of physical attractiveness in our society. With the available Padlet Wall, they can upload links or photos of people that they find physically attractive. Once there is sufficient number of photos added, the learners should try to identify common features of the people portrayed in the pictures and think about the characteristics that are typically judged to be beautiful. In a next step, they can watch an informative video on the evolutionary theory according to which many species are attracted to certain physical characteristics. After watching the video, the learners can proceed with creating a concept map to connect ideas about beautiful characteristics in humans with potential disadvantages. This way, learners are given the chance to view the concept of beauty from both sides and be critical towards it. Then, as the online virtual laboratory is about sexual selection in Guppies, the learners are encouraged to read an article about guppies and get some background information about them.

Conceptualization: At this phase the learners will formulate research questions and hypotheses that will in a next stage be tested through the

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices, requires Java

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[X] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:Creative Commons Attribution (CC BY)
Restrictions:

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Conservation of momentum in particle colisions

WEB ADDRESS (M)
Link to the activity or site of the activity

http://graasp.eu/ils/54731234e9934012b7c65f97?lang=en

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

particles, momentum, collisions, conservation, LHC, CERN

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

particle physics

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

16-18

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[X] Low	[ ] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice	[ ] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This inquiry learning space (ILS) aims to familiarize the learners with the use of the Large Hadron Collider (LHC) for studying the smallest known particles-the fundamental building blocks of all things; teach them to calculate the total momentum from all particles tracked after a particle collision; and finally, teach them to calculate the missing momentum (magnitude and direction). These learning objectives, are realized through an inquiry learning path that provides students with some basic methodology principles .

Orientation: The ILS begins with an introduction to the gigantic scientific instrument near Geneva, the LHC, which is a particle accelerator used by physicists to study the smallest known particles. The learners are presented with a short video on the topic and some background information about LHC. Before moving to the next stage, they are asked to think and answer few questions posed to them concerning CERN, and the aim of CERN's experiments.

Conceptualization: During this phase, the learners have to first realize how much they know about the topic. There is a number of questions available in order for them to answer or at least think about, so that they can proceed with creating a concept map. At a further step, the learners should state their hypothesis with the help of few guiding tips and questions.

Exploration: At this point learners are introduced to the lab that they are going to use for their data analysis. Before they start with the analysis, they are encouraged to explore the lab and conduct some primary measurements. The aim is to get familiar with the analysis tool so that they are able to plan more complex measurements in the next phase; the learners are given specific guidelines and steps in order to use

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access; the activity is compatible also with mobile devices; the investigation phase requires printed materials for the students.

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[X] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:Creative Commons Attribution (CC BY)
Restrictions:

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

pH scale

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.golabz.eu/spaces/ph-scale-ils

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

acids, basics, alcaline,, solution, liquids, pH meter

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Chemistry

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

pH scale, acids and basics

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [X] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

14-16

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [ ] Medium [X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90 minutes (2 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice [X] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The pH scale Inquiry Learning Space (ILS) provides an activity designed for young students of lower secondary school to familiarize them with the pH concept and scale. The benefit of conducting this virtual lab is that students can test liquids that are normally difficult to test in "real" labs, such as vomit and blood. It is also user-friendly and overcomes practical problems such as pH-meter calibration, need of multiple instruments and resources, lack of time and other educational difficulties. The lab guides students toward learning through an inquiry path where they can first get an overall idea about the topic, then conduct experiments to test their hypotheses, reach conclusions, and reflect on the process.

Orientation: The orientation phase aims to introduce the concepts of acidity and alkalinity of a solution or liquid and the way to measure Ph. This phase also connects the topic taught in the subject of chemistry with the real-life context (e.g. how many elements of our everyday life revolve around pH).

Conceptualization: In this phase, learners are introduced to the use of pH meter and they are asked to answer critical thinking questions posed to them before they can state their hypothesis.

Investigation: During the investigation, the learners can proceed with the experiments in order to explore the influence of volume and addition of water to the pH. There are instructions for each experiment to be conducted as well as tips and hints to be taken into specific consideration during the process. Once they get the results of their investigation, they have to note those down so that they can be accessible for the

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles. The activity also connects the theory with real-life problems.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[X] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:Creative Commons Attribution (CC BY)
Restrictions:

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

In the shadows

WEB ADDRESS (M)
Link to the activity or site of the activity

http://graasp.eu/ils/54a009bf51830bd46a6664c2?lang=en

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

shadows (umbra and penumbra), light

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

the phenomenon of shadows

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [X] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

10-14

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [X] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Basic (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Advanced (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Expert (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice [ ] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This Inquiry Learning Space (ILS) deals with the phenomenon of shadow (umbra and penumbra). Learners will gain a good understanding on the topic of shadows through an inquiry learning path.

Orientation: The orientation phase begins with pictures as examples of shadow in different contexts. The learners are posed questions about the phenomenon under study in order to activate prior knowledge and evaluate their level of knowledge at the given time, before moving to the next inquiry phase.

Conceptualization: Before investigating the effect of shadow, the learners can explore more about the phenomenon of shadow through an interactive whiteboard where they can change the size of the light source and the distance from it and observe what happens. They should discuss with their classmates about their observations and proceed with the formulation of a hypothesis.

Investigation: At this point learners are asked to design shadows in several relevant positions of Sun, Earth and Moon while also being posed few questions.

Conclusion: During this phase, the learners should discuss few issues with their peers and answer questions posed to them concerning the process by that point.

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[X] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:Creative Commons Attribution (CC BY)
Restrictions:

OWNER OF THE ACTIVITY(M)

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Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Sinking and Floating

WEB ADDRESS (M)
Link to the activity or site of the activity

http://graasp.eu/ils/54b8dce551830bd46a666970?lang=en

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

sinking, floating, volume, mass, density

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Sinking and Floating: laws and variables

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

10-14

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[ ] Medium	[X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

45 minutes (1 didactic hour)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The inquiry space "Sinking and floating" provides a student activity on the phenomena of sinking and floating and the various properties that influence them such as mass, density, volume and material. The activity poses the learners a scenario/problem to be solved. The activity guides the students to acquire knowledge on the properties that influence the phenomena of sinking and floating through the inquiry path. Learners are guided to activate prior knowledge and discover how much they know about the topic, chech the validity of their answers, make their own experiment, change their views or strengthen the existing ones, reach conclusions and report them. Apart from the content knowledge that learners gain through the process, they also become familiar with research methodology principles and learn how to reach conclusions through inquiry. Although the Inquiry Learning Space (ILS) is mainly designed for individual use, it can also be used in a classroom if there are enough computers available for each student.

Orientation: In the beginning of orientation phase the learners are given a scenario and a hypothetical task of having to create their own raft in order to get off of an island. They are also given few alternative solutions, such as different materials to build the raft from which they have to decide which option could be the best one. Learners have to support their choices by explaining their thoughts and writing down their arguments. This phase serves both the purpose of activating prior knowledge and triggering learner's interest. Afterwards, the learners are asked to watch videos and check whether their answers are correct. They are asked to think how they would solve their own scenario and they are encouraged to keep notes of their thoughts as well as to start creating a concept map.

Conceptualization: In this phase the learners are encouraged to set up and conduct an experiment in order to find out what are the properties

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity aims to educate learners on how to conduct research and familiarize them with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[X] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights: Creative Commons Attribution-NonCommercial (CC BY-NC)
Restrictions:

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Solar car

WEB ADDRESS (M)
Link to the activity or site of the activity

http://compass-project.eu/resources_detail.php?UG_hodnota_id=2

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

Solar energy, power, gears, proprtionality, functions, statistics, spatial reasoning, modelling

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics, mathematics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Solar powered transportation

LANGUAGE(S) (M)
Language(s) in which the activity is available

German, Dutch, Greek, Spanish, English, Slovak

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[x] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

11-14

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[x] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

270

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[x] Novice	[ ] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[x] Orientation	[x] Conceptualization	[x] Investigation	[x] Conclusion	[x] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This activity aims to familiarize learners with the impact of transport emissions on air pollution and how these could be reduced by building solar powered cars. It provides learners with opportunities to discover the significance of adapting and using solar energy in transportation whilst exploring relevant mathematical and scientific content. In the activity, learners complete a number of activities in mathematics, science and technology, applying knowledge from all three disciplines. Building on existing understanding and working on interdisciplinary activities, learners are offered the opportunity to design, build and operate their own model solar car. Overall the activity has very predefined inquiry path with fixed question setting and expected outcomes. For this reason it can be viewed as novice inquiry proficiency level.

The Solar car activity provides support for the teacher by introducing general guiding questions and more detailed task plans to proceed with the lessons. In the introduction phase thelearners learn about air pollution, emissions and the basic functioning of solar panels.

In the conceptualization and investigation phases the students study the relationship between surface area and a photovoltaic unit which later on helps them to develop their model solar car. They then calculate the amount of materials needed for their car and proceed sketching a 3D-model of it. They can also explore different types of transmissions and its implications for the design of their car by using the gears Applet provided by the activity. Due to the fact that the 3D design tool offers the learners more freedom to design their model solar car as they wish, the investigation phase can be seen departing from the overall novice proficiency level, and be basic.

In the conclusion and discussion phases the learners explore how the sale price of a car in relation to people's interest has an impact on a

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity can be mapped on the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles and promotes societal responsibility.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

☐ Low	☒ Medium	☐ High	☐ Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

☐ Yes	☒ No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

503635-LLP-1-2009-1-DE-COMENIUS-CMP

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Splash Buoyancy Lab

WEB ADDRESS (M)
Link to the activity or site of the activity

http://graasp.eu/ils/543faf6c2e2c55fc49b6259e?lang=en

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

floating, sinking, buoyancy, relative density, mass, volume, fluid

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Buoyancy Law

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [ ] Medium [X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

11-14

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [ ] Medium [X] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

90 mins (2 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice [X] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The inquiry space "Splash buoyancy lab" provides a student activity on buoyancy laws, and teaches the learners which materials float or sink depending on their density and different fluids. The activity guides the students to acquire knowledge on the topic through the inquiry path which includes all five phases of inquiry: orientation, conceptualization, investigation, conclusion, discussion.

In the beginning of the orientation phase a number of questions are posed regarding sinking and floating of objects and their relative density; the aim of this phase is to activate learners' prior knowledge and stimulate their interest on the topic. At this stage there is also a video on how objects sink and float according to their density and a concept map that students are asked to create in order to visualize the relationships between various concepts.

The conceptualization phase starts with an introduction to the main four variables to be manipulated in the lab; the learners are asked to formulate research questions and hypotheses based on the variables introduced to them; the terms variable and hypotheses are defined in this phase.

The next phase, investigation, consists of five main steps. Learners are first asked to make a plan of the experiment to be conducted and then to specify the values for the variables they are going to investigate. After these two actions are completed, they can execute the experiment. Then they should write down the observations, thoughts or ideas that can help them draw conclusions in the next phase. Designing a table or a graph for a visual representation of the data is also part of this phase. After these steps, the learners are ready to state their final conclusions

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity aims to educate learners on how to conduct research and familiarize them with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[X] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:Creative Commons Attribution (CC BY)
Restrictions:

OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Water Quality

WEB ADDRESS (M)
Link to the activity or site of the activity

http://www.compass-project.eu/resources_detail.php?UG_hodnota_id=11

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

water quality, Blue Flag programme, criteria, accuracy of acidity and nitrite testing, swimming water, seaside bathing zones

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Biology, Chemistry

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

purity of swimming water in seaside bathing zones

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, German, Spanish, Dutch, Greek, Slovak

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [ ] Medium [X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

14-16

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [X] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

225 mins (5 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice [ ] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

In this learning unit the learners will investigate how water quality can be determined, what are the water quality criteria, how they can test water, interpret the results, and reach conclusions regarding the purity of the swimming water in a specific area. The learning unit consists of separate activities each of which follows its own inquiry learning path including most of the inquiry phases; however, the activities are oriented toward the final product and needed for it to be reached. For the final product, learners will have to provide some advice for the local tourist office referring to the testing of water samples that they will have conducted by then.

The learning unit begins with an orientation on the topic of bathing water quality. For this purpose, an article from a newspaper on the pollution of swimming water is available to the learners. They have to conduct their own experiment, reach conclusion and present their findings at this task before moving on. In a next activity, learners are presented with the Blue Flag programme and all the necessary information about it. They need to learn through their own inquiry how reliable the measurements and the criteria are for the Blue Flag as well as discuss samples from their own area judging from those criteria. In a later stage, they will learn more in depth about the norms of the biological and chemical parameters (accuracy of the acidity of a colorimetric determination). They will also have to interpret and compare graphs with the set of norms in the Netherlands and Spain in order to decide upon the difference in swimming water quality between the two countries. After the learners experiment, critically evaluate and justify norms, they have to report the results, reflect, evaluate and discuss. At a final stage, the learners are asked to prepare a report for their local tourist office in which they have to explain why tourists should swim in that area or what should be done to be improved. In their reports, learners have to prove their arguments by referring to the experiments they have carried out and to the findings of the tests they conducted

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity can be mapped on the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The learning unit promotes research and societal responsibility

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Rights:
Restrictions:

OWNER OF THE ACTIVITY(M)

503635-LLP-1-2009-1-DE-COMENIUS-CMP

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

Water Shortage

WEB ADDRESS (M)
Link to the activity or site of the activity

http://compass-project.eu/resources_detail.php?UG_hodnota_id=9

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

water, water shortage, saving water strategies, water (hydrologic) cycle, disertification, desalination, water quality

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics, Engineering

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

water shortage and water quality

LANGUAGE(S) (M)
Language(s) in which the activity is available

English, German, Spanish, Dutch, Greek, Slovak

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [ ] Medium [X] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

12-15

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [X] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

315 (7 didactic hours)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[X] Novice [ ] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This learning unit aims to provide students with opportunities to study, learn, and discover concepts and processes related to water and water shortage, in an attempt to answer the question: "Can Water Shortages in Europe (and elsewhere) be Curbed?" Students go through a number of activities in mathematics and science, applying knowledge from the two disciplines. Building on existing understandings and working on interdisciplinary activities, students will develop a comprehensive strategy for facing Water Shortage at a personal and at an international level.

The learning unit provides different activities related to the topic of water and water shortage. Thus, the learning unit can be used either as a whole or as separate activities that have their own objectives but are still oriented to the same main topic. Each of the activities include all the inquiry phases; The orientation phase in each of the activities of the learning unit begins with some background information provided concerning the phenomenon or problem under study and after those the learners are asked questions about what they read while being encouraged not to limit their answers only to the material provided but to try to think also beyond those. The experiments-or problems to be solved- that the learners are given consist of two parts. In the first part learners are guided step by step on how to conduct the experiment and in a second stage they are asked to design their own solution, where they can be creative and pioneer but give a feasible idea or final product of their investigation. An important element is that the learners are asked to analyze the cost-effectiveness of the solution they propose as well as the environmental impact of it and the public benefit. Such a direct connection to the real-life context adds educational value to the activity since except for teaching inquiry skills; it also aims for the promotion of research and societal responsibility as well as innovation practices. The activities include also Discussion where the learners are asked to present their proposals to their peers, discuss with them and get their feedback, or to write a letter to convince the stakeholders that their proposal is worth it the cost. To a further extent, the Discussion includes

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity can be mapped on the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity promotes research and societal responsibility, and it familiarizes learners with innovation practices from a cost-effective perspective.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

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[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

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Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

How are the light fixtures in a house connected

WEB ADDRESS (M)
Link to the activity or site of the activity

http://graasp.eu/ils/54ae947251830bd46a6665b7?lang=en

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

electric circuits, parallel and in series circuit setups, electric current, light bulbs,

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

Electricity and magnetism, electric circuits

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low	[X] Medium	[ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

10-16

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low	[X] Medium	[ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

45 mins (1 didactic hour)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice	[X] Basic	[ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[ ] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

The activity resembles a lesson conducted through an online-virtual laboratory aiming to familiarize the learners with the elements that compose a simple electric circuit, to introduce them to both parallel and in series circuit setups and to familiarize them with the basic methodological principles of research. During the different inquiry phases the learners are introduced to the concepts of electric current and circuits, they are shown the differences between parallel and in series circuits and how to build those, they are asked to formulate their own hypotheses and conduct scientific investigations in order to compare the electric current flowing through different setups. They are also encouraged to investigate what happens in different cases and scenarios. They have to form conclusions based on the evidence collected and transfer the knowledge acquired in the lab to answer real-life questions. The targeted learning outcome of the activity is that by its completion, learners will know more about electric circuits, their different types, how to reach conclusions through inquiry as well as to decide in which setup the light fixtures in a house are connected and provide evidence for their answer. Discussion is not a part of this ILS.

Orientation: In the orientation phase the learners are introduced to the concepts of electric current and circuits and they are shown a video of what an electric circuit is, how the electric current flows in it, and what are the different types of electric circuits. Moreover, they are shown videos on how they can set up parallel and in series electrical circuits. After the videos, there are questions posed concerning the material taught through the videos which the learners have to answer before they continue to the next phase. These questions help the learners understand what they have learned so far and how well before continuing to more complex tasks.

Conceptualization: This phase of the Inquiry Learning Space aims to help learners identify which variables are related to the phenomenon they

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity aims to educate learners on how to conduct research and familiarize them with the research methodology principles. It also connects the learning content to the broader daily-life context.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[X] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

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OWNER OF THE ACTIVITY(M)

Ark of Inquiry: Inquiry Activities for Youth over Europe

Template for the Description of Inquiry Activities

This Criteria list consists of two types of elements:
Mandatory Criteria indicated with (M) need to be filled
Recommended Criteria indicated with (R) should be filled where possible
Checkboxes are text based, please insert an X to indicate selection

TITLE (M)
Descriptive title of the activity

The color of the light

WEB ADDRESS (M)
Link to the activity or site of the activity

http://graasp.eu/ils/5433c5942e2c55fc49b624db?lang=en

KEYWORD(S) (R)
Free keywords that capture the essence of the activity

colors in nature, digital or RGB colors on technology, color perception

DOMAIN (M)
The domain of the activity; Physics, Biology, Chemistry, Engineering, Technology, Mathematics

Physics

TOPIC (M)
The specific topic that the activity deals with (e.g. electrical circuits, particle physics, cell biology); this element constitutes a more detailed description of the domain attribute above

physics of colors and human vision

LANGUAGE(S) (M)
Language(s) in which the activity is available

English

LANGUAGE DEPENDENCY (R)
The degree to which the activity depends on the language feature e.g. an activity can be consider having low language decency if it has only a little text, meaning that it can be used by foreign language users without translation or by translating only keywords). Please select one of the choices below.

[ ] Low [X] Medium [ ] High

TYPICAL AGE RANGE (M)
The targeted age group needs to include students from 7 to 18 years old across Europe

10-14

INTERACTION LEVEL (R)
The degree of interaction with the material during the activity. Please select one of the choices below

[ ] Low [X] Medium [ ] High

TYPICAL LEARNING TIME IN MINUTES (R)
Indicate the overall time that is needed for the activity to be completed

45 minutes (1 didactic hour)

INQUIRY PROFICIENCY LEVEL (M)

The activity needs to map on one of the inquiry proficiency levels (Basic, Advanced, Expert). Please select one of the choices below.
Novice (predefined inquiry path, predefined learning outcome, well-defined activities, predefined questions that guide the interpretation of the activities, the goal is to teach learners how to engage in and conduct inquiry)
Basic (predefined problem space that sets limits to the research, ill-defined problem, partly scaffolded process, findings communicated in semi-structured or self-chosen way, goal is to teach learners think about what to investigate and guide them towards independency in knowing how to inquire)
Advanced (open-research activity, ill-defined problem space or in a complex societal context, students are provided with a problem area without given any specific instructions as to what to investigate and how to approach it, goal is the innovative and creative thinking)

[ ] Novice [X] Basic [ ] Advanced

INQUIRY PHASES COVERED (M)

The activity needs to cover, at the minimum, one of the below inquiry phases. Multiple selection is allowed.
Orientation phase (stimulates curiosity about the topic ,results in problem statement, places the activity in a wider context &provides personal meaning to it, fosters engagement, societal responsibility& gender inclusion)
Conceptualization phase (statement of research questions and hypotheses, scope and boundary of the inquiry activity are set)
Investigation phase (collection of empirical data, process of empirical data in order to answer research questions or hypotheses)
Conclusion phase (formulation of main research findings and implications, synthesis of the results)
Discussion phase (communication of outcomes, reflective thinking)

[X] Orientation	[X] Conceptualization	[X] Investigation	[X] Conclusion	[X] Discussion

DESCRIPTION OF THE ACTIVITY (M)

General description (basic idea of the activity, objectives of the activity, targeted learning outcome including both the content domain and the skills acquired by the completion of the activity)
- Description of inquiry phases covered in the activity
- Rationale for the proficiency level (including the description of inquiry phases departing from the overall proficiency level)
- Other noteworthy information about the activity (e.g.: the role of the teacher or other source of guidance, whether the activity includes communication and reflection of the results, whether the activity can be used in simplified curricula context)
Please provide as detailed description as possible so that it can be informative enough to help teachers while selecting the activities

This Inquiry Learning Space (ILS) teaches the learners about vision and perception of colors following an inquiry learning path which familiarizes them with research and its stages.

Orientation: The orientation phase begins with some information about the human vision. The learners are given an introductory video on the topic and they are encouraged to visit few links that explain where the vision starts, what the color is, and how many colors humans can see. While watching the videos or visiting the links, the learners are also advised to keep notes on what they hear and read. They are also given a few tips about the process of writing notes and concept maps. Learners can start making a concept map already at this stage, if they feel satisfied with their notes.

Conceptualization: At this phase the learners are introduced to more specific topics about human vision and colors. They are given definitions on the color as well as information on the mechanisms of human vision (how human vision is formed, how do the eyes and brain cooperate to provide us with vision etc.), the physics of color and the primary colors as a set of colors that combined can generate a range of other colors. After getting a better understanding on the related concepts of colors and human vision, they are asked to formulate their research question. The idea is that in a next phase they will try to answer the research question that they formulated here.

Investigation: At this point learners will conduct experiments to answer their research question. First, they will use the Mixing colors virtual laboratory in order to move sliders, combine primary colors and see their final color combination. In a second experiment, they will use the RGB

EVIDENCE ON THE SUCCESS OF THE ACTIVITY (M)

There needs to be evidence on the effectiveness of the activity in terms of learning outcomes, engagement, or both. The following four types of evidence are identified and an activity needs to be supported at least by one of them. Multiple selection is allowed.
Direct empirical evidence (research evidence obtained from the implementation/use of the activity)
Indirect empirical evidence (an activity that has been modified from an original one and its effectiveness has not been supported by direct empirical evidence yet; only the original activity has been supported by direct empirical evidence)
Theoretical evidence (theoretically informed design principles have been applied in the design of the activity)
Ecological evidence (evidence obtained from daily school practices, official recognition or prize in the context of a community, region or country where it has been used)

[ ] Direct	[ ] Indirect	[X] Theoretical	[ ] Ecological

EVIDENCE DESCRIPTION (M)

Describe in detail the evidence on the success of the activity

The activity is designed according to the theoretically informed principles of the Pedaste et al. (2015) Inquiry Model

SUPPORT FOR SOCIETAL RESPONSIBILITY AND GENDER INCLUSION (R)

Description on how the activity specifically addresses RRI elements in regard with these two dimensions of societal responsibility and gender inclusion -mainly during the orientation and discussion phases
(e.g. questions to be answered should be how and what kind of context is provided in the orientation phase, does the problem-solving type engage girls in the inquiry activity to the same level like it does with boys, how the discussion phase connects the context to the inquiry process and how frequently and how it supports reflection and communication with an audience).

The activity familiarizes the learners with the research methodology principles.

REQUIREMENTS FOR THE ACTIVITY (M)

Specify all technical requirements for conducting the activity (e.g.: equipment, internet access, software, plugins etc.)

Internet access, the activity is compatible also with mobile devices

THRESHOLD TO USE (R)

The amount of effort and preparation required (e.g.: from the teacher) in order to put the activity in use. Please select one of the choices below.

[X] Low	[ ] Medium	[ ] High	[ ] Excessive

AVAILABILITY RESTRICTIONS (R)

Any restrictions concerning practical issues in regard with the activity such as museum working hours, remote labs availability, booking requirements, activity location and contact information. Please select one of the choices below.

[ ] Yes	[X] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

Science Centers/museums working hours (and/or Science Centers/museums availability for schools):
Remote lab availability:
Booking Requirements (y/n):
Activity Location/place (country, address, ZIP, google map):
Contact information of science centers and museums (webpage, email, phone number of representative of science center/museum):
other:

COPYRIGHT AND OTHER RESTRICTIONS (M)

[X] Yes	[ ] No

In case the answer is yes then the restrictions should be specified; If the answer is no then the rights should be described

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