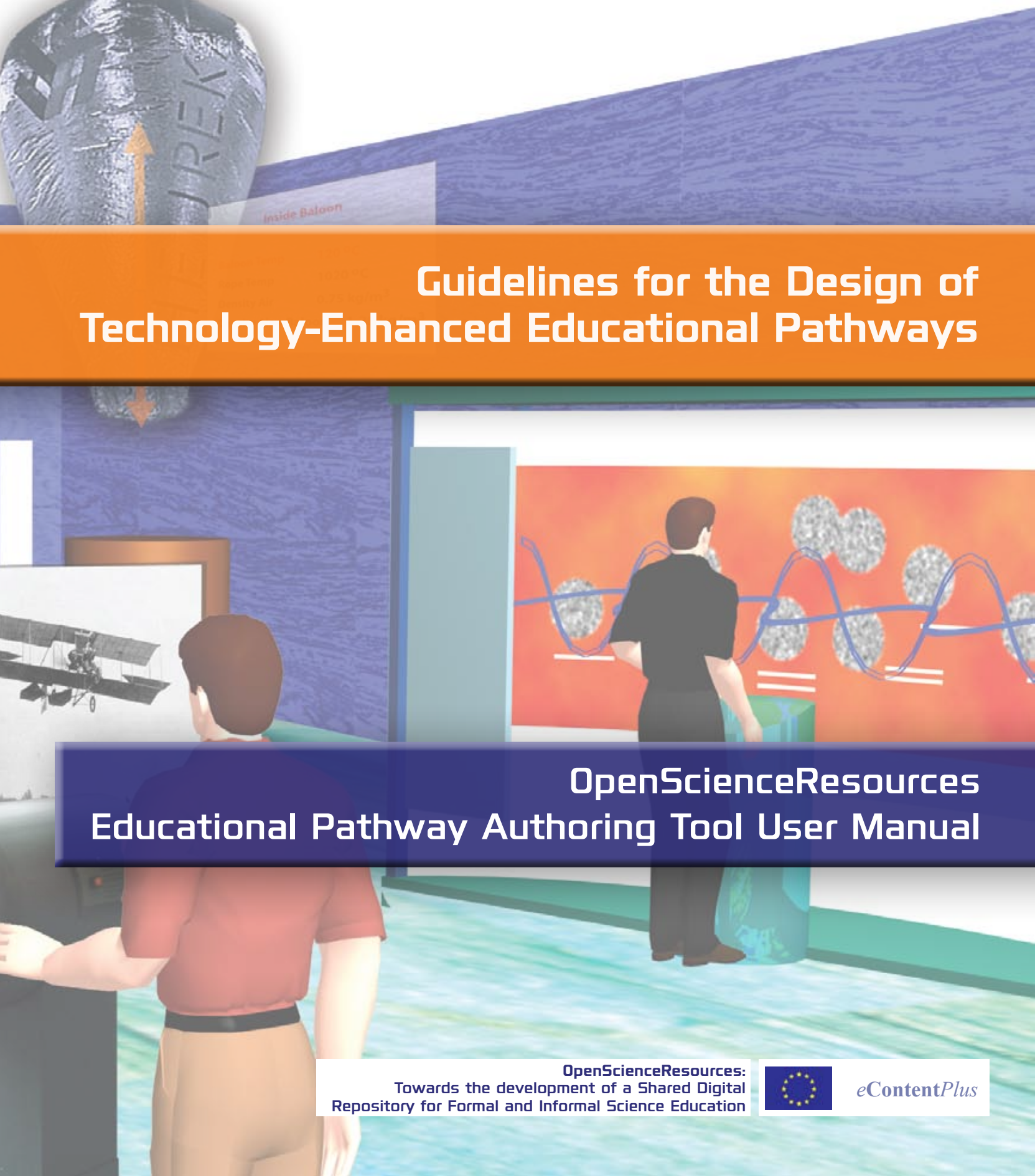

Guidelines for the Design of Technology-Enhanced Educational Pathways

OpenScienceResources Educational Pathway Authoring Tool User Manual

OpenScienceResources:
Towards the development of a Shared Digital Repository for Formal and Informal Science Education

eContentPlus

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Towards the development of a Shared Digital Repository for Formal and Informal Science Education

eContentPlus

Editors

INTRASOFT INTERNATIONAL S.A.
Nicholaos Athanasiades

IknowHow INFORMATICS S.A.
Menelaos Sotiriou, Xenia Bania, George Egglezos

ELLINOGERMANIKI AGOGI
Sofoklis Sotiriou, Fotis Kouris, Pavlos Koulouris, Eleftheria Tsourlidaki

Design

ELLINOGERMANIKI AGOGI
Sylvia Pentheroudaki

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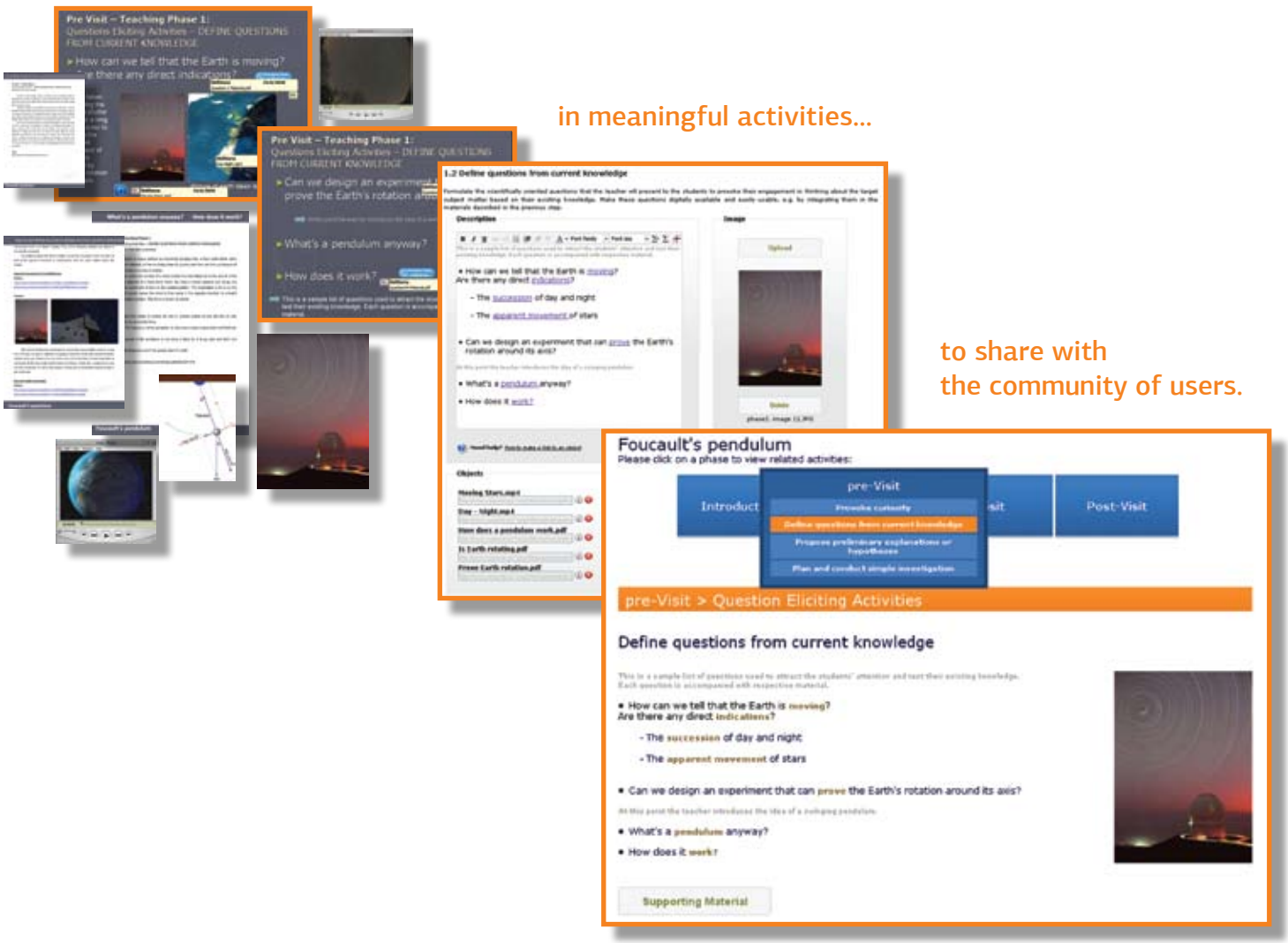
1. For the teacher and the museum educator

The OSR project proposes an approach for organizing the digital content of science centres and museums, so that it becomes useable by teachers and museum educators designing learning experiences combining formal science education with informal learning. This approach particularly invites users to create, exchange, and re-use educational materials in the form of Educational Pathways. The Educational Pathways are modular, consisting of elementary educational building blocks (activities), so that they facilitate a "mix and match" re-usability scheme. The Educational Pathway Authoring Tool helps the teacher and the museum educator to prepare easily for the Pre-visit, Visit and Post-visit stages of their students'/visitors' interaction with the OSR collection (the visit may be virtual or physical), to prepare a full educational scenario with ease, to re-use existing components, and to share the output of their work with colleagues all over Europe. Importantly, users contribute their content into the same digital repository that hosts professionally produced content. This manual aims to guide users through the process of authoring Educational Pathways using the relevant authoring tool of OSR.

Organise educational digital resources...



2. The OSR Educational Pathways

Learning science (or learning about science) is not the same experience and does not carry to same meaning for everyone. There are various perceptions of science learning, its nature, objectives and workings, as well as various personal and institutional circumstances in which it may occur.

What is more, the use of single, unconnected digital objects is not always an adequate response to the learning and teaching needs of individuals inside and outside schools. And, in any case, such an unconnected use of individual learning objects does not exploit the rich possibilities available today for combining learning resources from different repositories to generate learning experiences that could not exist in the past.

So, users may often need to be guided to access selected instances of digital learning content in purpose-appropriate, meaningful ways generating valuable learning experiences. This challenge is addressed by the OSR initiative through the employment of the concept of Educational Pathways.

2.1 The concept of Educational Pathway

The concept of Educational Pathway in OSR reflects the priority given by the project to responding to the needs of the diverse communities of potential users of the OSR services. Thus, an Educational Pathway in the OSR project describes the organization and coordination of various individual science learning resources into a coherent plan so that they become a meaningful science learning activity for a specific user group (e.g. teachers, students, other museum visitors, etc.) in a specific context of use. Further, Educational Pathways directly serve the priority assigned by the project to the integration of resources scattered in various science museums/centres into the same learning experience rather than the mere selection of resources from a single museum or science centre.

An OSR Educational Pathway may include the use of digital content at a distance, without physically visiting the science museum or centre ('virtual visit'), or a combination of using digital content (at a distance or on-site) with a physical visit to the science museum or centre ('physical visit'). However, it should be noted that physical visits without an element of use of digital content are beyond the scope of the OSR project.

In the OSR approach, a Pathway is understood as a dynamic rather than static conceptual tool. In the envisaged optimal function of the OSR community, creators of Pathways may revisit, revise and continually develop their Pathways, or even use Pathways created by others as a basis for creating their own new versions, in a process reflecting social learning as a course of personal and communal gradual development within the learning community.

2.2 OSR user roles and use contexts: Defining the dimensions of digital-resource-based science learning

Central to the definition of the OSR Educational Pathways is the definition of the user roles and use contexts anticipated. In other words, Pathways represent various combinations of users and contexts, with quite varying characteristics among them, sharing however an interest in using digital resources available in science museums and centres for science learning purposes – formally or informally.

The main OSR stakeholders are defined according to their roles as users of the OSR service as follows:

- Teachers: school teachers wishing to integrate the use of such resources in their teaching.
- Students: school students who may use such resources either as part of their curricular learning, or in out-of-school learning (e.g. in free time, or with family)
- Other learners / visitors ('lifelong learners'): people of all ages who may use such resources out of personal interest or by chance, either deliberately to learn science/about science, or simply learning informally as a by-product of leisure activities; a distinguishable part of this group may be parents / families interested in enjoyable science learning experiences.
- Science museum educators or science communication professionals: Staff who prepare science learning or awareness raising experiences for the visitors/users of their institutions (science museums and centres). An additional subgroup here might also be other professionals related to science communication, including journalists who may search for content relevant to the promotion of informal science learning.

Correspondingly, the contexts of use of the OSR service include the following combinations (Table 1):

In the science museum/centre (physical visit)	On the web (virtual visit)
In connection with the school	In connection with the school
In no connection with the school	In no connection with the school

Table 1: *Contexts of use of the OSR service*

In these contexts, individuals and groups may get involved in the use of digital content either in ways pre-designed by someone (e.g. a teacher, or a museum educator), or employing their own creative ways of exploring and interacting with the digital content.

The OSR Educational Pathways can then be seen as instances located in a system of possible combinations of use contexts, user roles, and varying levels of user independence (Table 2).

	In connection with the school		In no connection with the school	
	In the science museum/centre (physical visit)	On the web (virtual visit)	In the science museum/centre (physical visit)	On the web (virtual visit)
Teachers	usually pre-structured (or exploratory)	usually pre-structured (or exploratory)	As independent lifelong learners: usually exploratory (or pre-structured)	As independent lifelong learners: usually exploratory (or pre-structured)
Students	usually pre-structured (or exploratory)	usually pre-structured (or exploratory)	As independent lifelong learners: usually exploratory (or pre-structured)	As independent lifelong learners: usually exploratory (or pre-structured)
(Other) lifelong learners	-	-	usually exploratory (or pre-structured)	usually exploratory (or pre-structured)
Science museum educators or science communication professionals	[structuring activities for others]	[structuring activities for others]	[structuring activities for others]	[structuring activities for others]

Table 2: *Contexts of use, user roles, and user independence*

Such a system allows for possible dimensions of digital-resource-based science learning such as the following:

- Use of museum and science centre digital resources in school science education
  - Teacher-guided (top-down)
  - Student-driven (bottom-up)
- Use of museum and science centre digital resources in non-formal science learning
  - Curator-guided (top-down)
  - Visitor-driven (bottom-up)
- Use of museum and science centre digital resources in informal science learning
  - Curator-facilitated (top-down)
  - Visitor-driven (bottom-up).

2.3 Pre-structured and Open Pathways

In the context described in the previous section, a distinction between pre-structured and open Pathways is useful.

An OSR Educational Pathway is defined as pre-structured when it provides a rigid pre-defined 'route' through a set of science learning resources. This may be more relevant to more formal learning contexts, e.g. in the case of school science education, with specific curriculum references and teaching processes.

On the other hand, an OSR Educational Pathway is defined as open when it is more flexible and informal in its approach, allowing for considerable unbound user decisions, initiative and creativity in the ways the user will explore and exploit the science learning resources. This may be more relevant to less formal learning contexts, such as in the case of an adult independent visitor or a family, or even a teacher who has decided to involve her/his students in an open-ended exploration of the resources.

2.4 The Educational Pathway Patterns

Going one step closer to practical implementation, the OSR Educational Pathway Patterns are the templates offered by the project for designing, expressing and representing Educational Pathways for a certain user group and type of visit. Two main types of Patterns seem to be capable of describing the various possible Pathways: a Pre-Structured and an Open Educational Pathway Pattern, corresponding to the pre-structured and open educational Pathways as described in the previous section. The proposed two Educational Pathway Patterns correspond to the various user groups as presented in Table 3.

School community (teachers and students)	Pre-Structured Educational Pathway Pattern (potentially also Open)	Prepared mainly by: • Teachers • Science museum educators etc.
'Lifelong learners'	Open Educational Pathway Pattern (potentially also Pre-Structured)	Prepared mainly by: • Science museum educators etc. • Users / lifelong learners

Table 3: *Educational Pathway Patterns and user groups*

2.4.1. Structure of the OSR Educational Pathway Patterns

In many cases, learning experiences should be ideally embedded in a context which provides the means for the preparation of the learner for the learning experience before it takes place, as well as for facilitating the retention and future exploitation of the outcomes of the learning experience for a longer time after it has taken place. This is a fundamental principle in formal education, but can also be seen as a useful dimension (even if not that prescriptive) in informal learning environments. For this reason, the OSR Educational Pathway Patterns propose the organization of the science learning experience in three steps:

i. Pre-visit[1]: activities preparing for the interaction with the main resources of the science museum(s)/centre(s) in question. These activities may or may not include the use of digital resources.

ii. Visit: activities involving interaction with the targeted resources of the science museum(s)/centre(s) in question, in or outside the science museum/centre.

iii. Post-visit: activities rounding up and concluding the learning experience, after the interaction with the targeted resources of the science museum(s)/centre(s) in question.

From these, the Visit phase is the core of the learning experience and indispensable in any Educational Pathway Pattern. The Pre-visit and Post-visit phases are essential for the realization of effective connections between school science education with learning activities involving work with science museum/centre content. However these 'auxiliary' preparatory and follow-up phases may or may not be relevant to and desirable for open Educational Pathways. For example, if the designer of an informal learning experience feels that the adoption of the three-phase scheme implies linearity or a sequential nature that does not correspond to the intended experience, they may decide to omit the Pre-visit and Post-visit phases.

Indeed, the degree of freedom or prescription in the design of a Pathway has proven to be the most debated aspect of the OSR approach within the project consortium, which brings together two considerably separate 'worlds': those of formal school education and informal learning in science museum and centres.

In addition to the three phases, there is an introductory section outlining the identity of the Educational Pathway and providing guidance for any preparations necessary before the launch of the learning activity. Each section consists of a number of fields, for each one of which a description and/or guideline is provided.

2.4.2. The Educational Pathway Patterns developed

From the various possible Educational Pathway Patterns that the OSR project could develop, the most complex are those describing structured visits bridging formal and informal science learning through a school 'visit' (physical or virtual). Open 'visits' by independent informal learners, on the other hand, can be seen as simpler, less pre-defined experiences. Structured visits of non-school users that may be offered by some science museums or centres fall somewhere between the two ends of the 'complexity and structure' spectrum, their exact position depending on the degree of formality applied to the design of the visit by the science museum/centre.

1. The term 'visit' is used here metaphorically, and does not necessarily imply a physical visit to a science museum or centre. It aims to focus attention on the processes before, during, and after interaction with the digital learning resource(s) in question.

Therefore, the project at this stage proposes two structures as tools for use and experimentation:

- The OSR Educational Pathway Pattern for a Pre-Structured Visit by the School Community
- The OSR Educational Pathway Pattern for an Open Visit by Lifelong Learners.

These two Educational Pathway Patterns are presented in the following sections.

2.5 OSR Educational Pathway Pattern for a Pre-Structured Visit by the School Community

2.5.1. Introductory note

From the various possibilities of interaction with the OSR resources, structured visits of the school community correspond to the most complex, detailed and pre-defined Educational Pathways, reflecting the mapping sought between formal and informal learning practices. In the case of an Educational Pathway for a Pre-Structured Visit by the School Community, the teacher or the museum educator selects school science subject matter (e.g. complex physical phenomena typically causing difficulties to students) to present it through student-centred and student-friendly multidisciplinary educational activities involving the use of digital science learning resources available through the OSR Portal. The Learning Pathway should represent a learning experience connecting work in the classroom or school lab with virtual or physical visits to the OSR science museums/centres. The integration of resources scattered in various science museums/centres into meaningful learning experiences is a priority (rather than selecting resources from a single museum or science centre).

2.5.2. The underlying pedagogical approach for the structured visit

For the three steps of the learning process (Pre-visit, Visit, Post-visit), the model of Inquiry-Based Learning is chosen as the guiding principle for structuring the activities foreseen by the structured Educational Pathways.

Inquiry-Based Learning is currently the most influential approach to science learning, and particularly so in the field of school science education. According to it, learning should be based around learners' questions, as they work together to solve problems rather than receiving direct instructions from the teacher. The teacher should function as a facilitator helping students in the process of discovering knowledge themselves. In the science context in particular, learners use their background knowledge (of principles, concepts, theories) together with their science process skills to construct new explanations which allow them to understand the natural world. Learners are likely to begin to understand the natural world if they work directly with natural phenomena, using their senses to observe and using instruments to extend the power of their senses.

In practical terms, it is proposed that teacher and learner activity be described in the Educational Pathways as an iterative process consisting of the following five phases according to the Inquiry-Based Science Education (IBSE) model:

Teaching Phase 1: Question Eliciting Activities

- **Provoke curiosity:** The teacher tries to attract the students' attention by presenting/showing to them appropriate material.
- **Define questions from current knowledge:** Students are engaged by scientifically oriented questions imposed by the teacher.

Teaching Phase 2: Active Investigation

- **Propose preliminary explanations or hypotheses:** Students propose some possible explanations to the questions that emerged from the previous activity. The teacher identifies possible misconceptions.
- **Plan and conduct simple investigation:** Students give priority to evidence, which allows them to develop explanations that address scientifically oriented questions. The teacher facilitates the process.

Teaching Phase 3: Creation

- **Gather evidence from observation:** Teacher divides students in groups. Each group of students formulates and evaluates explanations from evidence to address scientifically oriented questions.

Teaching Phase 4: Discussion

- **Explanation based on evidence:** The teacher gives the correct explanation for the specific research topic.
- **Consider other explanations:** Each group of students evaluates its explanations in light of alternative explanations, particularly those reflecting scientific understanding.

Teaching Phase 5: Reflection

- **Communicate explanation:** Each group of students produces a report with its findings, presents and justifies its proposed explanations to other groups and the teacher.

The above model is proposed as a guide of appropriate teaching practice built around the observation of objects or phenomena in the natural world – in this case physically or virtually, directly or indirectly, in the science museum/centre.

2.5.3 The Educational Pathway Pattern for a Pre-Structured Visit by the School Community

The Inquiry-Based Science Education model of five Teaching Phases presented in the previous section originates in conventional school education contexts, where teaching is expected, implicitly or explicitly, to take place in the classroom. The OSR project makes a step towards the integration of this teaching process with the processes of preparing, conducting and following up a 'visit' (as defined in the previous sections) to a science museum/centre. To this end, in the Educational Pathway Pattern for a Pre-Structured Visit by the School Community, the five Teaching Phases are integrated into the Pre-visit, Visit, and Post-visit sections, as described below. Note that an introductory section precedes the Pre-visit section.

A) Introduction and preparation

Some basic information about the intended learning experience is to be defined at the outset. This information should allow the teacher to assess the relevance of the resource to his/her teaching needs and particular circumstances, and provide him/her with guidance for the preparation of the learning experience. Below the main necessary elements of introductory information are presented:

Title:
Give a title that helps easily recognize the content focus and purpose of the Educational Pathway.

Short description:
A description of no more than 30 words outlining the scope of the Educational Pathway, descriptive enough to help the user in the first instance to estimate its possible relevance to her/his interests.

Keywords:
A limited number of words/short phases reflecting the topic and scope.

Target audience:
The intended end user: teacher with students, teacher, students, other...

Age range:
Up to 6, 6-9, 9-12, 12-15, 15-18...

Context:
The places that the realisation of the Educational Pathway involves: school, science museum/centre, independently on the web.

Time required:
The approximate time typically needed to realize the Educational Pathway. This could be distinguished into the amount of time required for school-based work and science museum/centre-based work.

Connection with the curriculum:
Reference to the items of the science education curriculum mainly covered by the Educational Pathway, and prerequisite knowledge

Guidance for preparation:
Guidance provided by the creator of the Pathway about any necessary arrangements that will need to be made by the interested teacher before launching the activities described in the following sections.

B) Pre-visit

Teaching Phase 1: Question Eliciting Activities

- **Provoke curiosity:**
  Describe ways and materials (resources already available in the OSR Portal, or other) that the teacher will present to the students in the classroom to attract their attention to the targeted subject matter. Make sure they are easily available to the interested user in the OSR Portal, and give directions for finding them. Possibly and if appropriate, integrate them into one practical resource in the appropriate format (e.g. a slides presentation).

- **Define questions from current knowledge:**
  Formulate the scientifically oriented questions that the teacher will present to the students to provoke their engagement in thinking about the target subject matter based on their existing knowledge. Make these questions digitally available and easily usable, e.g. by integrating them in the materials described in the previous step.

Teaching Phase 2: Active Investigation

Note: This is a transitional phase on the borderline between the Pre-visit and Visit sections of the Educational Pathway. 'Active Investigation', and in particular the step of 'Planning and conducting simple investigation' can take place either before or during the 'visit', or both, depending on whether the teacher decides to use OSR resources of an 'exhibit nature' (exhibits, simulations, experiments, etc.) at this stage (on the web or during a physical visit to a science museum/centre). However the use of physical observation is concentrated mainly in the next Teaching Phase, under the 'Visit' section of the Educational Pathway.

- **Propose preliminary explanations or hypotheses:**
  Describe ways in which the teacher can encourage students to propose possible explanations to the questions that emerged from the previous activity. The teacher should be guided here to identify possible misconceptions in students' thinking. If applicable, locate or make relevant assistance materials available in the OSR Portal, and give directions for finding them. If appropriate, you may consider integrating them in the materials described in the previous steps (e.g. a slides presentation).

- **Plan and conduct simple investigation:**
  Describe ways and materials (resources already available in the OSR Portal, or other) that the teacher can use to facilitate the students to focus on evidence as a source of answers to scientific questions. This is the phase in which students are being prepared for the subsequent phase of evidence gathering during observation. Locate or make relevant assistance materials available in the OSR Portal, and give directions for finding them. If appropriate and relevant, it is possible to guide the teacher to use OSR resources of an 'exhibit nature' (exhibits, simulations, experiments, etc.) at this stage – in which case this activity should be moved to the 'Visit' section of the Educational Pathway. However it should be noted that the use of physical observation is concentrated mainly in the next Teaching Phase of 'Creation', under the 'Visit' section of the Educational Pathway.

C) Visit

(Teaching Phase 2: Active Investigation)

Note: 'Active Investigation', and in particular the step of 'Planning and conducting simple investigation' can take place in either the Pre-visit or the Visit phase of the experience, or in both, depending on whether the teacher decides to use OSR resources of an 'exhibit nature' (exhibits, simulations, experiments, etc.) at this stage (on the web or during a physical visit to a science museum/centre). However the use of observation for gathering evidence is concentrated mainly in the Teaching Phase of 'Creation' described below.

Teaching Phase 3: Creation

- **Gather evidence from observation:**
  This is the core element of the 'Visit' phase, and can be realized either in the school classroom/lab, by remotely using science learning resources made available by the science museums/centres on the web, or during a physical visit which will involve the use of digital resources. Locate the appropriate resource in the OSR Portal. Explain its use to the teacher, and provide access to any accompanying user support materials. The selected resource (e.g. a simulation, an experiment, an animation, a graph or other exhibit of similar nature) must provide students with an opportunity to collect evidence addressing the scientific questions posed in the previous stages through direct or indirect observation phenomena of the natural world. Provide guidance to the teacher organize and manage the activity most effectively and efficiently. It is recommended to introduce at this stage group work. Guide the teacher to divide students in groups, each of which will be facilitated by the teacher to formulate and evaluate explanations to the scientific questions based on the collected evidence. If applicable, locate or make relevant assistance materials available in the OSR Portal, and give directions for finding them.

Teaching Phase 4: Discussion

Note: This is a transitional phase on the borderline between the Visit and the Post-visit sections of the Educational Pathway. 'Discussion' can take place either during or after the 'visit', or both, depending on whether the teacher considers that the use of the digital 'exhibits' is necessary (or feasible) at this stage. Ideally, 'Discussion', and particularly the step of 'Explanation based on evidence', should take place in front of the 'exhibit', to reinforce the link between the physical experience of using the resource and the mental processing of the observed information by the students.

- **Explanation based on evidence:**
  Guide the teacher to provide the correct explanation for the researched topic. Describe ways and materials (resources already available in the OSR Portal, or other) she/he can use to this end, and give directions for finding them. If appropriate, integrate them into one practical resource in the appropriate format (e.g. a slides presentation).

- **Consider other explanations:**
  Guide the teacher to facilitate the student groups to evaluate their own explanations in the light of alternative explanations, particularly those reflecting scientific understanding. Describe ways and materials (resources already available in the OSR Portal, or other) the teacher can use to this end, and give directions for finding them. If appropriate, integrate them into one practical resource in the appropriate

format (e.g. a slides presentation).

D) Post-visit

(Teaching Phase 4: Discussion)

Note: This is a transitional phase on the borderline between the Visit and the Post-visit sections of the Educational Pathway. Ideally, 'Discussion' should take place in front of the 'exhibit', to reinforce the link between the physical experience of using the resource and the mental processing of the observed information by the students. However, if necessary or preferred, it can also be organized as a Post-visit activity leading into the next phase of 'Reflection'.

Teaching Phase 5: Reflection

- **Communicate explanation:**
  Guide the teacher to facilitate each student group to reflect on the previous experiences and produce a report with its findings, presenting and justifying its proposed explanations to other groups and the teacher. Make available or direct to materials (resources already available in the OSR Portal, or other) which the teacher can use to help the students familiarize themselves with and become effective in scientific writing.

Follow-up activities and materials

Describe and direct the user to any follow-up activities or materials that can be used to 'wrap-up' the main 'visit' experience. These could include appropriate learning assessment and/or reminder materials (e.g. quizzes, games, other user-friendly tests), hints for further activities, suggestions for other relevant 'visits', etc.

Sustainable contact

Describe and direct the user to any existing possibilities for maintaining contact with the digital resource and its provider, or with other users of the same learning experience.

2.6 OSR Educational Pathway Pattern for an Open Visit by Lifelong Learners

2.6.1. Introductory note

Among the possible Educational Pathway Patterns, the pattern for the description of open visits by independent informal learners can be seen as the simplest, least pre-defined learning experience examined in the OSR project. In this case, the museum educator/science communication professional, or even an experienced, motivated end-user, selects digital learning objects and combines them to form a meaningful, user-friendly informal learning experience. The integration of resources scattered in various science museums/centres into the same learning experience is a priority (rather than selecting resources from a single museum or science centre).

A considerable degree of variation in the 'degree of structure' of the open Pathway is expected, reflecting the varying degrees of user freedom in the context of informal science learning. In its extreme unstructured form, the open Pathway can merely relate to random browsing and/or exploring of a set of aggregated learning objects. In such a case, implying any form of prescribed linearity of the experience may not be relevant.

2.6.2. The underlying pedagogical approach for the open visit

Although the Inquiry-Based Learning approach adopted for the description of structured educational Pathways may well be relevant to open visits, too, it is felt that its structured nature may not correspond well with many of the possible formats of an open visit. Therefore, in this case a much wider Resource-Based-Learning conceptual framework is applied as the basis for the conception of the open visit. To allow for the highest possible flexibility, the present Pattern makes minimal use of different sub-phases, retaining however the basic organization in a three-step scheme of activities: before, during, and after the 'visit'. The core of the learning experience constitutes the 'visit' phase, with 'Pre-visit' and 'Post-visit' being left optional to the discretion of the designer of the Pathway.

2.6.3. The Educational Pathway Pattern for an Open Visit by Lifelong Learners

A) Introduction and preparation

Some basic information about the intended learning experience is to be defined at the outset. This information should allow the teacher to assess the relevance of the resource to his/her teaching needs and particular circumstances, and provide him/her with guidance for the preparation of the learning experience. Below the main necessary elements of introductory information are presented:

Title:
Give a title that helps easily recognize the content focus and purpose of the Educational Pathway.

Short description:
A description of no more than 30 words outlining the scope of the Educational Pathway, descriptive enough to help the user in the first instance to estimate its possible relevance to her/his interests.

Keywords:
A limited number of words/short phases reflecting the topic and scope.

Target audience:
The intended end user: independent informal learner, other...

Age range:
Up to 6, 6-9, 9-12, 12-15, 15-18, 18-25, 25+,...

Context:
The places that the realisation of the Educational Pathway involves: science museum/centre, independently on the web.

Time required:
The approximate time typically needed to realize the Educational Pathway.

Science learning elements:
Reference to the areas of science learning mainly covered by the Educational Pathway, and prerequisite knowledge

Guidance for preparation:
Guidance provided by the creator of the Pathway about any necessary arrangements that will need to be made by the interested user before launching the activities described in the following sections.

B) Pre-visit (optional)

Orientation information

Describe and direct the user to any information available on the context and elements of the learning activity, which may prepare and orient the use before the 'visit'. Such information may typically be available on the web (e.g. on the museum's website), but in cases it may also relate to other media, such as TV programmes, printed materials (e.g. museum leaflets) etc.

Building pre-experiences

Describe and direct the user to any information or activities that might exist and which would be a useful pre-experience preceding the main intended 'visit'. Such content may for example refer to other learning objects on the web, or, in the case of an open Pathway addressing children and families, elements of the school curriculum which children should have some knowledge of.

Support or guidance available before the visit

Describe and direct the user to any support or guidance mechanism or contact that may exist for the preparation of the 'visit'.

C) Visit (the minimal core of the learning experience)

Provoke curiosity: questions to ask, things to observe (optional)

Describe in simple terms the questions that the user could ask, or the observation or information he/she could concentrate on, during the 'visit' to get the most of the learning potential offered by the experience. Direct the user to any relevant digital resources.

The core experience

Direct the user to the digital resources constituting the core of the 'visit' and describe in detail the way in which the 'visit' should be conducted, focusing on information that will help the user's orientation through the resources involved. If appropriate, explain the rationale behind the proposed ordering of the activities, or state and explain the freedom in which the learning experience can be shaped by the user.

Support or guidance available during the visit (optional)

Describe and direct the user to any support or guidance mechanism or contact that may exist to support the 'visit' in real time.

Any other relevant information (optional)

Provide any other information that does not fall under the previous categories but is necessary or useful for the effective / efficient realisation of the 'visit'.

D) Post-visit (optional)

Follow-up activities and materials

Describe and direct the user to any follow-up activities or materials that can be used to 'wrap-up' the main 'visit' experience. These could include appropriate learning assessment and/or reminder materials (e.g. quizzes, games, other user-friendly tests), hints for further activities, suggestions for other relevant 'visits', etc.

Sustainable contact

Describe and direct the user to any existing possibilities for maintaining contact with the digital resource and its provider, or with other users of the same learning experience.

3. OSR Educational Pathway Authoring Tool

The OSR Educational Pathway Authoring Tool is a web based application aiming to help users develop Educational Pathways applying the Educational Pathway Patterns presented in the previous section of this Guide.

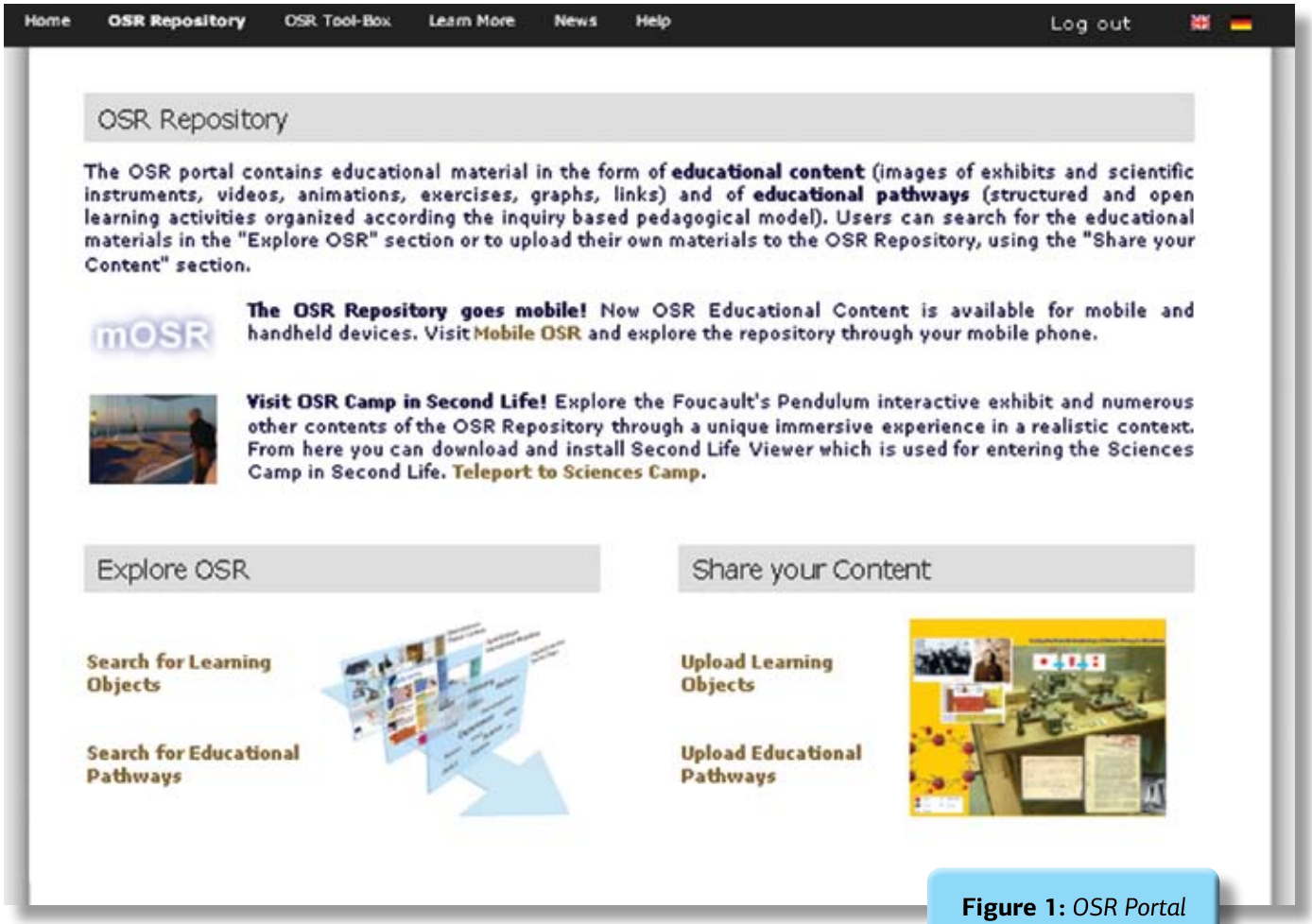


Figure 1: *OSR Portal*

3.1 Prerequisites

Basic familiarity with computers and how to browse the Internet will be adequate for using the OSR Educational Pathway Authoring Tool.

Before using the Educational Pathway Authoring Tool the user must ensure that the computer has the Mozilla Firefox 3.6 (or newer) browser installed and access to the internet. The installation programme for this open-source, free-of-charge browser can be easily downloaded from www.mozilla.com/firefox/.

In addition, it is recommended that the resolution of the computer display is adjusted to 1024x768 or higher.

3.2 Entering The OSR Pathway Authoring Tool

In order to proceed, direct the browser to OSR Portal, at http://www.osrportal.eu/, click on "OSR Repository" link and login by providing your account credentials (username/password). In case you do not have an account, please register with the portal by selecting the "Create New Account" link. (Figure 2)

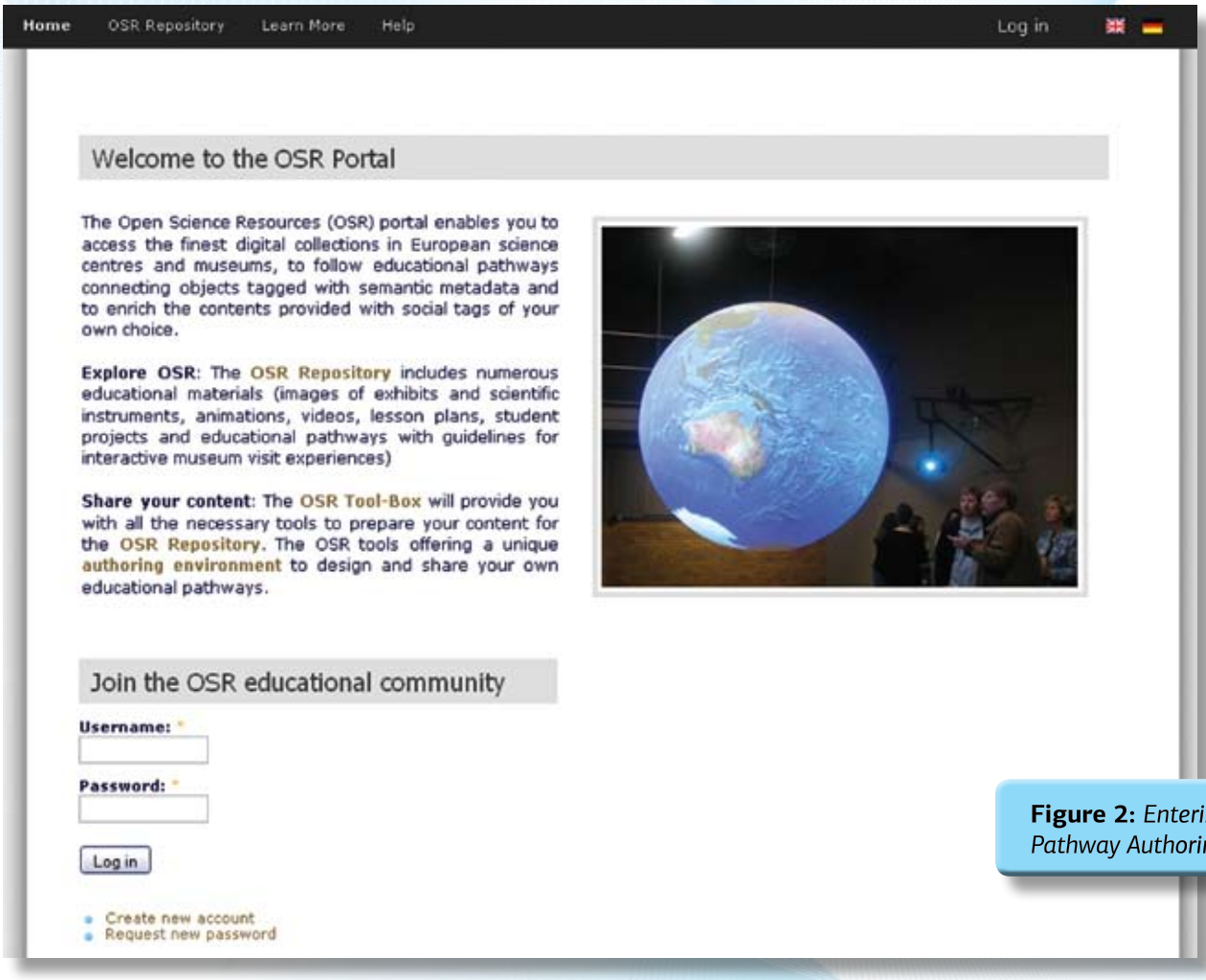


Figure 2: *Entering the OSR Pathway Authoring Tool*

Upon entering in Educational Pathway Authoring Tool, the user should choose what type of Pathway they wish to construct, 'structured' or 'open'. Detailed documentation about the difference between structured and open pathways is provided in the Section 2 of this Guide. The authoring of both types of Pathways is based on a similar structure and the same interface and tools. In the following sections of this Guide the construction of a Structured Pathway is presented.

Figure 3: *The OSR Pathway Tool Interface Introduction*

3.3 Creating An Educational Pathway

Upon selecting the Structured Pathway type the platform forwards the user to the authoring page. The authoring page consists of:

- **The phases navigation breadcrumb:** The breadcrumb is a navigation aid that helps the user to keep track of his/hers location within the different phases of the Educational Pathway. The breadcrumb appears both in the upper and lower section of the page. The navigation between the different phases can be done by the arrow buttons appearing below the breadcrumb (Figure 4a).
- **The "Save as Draft" button:** This button is used in order to save an unfinished Pathway. The unfinished Pathway can be retrieved later for completion. Once the user saves the Pathway as draft, the draft Pathway can be accessed by the "Item's I've contributed" section in the account page of the user (Figure 4b).
- **The main authoring pane of the phase:** In this pane the user will be able to provide input for each of the available activities of each phase (Figure 4c).
- **The Pathway Authoring Tool link & OSR Portal link:** The first link directs the user to the starting page of the authoring tool, ignoring any information provided to the tool so far and the second link redirects the user to the starting page of the OSR Portal (Figure 4d).

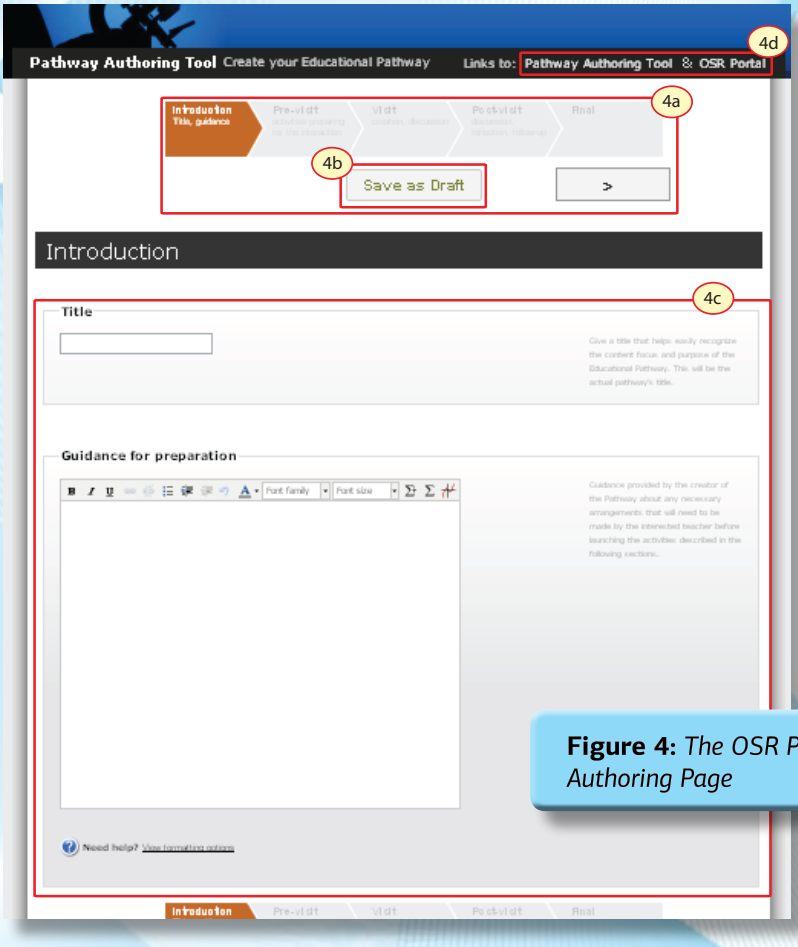


Figure 4: *The OSR Pathway Authoring Page*

3.4 Authoring Pane

The authoring pane is the section where the activities of each Pathway phase are inserted by the user. Both “Structured” and “Open” Pathways consist by four phases:

- Introduction
- Pre-visit
- Visit
- Post-visit

Each phase contains a series of activities, which the user completes in order to create the Pathway. An empty activity pane for the Pre-visit phase of a Structured Pathway is presented in Figure 5. Visit and Post-visit phases follow a similar design to the Pre-visit phase.

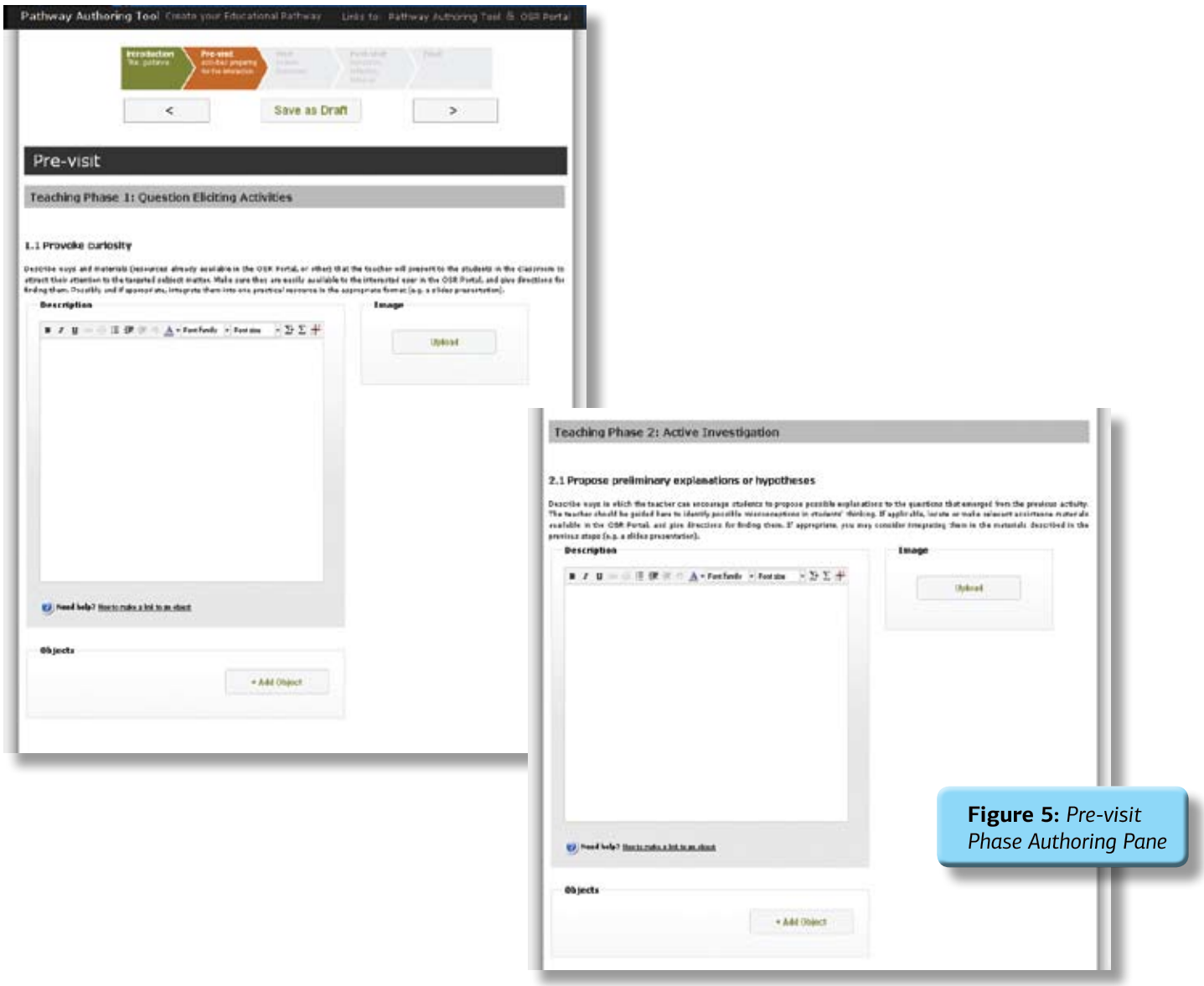


Figure 5: *Pre-visit Phase Authoring Pane*

Each activity consists of five fields:

- **Title of the Activity:** The title for each activity of the respective phase (Figure 6a).
- **Guidelines for each activity:** A short text describing the actions the user has to perform for the specific activity (Figure 6b).
- **Description:** In this field the user describes what the actual actions should be for the specific activity. To accomplish this the user has at his disposal a rich text editor where he/she can describe what should actions should take place during this activity. The user can format this description by adding bold, italic or underlined text, add bullets, change the color of the text and add hyperlinks to enrich his/her description with additional material (Figure 6c).
- **Adding Learning Objects:** In this filed the user can associate up to five digital learning resources to the specific activity (Figure 6d). A detailed description for the process is provided in paragraph 3.4.3 of this Guide
- **Adding an Image:** In this field the user can upload an image file by clicking on the "Upload" button. The image will be accompanying the description provided to the Description field (Figure 6e). A detailed description for the process is provided in paragraph 3.4.2 of this Guide

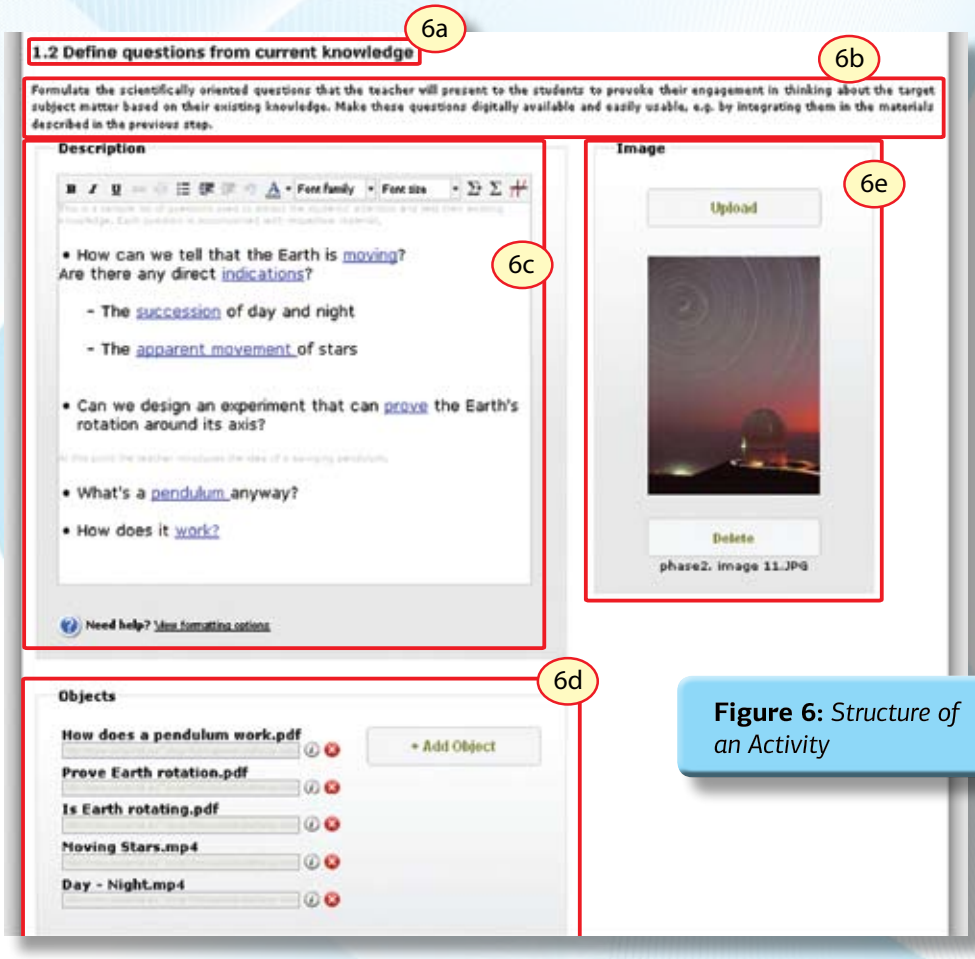


Figure 6: *Structure of an Activity*

3.4.1 Creating Hyperlinks

In the text editor the user can also create hyperlinks. This is a very useful feature since these hyperlinks once selected can lead the user directly to material associated with the text. In order to create a hyperlink the user will need the URL for the link. Once the user selects the text that he/she wants to add the hyperlink to, he/she needs to click on the Insert/edit link button on the text editor as shown below (Figure 7).

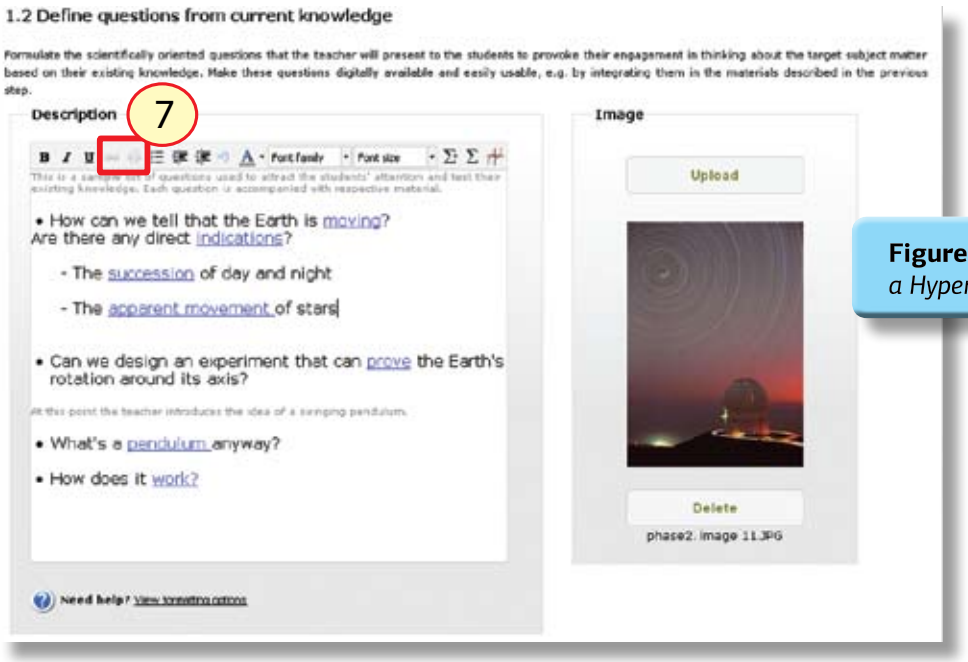


Figure 7: *Creating a Hyperlink*

Once the Insert/edit link button is clicked a pop-up window is presented (Figure 8). In this window the user should provide the URL of the link, specify if he/she wants the target link to be opened in the same browser window or in a new browser window and provide a short title to characterize the linked item. This title will appear in a tool tip when the cursor rests over the link in the editor or the when the end user views the Educational Pathway (Figure 9).

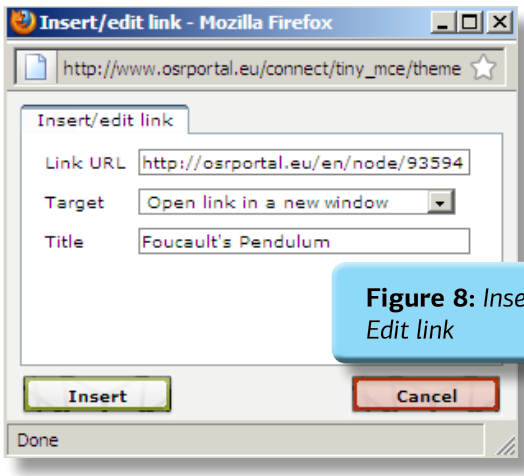


Figure 8: *Insert / Edit link*

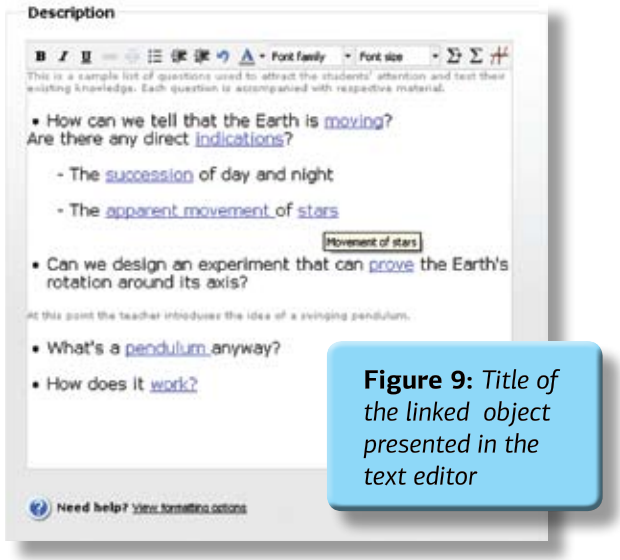


Figure 9: *Title of the linked object presented in the text editor*

3.4.2 Adding an accompanying image to the activity.

Here the user by clicking on the "Upload" button can upload an image file. The image will be accompanying the narrative of the Description element. The image file has to be in one of the following formats: jpeg, gif, jpg. Once the image file is uploaded the field will present the image as shown in (Figure 10).

Uploading anew image when an image has already been uploaded will replace the existing image. In order to remove an image and leave the activity without an image click on the "Delete" button

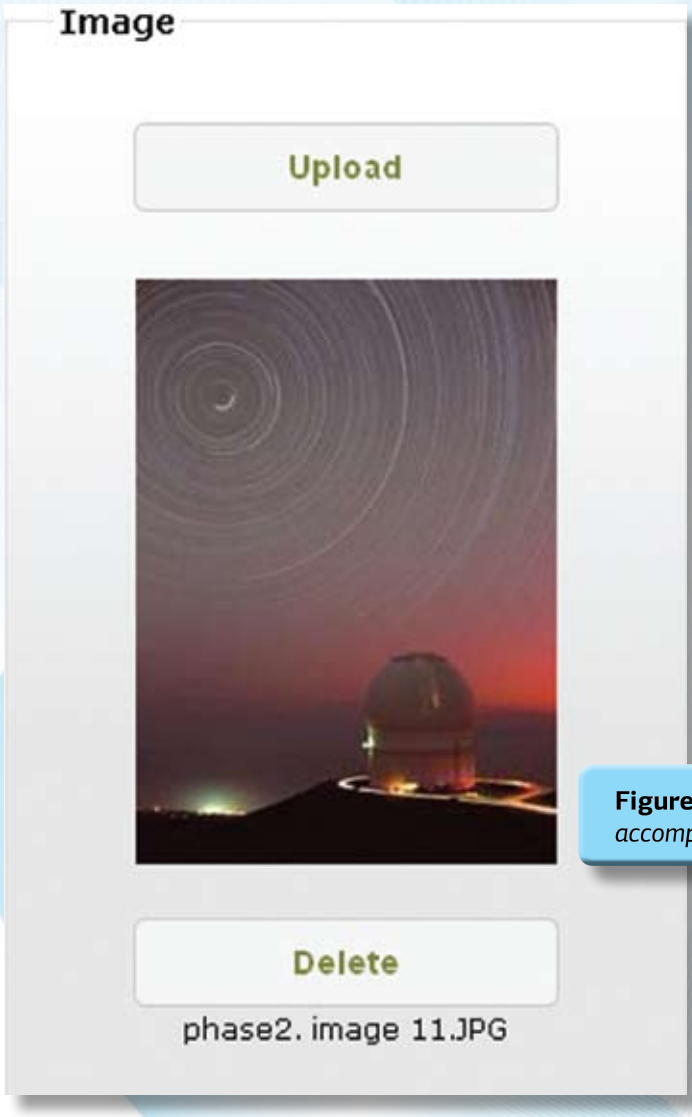


Figure 10: *Adding an accompanying image*

3.4.3 Adding Digital Resources

In this field the user can add up to five digital resources to each activity. An object can be either a Learning Object stored in the OSR Repository or any other digital resource.

Adding a Learning Object from the OSR Portal

- Search the OSR Repository for a leaning object. The user can search the OSR Repository by providing a free text string. The results of the search will appear under the "From OSR Repository" section. For each result the user can see the title and the plus sign (+). By clicking the (+) sign the object will be associated to the specific activity (Figure 11a).
- Use an object from the user's collected object list. If the desired object has been marked as a favorite, the title of the object along with a plus sign (+) will be presented under the "From Collected Objects" section. The user by clicking the (+) sign can automatically associate the respective object with the activity (Figure 11b).

Adding external digital resources

In order to add external digital resources the user has to click the "Upload Object" button under the "Attach external file" section. The user then will be prompted to select the desired file and click "Open". Automatically then the file starts uploading in the portal (Figure 11c).

While the user adds objects, these objects will appear in the Object section. In this section the object's link also appear and the user can highlight it and copy it, in order to use it to create the object's hyperlink in the text editor using the process described in section 3.5.1. Instructions are also provided by pressing the "i" next to each object's link (Figure 11d).

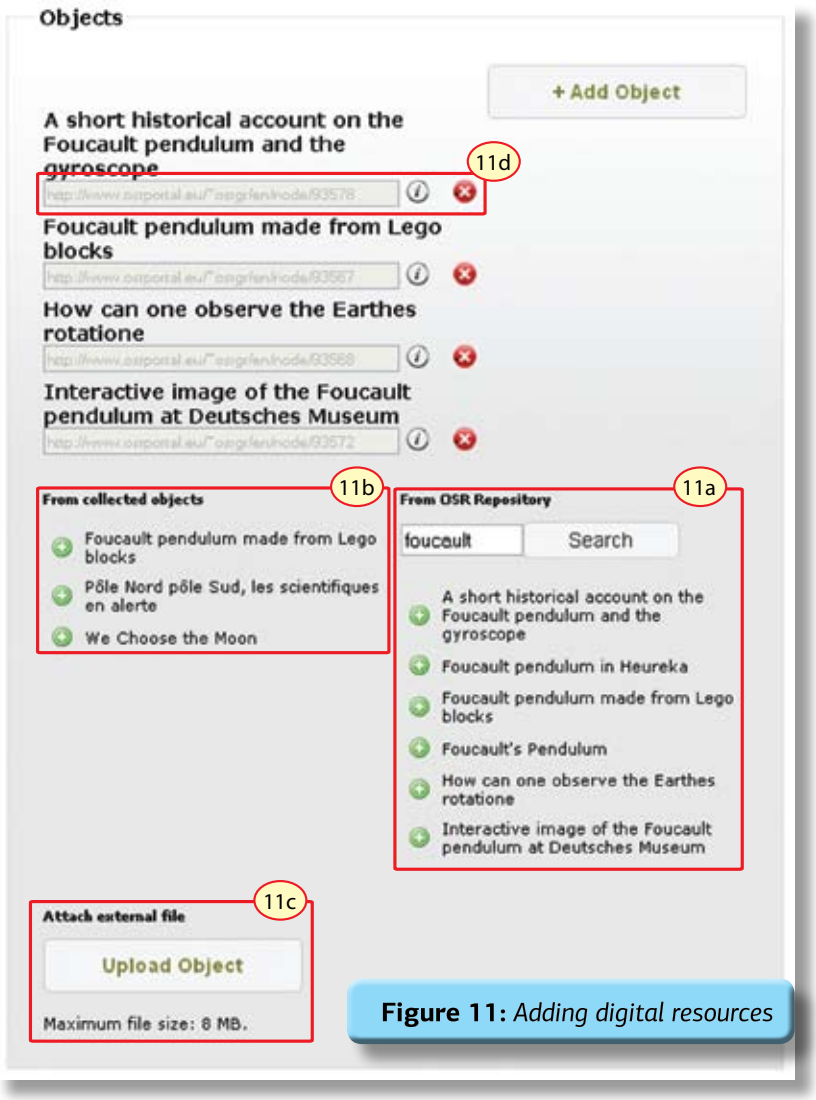


Figure 11: *Adding digital resources*

3.4.4 Authoring the Visit and Post-visit phases

The authoring and editing of the consequent two phases of a Pathway, 'Visit' and 'Post-visit', can be done in the same way as described in the previous sections for the 'Pre-visit' phase.

3.5 Finalising the Pathway

To finalize a Structured Pathway the user must complete all phases and activities. Upon completion the "Final" phase of the Educational Pathway Authoring Tool appears. In this authoring pane the user can preview the Educational Pathway developed and publish it.

By clicking the Preview button the user will be able to view the Educational Pathway. There the user is able to see all the information and the digital resources used for the specific Pathway. If the educational Pathway is not ready, the user is able to move back to the previous phases by clicking the "Back" button in the navigation breadcrumb and correct the corresponding activities. If the Pathway is completed and the user wants to publish it in the OSR Portal, the following actions must take place:

- Set the Pathways license attributes (Figure 12a).
- Upload a preview image. This image is the image that the end users will be able to see in the portal reference page (Figure 12b).
- Upload the formal educational metadata file (XML file) created by the OSR Metadata Authoring Tool (Figure 12c).
- Click on the "Save your Pathway!" to save your Pathway (Figure 12d) in the OSR Repository.

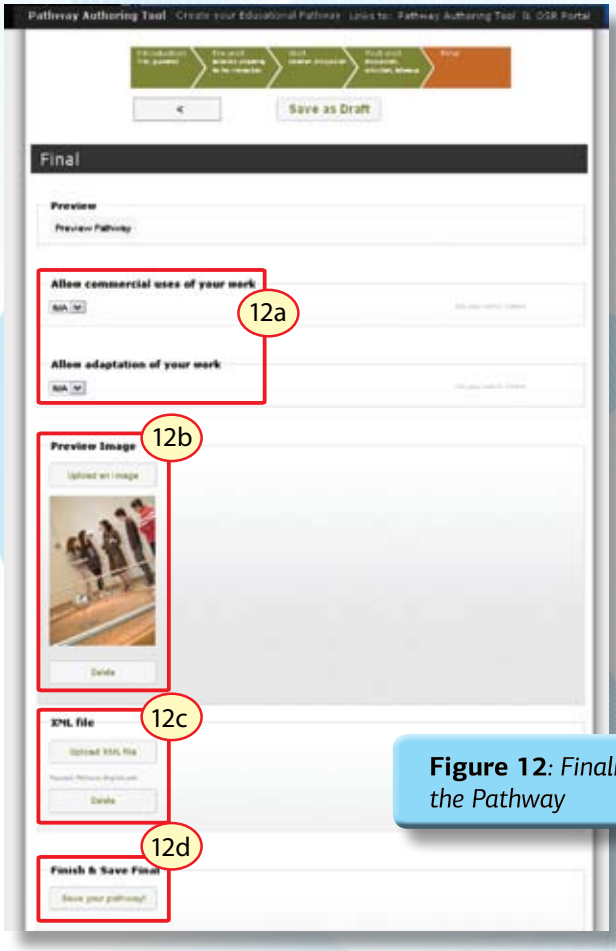


Figure 12: *Finalising the Pathway*

4. Amending a Draft Pathway

During the completion of the different phases, the user can temporally save the work that has been done by using the "Save as Draft" functionality. The user can retrieve the draft Pathway and continue authoring by visiting his account page (Figure 13) and selecting the draft Pathway that wishes to amend (Figure 14a). The same procedure applies also for completed Pathways should the user wishes to enhance them (Figure 14b).

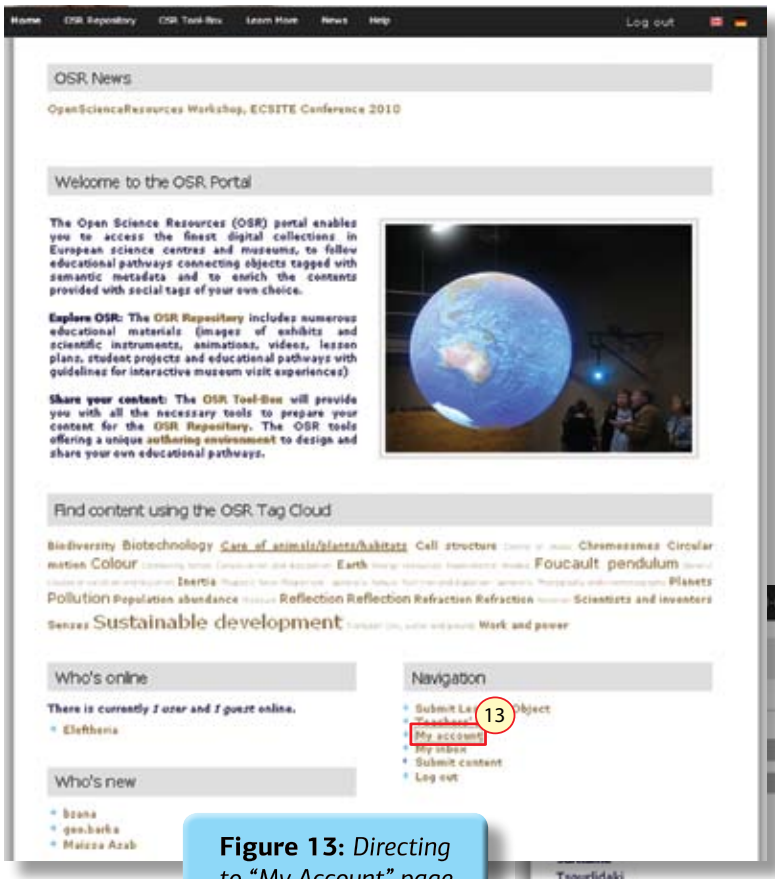


Figure 13: *Directing to "My Account" page*

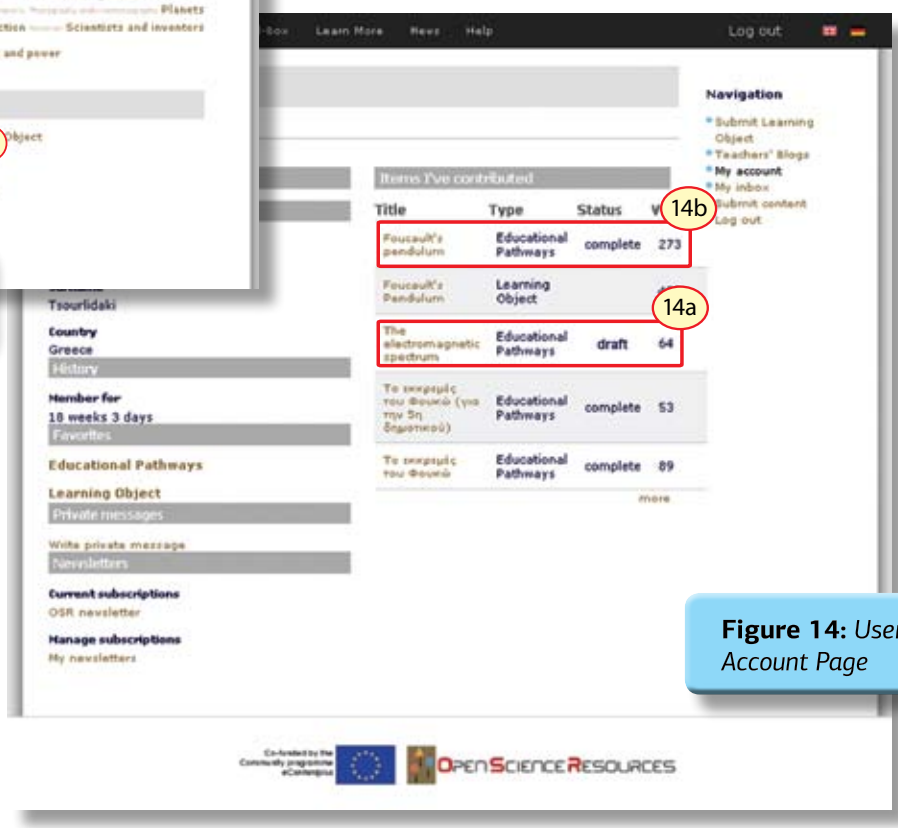


Figure 14: *User Account Page*

Once selecting the Pathway the user wishes to edit then is transferred to the Pathway node page where s/he has the following two options “Edit” and “Delete” (Figure 15). By clicking on the “Edit” link the system will retrieve the Pathway and will open the Educational Pathway Authoring environment in order for the user to continue the development of the Pathway. “Delete” removes the Pathway from the repository.

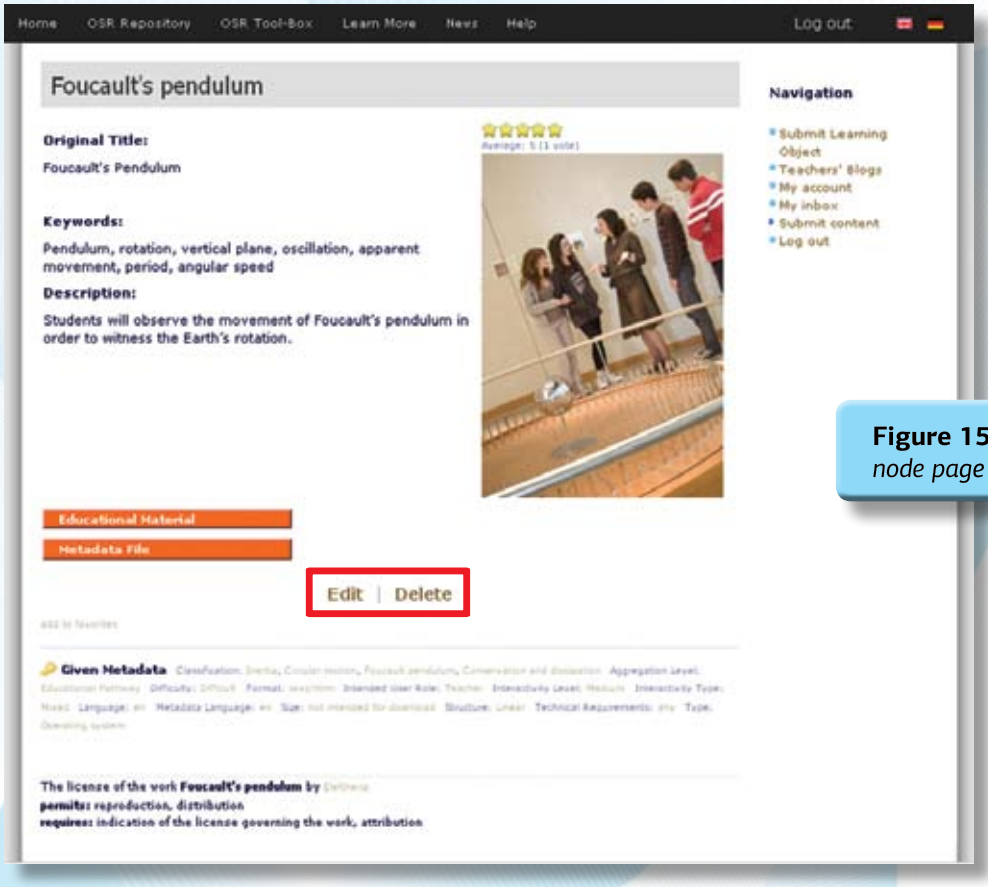


Figure 15: *Pathway node page*

5. Presenting your Pathways on the OSR Portal

The following screenshots present instances from both the authoring environment (left pages) and the end result presented to the users of the OSR Portal (right pages).

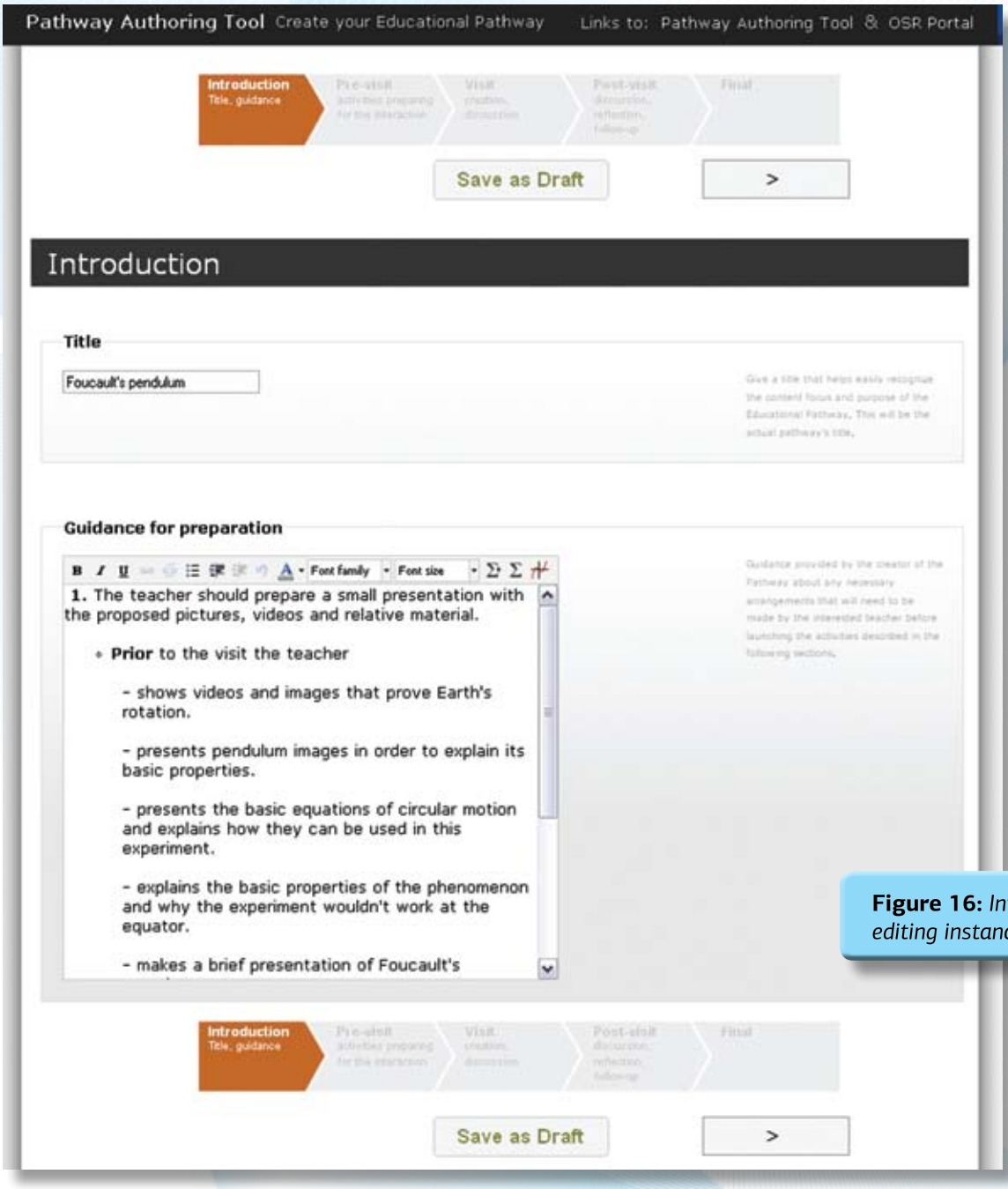


Figure 16: *Introduction editing instance*

Pathway Authoring Tool Viewer — Pathway Authoring Tool & OSR Portal

Foucault's pendulum

Please click on a phase to view related activities:

Introduction | Pre-Visit | Visit | Post-Visit

Introduction

Original Title:
Foucault's Pendulum

Description:
Students will observe the movement of Foucault's pendulum in order to witness the Earth's rotation.

Classification:
Inertia, Inertia, Circular motion, Foucault pendulum, Conservation and dissipation

Guidance for preparation

1. The teacher should prepare a small presentation with the proposed pictures, videos and relative material.

- **Prior** to the visit the teacher
  - shows videos and images that prove Earth's rotation.
  - presents pendulum images in order to explain its basic properties.
  - presents the basic equations of circular motion and explains how they can be used in this experiment.
  - explains the basic properties of the phenomenon and why the experiment wouldn't work at the equator.
  - makes a brief presentation of Foucault's experiments.
- **After** the visit the teacher
  - presents videos of pendulums around the world
  - presents videos that illustrate the difference in observation between an observer on Earth and a one over it.

2. The students' worksheets should be printed prior to the visit.

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Figure 17: *Introduction presentation instance*

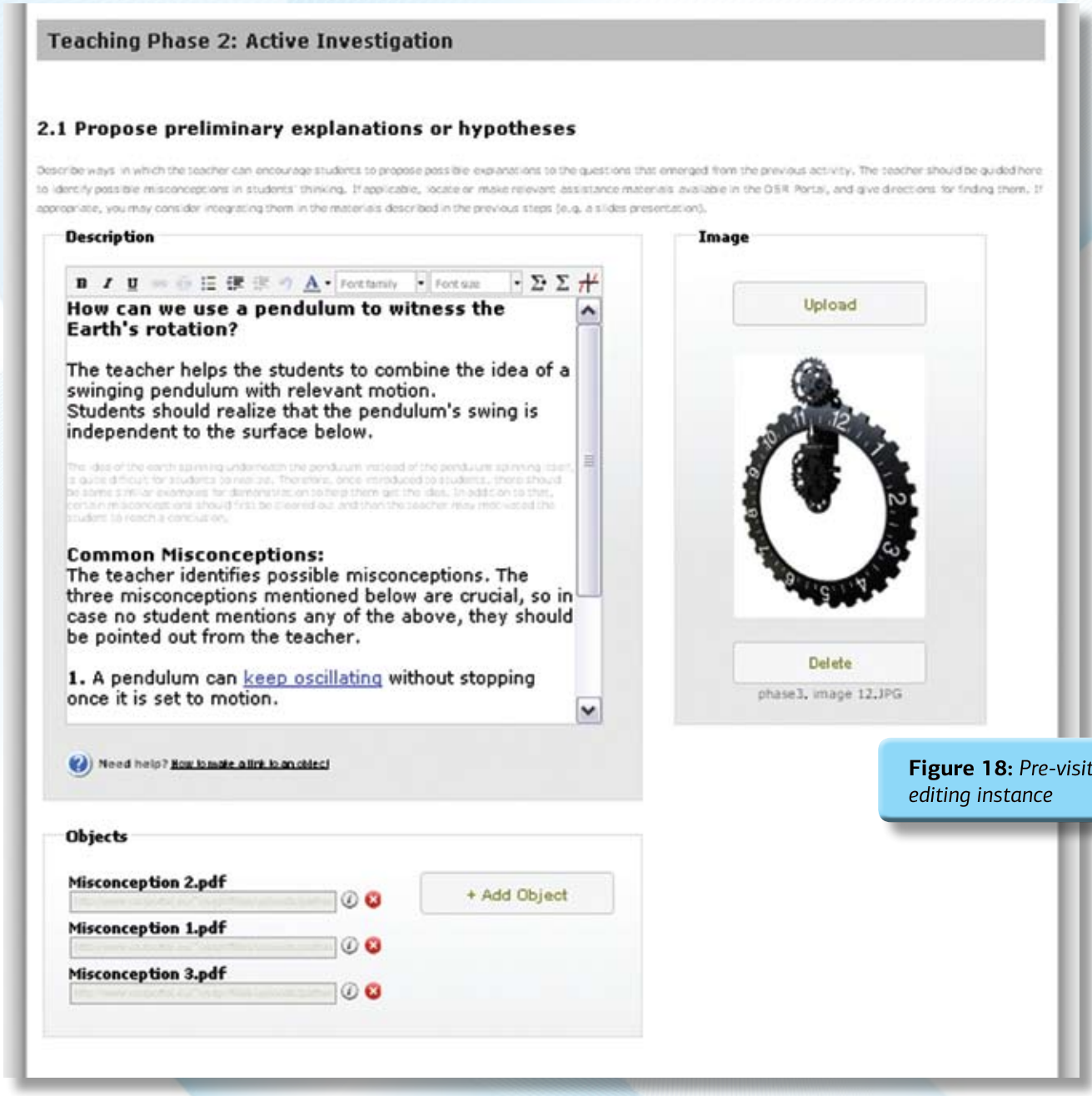

Figure 18: *Pre-visit editing instance*

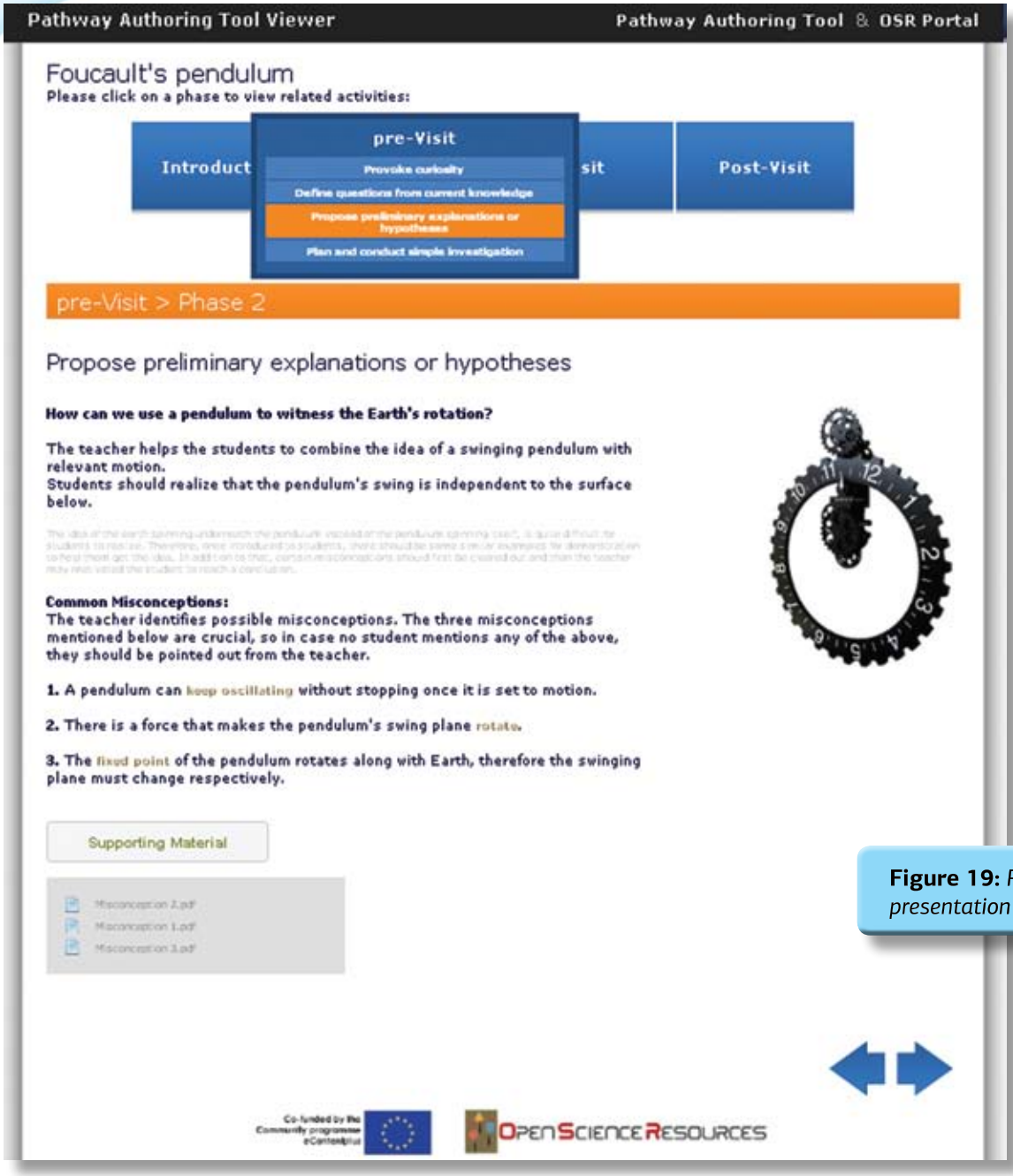

Figure 19: *Pre-visit presentation instance*

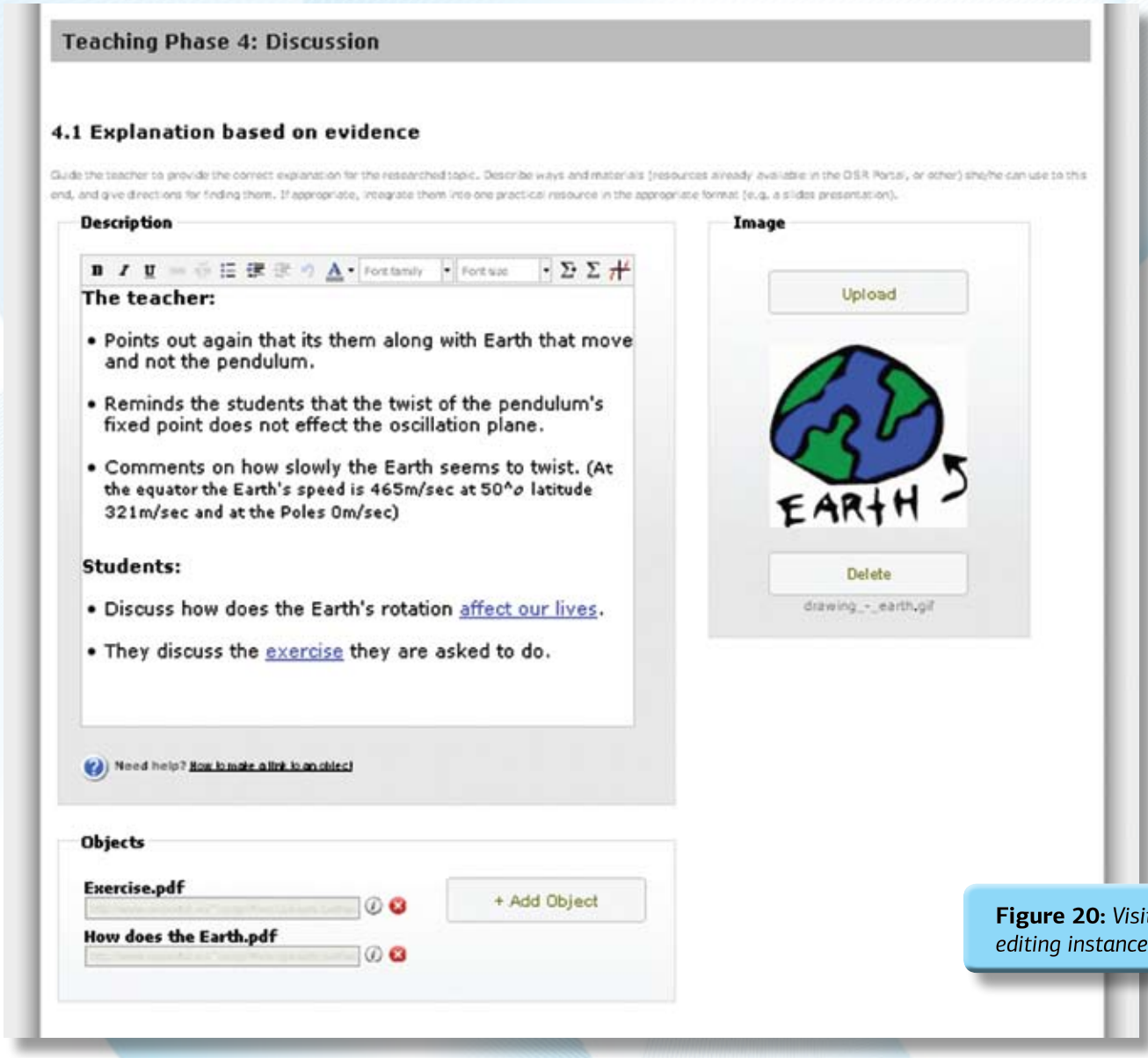

Figure 20: *Visit editing instance*

Figure 21: *Visit presentation instance*

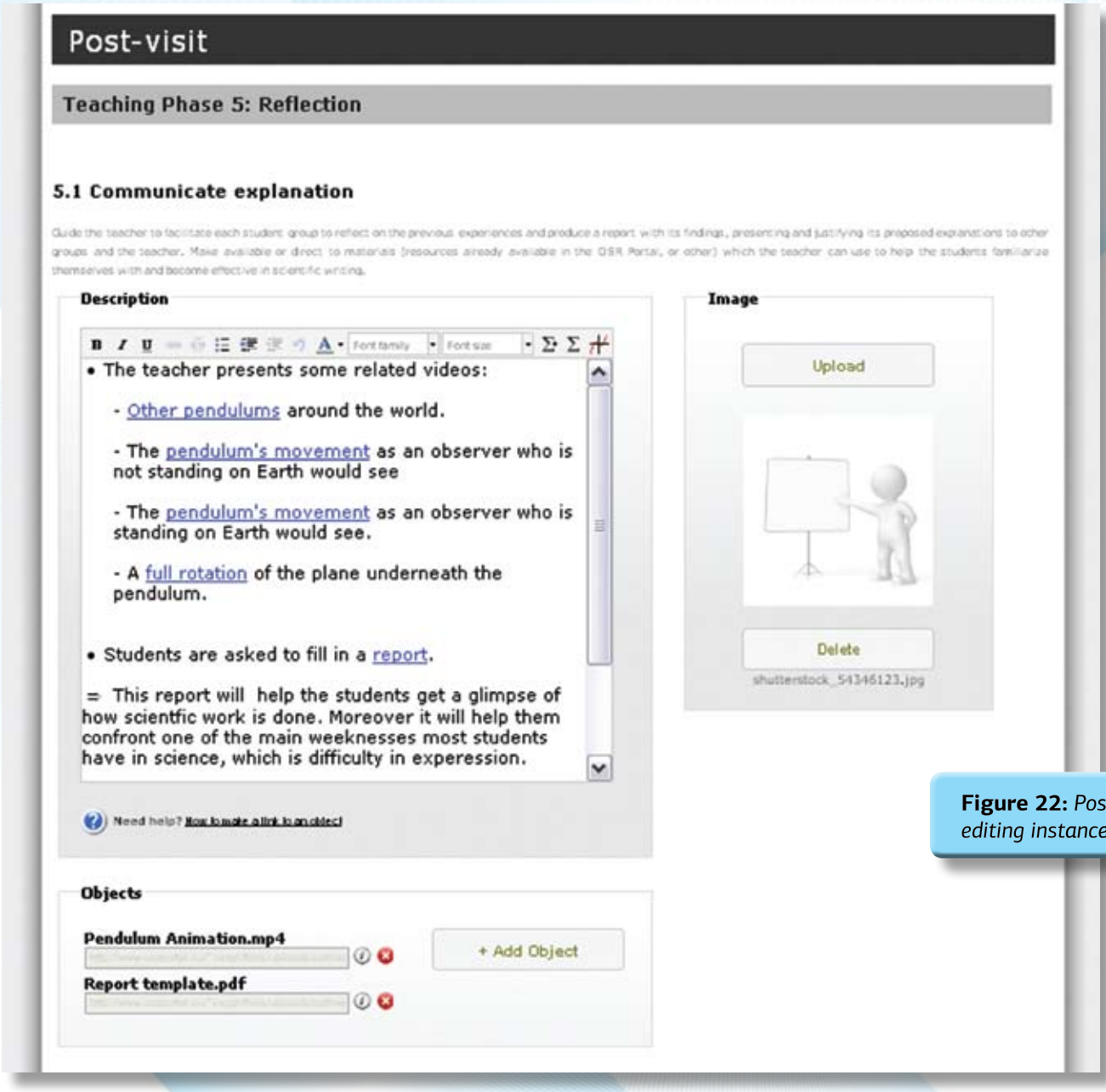

Figure 22: *Post-visit editing instance*

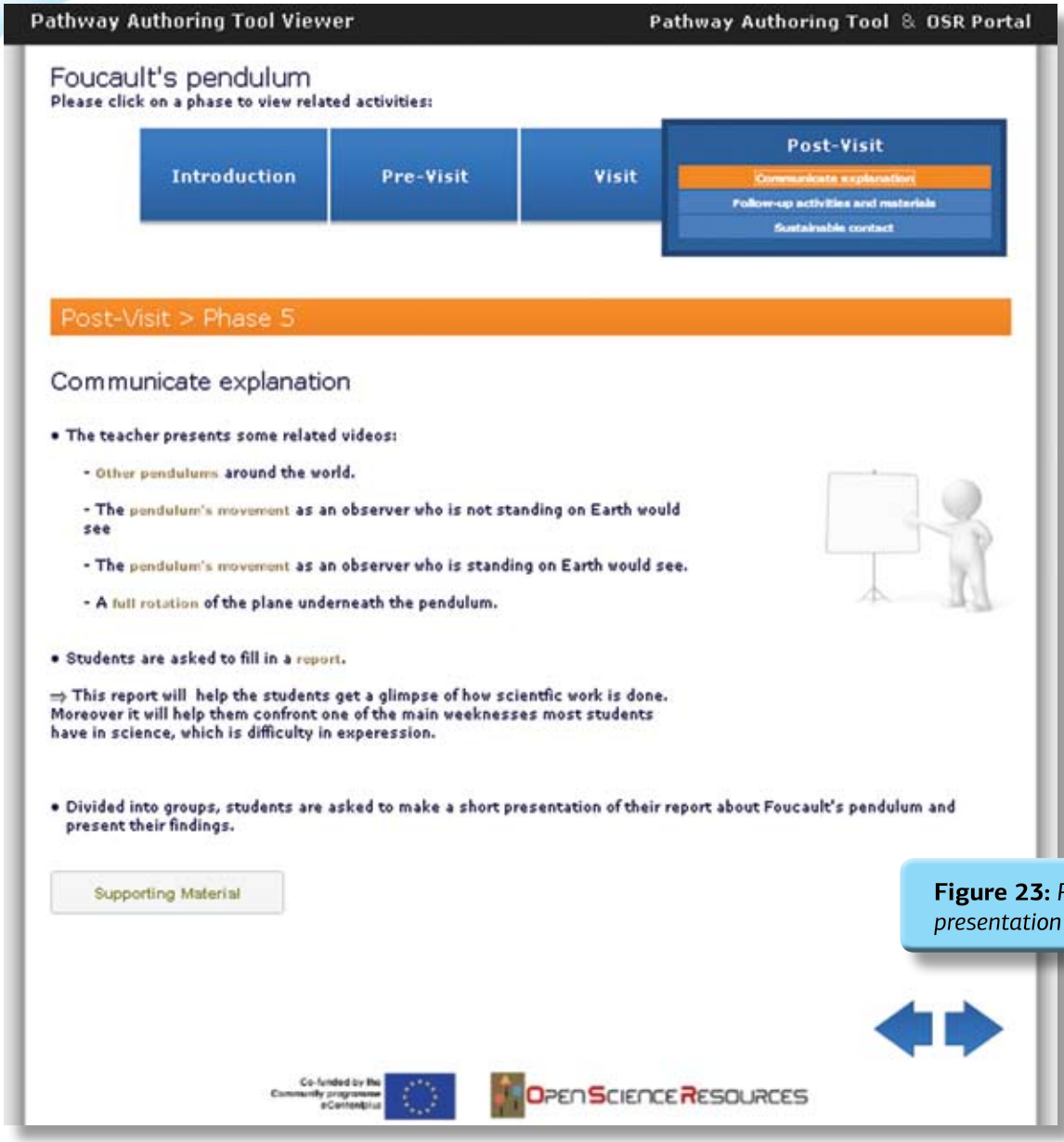

Figure 23: *Post-visit presentation instance*