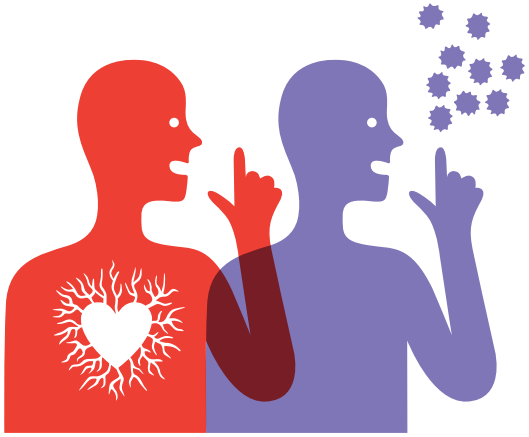

PILOTS

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
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EACEA
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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

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

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

Contributions and acknowledgments

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