IRRESISTIBLE EXHIBITION DEVELOPMENT GUIDE

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Engaging the Young with
Responsible Research and Innovation

IRRESISTIBLE EXHIBITIONS A DEVELOPMENT GUIDE

During Work Package 3, groups of teachers and students will be involved (and supported by the local Community of Learners — CoL) in the development of exhibitions addressing the concept of Responsible Research and Innovation. Through this process, teachers and students will understand that uncertainty and risk are inherent to scientific and technological enterprises. So, research and innovation must be driven by responsibility. Teachers will also develop their expertise on how to address Responsible Research and Innovation (related to cutting edge scientific and technological issues) through the construction of exhibitions centred on such issues. These exhibits will take place in schools, universities, and science centres or museums. This work package can be triggered, for example, by a visit to a science centre, a museum or an exploratory.

Teachers and students would consider not only the content of the exhibition but also its production values. The construction and presentation of exhibits will function as a pretext and a context to study the impact of this process on teachers' personal and professional development and students competences.

Each partner in charge of this work package will be responsible for finding three teachers and three groups of their students willing to participate in this process. The partners, the scientists and the science centre experts will be responsible for following and supporting the work of each group and studying the impact of this process on teachers and students. The idea is that the project team will produce a coherent set of exhibits that will combine into a travelling exhibition, which can be displayed in the different countries in appropriate places like science centres.

The different exhibitions should be interactive and should approach different aspects of Responsible Research and Innovation.

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IRRESISTIBLE is a project on teacher training, combining formal and informal learning focused on Responsible Research and Innovation.

It is a coordination and support action under FP7-SCIENCE-IN-SOCIETY-2013-1, ACTIVITY 5.2.2 Young people and science: Topic SiS.2013.2.2.1-1 Raising youth awareness to Responsible Research and Innovation through Inquiry Based Science Education.

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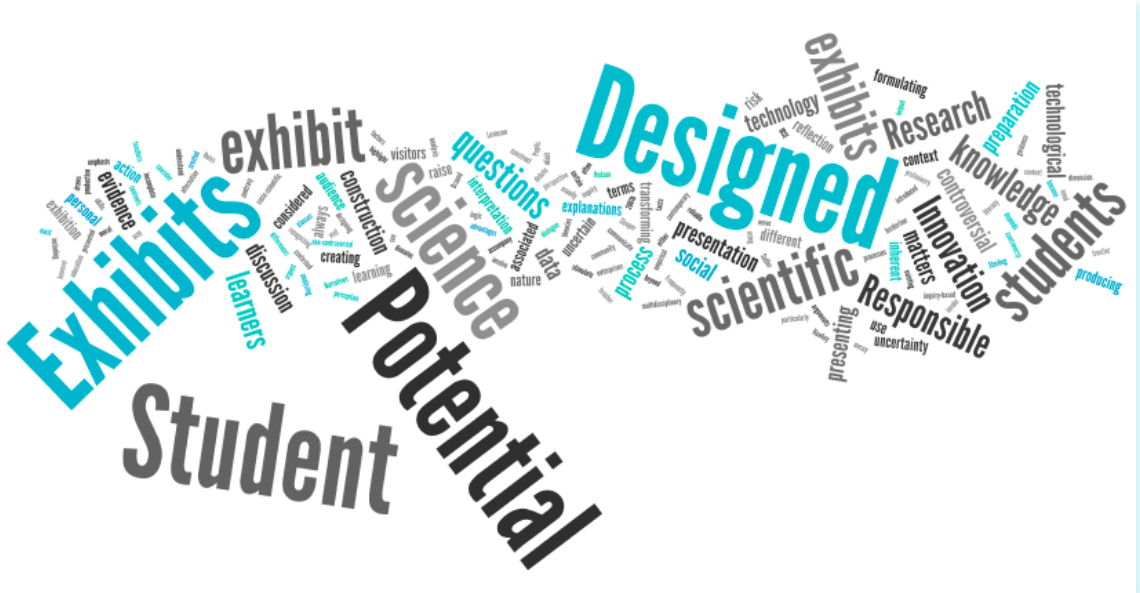
THE POTENTIAL OF STUDENT PLANNED AND DESIGNED EXHIBITS ABOUT RESPONSIBLE RESEARCH AND INNOVATION

Pupils devising and presenting an exhibition is a means of transforming science from product to process (Hawkey, 2001). One of the advantages of both producing and presenting an exhibit is that it draws upon the facets of IBSE: in producing an exhibition pupils can re-present scientific facts as speculative questions, transmissive teaching can be transformed, and the audience at the exhibit can construct their own learning. By presenting frontier knowledge or by using an exhibit to raise questions they become learners with their visitors. Encouraging students to research their own interests under the guidance of a teacher develops skills of formulating questions, collaboration and observation (Sleeper & Sterling, 2004).

The construction of exhibits can invoke inquiry-based approaches and the use of narrative to address the concept of Responsible Research and Innovation. In the process of either creating an exhibit or modifying an existing exhibit the emphasis would be on eliciting personal reflection by those engaging in the exhibit. Narratives can be created from a multidisciplinary perspective. In designing an exhibit, or a narrative/ inquiry focused dialogue to accompany an exhibit, students would need to consider how the exhibit gets the audience thinking about issues of Responsible Research and Innovation.

During these exhibits' preparation, learners will ask questions, use logic and evidence in formulating and revising scientific explanations, recognizing and analysing alternative explanations, and communicate scientific arguments.

Through the construction and presentation of exhibits on Responsible Research and Innovation both teachers and students are introduced to a



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different type of science from the one that is usually presented in science classes. Most of the formal science education focuses on a conventional, non-controversial, established and reliable science. On the contrary, cutting-edge scientific and technological matters highlight a "borderline science", that is controversial, preliminary, uncertain and under debate. The controversial dimension refers to "differences over the nature and content of the science such as the perception of risk, interpretation of empirical data and scientific theories, as well as the social impact of science and technology" (Levinson, 2006, p. 1202).

"Science is messy in application, often associated with complexity, uncertainty and controversy" (Jarman & McClune, 2007, p. 122). So, students must be helped to understand that relevant science knowledge may be considered as incomplete, uncertain and contested. Frequently, decision-making regarding scientific and technological matters depends on knowledge from different domains (not only from science and technology knowledge).

The preparation of exhibits on Responsible Research and Innovation helps learners to see that uncertainty and risk are inherent in scientific and technological enterprises: however strong the evidence for a theory, there are always the possibilities of alternatives; that data on which evidence is based is never certain but always has a degree of error associated with it; that the interpretation of data is influenced by many factors including contemporary knowledge and social context. The production and presentation of exhibits can involve students in inquiry and discussion. The discussion inherent to the preparation of exhibits on Responsible Research and Innovation can be particularly useful both in terms of learning about the contents, the processes and the nature of science and technology, and in terms of the students' cognitive, social, political, moral and ethical development (Hammerich, 2000; Kolstø, 2001b; Millar, 1997; Sadler, 2004).

Exhibitions about RRI, as a socio-cultural context, can raise questions, elicit personal reflection and stimulate conversations between students and visitors, transforming both of them into learners (Braund & Reiss, 2004).

The process of exhibits' construction and presentation allows students to move beyond analysis and discussion, creating an opportunity for them to participate in (and even to instigate) community action on socio-scientific controversial matters. Community action is frequently considered a major aspect of scientific literacy (Hodson, 1998; Roth, 2003).

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INTERACTIVE EXHIBITIONS

In the context of research in communication there are several coexisting vision for the concept of interactivity — from the ones that restrict it to a communicative experience mediated by technology, to the more encompassing ones that include all communication forms, including some mediated. Also in the domain of research in museums the notion of interactive exhibitions is not consensual, resulting from the concept of interactivity being used. However, according to Tost (2005) in the context of science centres and museums, interactivity seems, in general, to beclosely related with Information and Communication Technologies (ICT), and therefore is usually assumed as technologically mediated phenomenon.

Between the several existing definitions for the concept of interactive exhibitions, one of the most consensual ones is probably the one advanced by Hill and Miles (1987) according to whom real interactive exhibitions are those who change their presentation as a function of the designer's perception of the visitor's response (Ree & Kim, 2013). In this definition, the participant's response takes a crucial role, and may even take an effect on the exhibition itself. Bitgood (1991) also defines interactive exhibitions in a similar manner, putting the emphasis on the user's ability to change the exhibitions through his response to it. This author restricts his definition to the visitor's physical interaction with the artefacts, excluding mental interactions.

In the context of an interactive exhibition, the visitor his expect to attain a response from the exhibition through his actions on it (Bilda & Edmonds, 2008). Within this context, interactivity does not necessarily require a physical action from the visitor since one can be actively engaged in a process without any physical interaction. In this context, Wagensberg (2001), focusing on the interaction between subjects (visitors) and objects that takes place in science museums defined three levels of interactivity: manual or hands-on, mental or minds-on, and cultural or hearts-on. In the first, the visitor is expected to manipulate models, objects or artefacts — and because of this physical manipulation, he may be better able to understand the workings and the development of processes and natural phenomenon. When genuine, this type of interactivity allows a through dialogue between the visitors and such phenomenon, bringing him close to a scientist's role. However, Wagensberg points out that this type of interactivity requires much more than the simple touch of a button. Mental interactivity allows the visitor to practice his understanding of science, distinguishing the wood from the trees when comparing phenomena's, and finding similarities between what may apparently be different. It expects that the visitor, taking the museum artefact as a starting point will be able to establish connection with his daily life, with other phenomena and situations that may have similar essences and so develop his understanding of the world. For Chelini and Lopes (2008) exhibitions dealing with controversial scientific issues may easily fit into this type of interactivity. Exhibitions where the dialogue between different perspectives is stimulated and that challenge the visitor from both a

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cognitive and an emotional standpoint, leading him into adopting a critical stance.

Even though science is universal, the reality where it takes place and develops is not, and for this reason it is important to consider also the third type of interactivity — cultural or hearts-on. For this reason, exhibits should take into account the collective identities present and contextualizing the museum, stimulating the visitor's recognition of the local community with the exhibit; and when the visitor is not local promoting his awareness to a new culture. For Chelini and Lopes (2008), this is the type of interactivity that is promoted, for example, when a zoology museum chooses to build its exhibits based on local and traditional flora and/or fauna, promoting a local visitor's sense of identity and raising a non-local visitor engagement and awareness to a new environment. According to these authors, the expression "glocal focus" may illustrate this type of interactivity, since it advocates the development of global issues from a local perspective, and vice-versa. This allow for the development of familiar connections (from local to global) and the bridging towards more distanced themes (from global to local) but also the value and identity of local communities.

Referring to these three types of interactivity, Wagensberg comments that the ideal situation would be for their simultaneous presence. However, he defines a gradient of importance where manual interactivity is seen as convenient, cultural interactivity as desirable, and mental interactivity as essential.

The socio-cultural theory of learning emphasizes the idea that meaning emerges from the interaction between individuals that act on social contexts and from the mediators present in such contexts. According to McLean (1999) the social interaction amongst the visitors of an exhibit is, probably, one of the biggest contributions of museums for the current day social dynamics. The monitors present in the exhibits — as well as others, such as actors and storytellers — develop the context and encourage the visitors to interact amongst themselves and with the exhibition. In the absence of such mediators, it is the responsibility of the artefacts themselves to develop this mediation, promoting the social interaction that supports the visitor's understanding and knowledge development.

Even though, in the museum context, the expression interactivity is strongly anchored with the expression "interactive exhibition", for Tsitoura (2010) the "interactive" adjective is only a result of the use of ICT, ignoring most of the time the social and emotional aspects behind every museum exhibit — as a context – and interactivity — as a process. Exhibits have a tendency to be characterized as interactive even when their interactive value is very limited. This approach reveals a conception of interactivity that goes beyond the use of ICT. Tsitoura considers that interactivity may even be present when museums do not label their exhibits as "interactive".

The author criticizes the fact that many museums advertise their exhibits as interactive (simply because they use

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ICT), in a clear marketing campaign, relegating to a second level their educational role as promoters of critical thinking, crucial for the development of both individuals and society. These museums, by not conceptualizing interactivity as a process, but only as a product of the use of ICT, are missing a precious opportunity to contribute to truly engaging educational experiences.

Research has been able to show that a visitors' experience in a museum is greatly influenced and shaped by the social interaction and dialogue developed between visitors (vom Lehn et al. 2001; Crowley, 2000; Leinhardt et al., 2002). In addition, it has been shown that learning and cognitive development are supported when the participants engage in lasting activities with artefacts, and when they are engaged in social interactions and discussions with other participants (Heath, vom Lehm & Osborne, 2005).

There are several studies illustrating how computers can be extremely attractive to people, especially children, and how they can facilitate social interaction (Scrimshaw & Wegerif, 1997). However, it's use in the context of museum exhibits, even though it promotes a longer time spent by the visitors (Serrem & Raphling, 1992) does not seem to be effective for the promotion of social interaction (Flagg, 1994). Even so, more and more exhibits using computers are seen as a way for museums to effectively communicate with their audiences, as well as new ways to promote participation and interactivity, and so stimulate social interaction and discussion among the participants (Bradburne, 2000; Thomas & Mintz, 1998).

According to Hindmarsh, Heath, vom Lehn and Cleverly (2005), most interactive exhibits adopt a very poor concept of interactivity, related mostly with the individual engagement of the visitor with the exhibit/artefacts; and leaving the interaction between the visitors as a lesser concern, or completely absent. In addition, the so-called multi-users exhibits, even though one could expect them to promote interaction between visitors, fail in this purpose since they are planned to promote the simultaneous individual engagement of several users with the same artefact, they are not collaborating or interacting in any creative way — they are only acting in *tandem*. For these reasons, the authors recommend that it is crucial for museums to reconsider their concept of interaction when planning and developing exhibitions.

Hindmarsh, Heath, vom Lehn and Cleverly (2005) react to some studies identifying a positive relationship between the use of interactive artefacts and the time spent by visitors, presenting this relationship as possibly responsible for a more efficient learning given the fact that the visitors are more effectively engaged with the artefacts. These authors developed studies on exhibits requiring the use of touchscreens, revealing that most of the time spent by the visitors was used to understand the functioning of the artefact, instead of being used in the discovery and engagement with the educative message being explored. Based on these studies, these authors developed some guidelines that should be taken into account when developing an interactive exhibit that also aims to incorporate interaction between the participants. With this goal they suggest

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that opportunities should be created allowing the visitors to established a continued interaction and providing resources for them to model and creatively reconfigure each other's experiences, for example, changing some display aspects.

This is in clear contrast with many exhibits that follow a strict stimulus-response model, where participants are expected to perform an action (for example pressing a button) that triggers an effect. On the contrary, Hindmarsh, Heath, vom Lehn and Cleverly (2005) encourage the design of exhibits that are easy to transform and are collaboratively supported leaving a trail of activity for future visitors.

Tsitoura (2010) also considers important for museums to redefine their concept of interactivity and reflect about ways to implement it that go beyond traditional conceptualizations — that see it only as a characteristic of technologically mediated communication, and established in a philosophy of transmission as communication. According to Hooper-Greenhill (2000) the notion of communication associated with the concept of interactivity should not be seen as transmission, but instead as culture. The transmissive model describes communication as a linear process where information is transferred/transmitted from an authorative source to a non-informed receptor. Knowledge is regarded as objective, singular and without value. The message recipient is conceived as open to the proposed message. Which in turn is received more or less efficiently and in the same manner by all participants. This reveals an extremely limited view of communication sustained in technical practices and ignoring both social and cultural processes. On the other hand, the cultural model of communication is focused on the way meaning is constructed and supports communication as an integral part of culture — as a set of negotiated processes of meaning construction and part of a complex and diverse culture. This model accepts the coexistence of different perspectives, often in conflict, of how the world can be explained.

Therefore, and following the reasoning of Tsitoura (2010), museums that intend to promote interactivity from a non transmissive perspective, should make an effort to become spaces of dialogue that foster participation and interaction among visitors. Communication is not inherently interactive, or always developed from a bidirectional perspective – unless the responses are relevant and there is reciprocity for the messages exchanged between the participants. In the museological context, the main characteristic for interactivity is the promotion of opportunities for the visitors to be actively engaged in the museum spaces, and consequently have an effect on the exhibits. For Tsitoura (2010), more than discussing how to promote interactivity through the physical characteristics of the artefacts, the most important thing is to discuss the ideological, social and historical perspectives of what we want to communicate, and how we intend to do it. Moreover, we should consider how to actively engage citizens that are part of a changing society.

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Therefore, the active participation of visitors/leaners is a keystone to foster an effective learning environment, with dialogue being the key to promote participation – allowing the participants to raise hypothesis, argue, and challenge others, developing arguments that support their conceptual understanding and justify their points of view (Heath, von Lehm and Osborne, 2005). With other participants doing the same, this will fuel the emergence of a more clear conceptual understanding, with the knowledge developing as a co-construction of the group. In this context, social interaction is a key requisite for this construction to take place. The capacity for an exhibit to foster this kind of environment is a direct measure of its degree of effectiveness. In this way, it becomes fundamental for museums to put social interaction in the centre of their agenda. Otherwise, they will keep on experiencing the frustration of having visitors using their interactive artefacts in unexpected ways, and be faced with disappointment with their conducts, experiences and learning assessments.

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Interactive artefacts: What characteristics?

In the context of multimedia artefacts developed to support Learning, interactivity can and should be more than allowing the user to choose his own path in an application, only by "point and click" through a bunch of buttons and menus (Cairncross & Mannion, 2001). If we aim to foster deeper learning, then the applications should actively engage the user, challenging him with tasks to accomplish – allowing for the application of the new knowledge being presented/ introduced. It also important to stimulate the reflection about the experiences that are carried out.

Several authors have dedicated themselves to studying how can multimedia applications stimulate real interactivity and so foster the users' deeper learning (Caincross & Mannion, 1999; Rogers & Scaife, 1997). Aldrich, Rogers and Scaife (1998) consider that it is fundamental to design Learning activities that cognitively engage the user, leading him to reflect about the material being presented, its meaning, relevance, and how it can be applied in a variety of contexts.

There are several ways for the user to interact with multimedia artefacts: manipulating virtual objects on a screen, or different variables when simulating experiences or industrial processes. This allows them to safely experiment and analyse the consequences of choosing either a correct or an incorrect path, promoting a deeper understanding of a given subject. Users may even have access to alternative paths that may have positive or negative consequences. Interactivity is also closely related to role-playing, allowing the user to take into account a variety of perspectives. There may also be immediate assessments, with immediate feedback: the results may be stored allowing developers and users to monitor progress.

Interactivity can also be used in the context of synchronous and asynchronous communication between groups of learners' through the use of email, discussion forums and videoconferencing. This stimulates the users to apply the new knowledge being introduced in the context of a discussion with others, while at the same time facing him with alternative interpretations, helping to clarify any miss conceptions. This process of dialogue encourages reflexive thinking and promotes reconceptualization, leading to a deeper knowledge and understanding of the learning materials (Mayes, 1995). For McKendree et al. (1997), learning can be stimulated when the users/learners can have access to the discussions of previous groups who studied the same topics.

Allowing the learner to stop and reflect about the material that he is visualizing is very important, and can be accomplished through the inclusion of self-assessment questions. Interactivity may also be used to learners engagement with the activity, and therefore is learning, through the use of virtual questionnaires that allow him to test and apply his knowledge.

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INTERACTIVITY SCENARIOS FOR EXHIBITS

Next, we will present a set of interactivity scenarios sustained by a concept of interactivity that goes beyond physical interactivity with the artefacts, to require a mental or *minds-on* interactivity, accomplished through the characteristics of the artefacts promoting the mental engagement of the visitor with the exhibit. This perspective is also sustained by a conception of interactivity that privileges the interaction between visitors and with the artefact designers. Even though it may be mediated by technologies, we consider that interactivity may be present even when technologies are not; or that if present, it may not be the most important facet of the artefact.

For all the presented scenarios it is crucial to develop the conditions for the visitors to conduct the activities — required by the artefacts — in an interdependent mode, requiring them to collaborate, discuss, and share ideas and arguments. Another common characteristic is the opportunity for visitors to leave their mark in the exhibit — as a comment (for example in a poster) or by changing the configuration of some of the elements in the artefacts/ exhibit. It is also important that all of them, by the end of the exhibit, answer a questionnaire (online or in paper) about the impact of the exhibit in their understanding of the topics and about the possibility that it may have effectively made aware to change their behaviours. This will be important for the exhibit designers (students) to have access to the visitors' opinions and so assess their work.

SCENARIO 1 POSTER

The poster may explain the research design used by the students throughout their project — including text and images. As a matter of fact, any scientist has, as one of his priorities, to make the results of his work available for a larger scientific community. The visual presentation of the results as a poster is one of the possibilities to accomplish this task. Posters, being majorly static graphic presentations, allow for careful reading and understanding of their contents. Moreover, if the author is present, they facilitate direct contact and foster interesting discussions.

A poster should be considered a purely visual communication mode, meaning that it is an illustrated summary not requiring any spoken explanation. But, it will only fully accomplish its goal if it can attract and fixate the natural curiosity of a passer-by — being visually appealing.

OPTION 1 Physical poster

There are some recommendations to take into account when planning and choosing the materials for a poster — that will globally improve its ability to capture and retain the observers' attention.

The best way to plan this work is through a simulation; it is important to use a workbench or table top with the

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required measurements, or use a piece of paper with the dimensions of the final poster, where all the elements that are going to used can be included in order to study the interaction and dynamics between them.

On the poster's structure, it should be taken into consideration that the titles and subtitles play a defining role on its ability to capture the audience's passive attention. The choice of words is also of extreme importance, and preference should be given to small, simple, and evocative sentences. Besides the title and names of the authors and institutions that introduce the poster, it is common to divide the remaining information into basic units or sections — introduction, main topics (materials, methods and results), and conclusions. Both the introductions and conclusions should be short, and structured in a light and stimulating reading style, since they are the observer's immediate reading targets. Only after that, and if the topic raised is curiosity, will the observer read the poster with greater attention.

The main section should be written in a simple and concise mode, using short sentences. The exclusive use of capital letters should be avoided since they occupy 40-45% more space and lower-case and reduce the reading speed. Bibliographical references should be avoided since a poster's dynamic is completely different from a scientific paper or book.

The text section and visual elements should be placed on the supporting background occupying similar areas in order to compose a balanced set. The use of colour can greatly help the posters dynamic, highlighting the main sections over the less important ones. In general, it is recommended to use warm, clear, and appealing colours, for the backgrounds, and more saturated colours for the frames, lines and arrows. If the goal is to establish a duality between colours, it is convenient to use contrasting choices — but not to aberrant… the use of textured support surfaces or the creation of three dimensional elements — using, example, cardboard or Styrofoam — also contributes for the same goals.

The text is also an integral part of the poster: considering that it is going to be read from at least a one meter distance, it is important to carefully consider the choice of font styles and sizes. A less fortunate choice will make the poster hard to read and tiring for the observers. For these reasons, it is recommended to use our choice should rest on fonts with few curves such as Helvetic or Times New Roman, preferably bold. As a function of the font size it is then important to establish a hierarchy of values for the text: the title should be composed by the larger capital letters and dimensions (4-5 cm) capable of capturing an observer's attention from a 5 meter distance. The names of the authors and institutions may be written in a smaller size than the one use for the subtitles — capital letters with a dimension of 2,5 to 3,0 centimetre. Overall the entire title, authors and institutions set should not account for more than 18 cm in height. The main text should be in lower case font with dimensions between 0,8 and 1,0 centimetre.

Figures are the most appealing feature on a poster, and, therefore, should

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be carefully considered and planed for. In order be readable from 1,0-1,5 meters, illustrations should be designed with thick lines and have sufficient contrast — such as tables, graphs and diagrams. When necessary, the scale should not be forgotten, and captions should be preferably presented horizontally. It is recommended to avoid too much uniformity, creating a diversity of visual elements with a variety of dimensions; the amplification that they may be subjected to should not be more than the dimension of an A4 sheet (21,0 x 29,7 cm). All visual elements can be emphasized if they are framed with a small line of different colour or texture from the background.

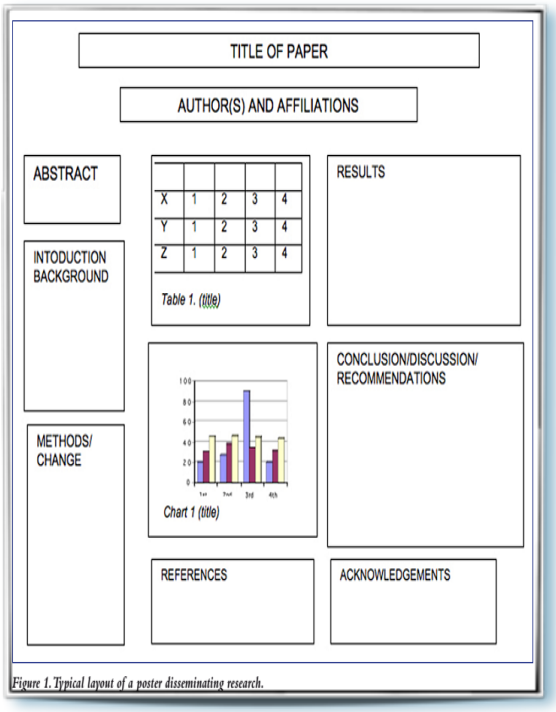

Figure 1 – Typical layout for a scientific research dissemination poster (Hardicre, Devitt & Coad, 2007, p. 399).

Even though it is a physical artefact, a poster can be an excellent promoter of interactivity. For example, if made of detachable Velcro panels, it may allow the visitors to "build" their own poster as function of their understanding of a given topic. It would also be interesting to have more panels than places in the poster, allowing the visitors to choose the panels that were more relevant according to their perception of a given topic.

Another option could be to design the poster but allow the visitor to choose only the panel to be used in the results or discussion sections. The interaction between visitors could be promoted if they were asked to, organizing teams, choose the most adequate panel — and then compare and discuss their choices. In this way, this artefact could be the trigger for an interactive experience, allowing each visitor to choose the end of the poster. It would also be interesting if the visitors, after making their choice, registered their arguments so that the next visitors could have access to them, and so confront their own choices with it.

OPTION 2
Digital poster

Students can also design their posters using web 2.0 tools such as *Glogster*: http://edu.glogster.com. Through this application they may select a poster model — from within several existing ones — or develop one from scratch, and include in it all the different elements that they would like to use.

Contrary to physical posters, digital posters allow for the embedding of other elements besides text and static images — students may also embed videos illustrating a given phenomenon (using something already available or developing

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their own), sound (audio files such as podcasts or music — from a database or developed by them, and hyperlinks for webpages or other objects. Through the use of these elements it is possible to engage the visitor in a more interactive and appealing experience mediated by technology.

The option for interactive digital posters requires the resource to devices allowing for its display — computers or tablets — and Internet access. This may be a limitation in some schools and/or museums and science centres where such equipment is not available. Furthermore, the simultaneous and congregated of these digital posters — done using small size screens, such as traditional computers and/or tablets — may be limiting, restricting the social interaction that such objects could promote.

Figure 2 – Example of a poster designed with Glogster (source: http://edu.glogster.com/).

SCENARIO 2
BOOK

OPTION 1
Classical book

The option for a classical book — that may be constructed with a variety of materials besides paper — may allow for the simultaneous access to various visitors. For this effect, students can construct a book larger than the traditional dimensions.

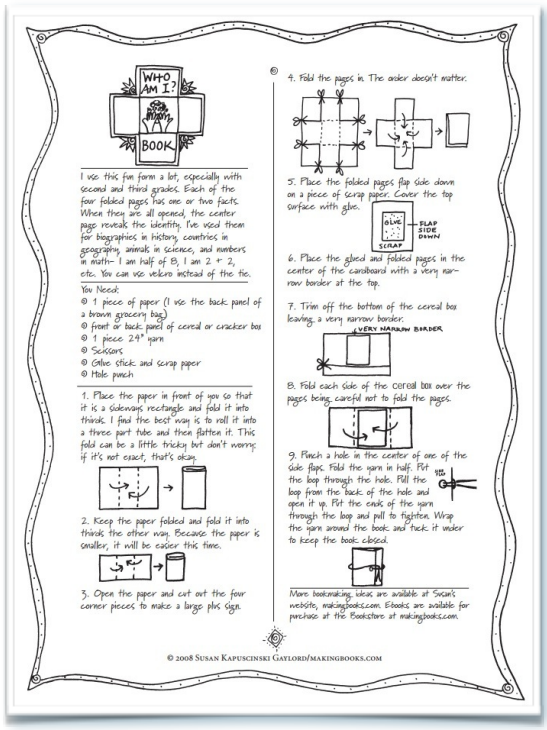

Figure 3 – Different book formats that can be constructed by the students using a variety of materials (source: http://www.makingbooks.com)

What is more, the choice of materials may contribute to enrich the visitors' experience — combining, for example, text, images, illustrations and textures. In the http://www.makingbooks.com/

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website can be found several examples with different book formats (figure 3).

OPTION 2
e-book

The e-book option (Figure 4) — using for example the *iBooks Author* application or using the website http://simplebooklet.com/ — even though very appealing given the possibility to include multimedia elements, requires the resource to devices that allow for its display — computers and/or tablets. This may be a limitation for some schools and or museums and science centres where such equipment is not available. Also, the e-book option — presented in traditional screens — makes it difficult for the simultaneous exploration of several visitors, restricting the possibilities for interaction.

Figure 4 – e-book cover designed with the *simplebooklet* application (source: http://simplebooklet.com/).

iBook for an irresistible exhibition

(source: https://www.apple.com/ibooks-author/)

iBooks are an alternative way for presenting students' projects as a result of their research. Here is presented a brief presentation of what the app *iBooks Author* for *Mac* allows and how an *iBook* can be presented and shared in an exhibition. The potential of its interactiveness is also explored. Finally, having *iBooks Author* in the classroom is briefly described. Some questions to take into account are also addressed.

iBooks Author & iBooks

iBooks Author[1] is a free app, only available for *Mac*, that allows creating digital multimedia interactive books. These books can be read on a *Mac*, *iPad* or *iPhone* using the *iBooks app* and include several kinds of interactive elements. These elements allow bringing "content to life" making reading a completely new and engaging activity. This is an extremely user-friendly app that comes with many templates for digital books.

[1] More information and download available here: https://www.apple.com/ibooks-author/

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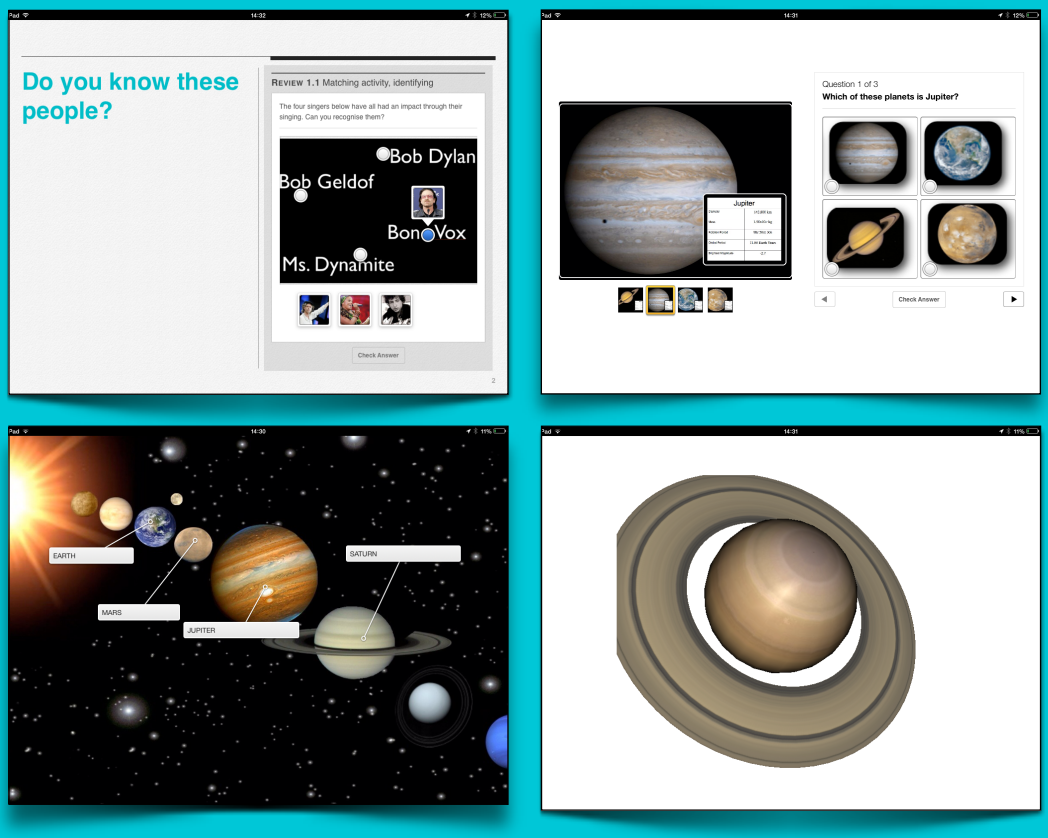
The *iBooks* are a different kind of digital books, because they can include different types of media and the reader can interact with them. From high-quality photo galleries to moving objects and animations, these are books the readers can also watch and listen to. Readers with special needs also benefit from these features.

Creating iBooks for the exhibition

Creating an *iBook* for this project would also involve students in planning and developing their own books, according to their research and/or experiments. Because the *iBook* is interactive, students would be able to include different "widgets"[2] according to the topics and processes they chose to work on. On the left there are some screenshots of *iBooks Author* on a *Mac* and *iBooks* on an *iPad* that have examples of interactive widgets. These *iBooks* were created by teachers for different purposes and school subjects, but can easily be created by students too. Widgets, like the ones in figures 5, 6, 7 and 8, may include interactive exercises with immediate feedback, photos, audio and videos (which can also be done by students with *GarageBand* and *iMovie* on an *iPad*, *iPhone* or *Mac*), photo galleries and presentations (*Keynote*), interactive



Figures 5, 6, 7 and 8: Interactive exercises, Interactive gallery and exercises, Interactive image, and 3D object

[2] More information on widgets and to explore demos here: https://www.apple.com/ibooks-author/gallery.html

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images (that zoom in and out for detailed labelling), explorable 3D objects and others that come originally with this *app*.

The *Bookry*[3] (Figure 9) website also allows creating other types of interactive widgets for free that can be downloaded and easily dropped in the book.

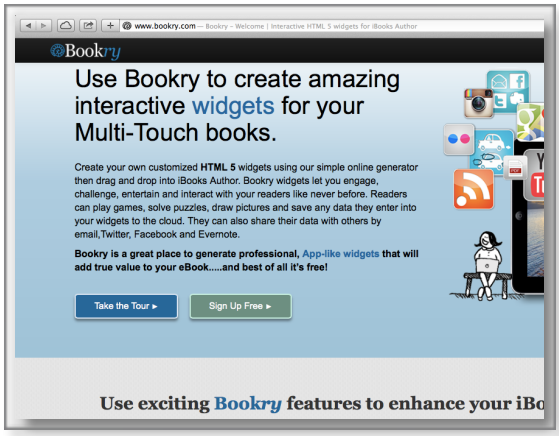

Figure 9 – Bookry website (source: http:/brookry.com).

A class of students can create one *iBook* with different chapters or plan and create different *iBooks*. These can also be exported as pdf files but will loose their interactiveness. It is important to bear in mind that these books are to be read on Apple devices only, so when exported or published to any other platform some features will be lost, particularly the most interesting ones — the interactive widgets and the smooth leafing through and reading of the *iBooks*.

Still, students can also print posters from parts of their books for their exhibition, thus creatively sharing the results of their research. Along with these, students can allow visitors to explore their *iBooks* on an *iPad* or *Mac* computer available on site.

The sharing of these *iBooks* can be done by allowing visitors to download a copy of the *iBooks* or *pdf* file to their own devices (using QR codes, for example). The *iBook* can also be published in the online *iBooks* store if the teacher or school has an *Apple* id fulfilling all the requirements.

A link for an online assessment survey (using *Google Forms*, for example) should also be left available, allowing visitors to leave comments and suggestions for further study. This would allow evaluating the exhibition and *iBooks*, as well as giving an idea of the conceptions the visitors had on the topic of the exhibition. All this information could then be used in the subsequent phase, letting students know the results to improve the content of the *iBooks* they had already finished and/or start new researches and creative processes.

Using iBooks Author in the classroom

To create *iBooks* in the classroom it would be necessary to have at least one Mac computer available for students to create their digital books.

While having one group working on their *iBook* project, the other groups might be using other devices and dealing with the different phases of their research and/or project creation. Ideally, all students would freely access their projects and continuously edit them at their own pace.

[3] http://www.bookry.com

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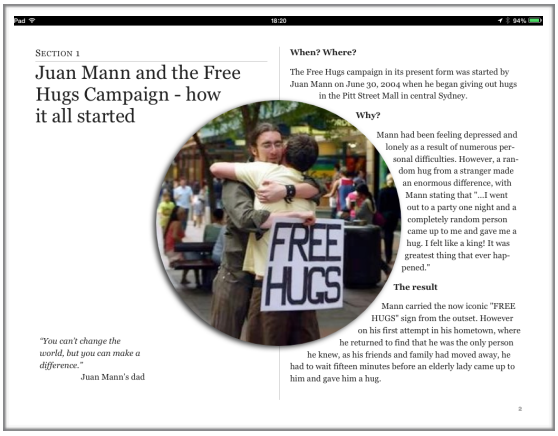

Figure 10 – iBook Page.

Students can plan and write their texts in other apps or software and then just drop the content in the template. The same with pictures, charts, tables, videos and presentations. They can also plan and create their widgets and a glossary, which is another interactive feature of iBooks, including terms, definitions, links and pictures in it. Readers can use the glossary just by tapping on a word in bold.

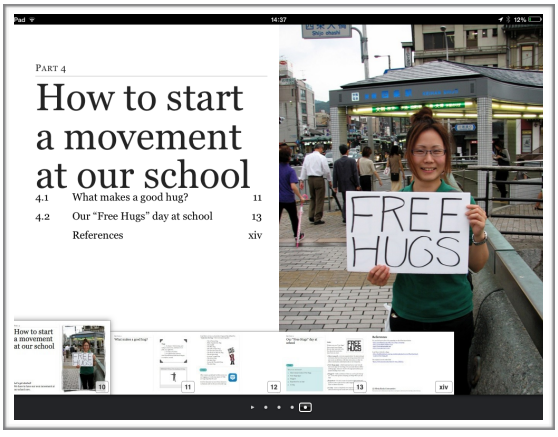

Figure 11 – iBook Chapter Page.

This creative process engages students and the fact that *iBooks Author* is such an easy app to use allows focusing on the content rather than in the process. Also, students have the opportunity to create their own artefacts, stimulating their creativity and empowering them, in the sense that they are making their decisions, while planning the book, and potentially managing their learning and productive processes.

SCENARIO 3 VIDEO

The video may be composed of one movie or by a compilation of several movies about a given topic, a student research report, student testimonies about their work, a newscast – including, for example, interviews done by the students to specialists on the researched topic — or a role-play activity dramatized by the students, among other options. Visitors may be invited to interact between themselves through explicit instructions given in the vide.

In case of the option for the creation of a story/dramatization, there are several issues that should be taken into consideration in order to create a story capable of engaging the visitors: the authors perspective should be present; there should be a key question that captures the visitors attention and that will be answered at the end of the story; the plot should be capable of enticing the visitor while connecting the story with its audience; only the resources needed to tell the story should be used, without overwhelming the viewer — letting him be the one to "fill in the blanks"; use to

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correct rhythm for the story's progression; make use of a narrator so as to personalize the story helping the audience to understand its context; take into account the soundtrack and sound effects so as to increase its dramatic value.

The option for the construction of a video requires several stages, including the preproduction — when the scrip is written for the narrative, the storyboard is constructed, and the existing resources (video clips, music, sound effects) that are going to enter the video are organized, and the audio narrative is recorded. In the post-production stage it will be required to compile all the components using editing software, while adding titles, text, subtitles and special effects, in order to compose the final product.

SCENARIO 4 GAME

The game may require the resource to external data sources — also developed by the students — in order to help the visitor to reach the right answer: for example, on a given stage, it may be asked to the players to listen to a podcast, to see a *vodcast*, or read a text. Besides some close and directed questions, it may also include open questions encouraging the participants to discuss, but defining a time limit — in case of agreement the game may proceed.

On the http://www.at-bristol.org.uk/cz/teachers/Default.htm website there are several suggestions of activities — some of them games — with the goal of leading the student to discuss socio-controversial issues. These activities may easily be adapted to the context of a science exhibit. As an example, we can consider a situation where the visitors are organized into teams, and where when faced with a given statement, each team would have to decide if they did or did not agree with it. It would also be interesting if each team could leave a record of its answer for the following visitors. In addition to "agree" and "disagree" cards, and of the cards with the statements, there should also be made available auxiliary cards with factual information to aid the decision making process. A similar example can be accessed through the http://www.at-bristol.org.uk/cz/teachers/Genetic_testing.pdf website.

Another game, resulting from the adaption of the traditional pairing game, could also be used as a trigger to initiate the discussion of controversial issues: each controversial question could be divided into two cards with the same image (figure 12). Visitors would be directed to find the right pair, and when that happened the question would finally be revealed and discussed. Such a game can be created, online, using the http://www.pexeso.net website.

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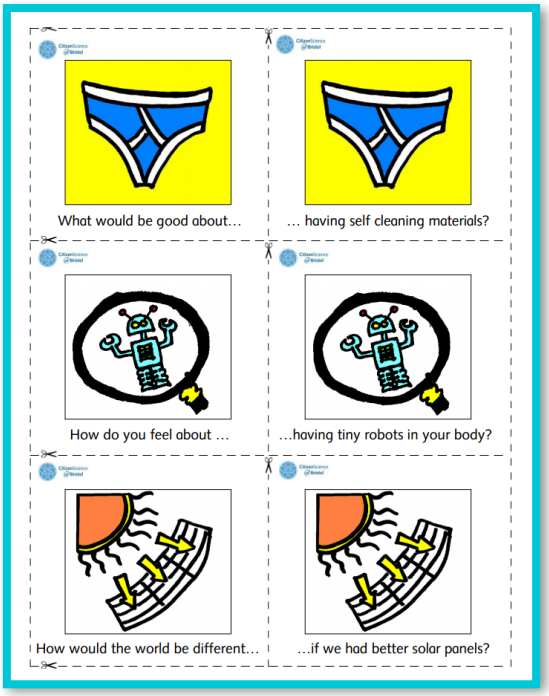

Figure 12–Cards for a pairing game (source: http://www.at-bristol.org.uk/cz/teachers/Nano%20pairs.pdf)

Similarly to the pairing game, other digital games can also be created — using software such as *Macromedia Flash* and *Hot Potatoes*, even though they have not been specifically created for developing games. However, they allow for the combination of intuitive interfaces with toolbars that permit the inclusion of images, sounds, videos and buttons, making them suitable for game design. One constraint of digital games is the fact that they limit the number of simultaneous players — as a result of the small screen size where they are presented — compromising the degree of interaction between the exhibit visitors.

GENERAL GUIDELINES FOR ALL SCENARIOS

Promotion of interaction between visitors: questions

The objects of each scenario, both digital and physical, may be used to promote interaction between visitors — using questioning as a possible strategy. Questions – posed in the beginning, middle or end of the exhibit or artefact exploration — direct the visitors' attention, raise issues and promote discussion, engaging the visitors with each other and with the artefact. However, the type of question to be used is crucial: questions that are too obvious or highly directed are of little interest and, therefore, not supportive of the level of engagement intended (Simon, 2010). If a question is used, it should demonstrate a real willingness to learn about the visitors' answers: making it possible to record their answers. One possible strategy may be using boards or flipcharts where the visitors can register their answers; another possibility is to audio and/or video-record their answers.

In order to promote the visitors' engagement and interaction, the posed questions should be open and allow for a diversity of answers — if there is only "one right answer" than we are facing the "wrong question". Furthermore, questions should appeal to each visitor's knowledge. How can such questions be developed? By stating them and trying to answer it: posing the questions to one self, to colleagues, friends and relatives and listening to the answers. If the answers are diverse and enthusiastic, then the question is good.

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According to Simon (2010), personal and speculative questions are the best ones, when we are looking for authentic and diverse answers. Personal questions help the visitor to connect his learning experience with the presented artefacts; speculative questions face the visitor with the creation of possible scenarios, involving the artefacts and/or their own ideas.

Personal questions are less centred on the artefact and more on the personal experiences of each visitor: if the goal is the promotion of a social experience among the visitors, it is advisable to start with more personal questions. This strategy may, for example, be fulfilled at the end of the exhibit — or of each artefact — implementing a platform where visitors can be prompted to answer some questions (registering their answers on paper, online or in audio/video) such as: (a) how did you learn about this exhibit?; (b) what is your overall impression about the exhibit?; (c) how did this exhibit added to or changed your previous knowledge about this topic?; (d) for you what was the most interesting part of the exhibit?

Speculative questions are best when we want the visitor to go further than his own knowledge — his experiences — and delve deeper into unknown territory. We may, for example, question an urban visitor about how would life be in a cabin with no electricity. His answer will require him to reflect, using his imagination to connect personal with unknown experiences. Questions starting with "what if…" are good choices when we want to prompt the visitors to face the artefacts as starting points for their inspiration, and not only as closed questions.

Promoting social interaction between visitors: instructions as a strategy for social engagement

The best way to invite strangers to interact comfortably between themselves is to give them explicit instructions on how to do it. If we intend to develop artefacts as social objects, it is important to clarify some engagement rules with the artefacts or the social contexts surrounding them (Simon, 2010). This may be achieved through the use of instructional captions with explicit, step-by-step, instructions about what to do and how to do it: these captions may be in either written or audio format. Such captions allow the visitor to engage in a social encounter, without making it feel forced or inadequate – the instruction legitimizes the physical contact with the other, facilitating the social experiments.

REFERENCES

Aldrich, F., Rogers, Y., & Scaife, M. (1998). Getting to grips with interactivity: helping teachers assess the educational value of CD-Roms. *British Journal of Education Technology, 29*(4), 321—332.

Bilda, Z., & Edmonds, E. (2008). Design for creative engagement. *Design Studies, 29*, 525—540.

Bitgood, S. (1991). Suggested guidelines for designing interactive exhibits. *Visitor Behavior, 6*(*4*), 4—11.

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Bradburne, J. M. (2000). *Interaction in museums. Observing supporting learning*. Hamburg: Libri Books on Demand.

Braund, M., & Reiss, M. (2004). *Learning science outside the classroom*. London: Routledge Falmer.

Caincross, S., & Mannion, M. (1999). How multimedia functions in engineering education. *Engineering Science and Education Journal, 8*(3), 100—107.

Cairncross, S., & Mannion, M. (2001). Interactive multimedia and learning: Realizing the benefits. *Innovations in Education and Teaching International, 38*(2), 156—164.

Chelini, M., & Lopes, S. (2008). Exposições em museus de ciências: Reflexões e critérios para análise. *Anais do Museu Paulista, 16*(2), 205—238.

Crowley, K. (2000). *Building islands of expertise in everyday family activity: Musings on family learning in and out of museums*. Pittsburgh, PA: Museum Learning Collaborative.

Flagg, B. N. (1994). Visitors in front of the small screen. What research says about learning in science museums. *ASTC News, 2*, 21–4.

Hammerich, P. (2000). Confronting students' conceptions of the nature of science with cooperative controversy. In W. McComas (Ed.), *The nature of science in science education: Rationales and strategies* (pp. 127—136). Dordrecht: Kluwer Academic Publishers.

Hardicre J., Devitt P., & Coad J. (2007). Ten steps to successful poster presentation. *British Journal of Nursing, 16*(7), 398—401.

Hawkey, R. (2001) Innovation, inspiration, interpretation: museums, science and learning. *Ways of Knowing Journal, 1*(1).

Heath, C., vom Lehm, D., & Osborne, J. (2005). Interaction and interactives: collaboration and participation with computer-based exhibits. *Public Understanding of Science, 14*(1), 91–101

Hindmarsh, J., Heath, C., vom Lehn, D., & Cleverly, J. (2005). Creating assemblies in public environments: Social interaction, interactive exhibits and CSCW. *Journal of Computer Supported Collaborative Work, 14*(1), 1—41.

Hodson, D. (1998). Teaching and learning science: Towards a personalized approach. Buckingham: Open University Press.

Hooper-Greenhill, E. (2000). *Museums and the Interpretation of Visual Culture*. London: Routledge.

Jarman, R., & B. McClune (2007). *Developing scientific literacy: Using news media in the classroom*. Berkshire: Open University Press.

Kolstø, S. (2001). Scientific literacy for citizenship: Tools for dealing with the science dimension of controversial socioscientific issues. *Science Education, 85*(3), 291—310.

Leinhardt, G., Crowley, K., & Knutson, K. (2002). *Learning conversations in museums*. Mahwah, NJ: Laurence Erlbaum Associates.

Levinson, R. (2006). Towards a theoretical framework for teaching controversial socio-scientific issues. *International Journal of Science Education*, *28*(10), 1201–1224.

Mayes, J. T., Kibby, M. R., & Anderson, A. (1990). Signposts for conceptual orientation: some requirements for learning from hypertext. In R. McAleese & A. Green (Eds), *Hypertext: State of the art*. Bristol: Intellect Books.

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McKendree, J., Reader, W., & Hammond, N. (1995). The homeophatic fallacy in learning from hypertext. *Interactions, 2*(3), 74_82.

McLean, K. (1999). Museum exhibitions and the dynamics of dialogue. *Daedalus, 128*(3), 83—107.

Millar, R. (1997). Science education for democracy: What can the school curriculum achieve? In R. Levinson & J. Thomas (Eds.), *Science today: Problem or crisis?* (pp. 87—101). London: Routledge.

Ree, B. T., & Kim, D. J. (2013). Summative evaluation of children's creative engagement through interactive exhibits: A case study on the participatory exhibition of masterpieces in South Korea. *International Journal of Advanced Science and Technology, 59*, 1—12.

Rogers, Y., & Scaife, M. (1997). How can interactive multimedia facilitate learning? In Proceedings of First International Workshop on Intelligence and Multimodalities in Multimedia (pp. 123–142). Palo Alto: The Live Oak Press.

Roth, W.-M. (2003). Scientific literacy as an emergent feature of collective human praxis. *Journal of Curriculum Studies*, *35*(1), 9—23.

Sadler, T. D. (2004). Informal reasoning regarding socioscientific issues: A critical review of research. *Journal of Research in Science Teaching*, *41*(5), 513—536.

Scrimshaw, P., & Wegerif, R. (1997). *Computers and talk in the primary classroom*. Clevedon: Multilingual Matters.

Serrell, B., & Raphling, B. (1992). Computers on the exhibit floor. Curator, *35*(3), 181–9.

Simon, N. (2010). *The participatory museum*. Santa Cruz: Museum. 2.0.

Sleeper, M., & Sterling, R. (2004). The in-class science exhibition. *Science Scope, 27*(6), 49—52.

Thomas, S., & Mintz, A. (1998). *The virtual and the real: media in the museums*. Washington, DC: American Association of Museums.

Tost, L. P. (2011). Integrating ICT in exhibitions. *Museum Management and Curatorship, 26(1)*, 63—79.

Tsitoura, A. (2010). Socio-cultural visions of Interactivity within museums. *Cadernos de Sociomuseologia*, *38*, 89—102.

vom Lehn, D., Heath, C., & Hindmarsh, J. (2001). Exhibiting interaction: Conduct and collaboration in museums and galleries. *Symbolic Interaction*, *24*(2), 189–216.

Wagensberg, J. (2001). Principios fundamentales de la museología científica moderna. *Cuaderno Central*, 55, 22—24.

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