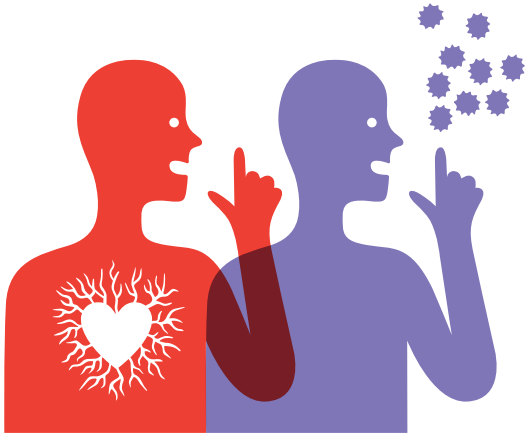

PILOTS

Pilots Resource Pack

Resources for the professional development of explainers in science centres and museums

Edited by Camilla Rossi-Linnemann and Michael Creek / **JUNE 2010**

Education and Culture DG
Lifelong Learning Programme

EACEA
Education, Audiovisual & Culture Executive Agency

Foreword

Who are explainers, and how is their role evolving? There are different names for the people working in a science centre or museum who come into face-to-face contact with the public – animators, mediators, facilitators and pilots, among others. Between 2008 and 2010, the Pilots project, coordinated by Ecsite, worked towards the professionalisation of the role of explainers in science centres and museums through developing European training courses and materials, through community-building and through research on the role of explainers, with a focus on adult learning. Science centres and museums are changing. As a result, the role of the explainer is changing too. The Pilots project deepened our understanding of this new profile across Europe, and raised awareness of the importance of the explainer across the European network of science centres and museums. The project built on work carried out in the previous FP6 European project Dotik and the Ecsite thematic group for human interface and explainers, THE Group, with a particular focus on their importance for lifelong learning.

The work of Pilots focused around five key areas:

1 - AWARENESS

With its results and findings, Pilots worked to raise awareness of the explainer's profile among science centres and museums and beyond our field, to reflect on this and collectively make groundwork towards a European definition of this profile and the relevant training needs for adult engagement in science.

2 - RESEARCH

The Pilots project research began by collecting scientific literature, good practices, and results of other projects about the professional profile of explainers. The quantitative and qualitative data produced within the project gave a unique insight into explainers and training practices in Europe.

3 - TRAINING

The Pilots training courses enhanced adults' engagement with science in science centres and museums, through the training of the explainers involved in the project, and in the long term, through dissemination to the Ecsite members, as well as other stakeholders. The four training courses organised within the project lifespan were at once a way to test training methodologies and a way to disseminate best practice, at local and European level. The multiplying Co-Pilots events allowed this best practice to spread throughout institutions.

4 - MATERIALS

The training materials developed within the project, a selection of which are contained in this document, were compiled to form a resource centre, available to explainers all over Europe.

5 - COMMUNITY

Lastly, a true community was established and is being developed, of individuals interested in the role of the explainer in science centres and museums, sustained on the Pilots Hub, http://pilots-hub.ning.com, our lively web platform that operates as a European community resource for explainers.

The pedagogical materials contained within this document were developed by science communication experts from the various European science centres and museums involved in Pilots, and have been thoroughly tested and reviewed throughout four international training courses and subsequent follow-up activities. Of course, these materials are just a part of the project results – I therefore invite you to join us on the Pilots Hub to learn more about the profile of explainers, to discuss the results and to share your own experiences.

Catherine Franche, Executive Director
Ecsite, the European Network of Science Centres and Museums

PARTNER INSTITUTIONS:

Ecsite, the European Network of Science Centres and Museums
Brussels, Belgium
www.ecsite.eu

Technopolis®, the Flemish Science Center
Mechelen, Belgium
www.technopolis.be

Universcience | Cité des sciences et de l'industrie
Paris, France
www.cite-sciences.fr

Museo Nazionale della Scienza e della Tecnologia Leonardo da Vinci
Milan, Italy
www.museoscienza.org

SISSA Medialab
Trieste, Italy
http://medialab.sissa.it

Pavilion of Knowledge - Ciência Viva
Lisbon, Portugal
www.pavconhecimento.pt

Ustanova Hiša eksperimentov
Ljubljana, Slovenia
www.h-e.si

RIGHTS OF USE

This material has been produced with support from the European Commission (Professionalisation for learning in technology and science 141872-LLP-1-2008-1-BE-GRUNDTVIG-GMP. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.)

To download your own copy of this guide visit:

www.ecsite.eu - http://pilots-hub.ning.com

INDEX

Supporting power point presentations and materials (to be downloaded separately)

MO_GeneralBibliography

1. The role of explainers
PPT1.1_RoleExplainers_FantasyAnimal
PPT1.2_RoleExplainers_PriorityGame
M1.2.1_RoleExplainers_PriorityGame
M1.3.1_RoleExplainers_AnswersToMyBoss

2. Fundamental characteristics of enquiry-based learning
PPT2.1_EnquiryBasedLearning_PracticingQuestioning
PPT2.2_ EnquiryBasedLearning_FromDemonstrations
PPT2.3_ EnquiryBasedLearning_ScientificConcepts
M2.2.1_ EnquiryBasedLearning_CakeDemo
M2.2.2_EnquiryBasedLearning_CakeRecipe
M2.2.3_EnquiryBasedLearning_CakeQuestions
M2.2.4_EnquiryBasedLearning_CakeEBL
M2.3.1_EnquiryBasedLearning_ScienceConcepts

3. Evolving dialogue
PPT3.1_ Debate_ControversialIssues
PPT3.2_ Debate_DiscussionGames
PPT3.3_ Debate_WarmUpActivities
M3.2.1_Debate_DebateContinuumAtBristol
M3.2.2_Debate_TabooCardsGenetics
M3.2.3_Debate_TabooCardsPaper
M3.2.4_Debate_PanoramaOnDebates
M3.3.1_Debate_CommunicationBoards
M3.3.2_Debate_CommunicationCards
M3.3.3_Debate_TabooCardsScienceNews

4. Science shows
PPT4.1_ScienceShows

Introduction by the editor

CAMILLA ROSSI-LINNEMANN
(NATIONAL MUSEUM OF SCIENCE AND TECHNOLOGY LEONARDO DA VINCI – MILAN, ITALY)

Explainers in science centres and museums are highly qualified professionals who constantly work to adapt to the current needs of new generations of visitors. Research conducted as part of the Pilots project shows that explainers are flexible communicators, who know how to listen to their various audiences and mediate between them and the world of science. In order to do this effectively explainers need to continually develop their skills by searching for new ways to communicate both basic scientific principles and the latest findings and perspectives of science research.

We believe that the best way to increase one's knowledge and abilities is to reflect on field-practice together with others. The activities propose new practical ideas, guided conversation and prompts for reflection that allow explainers to explore – together with their colleagues – issues that are pertinent to their professional development and practice. Activities and materials have been tested in four Pilots international training courses by explainers from over 25 counties, representing over 50 different institutions.

The resources are aimed at professional explainers and they are therefore intended mostly as practical activities that serve as "tools for thought". Rather than giving theoretical frameworks, they want to stimulate independent thinking and prepare for further personal, free learning. Activities are thus based on the idea of reflective practice, where participants are invited to experience some practical activities and use them to reflect on their own professional practice. All activities involve the sharing of personal reflections among participants and materials are thought of as triggers for thought and conversation.

These resources were written to support both expert and new explainers in their training, focusing on four areas of interest:

- The first cluster of activities is dedicated to reflections on the role of the explainer and it includes activities that help reflect on the specific skills and abilities that all explainers should have.
- The second cluster focuses on the idea of enquiry-based learning and on how to develop activities for visitors that take into consideration their pre-knowledge, interests and thinking patterns.
- The third cluster is dedicated to the development and conduction of debate activities which may be particularly interesting for those who want to involve adult visitors in controversial issues of current science.
- The last activity is dedicated to science shows as a means to engage visitors by creating emotionally charged experiences and environments.
- Resources include detailed descriptions on how to conduct the activities, printable handouts, supporting power point presentations and useful readings.

TIPS ON HOW TO USE THE RESOURCES

- Select and tailor these resources to suit the time and content needs of your institution. Finding the time for carrying out training sessions is – in fact – both essential and difficult. It is thus not necessary to carry out all the activities included in one cluster. Feel free to pick and choose!
- Think about how the activities you choose fit the needs of your institution. What do your colleagues already know? Can you create an introduction and conclusion that frame the workshops within their everyday practice? Be creative!
- Make sure you are confident with leading the activity and that you know what you want to come away with before you start. You might want to run through it first with your co-leader or another colleague.
- Make sure you have all the materials and handouts ready. You might want to translate them in your local language to make them more accessible to your colleagues.
- Lead the activity in a relaxed and informal way. Give people enough time to carry out the activities and keep them engaged and motivated by encouraging input from everyone. Remember you are there as a facilitator, to help your colleagues reflect on their practice.
- Think about how you are going to capture the reflections that emerge from the workshop. You can use flip charts, coloured post-its, photos and personal notes that you may want integrate in your conclusions. If you can devise an effective monitoring system it is useful to give feedback by sending participants a brief report of the workshop with findings and photographs.
- Spend a little time after the workshop to discuss the experience with your co-leader and colleagues. Self evaluation is precious: how did you feel the workshop went? What would you do differently the next time?
- Please note that activity descriptions refer to supporting materials and power point presentations that can be downloaded separately.

To share your results with Europe's community of explainers, and keep in touch with other explainers and trainers around the world, sign up on the Pilots Hub:

http://pilots-hub.ning.com

1. The role of explainers

PAOLA RODARI
(SISSA MEDIALAB – TRIESTE, ITALY)

Good explainers are an essential component of science centres and museums, yet they are too often neglected and their presence is frequently taken for granted. As a result, little effort is made to understand and raise awareness of their role. The activities included in this chapter aim to help explainers investigate the characteristics of their profession and their role within institutions.

Should explainers explain? Do explainers differ from teachers? What learning goals do they set for their visitors? Is it more important to amuse visitors or to help them in their investigation? Is it better to convey information or to stimulate questions? And are the answers to these questions valid for all the different kinds of activities offered by science centres and museums or should explainers behave differently in order to obtain different outcomes?

While reflecting on the role of explainers, participants will be thinking about what we mean by "informal learning". In fact, these training activities are a chance to experience informal settings, which may also suggest ways to lead and organise activities with visitors.

The activity on the fantasy animal offers an easy and fun way to start discussing the role and skills of science explainers. It can be very useful to include it in a beginners training, but it can also be used with senior staff and repeated through time to see if there are developments in the self-perception of explainers. It is also very useful to help explainers think about the existence of a wide, international community with a definite identity.

The activity that uses the priority game is a good example of how a discussion tool can be employed to reflect on one's own practice. Once again participants will be invited to explore and discuss the features that should characterise a "good" science explainer.

The activity "answers to my boss" was first conceived by Miha Kos, director of Hiša eksperimentov in Ljubljana, Slovenia. The workshop is based on the idea that explainers and CEOs can work together to solve problems within their institutions. Once again, explainers are involved in a reflection on their role, but this time the activity deals with existing problems that might emerge in the organisational structure of their own institution.

SELF PORTRAIT: THE FANTASY ANIMAL

EXPLAINERS REFLECT ON THE COMMON POINTS IN THEIR PRACTICE AND ON DIFFERENT WAYS OF DOING THEIR JOB.

AUTHOR
Anne Lise Mathieu (Universcience | Cité des sciences et de l'industrie – Paris, France)

AIMS
This workshop aims to help explainers see beyond their differences (different roles within the same institution, different ways of working, etc) and build a common representation of the science explainer's profession.

YOU CAN USE THIS WORKSHOP TO
- Create a feeling of shared representation of the explainer's job.
- See how beginner explainers see their job and see how this image evolves after training and after they have worked in the field for some time.
- Start a discussion on the most important skills of a science explainer.

TAKE HOME IDEAS

EXPLAINERS HAVE MANY DIFFERENT SKILLS.

EXPLAINERS DOING DIFFERENT JOBS MAY NEED TO BE ABLE TO DO DIFFERENT THINGS.

WE CAN IDENTIFY SOME COMMON CHARACTERISTICS OF EXPLAINERS IN DIFFERENT INSTITUTIONS.

SELF PORTRAIT: THE FANTASY ANIMAL - BEFORE YOU START

Timing
1 or 1.5 hours (depending on the number of participants)

Workshop facilitators
This workshop can be conducted by one workshop facilitator, although it is useful to have a co-facilitator who can note down remarks, conduct observations, document the work with photos and recordings.

Number of participants
From 3 to 30

Space organisation
Participants will work in groups of 3 to 8. Each group sits around a table that has to be large enough to fit a poster. Make sure you have enough chairs and table space for them to work comfortably together.
You might want to consider having a large flip chart on which to note comments that can help you introduce the workshop, lead large-group discussion and draw conclusions.
Projector and screen are optional but recommended: you can introduce the activity with PPT1.1, talking about the different names of explainers and conclude by showing the drawings of others groups of explainers around the world.

Materials
- Flip chart and large A2-sized sheets of paper
- Different colour felt-pens (a range of different colours per each group)
- Projector with computer and screen (optional but recommended)

Available for download:
- Workshop leading presentation: PPT1.1
- Pilots qualitative survey : M1.1.1

The workshop at a glance

5 min	Greet participants, introduce yourself and explain why you are doing this training
10 min	Introduction: the different names of explainers
15 min	Activity: drawing the fantasy animal
5 min per group	Each group presents its drawing to the other groups
20 min	Large group discussion: the skills of explainers
5 min	Presentation of other drawings (optional)
5 min	Conclusions by workshop facilitator

SELF PORTRAIT: THE FANTASY ANIMAL - THE WORKSHOP STEP BY STEP

Introduction: the different names of explainers

Time: 10 min
Setting: You can have the participants sit all together or sit at tables in smaller groups of 3 to 8.

What to do:
- Use the introductory PPT1.1 to begin a large group reflection on the differences and similarities of names and representations of the job in different countries. One first look shows that - under the general name of "science explainers" - there are a lot of different names that seem to indicate different jobs. But looking further you see that you can find similar names in many different countries and that these names revolve around four or five general ideas of the job. This is a good trigger to start thinking about the similarities and differences in the job of different explainers around the world.
- You can prompt a discussion on the name for science explainers used in your institution and think about the meanings of this name.

Tips for discussion on your institutional name for "science explainer"

- What are the skills and aims the name highlights the most?
- Do you feel it reflect the main characteristics of your practice?
- Do guides, entertainers and demonstrators do different jobs?
- Do different names reflect a different perception of the explainer's job?

Activity: drawing the fantasy animal

Time: 15 min
Setting: Participants sit at tables in small groups of 3 to 8.

What to do:
- Explain the game: the groups have 15 minutes to draw a fantasy animal that represents "the science explainer".
- Let participant do their drawings freely, without interfering, but go from one group to the other. Listen carefully to their conversations and note down their points of agreement or disagreement.

Note on the assignment

Note that – in the final discussion – there may be differences if participants interpret this assignment as "draw the ideal explainer" or if they think of drawing themselves and their everyday practice. You can try giving both tasks to the same group (one after the other) or with different groups, and see what happens.

Each group presents its drawing to the other groups

Time: 5 min per group
Setting: Each group to present takes turns in presenting their drawing to the other participants.

What to do:
- When they have finished drawing, each group presents its fantasy animal. Ask the presenters from each group to explain why they draw the animal as it is, what its characteristics are and why.
- Note down on the flip chart the described skills and characteristics for each drawing on the paperboard.

Large group discussion: the skills of explainers

Time: 20 min
Setting: Participants can stay where they are or re-gather in one big group.

What to do:
- This part is the most important. You can discuss the similarities between drawings and – if some characteristics are missing in some drawings – ask if the other groups agree or disagree with the skills/qualities that are not represented. As you facilitate the discussion, try to make sure that no important skills are forgotten and that all participants agree on some fundamental skills.
- The notes you have taken on the flip chart will help you sum up all the skills that were expressed by the different groups.

Examples of questions for prompting large-group discussion

- Are their many similarities or differences in the drawings of different groups? Does this surprise you?
- Was it difficult to reach an agreement within your group? Were there some points you were not able to agree with?
- When looking at the drawings of the other groups, did you agree and/or disagree with what the other groups put in their drawings?
- Would you add something to you drawing after looking at the other drawings?

Presentation of other drawings (optional)

Time: 5 min
Setting: As above.

What to do:
- Show drawings done by other explainers around the world (using PPT1.1 or visiting the Pilots Hub). It is always really interesting to see what other groups of science explainers have drawn. If you have several groups doing the activity this part may not be essential, but if there is only one group, drawings done by other explainers will stimulate the discussion. They will see common points between the drawings that express the specific characteristics of this profession (for ex. brain/s for ideas, tools for building scientific knowledge, mouth for talking, numerous arms for multi tasking, etc). This helps build a sense of belonging and sharing with other science explainers elsewhere in Europe.

Conclusions by workshop facilitator

Time: 5 min
Setting: As above.

What to do:
- You can end this activity by summarising the main skills that were represented through the drawings and identify those that are already acquired and those for which more training might be needed.
- This activity can lead to the next one. You can create a priority game that uses these identified skills as a starting point for sentences on the cards (see next workshop).
- You can use also PPT1.1 to make comparisons on who are science explainers in Europe, what are their skills and their training needs.
- You can write and photocopy the points that have emerged from the discussion and give them to participants after the end of the workshop. They can be distributed together with the results of the Pilots qualitative survey (M1.1.1) that was done for Pilots on the main skills of science explainers. These materials will serve as a reminder of what was discussed and of what other explainers around the world think about their profession.

Notes

SELF-PORTRAIT: THE PRIORITY GAME

EXPLAINERS REFLECT ON WHAT SHOULD BE THE CHARACTERISTICS OF A "GOOD" SCIENCE EXPLAINER.

AUTHOR
Paola Rodari (SISSA Medialab – Trieste, Italy)

AIMS
This group activity uses a discussion game (the priority game) to discuss some of the main abilities of a science explainer. A discussion game is a debate format that usually uses cards to stimulate dialogue on a certain topic. It aims to help participants shape a personal opinion about a particular issue, and to explore the differences of opinion among other participants. In a discussion game, nobody is wrong and nobody holds the truth – there are only differences of opinions. In fact, an added value of a good discussion is to discover new points of view and to understand the origins of the different opinions. Through a discussion game one can also learn facts and understand concepts, thanks to the materials provided and to the exchange of knowledge and experience among the group.

What is a "priority game"?

The priority game is based on a set of statements printed on different cards. Participants are asked to arrange the statements from the "most important" (highest priority) to the "less important" (lowest priority). In doing this, players will be encouraged to discuss the issue in depth. When all groups have ordered the cards, a general discussion facilitated by a mediator will help to understand the different points of view on the examined issue. The priority game format can be applied to any topic yet – in order to trigger conversation effectively – the statements on the cards must be carefully selected and expressed, making sure that all the opinions are equally acceptable, understandable and reasonable.

In this particular activity the statements on the cards (M1.2.1) proposed to promote discussion about "what should a good explainer do?" are:

- Show phenomena
- Help people express themselves
- Amuse people
- Help people experiment
- Provoke debate
- Explain concepts

These are clearly all "good" and reasonable statements, but by trying to arrange them by importance explainers are led to discuss the nature of informal learning, the possible differences among their publics, the goals of different types of activities (such as science shows, demonstrations, workshops, debates, etc.).

YOU CAN USE THIS WORKSHOP TO
- To promote debate among explainers on their mission in communicating with the public.
- To give an idea of what a discussion game is.
- To give a practical and simple example of an activity the explainers may use with the public based on other subjects.

TAKE HOME IDEAS

EXPLAINERS HAVE MANY DIFFERENT SKILLS.

EXPLAINERS DOING DIFFERENT JOBS MAY NEED TO BE ABLE TO DO DIFFERENT THINGS.

DEBATING HELPS TO UNDERSTAND A TOPIC.

SELF PORTRAIT: THE PRIORITY GAME - BEFORE YOU START

Timing
45 minutes

Workshop facilitators
This workshop can be conducted by one workshop facilitator, although it is useful to have a co-facilitator who can note down results, especially if you are using the projector to display the outcomes of the game.

Number of participants
Ideally the priority game can be played in groups of up to 7 people. In total you should try to have less than 35 people, in order to ensure that everyone can participate in the final discussion.

Space organisation
Participants will work in groups of up to 7, sated around tables. Make sure you have enough chairs and table space for them to work comfortably.
Projector and screen are optional but recommended for showing the results of the game. In alternative you can use a large flip chart (or any other device for hanging up cards so that all participants can see them clearly).

Materials
Projector with computer and screen (or, in alternative a flip chart or other wall space to display the results)
Available for download:
Workshop leading presentation: PPT1.2
Print a set of 7 different coloured cards for each group: M1.2.1

The workshop at a glance

5 min	Greet participants, introduce yourself and explain why you are doing this training
20 min	Activity: play the priority game
20 min	Large group discussion: the skills of explainers

SELF PORTRAIT: THE PRIORITY GAME - THE WORKSHOP STEP BY STEP

Activity: play the priority game

Time: 20 min
Setting: Participants sit at tables in groups of up to 7.

What to do:
- Give each group the same set of 7 cards (M1.2.1). Six cards mention different actions of a good explainer and one card is blank so that participants can add their own ideas if they feel it is necessary.
- Remind participants that in the game there are no right or wrong positions, but only different opinions and points of view.
- Ask groups to discuss among themselves the relevance of each sentence.
- Ask them to try and reach an agreement on the importance of each feature and have them arrange the cards in a line from what they think has the highest priority to lowest. Which is the most important feature of a "good" explainer? Which gets the second place? And so on.
- Ask groups to keep a note if any of the members strongly disagreed with the rest of the group on the position of a card.
- As soon as they are ready, gather the cards in the defined order from all groups.

Large group discussion: the skills of explainers

Time: 20 min
Setting: See above.

What to do:
- Project the results of all groups on the screen (you can use the layout in PPT1.2) or stick the cards in parallel lines (one per each group) directly on the paperboard or on the wall.
- Compare results and try to identify recurrences and differences in the outcomes of each group.
- Ask participants to clarify their opinions and facilitate the sharing of different approaches.

Tips for facilitating large-group discussion

Lead the discussion so that everybody can express his/her own point of view. You, as facilitator should try and be careful not to express your opinion. You can start the discussion by pointing out the major differences. For example: group 1 thinks that "to show phenomena" is the most important mission for an explainer, but group 2 considers it as the least important feature: could someone from each group explain why they decided that?

Notes

ANSWERS TO MY BOSS

EXPLAINERS BECOME CEOS FOR TWO HOURS AND ARE ASKED TO DEAL WITH THEIR DILEMMAS AND PROBLEMS.

AUTHOR
Miha Kos (Ustanova Hiša eksperimentov – Ljubljana, Slovenia)
Walter Ginkels (Technopolis – Mechelen, Belgium).

AIMS
This workshop aims to help explainers understand the problems with which they are confronted daily in a much broader context. Explainers are also introduced to the dynamics and nature of solving problems.

YOU CAN USE THIS WORKSHOP TO
- Inform explainers on common problems concerning them that are bothering their bosses.
- Involve explainers in giving suggestions to their bosses.
- Reflect on the role of the explainer and its position within the institution.
- Listen, understand and accept others views.
- Have fun.

The session was inspired by the Ecsite Directors Forum held in Valencia, Spain in 2009. There the directors of various science centres and museums from across Europe met and discussed problems concerning human resources. On this occasion some of the discussed problems were collected, revised and grouped by authors into three categories (Communication, Motivation of staff and Recruitment of staff), who then developed the questions for group discussion. In this workshop participants are invited to play the role of the CEO (the Chief Executive Officer or Director) of their organisation. They have to think that they are "wearing the skin" of the CEO with the added value of having an experience as explainer.

In the explainers' everyday work one forgets about the similarities and differences of problems and dilemmas with which CEOs and explainers are confronted. By taking the other's role (even if just for the duration of the workshop), one contributes in opening new communication channels between the two groups.

TAKE HOME IDEAS

CEOS NEED THE HELP OF EXPLAINERS.

COMMUNICATION HELPS IN THE PROCESS OF SOLVING PROBLEMS.

IF YOU WANT TO UNDERSTAND OTHERS, LISTEN AND TRY TO GET "INTO THEIR SKIN".

ANSWERS TO MY BOSS - BEFORE YOU START

Timing
2 hours

Workshop facilitators
This workshop can be conducted by a single workshop facilitator although it runs much more smoothly with two. While one focuses on communication with the explainers the other distributes the questions, collects the posters, makes observations and documents the work through photos and recordings.

Number of participants
Between 10 and 40. Depending on the number of participants the workshop facilitator decides on the number of participants per group (3 to 6).

Space organisation
Participants will work in groups of 3 to 6. Each group sits around a table that has to be large enough to fit a poster. Make sure you have enough chairs and table space for them to work comfortably together.
For the discussion you might need a flip chart and/or LCD projector and computer.
The workshop facilitator should prepare the questions without being seen by participants.

Materials
Flip chart and large A2-sized sheets of paper
Large tip felt-pens
Projector with computer and screen (optional but recommended)
Available for download:
Workshop leading presentation: PPT1.2
One set of question cards divided in several themes: M1.3.1

The workshop at a glance

5 min	Greet participants and short introduction
5 min	Metamorphosis from Explainer into CEO
25 min	Activity: first set of posters (recruitment of explainers)
25 min	Activity: second set of posters (communication)
25 min	Activity: third set of posters (motivation of explainers)
35 min	Large group discussion on material produced by participants

Notes

ANSWERS TO MY BOSS - THE WORKSHOP STEP BY STEP

Greet participants and short introduction

Time: 5 min
Setting: Split participants into groups of 3 to 6. One group per table.

What to do:
Introduce the workshop by explaining how the activity was first devised and why.

Metamorphosis from Explainer into CEO

Time: 5 min
Setting: See above.

What to do:
- As a teaser you can show a magic trick (such as a card trick or similar) in order to explain that you can do magic.
- Explain that now the spell will be performed on participants. They have to close their eyes and listen to you telling them in a hypnotic voice that they are going to be transformed into their CEO. Count slowly from 1 to 10 and then greet all the participants again as if they were CEOs.
- Tell participants that they – as CEOs – are kindly invited to take part in a workshop to help other CEOs in discussing some questions concerning the community and explainers working in "our" centre.

Activity: first set of posters (recruitment of explainers)

Time: 25 minutes
Setting: Groups discuss and produce posters at their table.

What to do:
Stick a question card on the top of each blank poster on the table (one poster for each group).
Ask groups to discuss for 25 minutes and come up with the three top suggestions/solutions to the problem.
At the end of the activity collect all the posters.

Activity: second set of posters (communication)

Time: 25 minutes
Setting: See above.

What to do:
- Stick a question card on the top of each blank poster on the table (one poster for each group).
- Ask groups to discuss for 25 minutes and come up with the three top suggestions/solutions to the problem.
- At the end of the activity collect all the posters.

Activity: third set of posters (motivation of explainers)

Time: 25 minutes
Setting: See above.

What to do:
- Stick a question card on the top of each blank poster on the table (one poster for each group).
- Ask groups to discuss for 25 minutes and come up with the three top suggestions/solutions to the problem.
- At the end of the activity collect all the posters.

Large group discussion on material produced by participants

Time: 35 minutes
Setting: Posters are hung around the room so that all groups can see them clearly.

What to do:
- Invite participants to explain to the other groups the ideas presented on their posters.
- You can also ask participants to compose their own questions from the point of view of the boss so that you can use these questions in future training sessions and/or continue the discussion on a broader level on the Pilots Hub.
- Participants are then transformed back from CEOs into explainers again.

2. Fundamental characteristics of Enquiry-Based Learning

ANTONIO GOMES DA COSTA
(ECSITE – BRUSSELS, BELGIUM)

Let us start by describing the following situation: a person is analysing objects and events, describing them for herself or to the members of the group she is working with. She then puts forward questions, raises new problems and develops possible explanations and answers. She tests those explanations by means of experiments and also by assessing their validity according to current knowledge. She puts forward new questions, and so on.

The previous paragraph could be describing the scientific process. Actually, it is describing the basis of Enquiry-Based Learning (EBL), and this is the essential characteristic of the broad range of learning activities that fit the concept of EBL: they reproduce the activities and processes that are inherent to science. That is why EBL is so effective for learning science.

As with any educational methodology, EBL has many variants. However, it usually includes the following components.

It always starts with the formulation of a question or the description of a problem to be solved. Notice that this stage should include a very active participation of the learner. In fact, learning how to formulate appropriate questions in science is one of the most overlooked and essential aspects of science teaching.

After this stage, a guided process follows, in which learners come up with answers or possible explanations and design and conduct practical tests to check the validity of those answers. During this stage, essential aspects of experimentation, such as the number of simultaneous variables to be tested (only one) and experimental accuracy, should be made obvious.

The final stage consists of critically analysing the findings of the previous stage, comparing and complementing them with existing knowledge. New questions and problems should come up at this stage.

Most importantly, all the above components are learner centred: learning is driven by the learner, not by the teacher or educator. Connected with this aspect, a common misconception about EBL is that it consists of random activities, with no structure or guidance. From the above, one can conclude that this is not the case, quite the contrary: EBL is a very carefully structured and guided process. The guidance, however, must always take into account that EBL is learner centred: the educator or teacher should carefully "limit" themselves to the role of stimulating and coaching the learners, avoiding any direct instructions or answers.

Another misconception is that EBL excludes other methods of learning and teaching. The fact is that EBL is a very efficient set-up to include other processes of learning and teaching. For instance, after an EBL activity, the learners may have the clear perception that vital information and data is needed and that it is not easy (or worthwhile) to obtain this data by themselves. This may lead either to a search in books, articles, on the internet or other sources of information, or to a "classical" teaching session, in which the teacher directly provides information and instructions. Notice that a search for data on the Internet or in a library can be a specific kind of EBL, as long as the learner leads it and he or she is critically assessing the information gathered by this method.

Also, and of particular importance for our field, one should avoid the frequent mistake of equating hands-on activities with EBL. Not all hands-on is EBL and, in fact, most times hands-on activities are simply practical tasks where the participants follow very precise instructions to verify a very specific result. In other words, they are practical means of conveying information and data, in a way that may be more interesting and appealing than usual, but which is far from being even remotely connected with enquiry.

The complementary mistake is to consider that EBL implies hands-on activities. In fact, not all EBL is necessarily hands-on and, for instance, finding answers for a problem by looking up information in the literature, or discussing a hypothesis in a group can be enquiry-based activities, depending on how they are conducted.

Learning science may be divided into two main, deeply interconnected aspects: learning facts and data, and learning processes and attitudes. It may be an oversimplification, but it is tempting to consider "classical" teaching models to be more efficient for transmitting a large amount of facts and data, while EBL has as main focus the development of scientific competencies and skills; most of all, EBL aims at developing the scientific attitude of actively trying to find answers to questions and problems, and critically assessing existing explanations.

Clearly, EBL requires time. This is possibly the fundamental drawback of EBL, and is one of the main reasons why it is difficult to implement in schools (another one being the lack of appropriate training of teachers). The necessity to comply with the curricula and the need to prepare the students to aptly perform in final exams puts the emphasis on data and fact learning, which is quickly done using more traditional methods. However, performing well in exams is far from being a clear measure of scientific literacy and scientific attitudes.

Science centres and museums aim at increasing scientific literacy in our societies, and Science in Society issues are becoming central to our activity. In this perspective, we should strive to help our public to develop scientific competencies and a scientifically critical attitude. Therefore, Enquiry-Based Learning activities should be an essential component of our programmes and, in fact, they are becoming increasingly so.

Suggested reading

- The Rocard Report on Science Education
  Can be downloaded from:
  http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=1100
- Foundations: a monograph for professionals in science, mathematics and technology education.
  Part 2- Inquiry: thoughts, views and strategies for the K-5.
  Can be downloaded from:
  www.nsf.gov/pubs/2000/nsf99148/

PRACTICING QUESTIONING

EXPLAINERS REFLECT ON THE IMPORTANCE OF QUESTIONS AS A TOOL TO ENHANCE VISITORS' LEARNING PROCESSES.

AUTHOR
Camilla Rossi-Linnemann (National Museum of Science and Technology Leonardo da Vinci – Milan, Italy)
Sofia Lucas (Pavilion of Knowledge – Lisbon, Portugal)

AIMS
This workshop aims to help explainers reflect on the importance of good questioning and observations.

Enquiry learning is based on a learner-centred educational philosophy. It stands on the premise that the learner should be placed at the heart of the experience.
In this frame of mind the explainer becomes a facilitator of the learning process who does not provide knowledge, but instead helps learners in the process of understanding and discovering information themselves.
Learners can be challenged to solve problems by using their own thinking patterns, drawing on their prior experience and being stimulated by their personal motivation.
In conversation, this problem-solving setting is typically achieved through questioning.
The activities proposed in this workshop are designed as exercises to help reflect on the questioning process. They are not intended as role-plays mimicking real conversation scenarios, but as artificial settings that can stimulate reflection.

YOU CAN USE THIS WORKSHOP TO
- Think about the role of questions and about how and when we can use them in our everyday practice.
- Identify different types of questions that serve different purposes.
- Practice different ways to elicit information from visitors.
- Reflect on how important it is to take into consideration the visitor's individuality when you need to "explain" something effectively.

TAKE HOME IDEAS

MEANING IS CONSTRUCTED DIALOGICALLY.

INTERPRETATION CAN BE GUIDED THROUGH EXPLANATIONS, BUT ALSO THROUGH QUESTIONING (WITH A GOOD BALANCE OF THE TWO).

QUESTIONS CAN BE USED TO PUT LEARNERS AT THE CENTRE OF THEIR LEARNING PROCESS.

PRACTISING QUESTIONING - BEFORE YOU START

Timing
2 hours

Workshop facilitators
This workshop can be conducted by one workshop facilitator, although it is useful to have a co-facilitator who can note down remarks, conduct observations, document the work with photos and recordings.

Number of participants
From 9 to 24 participants, preferably in a number which is divisible by 3.

Space organisation
Participants will work in groups of 3.
Make sure you have enough chairs and table space for them to work comfortably together.
To introduce the workshop, lead large-group discussion and draw conclusions you might want to consider having a flip chart on which to note comments.
Place all mysterious objects on a table in a reachable corner of the room or on a tray that you can easily pull out when needed. Make sure that they are covered and participants don't see them as they come in the workshop.
Projector and screen are optional (if you decide to use the supporting presentation PPT2.1).

Materials
- Mysterious objects (consider at least one per participant)
- Post-it blocks (1 every 3 participants)
- Pens for participants
- Large white poster sheets of paper on which to reorganise post-its (1 every 3 participants)
- Flip chart to summarise comments
- Projector with computer and screen (optional)

Available for download:
- Workshop leading presentation: PPT2.1

Mysterious objects

The mysterious objects can be objects that are used in specific areas such as gardening, medical tools, cooking devices, specific art & craft tools, design objects, etc.
Once extrapolated by their context it can become very difficult to recognise them!
Some examples:

Alessi nutcracker
Medical cupping devices

The workshop at a glance

5 min	Greet participants, introduce yourself and explain why you are doing this training
10 min	Activity 1 (warm-up): who is who
10 min	Introduce workshop and take home ideas
30 min	Activity 2: the mysterious object
20 min	Large group discussion: what happened?
20 min	Activity 3: types of questions
20 min	Large group discussion: types of questions
5 min	Conclusions by workshop leader

PRACTISING QUESTIONING - THE WORKSHOP STEP BY STEP

Activity 1 (warm up): who is who

Time: 10 min
Setting: Split the group in two and have the two teams standing in front of each other.

What to do:
- Each team identifies a person from the other team (without revealing who it is).
- Explain the rules of the game: like in the classical game "Who is Who" each team takes turns to ask questions to guess who the chosen person is. The other team can only respond with yes and no answers. The first team to guess the right person wins!

Introduce workshop and take home ideas

Time: 10 min
Setting: Participants sit at tables.

What to do:
- Address the group by introducing the concept of the workshop: the idea is to think about how we can use questions in our practice with visitors. (You can use the supporting presentation PPT2.1 if you think it is useful).
- Every day visitors in our science centres and museums come into contact with exhibits and objects. They look at them and question them in the attempt to learn – or better – to make sense of them and of the surrounding world and ideas.
- How do we – as explainers – fit in this process of questioning, interpretation and meaning making?
- How can we use questions to challenge visitors to solve problems by using their own thinking patterns, drawing on their prior knowledge and experience, and stimulated by their personal motivation?

Notes

Activity 2: the mysterious object

Time: 30 min (10 minutes for each object)
Setting: Position all the mysterious objects on a desk at the centre of the room and ask participants to sit at tables in groups of 3. In each group explainers will play in turns three roles: EX=Explainer, VI=Visitors, OB=Observer. They will perform the activity and switch roles every 10 minutes.

What to do:
- Ask explainers to sit in groups of three and to choose a role (tell them that they will get a chance to play all the three different roles).
- Ask participants that are playing the role of VI to look at the mysterious objects and to choose one that they don't know what it is and/or how it works.
- If the EX in the group doesn't know what the object is, tell him/her what it is (making sure that the VI doesn't hear).
- Explain the game: the aim of the EXs is to help the VIs understand what the object is and how it works. Yet they must follow one important rule: they can't explain directly, they can only ask questions (for example "what does it remind you of?", "does it have any mobile parts?", "why do you think it is made of this material?", etc). They can give "explanatory" clues but only if strictly necessary and – in this case – they must embed them in their questions.
- EX carry on asking questions until the VI understands what the object is.
- During this process the OB must note down all the questions posed by the EX (one question per post-it).
- Double check instructions before starting the activity! Participants might be confused by the counterintuitive directions. Make sure that they have understood that EX ask questions and VI answer them (not vice-versa, as it might normally happen in an Explainer /Visitor situation).
- After 10 minutes ask participants to exchange roles and repeat the activity with a new mysterious object.
- After another 10 minutes ask participants to exchange roles one last time and repeat the activity with a new mysterious object.

Large group discussion: what happened?

Time: 20 min
Setting: Participants sit at tables and workshop facilitator manages conversation and notes down interesting comments on the flip chart.

What to do:
- Prompt large group discussion on what happened and on what participants have felt and observed when playing different roles.

Examples of questions for prompting large-group discussion

Ask VIs:
What level of knowledge of the object do you feel you have reached? Would it have been the same/better/worse if the EX had just "told you" about what the object was? Why?
(You can feed some other questions in the discussion if it feels appropriate: By playing this game, did you obtain some contiguous information that has helped you to understand more "deeply" the object, its functions, its relation to other things? Did the process help you to make new, unexpected connections to things you knew? Does the information acquired feel durable? Does it feel somehow relevant to you?)

Ask EXs:
Were there moments in which you felt that your questions were "exploratory", in the sense that you used them to understand what the person in front of you already knew and thought?

Ask OBs:
What was the general feeling? Were the questions provocative? Too simple? Were they too full of the EX's knowledge?

Activity 3: types of questions

Time: 20 min
Setting: Participants work in groups of 3 (the same groups as before), then workshop facilitator manages feed-back and notes down interesting comments on the flip chart.

What to do:
- Ask groups to look at all their questions and to organise them in "sets" by similarities sticking the post-its on their posters).
- After they have finished grouping the questions they should try and formalise the categories of questions that have emerged. What are the characteristics of the questions in each set?
- Each group then reports what categories they have found, also giving examples of associated questions. Groups can do this from their tables or by coming up front and hanging on the wall their posters with post-its.
- Note down on the flip chart all the categories emerging from the groups.

Large group discussion: types of questions

Time: 20 min
Setting: Participants sit at tables and workshop facilitator manages conversation and notes down interesting comments on the flip chart.

What to do:
- Prompt large group discussion to draw some conclusions on the types of categories, and on similarities/differences between categories.
- Note that questions can be grouped in many different ways.

Questions can be categorised in many different ways!

Here are some examples based on previous workshops and academic research.

Example 1:
Questions that encourage the use of senses
(For ex. Is it sharp? What material is it made of and why do you think so?)
Questions that encourage comparison between the mysterious object and objects known by the VI
(For ex. What does it remind you of?)
Questions that encourage the expression of feelings and/or personal memories
(For ex. Did your grandparents have anything similar?)
Questions that include some new bits of information given by the EX
(For ex. Have you noticed that it is made of 3 parts?)

Example 2:
Open ended or closed

Example 3:
That are based on facts or on imagination

Example 4:
Factual, convergent, divergent, evaluative or a combination of the four.
(Erickson, H. L.. (2007) Concept-based curriculum and instruction for the thinking classroom. Thousand Oaks, CA. Corwin Press)

Example 5:
Factual, conceptual, provocative.
(Lindley, D. (1993) This rough magic. Westport, CN. Bergin & Garvey).

FROM DEMONSTRATIONS TO ENQUIRY-BASED LEARNING

EXPLAINERS REFLECT ON THE ROLE OF THE EXPLAINER WHILE RUNNING THE SAME PEDAGOGICAL ACTIVITY WITH THREE DIFFERENT MODALITIES.

AUTHOR
Sofia Lucas (Pavilion of Knowledge – Lisbon, Portugal)

AIMS
This workshop aims to help explainers reflect on their role while running activities in science centres.

When we think about the learning process we must focus on how to benefit from it. One of the ways is to place the learner/visitor at the centre of this process. Enquiry-based learning describes a range of curricular, pedagogical and philosophical approaches. The main premise is that learning should be based around students' questions. Enquiry-based learning can take many shapes and forms depending of the area of knowledge that is being explored. However the principles remain always the same: this process involves taking control of your learning and trying to do things by yourself without having someone telling you what to do or reading a list of procedures to accomplish your objective.

YOU CAN USE THIS WORKSHOP TO
- Find out what is a visitor-centred, enquiry-based activity.
- Investigate the role of the explainer in three different situations.
- Analyse how the process can influence the outcomes of the activity.

TAKE HOME IDEAS

DIFFERENT APPROACHES SUPPORT DIFFERENT LEARNING OBJECTIVES.

EFFECTIVE LEARNING REQUIRES A MORE ACTIVE PARTICIPATION FROM THE LEARNER/VISITOR.

ACTIVITIES CAN BE MODIFIED IN ORDER TO ACHIEVE SPECIFIC PURPOSES.

FROM DEMONSTRATIONS TO ENQUIRY-BASED LEARNING - BEFORE YOU START

Timing
1.5 hours

Workshop facilitators
This workshop can be conducted by one workshop facilitator and two/three co-facilitators, who can help in leading the activities and also note down remarks, conduct observations, document the work with photos and recordings.

Number of participants
We recommend from 6 to 18 participants, preferably in a number which is divisible by 3. Having more participants can raise some difficulties for the workshop-leader.

Space organisation
Participants will work in groups of 2 to 6. Make sure you have enough chairs and table space for them to work comfortably together.
The best thing is to start the training in one room and then have two more rooms. Each group will use one room to develop the practical part. If this is not possible make sure that groups are far enough not to disturb each other and see what other groups are doing.
The discussion with the entire group will take place inside the room where the training started. Projector and screen will be used in this first room.
In order to run the activity workshop facilitators must put all the necessary materials on one table in each room.

Materials
- Ingredients and materials to make the cake (see recipe described in M2.2.2)
- Flip chart
- Pens for participants

Available for download:
- Workshop leading presentation: PPT2.2
- Activity A worksheets for facilitators (one copy): M2.2.1
- Activity B worksheets for facilitators (one copy): M2.2.2 and M2.2.3
- Activity C worksheets for facilitators (one copy): M2.2.4
- Discussion grid (one copy per group): M2.2.5

The workshop at a glance

5 min	Greet participants, introduce yourself and explain why you are doing this training
5 minutes	Introduce workshop
30 min	Three practical activities (taking place in parallel)
20 min	Small group discussion
20 min	Large group discussion
10 min	Conclusions by workshop leader

Notes

FROM DEMONSTRATIONS TO ENQUIRY-BASED LEARNING - THE WORKSHOP STEP BY STEP

Introduce workshop

Time: 5 min
Setting: Participants sit at tables

What to do:
- Address the group by outlining the structure of the workshop: first we will have the practical activity followed by a small group discussion and then a large group discussion with some conclusions (you can use PPT2.2 if you think it is useful).
- Explain that to run the practical activity they need to split into three groups. As soon as they start the activity they cannot talk with the colleagues in the other groups. The sharing of the experience will only happen during the large discussion group. (Note that each group will be asked to work on the same activity "Cake-in-the-mug", yet only the facilitators know that each group will work with a different methodology).
- Each small group is followed by a facilitator who must know what to do. His role in each situation will be described later.
- Explain that every day visitors come to science centres with expectations regarding science experiences. The type and amount of information given by the explainer depends on the type of learning experience you want to provide. This activity will offer the opportunity to reflect on different roles, different kinds of engagement and different types of outcomes when we think about the learning effectiveness.
- Do not provide any information about what the different groups are experiencing. They will discover what really happened during the large group discussion.

Three practical activities

Time: 30 min
Setting: Position the three small groups in the three different rooms.

Room A
What to do:
- The facilitator should put all the necessary materials to run the activity on a table. We will carry out a demonstration of the making of a "Cake-in-the-Mug".
- The demonstration will be made entirely by the facilitator, following closely a suggested presentation mode (see M2.2.1).
- During the presentation the facilitator should not raise questions.
- At the end of the presentation there are 5 minutes in which the participants can ask questions related to the activity (as if they were visitors).
- At this point the group should stay in the room for a small group discussion about what happened.

Room B
What to do:
- The facilitator should put all the materials necessary to run the activity on a table. We will run the activity "Cake-in-the-Mug" together with the participants.
- The activity is more interactive and the participants will participate in the activity by following a suggested recipe (see: M2.2.2).
- During the activity an informal conversation will be established between the facilitator and the participants. The facilitator raises some questions while participants develop the practical activity in order to reach some answers through experimentation (to ask questions on ingredients see attached suggestions M2.2.3);
- During the development of the activity the facilitator should not touch the materials. It is up to participants to make the cake.
- At the end of the presentation there are 5 minutes in which participants can ask questions related to the activity (as if they were visitors).
- At this point the group should stay in the room for a small group discussion about what happened.

Room C
What to do:
- The facilitator should puts all the necessary materials to run the activity on a table. Participants will run the activity "Cake-in-the-Mug".
- The group is led to approach the activity as an enquiry-based experience (almost). Participants are invited to make 4 different cakes in order to understand through practical, comparative and autonomous experimentation which is the role of each ingredient (see 4 recipes on M2.2.4). Ideally the facilitator is there not to lead, but just to help the group.
- At the end of the presentation there are 5 minutes in which participants can ask questions related to the activity (as if they were visitors).
- At this point the group should stay in the room for a small group discussion about what happened.

Small group discussion: what happened?

Time: 20 min
Setting: Participants sit at tables to discuss (separated in each room).

What to do:
- Each facilitator should stay inside the room with the participants.
- The facilitator distributes a worksheet (see attached worksheet M2.2.5) for triggering and organising discussion. Each group discusses the issues on the worksheet relating the situation that they have experienced.

Large group discussion: what happened?

Time: 20 min
Setting: All participants sit at tables inside the initial room and workshop facilitator manages discussion and notes down the interesting comments on the flip chart.

What to do:
- After the small group discussion, it's important to share results.
- Start the discussion by asking a participant from group A if he/she liked the activity. Continue by asking if it was interactive.
- Do the same procedure with group B and then with group C.
- Ask participants to look to the flip chart and check the different considerations made.
- At this point participants should be confused seeing that opinions on a same activity are so different.
- Following the same order (first A, then B and C) ask a participant to describe how they had conducted the activity and what happened with their group, pointing out the parameters used in the worksheet during the small group discussion.
- During this discussion they will realise how the same activity can be carried out in different ways and produce a different impact on participants.

Conclusions by workshop leader

Time: 10 min
Setting: Participants sit at tables and workshop facilitator draws conclusions.

What to do:
- Summarise what has emerged from the discussion. To help, you can use the table on the 6th slide of PPT2.2.
- Note that the situation C is not a real enquiry-based activity. An enquiry based activity usually needs more time. If we wanted to make an enquiry-based activity with the Cake-in-the-Mug, we should only give the recipe and the ingredients/materials and then ask the big question: "How can I investigate the role of each ingredient?" And leave participants in charge of developing the research strategies.
- Show the next two slides where you have a small description of what enquiry-based learning is.
- The last slide will present the skills developed through enquiry-based learning, where learners use enquiry processes they need to make observations, raise questions, plan and carry out investigations, propose tentative explanations, test the experiments by making predictions, interpret results and communicate those results to others.
- Remind participants that this was an "exercise" to reflect on different methodologies. The discussion was meant to highlight the role of the explainer and of the visitors in science centres and also the skills needed by those who approach the activity (normally, the visitors) in each situation. This means that different pedagogical approaches (demonstrative, interactive and enquiry-based) can be chosen depending on the type of public and on the purpose of the activity.
- Invite participants to continue reflecting on their practice in their daily work.

Suggested guidelines for points to be made

- Often visitors expect explainers in science centres to control the entire process of the activity. But we must think that sometimes this "easy way" is not the most effective one.
- Being able to identify to best methodology for running the activity is a very complex task demanding careful thought from those who design and run the activity.
- Often "the easy way" is to be completely in control of the activity instead of allowing visitors to draw their own lines of enquiry.

HOW TO "DISASSEMBLE" A WELL-KNOWN SCIENTIFIC CONCEPT?

EXPLAINERS REFLECT ON HOW TO DISASSEMBLE SCIENTIFIC CONCEPTS WHILE EXPLORING EXHIBITS WITH VISITORS.

AUTHOR
Sofia Lucas (Pavilion of Knowledge – Lisbon, Portugal)

AIMS
This workshop aims to help explainers reflect on visitors' constraints when understanding scientific concepts.

During their visits to museums and science centres, visitors frequently meet scientific concepts that they don't know and which are not always easy to understand. The age of the visitor is the first thing to be considered, as we should adapt the language to the target audience. We should never avoid giving scientific explanations just because the visitor is too young. The introduction of scientific vocabulary should be done at an early age in order to develop scientific literacy in youngsters.
Since in most cases a theorem or a concept involves other ideas and pre-requisites, explainers should find a way to give a complex explanation through disassembling it into elementary and easy-to-understand scientific concepts associated to the original notion they want to communicate.

YOU CAN USE THIS WORKSHOP TO
- Deal with visitors' difficulties when exploring exhibits.
- Try out ways to break down complex scientific concepts to develop new enquiry-based activities related to your topics of interest.
- Understand how the breakdown process can be done.

TAKE HOME IDEAS

DISASSEMBLING SCIENTIFIC CONCEPTS REQUIRES A GOOD SCIENTIFIC BACKGROUND.

SCIENTIFIC LITERACY SHOULD BE INTRODUCED AT AN EARLY AGE.

EXPLANATIONS OF EXHIBITS MUST INCLUDE THE CLARIFICATION OF SCIENTIFIC CONCEPTS.

HOW TO "DISASSEMBLE" A WELL-KNOWN SCIENTIFIC CONCEPT? - BEFORE YOU START

Timing
1 hour

Workshop facilitators
This workshop can be conducted by one workshop facilitator, yet the presence of a co-facilitator can be very useful to note down remarks, conduct observations and document the work through photos and recordings.

Number of participants
We recommend a maximum of 20 participants in groups of up to 5. Having more participants only implies that the workshop has a longer duration allowing sufficient time for the practical activity presentation.

Space organisation
Participants will work in groups of 5.
Make sure you have enough chairs and table space for them to work comfortably together.
To introduce the workshop, lead large-group discussion about the difficulties in disassembling scientific concepts during visits, and draw conclusions, you can use PPT2.3.

Materials
Post-its
Pens for participants
Flip chart
Available for download:
Workshop leading presentation: PPT2.3
Discussion grid (one copy per group): M2.2.3

The workshop at a glance

5 min	Greet participants, introduce yourself and explain why you are doing this training
5 minutes	Introduce workshop
10 min	Explaining one example of how to break down a scientific concept
15 min	Practical activity
20 min	Presentation and discussion of the results
5 min	Conclusions by workshop facilitator

HOW TO "DISASSEMBLE" A WELL-KNOWN SCIENTIFIC CONCEPT? - THE WORKSHOP STEP BY STEP

Introduce workshop

Time: 5 min
Setting: Participants sit at tables.

What to do:
- Address the group by introducing the different parts of the workshop: first we will have an example presented by the workshop facilitator followed by a practical group activity.
- Explain that to run the practical activity they need to split into groups of up to 5.
- In our daily work we deal with different types of visitors. Very often we need them to understand complex scientific concepts related to the activities, workshops, shows and interactive exhibits that we propose. Some of these concepts can be disassembled to facilitate their understanding: we need to be trained to do this and practice the skill.
- During the practical activity, try not to influence how they are disassembling the scientific concepts. During the presentation of the practical activity, each group will disassemble a concept and will try to understand if it was effective. This will happen in the large discussion group. (You can use PPT2.3 if you think it is useful).

Explaining one example of how to break down a scientific concept

Time: 10 min
Setting: Participants sit at tables.

What to do:
- Present one example of how to break down a scientific concept. In PPT2.3 the scientific example is the Theorem of Pythagoras but you can choose another one if you prefer.
- The scheme for presenting the example is: first present the scientific concept or theorem and from there explain each of the small notions that make up the complex concept, linking all the different notions together.
- Depending on the participants the workshop leader can decide if it's necessary to present more than one example.
- At the end, make sure all participants understood the concept. If necessary present other connections that could help the understanding and learning of the concept using simple materials.

Practical activity

Time: 15 min
Setting: Position the small groups inside the room (if possible, the training session can take place in a space that is similar to where explainers work with visitors.)

What to do:
- Make sure that all groups are capable to run the activity concerning the space/materials needed to disassemble the activities.
- Ask each group to choose a scientific concept and try to disassemble it into basic notions and models (you can use M2.3.1 to note down ideas). If you think that explainers will have difficulties in choosing the scientific topic you can give them some ideas.
- During the practical activity you can give some tips if you realise that some groups are facing difficulties.

Presentation and discussion of the results

Time: 20 min
Setting: Some participants sit at tables while others present their work

What to do:
- Ask each group to explain how they disassembled the scientific concept they chose.
- During the different presentations you should make sure that whoever is watching understood the concept explored.
- Note down the flip chart all the aspects that you consider particularly relevant in order to recall and strengthened them during the final conclusions.

Conclusions by workshop facilitator

Time: 5 min
Setting: Participants sit at tables and workshop facilitator draws conclusions.

What to do:
Before drawing any conclusion ask participants if they felt any difficulties in running the practical activity and why.
Summarise what has emerged from the discussion.
Show the last slide of PPT2.3 where you have a small description of what are the needed skills to develop this kind of activity.
Remind participants that this was an exercise to reflect on their practices and to identify which skills are needed to run a good workshop.
Invite participants to continue reflecting on their practices in their daily work.

Suggested guidelines of points to be made

- The presence of an explainer in science centres should be an added value for the exhibitions.
- Explainers facilitate the understanding of complex scientific concepts through simple examples and relations/comparisons that enhance the learning process.
- The process of disassembling a complex concept requires backstage work and group discussion so it's good to seek for suggestions from colleagues as well as taking into account the type of public you will be facing.

Notes

3.
Evolving dialogue

- MATTEO MERZAGORA
(TRACES – PARIS, FRANCE, PILOTS PROJECT EVALUATOR)
- CO-AUTHOR: PAOLA RODARI
(SISSA MEDIALAB – TRIESTE, ITALY)

The wording and the rhetoric used to justify the need of public communication of science has dramatically evolved in the last 20 years or so. The limits of the so called "deficit model" have been clearly identified and embedded in most national and European policies. We have witnessed a tangible transition: in acronyms, we have moved from PUS (Public Understanding of Science, with a strong focus of policies on fighting scientific illiteracy through a unidirectional transfer of information) to PEST (Public Engagement in Science and Technology, where the attention is directed in convincing the public of the importance of participating to the scientific debates) and PUR (Public Understanding of Research, where science is seen more as an ongoing activity than as a series of results)[1], to what we are generically referring to as science-society dialogue, which we can define as a critical exchange of knowledge and values between the scientific community and the non scientists aimed at a concrete change of perspective in both actors.

"Dialogue", "engagement" and "participation" have now become unavoidable keywords. Several social scientists[2] have helped us understand that the chains of equations that link scientific literacy, engagement in science and technology, engagement in science and technology careers, public support for science and technology, etc. are far from being linear, and are strongly dependent on the evolution of science itself. Much effort has been deployed to blur the frontiers between science and society, for example by moving from a "science and society" to a "science in society" perspective[3], and we can bet the next step will be to further enhance the "society in science" mode on one hand (implying a stronger engagement of citizens in understanding science to become dynamic actors in scientific development), and the "science for society" mode on the other hand (implying a stronger engagement of scientists in understanding what the desired and undesired, asked and unasked scientific developments are, to become dynamic actors in the social development).

Words have indeed changed. But also moving from words to actions we can be quite optimistic: whether the trend is supported top-down or bottom-up (that is, generated by opportunities of funding or generated by public demand), the number of initiatives aimed at engaging the public, involving participation, focusing on controversies, demanding the expression of the public hopes and concerns, etc, has enormously increased. This is well documented, for example, in the analysis of the UK case edited by Jon Turney for the Wellcome Trust[4], or, to remain closer to the science centre sector, by the many recent FP6 projects focusing on dialogue and participation, in which Ecsite was directly or indirectly involved: Cipast, Decide, Dotik, Nanodialogue, Messengers, Meeting of minds, Alter-Net, and so on.

The main challenge seems now to move from "dialogue events" to a dialogue culture. It is essential that dialogue is intended by the parties concerned not just as a new umbrella to reproduce the usual strategies, but as a concrete mean to obtain new results. That is, as a pathway to provoke a however small social and political change. This implies a shift of the focus from the methodologies of dialogue to its objectives.

Science centres are indeed among the best institutions where to achieve this. But they still have not fully exploited this opportunity. Let's ask ourselves two questions.

First: are science centres today the place where citizens have the instinct to go when they want their voice to be heard on controversial issues involving scientific expertise? The answer is still mostly no: science centres organise exhibitions and events on controversial issues, from GMOs to vaccines to nanotechnology, but are very seldom used by pressure groups of citizens, watchdogs or advocates of demand-driven research as a platform to practically defend their issues and to reach their objectives[5].

Second: are science centres today the place where scientists think to go when they want to defend their particular viewpoints, to lobby, or to stage the competition among them for cultural and financial recognition? The answer is, once again, mostly no: science centres organise debates on front-end current research, but have mostly failed to convince scientists to use them as a public stage on which, for example, to advocate for investment in the ITER reactor rather than in energy saving domestic appliances, or in string theory rather than loop quantum gravity research. These functions – which are essential for a social dialogue to occur, - are still covered mostly by mass media, where the battles among scientific institutions to conquer the public opinion is clearly experienced by any science journalist. Yet science explainers can play a key role in proposing innovative and engaging debate activities and dialogue situations wherever possible.

1 - The literature on the subject is quite vast: it has been usefully reviewed by Bruce Lewenstein of Cornell University at www.people.cornell.edu/pages/bvl1/scicomm.html. From a science centre perspective, see also Chittenden et al. (eds) Creating Connections, Altamira press, 2004.
2 - Such as Brian Wynne in the UK, Michel Callon in France, Helga Novotny in Switzerland, Massimiano Bucchi or Pietro Greco in Italy, to quote but a few.
3 - This is clearly visible by reading the evolution of the introduction of the science and society
sections in the 5th, 6th and 7th Research framework programmes of the European Commission.
4 - J. Turney, ed., Engaging Science, Wellcome Trust, 2006.
5 - A series of contributions on the future of dialogue, mainly form the science centre community, have been published on the latest issue of the online Journal of Science Communication (jcom.sissa.it).

Suggested reading

- *The UK Government's Approach to Public Dialogue on Science and technology*
http://www.sciencewise-erc.org.uk/cms/assets/Uploads/TrackedDocuments/Sciencewise-ERC-Guiding-Principles.pdf
- *Related resources website*
www.sciencewise-erc.org.uk/cms/assets/Uploads/TrackedDocuments/Sciencewise-ERC-Guiding-Principles.pdf
- *Public Engagement in Science – Report of the Science in Society Session*
http://ec.europa.eu/research/science-society/document_library/pdf_06/public-engagement-081002_en.pdf
- *Participatory Methods overview by the Danish Board of Technology*
www.tekno.dk/subpage.php3?survey=16&language=uk
- *Participatory Methods Toolkit – A practitioner's manual*
www.kbs-frb.be/publication.aspx?id=178268&LangType=1033
- *Cipast in practice*
www.cipast.org/download/CD%20CIPAST%20in%20Practice/cipast/en/whatelse_4.htm
- *Annotated Bibliography on Citizen Participation and Local Governance*
www2.ids.ac.uk/logolink/resources/annotbiblio.htm
- Chittenden, David, Graham Farmelo and Bruce V. Lewenste in *Creating Connections: Museums and the Public Understanding of Current Research.* AltaMira Press, 379 pgs., 2004. Google books link: http://books.google.com/books?id=ZkVyylNpWtUC
- Field, H., & Powell, P. *Public understanding of science versus public understanding of research.* Public Understanding of Science, 10(4), 421-6, 2001
- *Citizens science*
www.at-bristol.org.uk/cz/
- *Play Decide*
www.playdecide.eu

HOW TO ENGAGE ADULTS IN CONTROVERSIAL ISSUES THROUGH EVERYDAY LIFE?

THIS WORKSHOP IS DESIGNED TO EMPHASISE THE IMPACT OF SCIENCE IN EVERYDAY LIFE, TO INVOLVE ADULTS IN DISCUSSION AROUND SCIENCE AND SOCIETY TOPICS AND CONTROVERSIAL ISSUES.

AUTHOR
Anne Lise Mathieu (Universcience | Cité des sciences et de l'industrie – Paris, France)

AIMS
One aim of this workshop is to make explainers aware that there is more than one way to treat a scientific topic, and that usually science is closely linked with our everyday life and has an impact on our choices in society. It shows that starting from our everyday life is a very efficient way to involve people in discussing science and society topics.
It also aims to show that starting from everyday objects you can discuss about many different scientific and science and society topics and that adopting a multi-angle approach can be very effective.
The session is composed of two different activities: "the shopping bag activity" and "the everyday object activity". These activities can be done separately, but are more effective if done in the same training session.
This session can be very useful to start the designing of a new activity on any scientific topic by a similar workshop.

YOU CAN USE THIS WORKSHOP TO
- Give an example of an activity that generates questions, discussion and debates among adults.
- Establish links between everyday life, fundamental science and science and society topics.
- Show the importance of choosing a specific angle and formulation of the topic when triggering discussion among adults.
- Design your own debate activities.

TAKE HOME IDEAS

YOU CAN DESIGN AND REPRODUCE EFFECTIVE ACTIVITIES WITH VERY SIMPLE MATERIAL (FOR EX. FOOD PACKAGING OR EVERYDAY OBJECTS).

WHEN CONDUCTING DEBATE ACTIVITIES YOU MUST PREPARE WELL ON THE TOPIC TO BE ABLE TO FACE THE REACTIONS OF YOUR VISITORS.

HOW TO ENGAGE ADULTS IN CONTROVERSIAL ISSUES THROUGH EVERYDAY LIFE? - BEFORE YOU START

Timing
2 hours

Workshop facilitators
This workshop can be conducted by one workshop facilitator, although it is useful to have a co-facilitator who can note down remarks, conduct observations, document the work with photos and recordings.

Number of participants
From 3 to 30.

Space organisation
Participants will work in groups of 3 to 8 people. They will be gathered around tables.
To introduce the workshop, lead large-group discussion and draw conclusions you might want to consider having a large flip board on which to note comments.
Projector and screen are optional but recommended if you intend to use the ppt (PPT3.1) to introduce the workshop and give instructions.

Materials
- 4 to 6 shopping bags (1 per group) containing about 10 different food packages: for ex. cookies, canned vegetables, pre-cooked dishes, cooking oil, meat, etc. One of them should mention "may contains GMOs", others should be organic products, some others with the indication "does not contain GMO", some with soja, corn, cotton oil (ingredients that may be issued from GMO).
- 1 bag/box with about 10 different everyday objects that can serve as a starting point for discussing fundamental science or science and society topics, for ex. an imported bottled water, some pills, a cell phone, a biometric transport pass, polyester and cotton boxer shorts from China, a counterfeit gold watch, a plastic bag, a battery, a TV remote control, a fresh orange, a beer can, etc.
- flip charts (one per group)
- Different coloured markers for participants
- Computer and video projector

Available for download:
- Workshop leading presentation: PPT3.1

The workshop at a glance

5 min	Greet participants, introduce yourself and explain why you are doing this training
5 min	Introduction to the first activity
20 min	Activity 1: the shopping bag activity
25 min	Presentation of the results of each group and general discussion
30 min	Activity 2: the everyday object
30 min	Presentation of the results of each group and general discussion
5 min	Conclusions by workshop leader

Tips and tricks for choosing the objects

Some objects are easier to use than others for science and society topics. The objects you choose could have a link with the general topics of global warming (imported goods, high cost energy…), security (biometry devices), health, social inequity and so on.

HOW TO ENGAGE ADULTS IN CONTROVERSIAL ISSUES THROUGH EVERYDAY LIFE? - THE WORKSHOP STEP BY STEP

Introduction of the first activity

Time: 5 min
Setting: You can have the participants gathered in one big group or already split in smaller groups of 3 to 8.

What to do:
- After a very short introduction on the difficulties that explainers may encounter when they want to involve adults in discussion and debate, ask participants to split in smaller groups (3 to 8) around tables.
- You can explain that this activity has already been tested with adult visitors in a science centre as a starting point to discuss GMOs and the legislation on food packaging.
- Put on each table a shopping bag containing food packaging and give participants the following instructions: "You have 15 minutes try to find out if there is any GMO (genetically modified organism) food in your bag." You can add, depending on your public, a little story to make the activity more concrete. For ex: "you are having friends over for dinner and you know that they are really anti-GMO, so you want to make sure that what you will give them to eat does not contain any GMO."

Activity 1: the shopping bag activity

Time: 20 min
Setting: Participants are gathered around the table with their shopping bag.

What to do:
- Each participant will start reading the information on the packaging, each taking a different package or discussing the same one all together (as they wish).
- Move from table to table taking notes and listening to the questions, information and discussions triggered by the activity.

Presentation of the results of each groups and general discussion.

Time: 25 min
Setting: As above.

What to do:
- Ask participants about the topics they discussed during the activity. What were the questions that were raised?
- Note down all the topics and questions and try to identify the more "fundamental science" questions vs the science and society ones. Help participants understand how many questions are raised by such an activity. The workshop is not the place where all questions can be answered, but – in order to avoid too much frustration among participants – you should try to answer al least some of them.

Notes on the discussion on topics

Usually the topics that emerge are numerous and diverse. From fundamental science questions such as "What is a GMO? How does it differ from plant selection or transformation?" to science and society topics such as "Is it safe for the health?" and also very practical questions on "How do we read the information on a package?" or "What are the laws concerning GMO in my country? Is it allowed to have GMO in food? And if so, in which food?

Using this activity with visitors

• You can use this activity with adult visitors. In this case you can ask the following questions:
• Did you find any GMO food?
• Is there something written on the packaging indicating the presence or absence of GMO?
• What are the obligatory indications that you should find on a food package?
This very simple activity generates a lot of questions. The explainer follows the lead of these questions to give information to the public. In this case, the duration of the discussion generated can be quite long (around one hour). The explainer will have to be very well prepared (fundamental science, economy, law, and so on) which means a lot of training materials or training with science and law specialists. He/she can lead the debate, making people discuss on topics linked to the environmental or health impact of GMO. You can also decide to involve science and law specialists in the activity itself, bringing together visitors and experts.

Some ideas of objects, topics and catchy phrases

Object: Orange
Examples of fundamental or applied science topics
• plant reproduction
• what is a fruit, a seed?
• geometry volumes vs. surfaces
• cellular organization of plants

Examples of science and society topics
• ecological foot print,
• sustainable development
• global warming
• grey energy: what is the required energy to put one litre of orange juice on your table ?

Examples of phrases to start a discussion
• Should we eat only fruit from our country and in the right season?
• Would you be ready to stop eating out of season fruit?

Object: Travel Pass
Examples of fundamental or applied science topics
• electromagnetism
• smart card technology
• nanotechnology

Examples of science and society topics
• security vs. individual rights
• biometry: applications in everyday life

Examples of phrases to start a discussion
• Do you agree to a system that knows about each of you travels for security reasons?

Object: Polyester and cotton boxer shorts
Examples of fundamental or applied science topics
• polyester chemical composition
• cotton farming

Examples of science and society topics
• GMO cotton: pros and cons
• water waste and recycling
• the use of herbicide and health
• the work of children and relocated industry

Examples of phrases to start a discussion
• Would you buy imported clothes made by children if they were much less expensive?

Participants will find many other ideas.

Activity 2: the everyday object activity

Time: 25 min
Setting: Participants are gathered in small groups of 3 to 8 around tables.

What to do:
- Ask each group to choose an everyday object in the bag/box and give the following instructions: "Starting from that object, make a list of: 1. fundamental science or applied science topics; 2. science and society related topics that may be triggered by the object itself."
- Then ask groups to find a question or a phrase that could trigger a discussion on one of the science and society topics that they have identified.
- PPT3.1 with the information on the activity can remain available during the activity to help participants remember instructions.
- Move from table to table taking notes and listening to the questions, information and discussions triggered by the activity.

Presentation of the results of each groups and general discussion

Time: 30 min
Setting: Participants can stay sitting around the tables.

What to do:
- Ask each group to present the object they chose and to list all the "fundamental science" and the "science and society" topics as well as the phrase they found to trigger discussion.
- If there is time enough, the phrases can be tested to see if they generate discussion or not.
- To stimulate the discussion you can ask some questions such as: do you think this is an interesting way to start thinking about a topic when we design a new activity? Could we design an activity for the public that is similar to what we have done here? Are some objects more efficient than others to raise science and society topics? What are the characteristics of an efficient sentence/question to start a discussion?
- Stimulate discussion also on other topics such as: "Where do we meet science in our everyday life? How – through this very practical approach – can we involve adults in discussing science and society topics? What is the role of the explainer when leading this type of activities (explaining scientific concepts, facilitating multi angle approaches of a scientific topic, provoking debate, etc...)

Notes

DISCUSSION GAMES

INVOLVING ADULTS IN DEBATE

AUTHOR
Sara Calcagnini (National Museum of Science and Technology Leonardo da Vinci – Milan, Italy)

AIMS
The aims of this workshop are:
- play two discussion games (Taboo and Debate Continuum)
- present techniques of informal discussion about science
- discuss how to use the games in different institutions
- integrate these techniques in the debate about science in society

Museums and science centres are increasingly becoming places where science is not just exhibited but also discussed. A new kind of science is presented: contemporary science, post-academic science, a science that is more debatable and less crystallized, that needs new tools in order to be communicated and formulated. This workshop presents some tools developed by the science centre At Bristol in the UK and used in new ways in Italy by the National Museum of Science and Technology in Milan also in connection with historical objects.

The tools are so flexible that they can be used in different institution with different aims: to discuss social implications of science, to present historical collections more effectively in museums, to train teachers and so on.

The games are inspired by those produced by CitizenScience (At Bristol-Wellcome Trust):
www.at-bristol.org.uk/cz/teachers/Default.htm

YOU CAN USE THIS WORKSHOP TO
- Engage visitors in discussions about contemporary scientific topics.
- Propose a view of science which deals not just with facts but also with different points of view, consensus, ethics, and uncertainty.
- Stimulate visitors to express their personal point of view and debate.
- Find out more about historical objects in an uncommon way.
- Manage debates.

TAKE HOME IDEAS

GAMES ARE A GOOD WAY TO STIMULATE DEBATE ON CONTEMPORARY SCIENCE AND DELICATE SOCIAL TOPICS.

GAMES ARE A GOOD WAY TO MAKE ADULTS INTERACT, AS THEY ARE A PLEASANT AND “LIGHT” WAY TO STAGE AND PUT FACE TO FACE DIVERGING POINTS OF VIEW.

DIFFERENT TYPES OF PUBLIC REACT DIFFERENTLY TO GAMES.

DISCUSSION GAMES - BEFORE YOU START

Timing
1.5 hours

Workshop facilitators
This workshop can be conducted by one workshop facilitator, although it is useful to have a co-facilitator who can note down remarks, conduct observations, document the work with photos and recordings.

Number of participants
From 4 to 30.

Space organisation
Participants will work in groups of 4/5 people. They will be gathered around tables.
To introduce the workshop, lead large-group discussion and draw conclusions you might want to consider having a flip chart on which to note comments.
Projector and screen are optional but recommended if you intend to use PPT3.2 to introduce the workshop and give instructions.

Materials
• Flip chart and markers
Available for download:
• Workshop leading presentation: PPT3.2
• Debate Continuum instructions and cards (one copy per group): M3.2.1
• Taboo cards (one set per group): on genetics M2.2.2 or on paper: M2.2.3

The workshop at a glance

5 min	Greet participants, introduce yourself and explain why you are doing this training
20 min	Game 1: Debate Continuum
20 min	Game 2: Taboo
30 min	Large group discussion
20 min	Final presentation

Notes

DISCUSSION GAMES - THE WORKSHOP STEP BY STEP

Game 1: Debate continuum

Time: 20 min
Setting: Participants split in smaller groups of 4/5 people and sit around tables.

What to do:
- Ask participants to split in small groups (4/5 persons each).
- Give them the handout with the instructions and cards (M3.2.1) and go over the rules together.
- Ask groups to play the game.
- After 15 minutes interrupt the game.

Game 2: Taboo

Time: 20 min
Setting: As above.

What to do:
- Ask participants to split in small groups (4/5 persons each).
- Give each group a set of cards (M3.2.2 on genetics or M3.2.3 on paper or other that you may wish to prepare) and go over the rules of the game together: one at the time participants should pick a card and explain the word on the card to the other members of the group. The word on the card cannot be pronounced. Each person in the group has 1 minute to describe as many words as possible to the team. Used cards do not go back in the pack. At the end of the game, write down the unknown words. (You can play the same game using drawings instead of sentences, like in the classic "Pictionary" game).
- After 15 minutes interrupt the game. The team with the most words guessed wins.

Large group discussion

Time: 30 min
Setting: Participants sit where they are.

What to do:
- Ask participants if the games were interesting, useful, etc.

Tips for discussion

What happened?
Did you find the games interesting?
Did you enjoy playing?
Did you find any problems?
Positive/negative aspects of the game
Do you think you can integrate them in some of your activities?

Which kind of topics can be discussed using games?
Contemporary science and research / Social and ethical aspects / Historical objects

With which kind of public can we use games?
Adult visitors / Teenagers / Teachers

Final presentation

Time: 15 min
Setting: Participants sit where they are.

What to do:
- Use PPT3.2 to present different ways of playing the games.
- You can use M3.2.4 as a presentation or as a handout to give an overview of which institutions are using debate activities to engage adult learners.

REFLECTING ON SETTINGS FOR DEBATE

EXPLAINERS REFLECT ON HOW WARM-UP ACTIVITIES CAN CREATE AN EFFECTIVE SETTING FOR CONDUCTING DEBATE ACTIVITIES.

AUTHOR
Camilla Rossi-Linnemann (National Museum of Science and Technology Leonardo da Vinci – Milan, Italy)

AIMS
Reflect on how a good "warm up" activity can create a good setting for debate.

YOU CAN USE THIS WORKSHOP TO
- Reflect on the characteristics of a good "warm up" activity in order to design new effective activities,
- Think about the characteristics of a good setting for debate: making people feel comfortable; helping them to interact with the rest of the group; approaching a topic.

Activities – especially debate activities – include three basic "ingredients": the individual participant, the interacting group, the topic which is being discussed.
In the workshop we will thus analyse how to:
- help the individual feel comfortable
- help the group interact effectively
- help participants approach a topic with which they may be familiar or not

We are proposing three warm-up activities, but you can substitute or integrate them with activities from your own institution. This may facilitate reflection.

TAKE HOME IDEAS

WARM-UP ACTIVITIES CAN BE USED TO PREPARE EFFECTIVE SETTINGS.

EFFECTIVE DEBATE APPEARS TO OCCURS WHEN:
- PEOPLE FEEL COMFORTABLE
- PEOPLE ARE ENCOURAGED TO INTERACT WITH THE REST OF THE GROUP
- SOME INITIAL INFORMATION ON THE TOPIC OF DEBATE IS GIVEN, PROVIDING PARTICIPANTS WITH BASIC INFORMATION

REFLECTING ON SETTINGS FOR DEBATE - BEFORE YOU START

Timing
From 2 to 2.5 hours (or less if you choose to work on only one or two warm-up activities)

Workshop facilitators
This workshop can be conducted by one workshop facilitator, although it is useful to have a co-facilitator who can note down remarks, conduct observations, document the work with photos and recordings.

Number of participants
From 4 to 30.

Space organisation
Participants will work in pairs and small groups. Make sure you have enough chairs and table space for them to work comfortably together.
To introduce the workshop, lead large-group discussion and draw conclusions you might want to consider having a flip chart on which to note comments. Projector and screen are optional (if you decide to use the supporting PPT).

Materials
- Flip chart and markers
- Pens for participants

Available for download:
- Workshop leading presentation: PPT3.3

FIRST ACTIVITY
- Pictures of objects related to the chosen topic (for example you can search on the google images for "science icons" or any other topic which you may want to debate)

SECOND ACTIVITY
- Copies of blank message grids (at least one per group, but make more copies in case participants want to correct their work)
- Post-its
- Large tip black markers (one per group)
- Available for download:
- Communication grids (at least one per group): M3.3.1
- Communication cards with messages (one card per group): M3.3.2

THIRD ACTIVITY
- Set of cards with words (one set per group): the words suggested here are have all been taken from the front pages of popular newspapers, but you can use any set of pictures that loosely relates to the subject you are going to debate, for ex. food, space, health, etc. The words can also be simple/difficult in relation to the target group, as this game can be played by all ages.

Available for download:
- Taboo cards on science news (one set of cards per group): M3.3.3

The workshop at a glance

5 min	Greet participants, introduce yourself and explain why you are doing this training
10 min	Introduce workshop and take home ideas
5-15 min	Activity 1: who am I?
40 min	Activity 2: the communication board
5-15 min	Activity 3: taboo
20 min	Small group discussion
30 min	Large group discussion
5 min	Conclusions by workshop facilitator

REFLECTING ON SETTINGS FOR DEBATE - THE WORKSHOP: STEP BY STEP

Introduce workshop

Time: 10 min
Setting: Participants sit at tables

What to do:
- Address the group by introducing the concept of the workshop: the idea is to think about what can help to create an "effective setting" for debate (You can use the PPT3.3 if you think it is useful).
- This workshop is in fact designed to support activities on debate, yet it can also be used to reflect on warm-up activities in general.
- Warm-up activities are used every day in science centres and museums. They allow us to create a setting in which people can fully and comfortably participate in the experience.
- Activities – especially debate activities – include three basic "ingredients": the individual participant, the interacting group, the topic which is being discussed.
- We can thus reflect on how our warm-up activity:
  helps individuals feel comfortable, making it easy for them to share their knowledge and beliefs.
  helps the group interact effectively, creating a feeling of trust and community among participants, allowing space for individual opinion and reciprocal listening.
  helps participants approach a topic with which they may or may not be familiar, starting to stimulate personal ways of looking at it and understanding what others already know about it.

Activity 1: who am I?

Time: From 5 to 15 min depending on number of participants
Setting: Split participants in groups of approximately 4.

What to do:
- Explain the rules of the game: each person in the group is asked to look at the pictures on the table and quickly choose one of them which he/she thinks describes him/her well enough.
- Each participant is then asked to present him/herself (in a max of 5 minutes) to the rest of the group by motivating the choice of the image.
- Ask participants to try and remember what happened, how they felt etc (this will be useful in the final discussion).

Warm-up 2: the communication board

Time: 40 min
Setting: Split participants in pairs

What to do:
- Give each group a sheet with an 8x8 square grid (M3.3.1), a black large-tip marker and a message card (M3.3.2) with a "secret" message that they have to communicate to other groups
- The groups have 20 min to "compose" the message on the grid, following this rule: they are allowed to colour in as many squares of the grids as they want, but they can only colour them in completely – no half-squares are allowed.
- When finished, ask each group to stick its message grid on the wall or on a table.
- Invite all groups to go round the room, look at other groups' message grids and write on a post-it near each message grid what message they think it transmits.
- Ask participants to try and remember what happened, how they felt etc (this will be useful in the final discussion).

Notes on how to choose the "messages" for the activity

- If you give two groups the same message you can then reflect on the different strategies they have used to communicate it.
- Giving different groups different types of messages (words, sentences, numbers) is interesting because strategies may be different.
- Choosing words, sentences, numbers of 8 digits helps, as it is the number of lines on the board and also the number of bits in a byte (so if you do the activity with your visitors you can link it with a reflection on computers and digitalisation processes).

Warm-up 3: Taboo

Time: From 5 to 15 min depending on number of participants
Setting: Split participants in groups of approximately 4.

What to do:
- Give each group a set of cards (face down so that participants can't see the words).
- Ask each member in turn to pick up a card and has to help the others guess the word on the card. He/she can say anything except for the word itself (like in the classic "Taboo" game).
- The first group to finish all the cards (you can choose how many to give to each group, depending on how much time you have) wins!
- Ask participants to try and remember what happened, how they felt etc (this will be useful in the final discussion).

Small group discussion

Time: 20 min
Setting: As above.

What to do:
The groups are given a reflection task. They discuss and then write on a poster what are the practical features that made each of the three activities good for:
- Making people comfortable (making it easy for them to share their previous knowledge and beliefs)
- Helping people to get to know the group (facilitate the interaction within the group and not only with the explainer)
- Stimulating a first approach to the topic (encouraging different ways of looking at a same topic and setting the ground for presenting one's own opinion as well as understanding what others know about it)

Time for large group discussion

Time: 30 min
Setting: Participants sit all together.

What to do:
- Prompt large group discussion on what happened and what participants have felt and observed when playing the different games.

Examples of questions for prompting large-group discussion

What can be the advantages of using each activity as an introduction?
Which role did competitiveness play? Do you necessarily need a reward?
What was the balance between explainer-centred time and player-centred time?
If you had used this activity as a wrap up at the end of a workshop do you think reactions would have been different?
Do you feel these activities were more fit for adults/teenagers or children? Why?
Did you feel empowered/comfortable from the very start of the activity?
Can you identify the reasons of your comfort/uneasiness?
What are the ways in which the activity stimulated you to contribute your knowledge?
Does the number of people influence the setting? How?
Is it good that activities resemble games that are widely known?
Would the activity help to introduce "difficult" topics? Why?
Are certain aspects too "personal"?
Is it better if the activity is dynamic?
Do shy people get involved? Why?
Does it help if the activity has a product "for someone else"?

Conclusions by workshop leader

Time: 5 min
Setting: Participants sit at tables and workshop facilitators draws conclusions.

What to do:
- Summarise the concepts that have emerged from the discussion, making sure you embrace all points of view and point out the most interesting findings.

4. Science Shows

LUKA VIDIC
(USTANOVA HIŠA EKSPERIMENTOV – LJUBLJANA, SLOVENIA)

Here is the pedagogical material for the workshop on how to create and present a successful science show. Before you start reading the pedagogical material, we would like to briefly immerse you into the world of science shows.

What is a science show? One could briefly describe it as an interaction between the performer/s (usually one or two) and the audience, enriched with experiments. Yet this description does very little justice to the wide variety of forms in which science shows might be presented. Let's expand it!

A science show is not as formal as a lecture. It involves more interaction between the performer and the audience than a standard demonstration. It evolves and adapts to the audience itself. Science shows often include elements of theatre, stand-up comedy, storytelling, circus and much more – all used to create a relaxed atmosphere.
Science shows use what the audience already knows, and take this to a new level of experience and knowledge.

Promoting science is usually the secondary goal of a science show. The foremost objective is to promote learning and understanding through enquiry and questioning.

Science shows have a storyline. They can be based on a theme – for example science shows on electricity or on geology. Or they can be kept together by a context, or story, which links seemingly unconnected experiments.

Science shows can be developed for a specific audience or they can be adapted to different kinds of target groups. In the latter case the experiments and their arrangement remain the same, while it is up to the performers to present the experiments and to adapt the knowledge level to their public.

Science shows are "living" entities with their own evolution. Performers can try different approaches to present the selected aspects of an experiment to a variety of different audiences. For this reason, a written script of a science show with "performing" suggestions is always welcome.

Sometimes an experiment itself or the way it is presented will not work as desired. When this happens it will be changed or substituted by a different one. For this purpose, performers should always have some "parachute" experiments up their sleeves to use in case of need.
"Be prepared for more and show just the right amount" is a good approach for presenting science shows.

We would like to point out the importance of the science show performer! Imagine yourself going sightseeing with a tour guide. A good guide will not mention only dates and give you an evil eye when you ask a question (although it is good to listen to a "word-by-word rehearsed" guide once in a lifetime – so you can appreciate the good ones more). A good guide will connect the sights with a narrative line and plunge you into it: stories and anecdotes make the experience taste much better. We can say something similar of a good science show performer. A good performer is always keen to learn more and should enjoy not only communicating with people, but encouraging them to actively participate in the science show.

Remember, no matter how much good advice you may get from fellow performers and from literature, nothing beats practice!

Some thoughts on theatre in science museums

MASSIMO ABBAMONTE
(NATIONAL MUSEUM OF SCIENCE AND TECHNOLOGY LEONARDO DA VINCI – MILAN, ITALY)

Museums and science museums often host shows and theatre performances. But why should theatre take place in such institutions? What makes museums – and more specifically science centres and science museums – suitable locations for this form of artistic expression?
Among the goals of contemporary science museums are to inspire a connection between collections and visitors, to encourage discussion, to create an informal atmosphere during visits, to enhance an active acquisition of knowledge. In this perspective "theatrical media" can be considered extremely useful tools to engage the public in museums.
Theatre is above all a form of art able to communicate effectively with the public being multifaceted and multidisciplinary. It is based on bilateral communication between the performers and an audience that receives messages through an emotional connection with the story and characters of the performance itself.

Science and technology are not easy subjects to present to the public, but they strongly relate to our daily lives, have a great impact on how we think and behave and often have also an ethical dimension. Theatre describes life in a focused and emphasised way. So science can be part of what theatre investigates and questions.

One of the main advantages of theatre focusing on science in museums and science centres is that the possibility to talk during a performance about scientific issues even if they are controversial, without necessarily having to be neutral. Performers can show absurd situations, stage "politically incorrect" settings or present explicit points of view. In this case, the audience is aware that artistic performances do not have the aim to transmit science contents, but rather that they are situations which help us plunge in an emotional state that encourages questioning on specific topics.

In this perspective the point is not having the public agreeing or not with the views proposed in the narrative; the focus of the narrative stays with making people think about a given topic. Theatre does not give answers, it stimulates personal and conscious reflections.

Moreover, when we participate in a theatre performance we participate in a "playing" process. Children relate to the world around them through play. This can also be true for adults, who can use play to create links with scientific and technological issues of contemporary life. Theatre can and should be an intense and lively means of communication, able to speak to a wide range of people.

Different styles can be adopted to communicate a given topic: from sparkling and humoristic to serious and dramatic. There are therefore different types of performances: interactive narratives in first person, historical representations and role plays, classical drama performances, science shows, etc. Yet these definitions should not prevent contamination between different genres and techniques that can – and should – emerge and merge in museum theatrical performances.

Suggested reading

- Chris Ford, Museum-Theatre, Museum Practice, Issue 13 (volume 5, Number 1) 2000, pp. 62-64
- Jonathan Milton. Laughing matter, Museum Journal October 2006, p. 23
- Catherine Hughes, Museum Theatre: Communicating with visitors through drama, Heineman, Porthsmouth, 1998
- Peter Brook, The Empty Space, 1968

SCIENCE SHOWS

TIPS AND TRICKS TO CONDUCT A GOOD SCIENCE SHOW.

AUTHOR
Walter Ginkels (Technopolis® - Mechelen, Belgium)
Luka Vidic (Hisa Eksperimentov – Ljubljana, Slovenia)

AIMS
This workshop aims to enhance the confidence of explainers in performing an entertaining and instructive science show for adults.

The workshop shows the development of an explainer in giving a successful science show. Within every phase of this process, tips and tricks will be provided to master this 'art'.

What is a successful science show? The answer to this question depends both on the culture of the audience and on the performer. What works in one country will not necessarily work in another. Something that is entertaining when done by one explainer, could be a bummer when done by someone else.

This workshop will only facilitate the growth of an explainer towards the art of performing a good science show. There are no golden rules nor an absolute key to success. Much depends on the creativity and personality of the performer.

This aside, there are a couple of basic techniques that work. They are presented in this workshop. Communicating science to adults isn't always easy, moreover using science shows as a medium isn't always an obvious choice. Although a show is often linked with explaining science to children, it can also be very useful to use for adults.

YOU CAN USE THIS WORKSHOP TO
- Get tips on how to conduct science shows and other similar activities.
- Reflect on the general skills needed to perform in front of an audience.
- Show that one problem can be solved successfully in many different ways.

TAKE HOME IDEAS

Science shows are not only for children.

Science shows depend on cultures and rely strongly on the performer.

Demonstrating scientific principles will ensure deeper learning.

An experiment can fail. It's the reaction of the explainer that never fails.

SCIENCE SHOWS - BEFORE YOU START

Timing
1.5 or 2 hours + one short assignment given to two or more participants (preferably 2 weeks before the workshop)

Workshop facilitators
This workshop can be conducted by one workshop facilitator, although it is useful to have a co-facilitator who can assist and interact.

Number of participants
From 10 to 25.

Space organisation
During the workshop there is no need for tables. It's actually best to remove them from the workspace. This ensures a rapid reorganization of chairs.
The actual workshop starts with a presentation. Therefore the chairs need to face a projection screen.
There is no need to take notes. Handouts of the presentation can be printed as a reminder.
For the second part of the workshop, the group is split in smaller groups of 3 to 4 participants.
Groups are spread out through the room, not to disturb each other.

Materials
- Flip charts (one for each group)
- Markers (one for each group)
- Projector with computer and screen (optional but recommended)

Available for download:
- Workshop leading presentation: PPT4.1

The workshop at a glance
Pre-assignment given to two or more participants (preferably 2 weeks before the workshop)

5 min	Greet participants, introduce yourself and explain why you are doing this training
25 min	PPT presentation
30 min	Tips and Tricks (optional)
15 min	Discussion in small subgroups (question 1)
15 min	Discussion in small subgroups (question 2)
30 min	Presentation by every subgroup and conclusions by workshop facilitator

SCIENCE SHOWS - THE WORKSHOP STEP BY STEP

Pre-assignment given to participants (preferably 2 weeks before the workshop)

Time: 10 min
Setting: You can ask participants to fulfil the assignment wherever they want and send you their materials.

What to do:
- Ask two or more participants to note down on a piece of paper the problems they normally encounter when performing a science show. This ensures that the workshop is specifically tuned to the needs of the participants rather than being a general and abstract presentation.
- Turn those problems into "how to… ?" questions. Some examples:
  how to invite adults as volunteers on your stage? How to act when an experiment goes wrong?
- Reduce these to approximately 10 questions by combining related themes and ideas into one question.
  Make sure that none of the problems is left out.
- Include these 10 questions in the last slide of PPT4.1 as an initial input and warm up for discussion.

PPT presentation

Time: 25 min
Setting: As above.

What to do:
- Use PPT4.1 to start the workshop and to present and discuss the steps which are needed to perform a successful science show. Also do's and don'ts are discussed.

Note on the presentation

Try to familiarise yourself with the presentation and adapt it to your own performing style.
It is important to speak from personal experience.
Every part of the presentation can be illustrated with a scientific experiment to show and strengthen the content of each statement. This can make the presentation looser, more fun and more relevant to what is done in your institution.

Tips and Tricks (optional)

Time: 30 min
Setting: Participants sit in front facing the facilitator/s

What to do:
- After do's and don'ts we recommend a short presentation of tips and tricks.
  These can analyse specific situations or versions of science shows.
- Invite one experienced science show performer (or yourself) to perform a science show or a small piece of it. You can decide instead that you want to invite several science show performers (in this case, limit the time to 2 minutes per presenter). In any case, the performance should be based on a "show and tell your experience" structure, so that presenters can speak about their own suggestions on do's and don'ts from personal experience.

Discussion in small subgroups (question 1)

Time: 15 min
Setting: Participants split in small groups of 3 to 4

What to do:
- The last slide of the presentation is the one with the 10 questions from participants. These are the basis for discussion within the subgroups.
- Distribute flip charts and markers to groups.
- Ask each group to choose 2 questions from the final slide.
- Ask each group to discuss one of the two questions for 15 minutes and ask them to note down on the flip charts their suggested solutions based on personal experience or on what they have heard in the presentation.

Discussion in small subgroups (question 2)

Time: 15 min
Setting: As above.

What to do:
Repeat the above actions for the second question chosen by groups.

Presentation by every subgroup and conclusions by workshop facilitator

Time: 30 min
Setting: Participants can stay were they are and sit facing the facilitator

What to do:
- Ask each group to present its solutions for one of the questions. This can be done by the spokesperson of every group (of course this person can be assisted by the other group members).
- Encourage groups that have chosen the same questions to complete and participate in the presentations. In any case you should try to facilitate reactions by all participants.
- Ask someone from each group to note down all the integrative solutions that come up in the plenary discussion so that you can then create a report to give to participants after the end of the workshop.
- After all subgroups have presented their first question, proceed with another round of presentations for the second question.

Notes

Contributions and acknowledgments

Editing

Camilla Rossi-Linnemann
Contact: **linnemann@museoscienza.it**
National Museum of Science and Technology Leonardo da Vinci – Milan, Italy

Pilots Project Coordinator

Michael Creek
Contact: **mcreek@ecsite.eu**
Ecsite, the European Network of Science Centres and Museums – Brussels, Belgium

Authors

Massimo Abbamonte
National Museum of Science and Technology Leonardo da Vinci – Milan, Italy
Contact: **abbamonte@museoscienza.it**
Massimo Abbamonte works in the Education Department of the Museum as a science theatre expert. He holds a BA degree in Physics and is also a professional actor. Before becoming trainer, he worked as explainer at the Museum for several years. Recently, he participated in the Dotik European Training School for Young Scientists and Museum Explainers both for his personal development and for transferring the expertise acquired to the explainers of the Museum.

Sara Calcagnini
National Museum of Science and Technology Leonardo da Vinci – Milan, Italy
Contact: **calcagnini@museoscienza.it**
Sara Calcagnini is in charge of the Science & Society programme. She holds a BA degree in Cultural Heritage. Her expertise focuses on participatory strategies used by museums and science centres for engaging adult citizens in dialogue on cutting-edge science. In the Museum she works for the development of programmes for adult visitors based on active engagement and dialogue with science experts. She is also involved in European cooperation projects on European citizenship and informal learning. She contributes to teacher training activities focusing mainly on methodological issues.

Walter Ginkels
Technopolis®, the Flemish Science Center - Mechelen, Belgium
Contact: **walterg@technopolis.be**
Head of Edutainment, Walter Ginckels is responsible for developing and performing shows inside and outside Technopolis® since 2003. He also participated in different RAP sessions (Round-table for the Advancement of the Profession on 'Travelling Science: Mobile Exhibition Projects').

Antonio Gomes Da Costa
Contact: **agomesdacosta@ecsite.eu**
Antonio Gomes da Costa was a teacher and a researcher in the field of bioenergetics. In 1996 he received a PhD from the University of Coimbra, Portugal, where he worked as associate professor until 2000. In 2000 he started working for the Ciencia Viva, the Portuguese National Agency for Scientific and Technological Culture. He became Head of Education and, after, Director of the Pavilion of Knowledge, in Lisbon. He was the Portuguese coordinator for several EU Projects in Science in Society. He is presently at Ecsite, as Coordinator of the PLACES Project - Platform of Local Authorities and Communicators Engaged in Science.

Miha Kos
Ustanova Hiša eksperimentov – Ljubljana, Slovenia
Contact: **miha.kos@h-e.si**
Miha Kos was born in 1962 in Slovenia. He defended his PhD thesis on MRI in the Earth's magnetic field in 1992. He worked as assistant professor in the Physics department of the University of Ljubljana, Slovenia, and as postdoc in Albuquerque, USA. After returning to Slovenia it was his idea to establish the first "hands-on" science centre in Slovenia. The centre was established in 1996 and the first permanent premises were gained in 2000. Since 1996 he is the director of the centre. He is also author of several science popularisation TV shows, four science on stage shows and several hands-on exhibits. For 14 years, he is also the chief editor and co-owner of the children's magazine for curious children.

Sofia Lucas
Pavilion of Knowledge – Lisbon, Portugal
Contact: **slucas@pavconhecimento.pt**
Sofia Lucas is a former Mathematics teacher and since February 2007 has been working in the Educational Department. During this time she has participated in some European projects such as Pencil, and she is now involved in other European projects (FP7): Time for Nano, My Ideal City and Open Science Resources. Besides developing pedagogical contents for these projects she also works in the financial management. She participated in the last three Ecsite Conferences with presentations about establishing sustainable relationships between science centres and schools. Currently she is Head of the Training Centre for Teachers (development of new training courses, evaluation and financial management).

Anne Lise Mathieu
Universcience | Cité des Sciences et de l'Industrie – Paris, France
Contact: **anne-lise.mathieu@universcience.fr**
Anne Lise Mathieu is head of the explainers' service in the Cultural Affairs Department of the Cité des Sciences et de l'Industrie. She has two Master degrees, in psychology and in ethnology. She is managing a team of 30 explainers working with different types of publics. She is coordinating a work on innovative products of informal learning for adults. She was an explainer herself for fifteen years and has developed different activities for specific publics (visually impaired persons, young adults in reinsertion...). Since 2006 she actively participates in a work group with five major French museums (Palais de la Découverte, National Museum of Natural History, Musée National des Arts et Métiers and Musée du Quai Branly).

Paola Rodari
SISSA Medialab – Trieste, Italy
Contact: **paola@medialab.sissa.it**
Paola works as content developer and project manager for the realization of science exhibitions and science centres. She teaches Museums Studies at the Master in Science Communication at SISSA, Italy. She was the coordinator of the DOTIK project (FP6, Science and Society), designing and testing new schemes for the training of museums explainers, and has been involved in other European projects: SEDEC – Science Education for the Development of European Citizenship; CIS – Communication in Science; FUND - Facilitators Units' Networks for Debates. She is in the steering committee of Ecsite THE group (the Thematic Human Interface and Explainers group), promoting the professional growth of museum educators.

Camilla Rossi-Linnemann
National Museum of Science and Technology Leonardo da Vinci – Milan, Italy
Contact: **linnemann@museoscienza.it**
Camilla Rossi-Linnemann holds an MA in Museum Studies (Leicester University – UK) and a Bachelor in Art History (University of Milano – Italy). At the Museum she works in the Education and International Relations department on the development of networks and collaborations with museums and science centres at international level, participates in the management of EU funded projects, develops pilot projects for engaging new audiences, researches issues of accessibility of historical collections and of hands-on educational activities.

Luka Vidic
Ustanova Hiša eksperimentov – Ljubljana, Slovenia
Contact: **luka.vidic@h-e.si**
Luka Vidic was born in Kranj in 1978. He graduated at the Faculty of Mathematics and Physics in 2002 and is a high school teacher of physics. He started to work in Hiša eksperimentov in 2000, first as an explainer and from 2001 also as a presenter of Science Adventures. He became an employee in 2004 as Activity Editor. Apart from constructing new exhibits, presenting Science Adventures and writing science popularisation articles his work also includes organisation of science competitions, workshops and public science popularisation lectures. He also takes part in local and international projects.

Special Thanks
Pilots partners also wish to thank all the explainers from across Europe who took part in the international training courses for which these materials were first created. Their professional contribution was extremely precious and has helped to select and review these pedagogical materials, making them even more relevant to everyday practice of professionals in science centres and museums.
We also wish to thank, for their precious contribution in the development of workshops: Enrico M. Balli, Marie-Josée Couchaere, Laurence Denis, Matteo Merzagora, Enrico Miotto, Vesna Pajic Djukic, Matthias Reuter, Federica Sgorbissa, Donato Vozza, Maria Xanthoudaki, Sabina Založnik Vidic, At Bristol staff.