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# The selective uptake of ideas about out-of-school science education

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**Abstract.** This paper was presented as part of an invited session, *A wake-up call for learning research and practice,* at the annual Ecsite (European Network for Science Centres and Museums) conference in June 2015, held in Trento, Italy. In the paper, I argue that the present-day interpretation efforts of science centres and museums suffer from two shortcomings, both of which may be the inadvertent outcomes of the Contextual Model of Learning. I outline these shortcomings and problematize them in terms of what is currently known about science and science education. Finally, I offer my suggestions for solutions to these shortcomings, in terms of both practice and research in science centres and museums.

**Key words:** out-of-school science education, science centre, museum, learning research

## The state of the art

Research and practice in out-of-school science education (such as, for example, science centres and museums) has for a number of years been influenced by the work of John Falk and Lynn Dierking. In 1992, they published the excellent book *The Museum Experience* in which they presented the 'Interactive Experience Model' (shown in Figure 1), which conceived the visitor's experience in the museum as being compounded by the interaction between three elements, namely the physical context of the museum, the social context in which the visitor carried out their visit (the presence of friends, family, museum staff and even other visitors), and the visitor's own personal context.

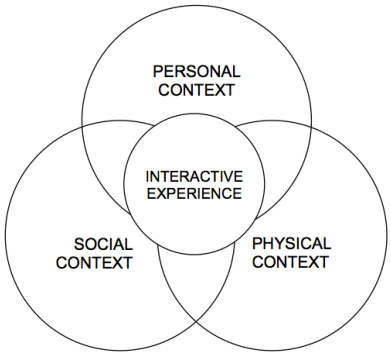


**Figure 1.** *The Interactive Experience Model. From Falk and Dierking (1992).*

Continuing to build upon their insights, in 2013 John Falk and Lynn Dierking published the book *The Museum Experience Revisited,* which featured a new, revised version of the Interactive Experience Model. The new model still saw the museum visitor's experience as an interaction between the personal, physical, and social contexts, but now also included the dimension of time (Figure 2). The authors thus saw the museum experience as being affected by what occurred prior to it as well as what occurs after it.

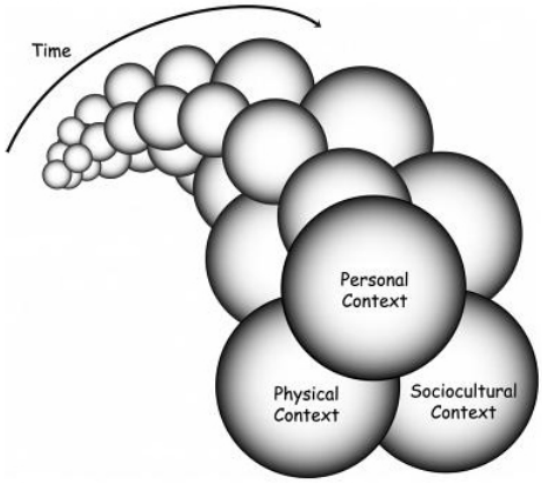


**Figure 2.** *The Contextual Model of Learning. From Falk and Dierking (2013).*

It is difficult to overestimate how important the work of John Falk and Lynn Dierking has been for science centre and museum research and practice. When they began their work, it was not unusual for museums to define themselves very much in terms of their collection and research capabilities. In contrast to this, Falk and Dierking were, above all, advocates for the museum visitors. In her introduction to *The Museum Experience*, Marsha Semmel explains:

> *The museum visitor is not an empty vessel, waiting to be filled with our wisdom. […] Until I encountered that truism head-on in the first edition of* The Museum Experience*, I have to admit that I hadn't really tried to understand*

> *the visitor's perspective in the many museum programs I created in the early years of my career (Semmel, in Falk & Dierking, 1992).*

Marsha Semmel's sentiments probably echo what many museum practitioners felt upon reading *The Museum Experience*. But the work of Falk and Dierking had equal, if not greater impact on museum research. In a review of articles published on informal science education in the top three science education research journals in the years 1997-2007, Molly Phipps (2010) showed that 14 of 85 articles (or 16%) directly used the Contextual Model of Learning as their conceptual framework. In summary, the work of John Falk and Lynn Dierking has had a strong influence in putting the visitor firmly on the agenda of museums and science centres, for both practitioners and researchers.

## What's the problem?

Although I wholeheartedly concur that the visitors are the *raison d'être* of science centres and museums, the uncritical uptake of the Model of Contextual Learning as a comprehensive model of what takes place during museum visits may lead to unintended outcomes. One such outcome may be what Cheryl Meszaros (2006) calls the 'absolution of interpretative responsibility'. Indeed, if one scrutinizes the Contextual Model of Learning, one gets the impression that an overwhelming part of the science centre or museum visit is beyond the immediate control of the museum staff (Figure 3).

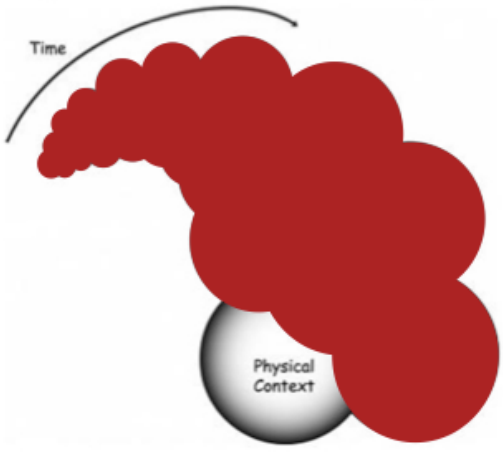


**Figure 3.** *The Contextual Model of Learning with the elements blocked out that are not under the control of the science centre/museum staff. Modified from Falk and Dierking (2013).*

From this point of view, it seems understandable for a science centre or museum staff member to reason that if they have minimal influence over what goes on during the visit—if their carefully designed educational programmes or exhibitions have little or no impact on the visitor's learning outcomes—how can they be held responsible for any of these learning outcomes? Cheryl Meszaros goes one step further:

> *By placing interpretive authority in the hands of the individual, and further, by championing the "whatever" interpretation as the final and desired outcome of the museum visit, the museum not only justifies its failure to communicate, but also it absolves itself of any interpretive responsibility for the meanings it produces and circulates in culture (Meszaros, 2006, p. 13).*

In other words, the notion inadvertently promoted by the Contextual Model of Learning that the visitors' experiences are more or less decoupled from the museum's interpretative efforts is not only *accepted* by museum practitioners and researchers, it may even be *celebrated* by them. This can lead to a partial or complete evasion of interpretative responsibility on the part of the museum (Meszaros, 2006).

Another unintended outcome of the Contextual Model of Learning is that it fails to specifically address the content of what is being learnt or experienced. Although it could be argued that the model was developed for museums irrespective of their particular content area, and therefore was required to be somewhat content-general, I still find it puzzling that *what* is being learnt is not a part of a model of learning. In the words of Leona Schauble:

> *The past 30 years of cognitive psychology demonstrate that thinking and problem solving are always modulated by the problem at hand. Although it is possible to describe general strategies for supporting learning, general strategies are relatively prone to error and are not very well tuned for developing knowledge about qualities of particular domains (Schauble et al., 2002, p. 426).*

In other words, models that attempt to describe learning in a general way tend to be too abstract to say anything very precise about that learning. And considering that science centres and museums are always *about* something (namely science), it seems a more content-specific or content-oriented approach is needed to understand and/or design the science centre/museum experience (cf. Achiam, 2013).

In sum, I argue that although the work of John Falk and Lynn Dierking has been enormously influential, and the Contextual Model of Learning in particular has done excellent work in focusing the attention of museum practitioners and researchers on the visitor's experience, the model has two unintended effects:

1. The assertion that the museum experience is composed of multiple factors may cause museums to fail to assume their interpretative responsibility towards their visitors
2. The discipline-general view of the museum experience may cause museums to disregard the specific ways in which the scientific content is experienced by their visitors

## What are possible solutions?

To my mind, an important step towards solving the issues that affect research and practice is realizing that the content - in this case science - matters! Science is difficult, science is profound, science is coming to know about the world! Most importantly, perhaps, science is what scientists do: In the words of Charles Ault and Jeff Dodick:

> *Scientists deploy imagination and imagery, rely upon relevant understandings, and engineer methods of inquiry suitable within particular contexts (Ault & Dodick, 2010, p. 1101),*

What does this mean for the design of experiences in science centres and museums? First of all, it means that in any scientific encounter, whether it involves a scientist or a science centre visitor, there are relevant understandings that can be brought to bear and trajectories of inquiry that can be carried out. The job of the science centre or museum designer is thus to elucidate the potentially relevant understandings of their target visitors, and to design encounters so that those understandings can lead to productive trajectories of inquiry. The more explicit designers are about their assumptions and intentions at all phases of the design process, the easier it is for all involved to evaluate those assumptions and intentions.

Consider, for example, the palaeontology exhibit shown in Figure 4. Here, the visitor encounters a situation where their understanding of a jigsaw puzzle is relevant for the intended trajectory of inquiry. By correctly assembling the bones of the *Iguanodon's* foot, the visitor is essentially engaging in the palaeontological practice of piecing together the fossilized remains of extinct animals to make inferences about them. Visitors thus follow a trajectory of inquiry similar to that of palaeontologists.

**Figure 4.** *A hands-on exhibit in the Palaeontology Lab at the Royal Belgian Institute of Natural Sciences in Brussels. Casts of fossilized Iguanodon foot bones can be fit together using the outline of the foot on the table. Photo by M. Achiam.*

Another example is given in Figure 5, which shows a parabola exhibit popular in many science centres. The two matching parabolas (only one is shown) allow visitors to carry out conversations over long distances, exemplifying a fundamental principle of acoustics.

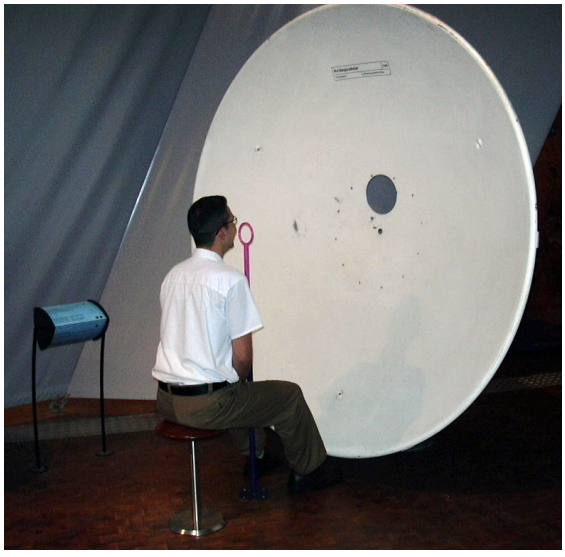

**Figure 5.** *A hands-on exhibit at Experimentarium in Copenhagen. The parabolic dish focuses incoming sound waves in the focus point (the pink ring directly in front of the visitor), and transmits outgoing sounds (e.g. spoken words) to a twin parabolic dish which may be located many metres away. Photo courtesy of N. Quistgaard.*

In this case, the visitor encounters a situation where productive trajectories of inquiry are afforded by the stool in front of the exhibit, the

clear demarcation of the parabola's focus point, and the distance between the two parabolas. Although the visitor's trajectories of inquiry in this case are perhaps more distantly related to those of a real scientist than in the example given in Figure 4, still the parabola exhibit affords the variation of the visitor's position, distance, and sound intensity much in the same way as a physicist would carry out systematic testing and experimentation in the laboratory.

If at this point the reader agrees that it is important for science centre and museum *practitioners* to realise that the scientific content matters, a reasonable question would then be: What are the implications of such a realisation for science centre and museum *researchers*?

To me, the most important implication for those of us who construct and use models for designing and understanding science experiences in out-of-school environments is the following: These models must explicitly address the scientific content in question. This entails providing the means, within our models, for the mapping out of the intended trajectories of inquiry of visitors, and for clarifying our assumptions about the relevant prior understandings that visitors bring to the museum encounter:

1. The inclusion of the content as a crucial part of the museum experience would oblige researchers to explicitly address the interpretative responsibility of museums
2. A science-specific view of the museum experience would oblige researchers to explicitly focus on how science is experienced

Thus, I invite myself and my fellow researchers and practitioners to work towards these ends to ultimately improve the science centre and museum experience.

## Final remarks

I was invited to give this presentation in my capacity as a science education researcher at the University of Copenhagen in Denmark. However, prior to working in research, I was a science educator at several museums, a zoo and an aquarium. Therefore, I hope that what I have discussed in the preceding resonates in some way with all of you, both practitioners, researchers, and other museum and science centre actors.

## Acknowledgements

I am indebted to Heather King for her invitation to be a part of this session. I was greatly honored to speak alongside Justin Dillon and Kevin Crowley at the Ecsite conference in Trento. I finally wish to acknowledge the insightful work of Lynn Dierking and John Falk - without their tireless and ongoing efforts, I would not be in a position to critique their work today.

## References

Achiam, M. (2013). A content-oriented model for science exhibit engineering. *International Journal of Science Education, Part B, 3*(3), 214-232.

Ault, C. R., & Dodick, J. (2010). Tracking the footprints puzzle: The problematic persistence of science-as-process in teaching the nature and culture of science. *Science Education, 94*(6), 1092-1122.

Falk, J. H., & Dierking, L. D. (1992). *The museum experience*. Washington, DC: Whalesback Books.

Falk, J. H., & Dierking, L. D. (2013). *The museum experience revisited*. Walnut Creek: Left Coast Press.

Meszaros, C. (2006). Now THAT is evidence: Tracking down the evil "whatever" interpretation. *Visitor Studies Today, 9*(3), 10-15.

Phipps, M. (2010). Research trends and findings from a decade (1997-2007) of research on informal science education and free-choice science learning. *Visitor Studies, 13*(1), 3-22.

Schauble, L., Gleason, M. E., Lehrer, R., Bartlett, K., Petrosino, A., Allen, A., . . . Street, J. (2002). Supporting science learning in museums. In G. Leinhardt, K. Crowley & K. Knutson (Eds.), *Learning Conversations in Museums* (pp. 425-452). Mahwah: Lawrence Erlbaum Associates.