

**British Interactive Group Summer Conference**  
**Learning with interactive exhibits**  
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Good morning ladies and gentlemen

My paper today is going to consider the effectiveness of hands-on activities to support learning. It is meant as a stimulus for discussion and recognises that “interactives” vary considerably.

I want to act as a devil’s advocate to make you think. You may well be aware of some of the issues I intend to cover but hope that some of it will be new. Please say if I do not make sense!

My paper today focuses on learning and supporting learning at interactive exhibits. My research tutor at Leicester said that when she visited science centres she panicked. She hates Science and finds the approach taken too similar and doesn’t know what to do or where to start.

I am worried about the limited amount of learning<sup>1</sup> that I see occurring. I say see, because my research into informal learning has lead me to spend hours and hours observing children as they use a range of hands-on activities. These observations have largely been undertaken in museums. Some of these museums include:

- Science Museum Things Gallery (picture – types of activity include manipulating tools, building chairs, making simple machines function and designing a bicycle using a computer game)
- Rocky Road Show, a travelling exhibition on geology developed at St Albans Museum (activities include sorting and classification of real geological material, considering fossil formation and the use of material from the ground in common items in our homes)
- Bruce Castle Museum, Tottenham, Inventor Centre (activities include computer quizzes, a board game and a camera)

When observing children I often see them pressing buttons, or moving items without any thinking skills being used, while many others walk away after a very short time.

The remainder do of course “stick at it” and I have become very interested in finding out what actually happens when they interact with the exhibit and what they learn.

Are these children those that already like science?

Do they follow the learning path that the designers and other staff planned or do they discover other things.

My research has taken over 6 years and although will not be written up as a doctorate thesis due to commitments, time etc I am keen to use the ideas and develop them further. I also want to inform the museums and science centres community of workers. My research focused on science museums and how effective they are as informal learning environments, where people learn

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<sup>1</sup> And I do see learning in a very broad sense, not just the cognitive

different things. Thus I did not set out to discover information about what they learnt but rather ways of assessing whether they were in the process of learning.

I have concluded that there are a number of behaviours that can if found suggest that learning is taking place. However this is not what I want to focus on here. What I want to do is summarise the conclusions made about the use of the “interactives”. Much of this I am sure will be familiar to you but it is based on a large amount of data – approximately 140 observed visits where actions, interactions and conversations were recorded. For each observed visit to the gallery an exit interview was also conducted with each child.

## **SUMMARY OF FINDINGS**

1. People, and in this case children choose only a selection of the interactive exhibits , available concentrating on the ones that “grab” and excite them.
2. They will try the activity and either leave very quickly or stay for a long period of time. Those that persevere do so because of their interest but also their need to complete the challenge (just as long as it is not too difficult – or too easy!).
3. They particularly like the games where they can succeed and thus develop further, their confidence and self-esteem. They often do these over and over again. What are they really learning at these I wonder.
4. They also enjoy competing with others. Children also like working together.
5. Children are less likely to enjoy the activities that appear too difficult, too easy or too confusing. Others that take too long to finish one “game” are also not popular. Eg building the grey chair at the Science Museum. However watching others use activities can act as a stimulus to want to try too.
6. They enjoy telling others about their experiences, showing people the activity and how it works and showing what they have done, or found out. This can be useful as a form of evaluation.
7. Children often ask questions about the activity. These are largely “low-level” thinking questions such as asking how to do the activity. However there were a small proportion of questions that indicated higher level thinking about the activity and the associated learning concepts. Eg questions about where items should be classified in a sorting game.

8. Any learning seen or heard discussed was largely of concrete concepts – things children could see happening – eg the tools which were easier to use to gather marbles and place on a conveyor. More abstract ideas associated with such activity rarely occurred.
9. Creative use of “interactives” for purposes other than that intended were common and included games, play and imaginative role- play. Here the learning was occurring but not necessarily related to the scientific concept.

Digging further into why all this occurs and thus helping us to consider how to develop the aspects which support learning, lets consider some learning theory. I believe that here, constructivism is a useful theory – it is not perfect but it does provide an understanding of the diversity of children’s responses seen at exhibits and also takes into account that learners are not empty vessels when they arrive.

Constructivism suggests that learning is dependent on what people already know and have experienced and thus each person learns something slightly different when they do the same hands-on activity (or anything else for that matter).

Hein describes constructivist learning by saying that “learners construct knowledge for themselves – each learner individually (and socially) constructs meaning – as he or she learns ....We have to focus on the learner in thinking about learning”

This means we need to cater for diversity when developing activities – people who know something about the subject, people who think they know very little, some who have learnt about it at school, others who have learnt about it at home or on the TV. Can we predict what each different type of audience will want to learn and present different approaches or opportunities for different people?

Let’s develop this idea of individual learning paths in a different direction too. Researchers in science education have also shown that people learn about science (and possibly other topics) by developing their ideas and adapting them as their knowledge and experience of the subject develops. Maturity of the learner also seems to play a part with under seven’s finding it difficult to understand abstract ideas.

For example getting children to learn about a spherical earth is not normally possible until they are quite old. Young children, if asked to draw the earth, will produce a flat earth. Once they are taught that it is supposed to be spherical they adapt their naive ideas but are unable to adapt them fully. They come up with a number of interesting pictures of a round earth that bares no relation to the spherical world that scientists describe.

Some for example have the land in the bottom part of the sphere and the air/atmosphere in the top half. There seems to be a series of different ideas that children mentally “work through” before they finally develop the notion of a true globe.

It may also be true, although little research has been done in this area, that adults who have learnt little science in school, or elsewhere, also need to start by challenging some of these simplistic or “naive” understandings before they are ready to develop their ideas into more “scientific” concepts. People develop “schema” (knowledge patterns held in the brain) that make sense in the world they are living and working in.

However, it has also been shown that it is no use trying to expect them to learn the more scientific ideas until people are ready to explore them, and this readiness may occur at different times for different people. It may however be useful to expose them to a variety of stimulus that helps challenge these ideas. Roschelle suggests that learning usually develops by confirmation and adaptation of ideas or schemas already held by the person. Rarely do new theories or “schema” develop but when they do it is a result of a major challenge to the currently held beliefs. When this happens the person *“undertak(es) major transformations of thought that affect everything from fundamental assumptions to their ways of seeing, conceiving, and talking about their experience. While rare, this kind of change is most profound and highly valued”.* (Roschelle)

More frequently though people turn away from the challenge and continue with their own beliefs. We need to consider this too when developing interactives

So to conclude then, learning theory says that visitors to hands-on centres and museums:

- Have different understandings before they arrive. These are based on their previous experiences and learning opportunities and what ideas fit with their own practical understanding of how they see the world work.
- Some of these understandings, particularly in children relate to their maturity and development stage of their scientific thinking
- Visitors are likely to maintain their own beliefs which make sense of their own world. Changing these is difficult and a rare event but results from appropriate challenges.

We have also seen from observations that children

- are excited by appropriate challenges that develop their self esteem,
- like social experiences,
- will adapt activities to suit their own needs
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So what are the implications for developing interactive exhibits?  
What can we do to support this diversity.

I think it is important that we consider the audience and its diversity when planning such exhibits.

Who are they intended for?

What do they already know?

What sorts of things do they want to learn?

How can we challenge ideas?

We also need to accept that learning scientific concepts is not easy. Perhaps we could make the experience much more exploratory and useable at different “levels”. I also think it is important to not only test activities but also talk to potential users about the topic before hand.

In his study of the interactive “whispering dishes”, McClafferty asked visitors to a hands-on centre in Australia about what they had found out at this activity.

The whispering dishes activity is based on two sound dishes one at each end of the room. Not only does there need to be 2 people but the users also have to co-ordinate their “making sounds” and “listening” activities at the different sites to make the experiment work. Even when it works will they learn anything about how sound works? What other learning might they experience? Can they use the activity to explore sound further?

McClafferty asked the following questions:

- Can you tell me how you learnt to use the Whispering Dishes?
- Can you tell me how the Whispering Dishes work?
- How could you hear others on the other side?

He found out that only a small percentage of people developed and understanding of the way sound travels:

“In the case of the whispering Dishes, results show that for the 340 visitors who mounted the platform to interact with the exhibit, only 165 visitors were able to achieve the objective of getting the exhibit to work; that is just under half the visitors. Were the others left frustrated or confused? Of these 165 visitors there were only 55 who had an understanding that the exhibit works by sound waves”

One wonders how many of these 55 already knew about sound waves when they entered the science centre!

What did the other 115 gain from the experience?

Did it help in providing challenges for pre-conceived ideas?

So my initial premise then that hands-on activities can fail to teach specific ideas and are often used in diverse ways is founded not only in my research but also on learning theory and other site based research.

However it is also clear from this work that we should not expect major learning experiences to occur all the time. This should not make us forget

about supporting the visitor but develop strategies to consult and test interactives and also to explore ways of making them interesting and challenging to a range of different audiences. They should become a way of exploring science and not in “teaching” it. This way, visitors can take their own learning path and develop their own understandings. These understandings may not fit with the ideas we wish to teach but will help visitors explore their own concepts with the possibility of adapting or changing them. We need to be less proscriptive and more supportive. We also need to think carefully about how we are going to evaluate their success.

Hein suggests that to support constructivist learning in museums we need to:

- Contains the familiar eg place, environment, objects and concepts
- Contains the unfamiliar as well (in all the above)
- Be comfortable spaces, intellectually and physically eg easy to orientate, seating, temperature, toilets etc
- Easy to use – clear and un-confusing where visitors feel confident and competent as well as in control
- Range of different approaches with different opportunities for a range of learning styles, abilities and preferences
- Are sociable experiences
- Flexible with multiple paths within exhibits themselves and more generally in the gallery and museum
- Challenge at appropriate level for the individual

*“The trick, of course, (Hein says) is to find just the right degree of intellectual challenge to leave the learner slightly uncomfortable but sufficiently oriented and able to recognize the challenge that she will accept it”*

Perhaps we could consider these aspects when discussing and developing interactive exhibits.

#### *Discussion and questions*

*We agreed in the discussion afterwards that interactive exhibits were not just about the cognitive learning that takes place but also about developing the affective and social skills, and about developing an understanding and sympathy with science and its culture. In fact, some in the group saw the developing of a cultural context as very important. It was suggested that although many people who made interactives were aware of the scope of learning possible many of those in museums and managing positions often focused on evaluating such experiences against cognitive outcomes only. So while we need to consider the whole variety of learning experiences when building interactives we also need to be aware of this when evaluating them*

#### References

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