IMPACT: SCIENCE CENTRES INFLUENCE LEARNING

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World Wide Science Centre Movement

Today, there are more than 3000 science centres in the world. They are visited by more than 300 million visitors each year.

25 years ago, only ten percent of these institutions existed. We are in the midst of a global movement that continues to expand. It is hardly just because science centres are nice: they are perceived to perform a service to their communities.

Persson (2000) indicated global growth estimates of numbers of institutions at 5 % per year and attendance at 2 % per year in the 1990s. Growth has continued.

Enhancing Learning

Contextual Model of Learning in Museums:

The personal context: a variety of experience and knowledge

The sociocultural context: culture and social interaction

The physical context: architecture, design, ambience, both physical and virtual

(Falk & Dierking 2013)


MOUNTAIN
ZONE
92

Visitor Agendas

People come for different reasons: visitor identities

- Explorers: curiosity
- Facilitators: socially motivated
- Professionals/Hobbyists: professional passion
- Experience Seekers: reputation of museum
- Rechargers: contemplative experience

(Falk 2009)

Making Meaning

Learning to be regarded as “a personally constructed, highly idiosyncratic, lifelong process of making meaning.”

“Most of what we learn in our lives we learn not because we have to, but because we choose to”.

(Falk et al. 2007)

Learning Happens in Many Places

Falk & Dierking (2010):

”Average Americans spend less than 5 % of their life in school classrooms; and an ever growing body of evidence demonstrates that most science is learned outside of school.”

This is probably true for many other countries, as well.

You Learn from Many Sources

Falk & Needham (2011):

”An individual’s understanding of the physics of flight, for example, might represent the cumulative experiences of completing a classroom assignment on Bernoulli’s principle, reading a book on the Wright brothers, visiting a science center exhibit on lift and drag, and watching a television program on birds. All of these experiences are combined, often seamlessly, to construct a personal understanding of flight; no one source is sufficient to create understanding, nor one single institution solely responsible.”

Sources of Informal Learning

Sources of information for learning about science and technology:

- school,
- books and printed matter,
- life experiences,
- television,
- work,
- museums, zoos and science centres,
- internet,
- friends or family,
- radio.

Museums were used to some extent by 38.2 %, a lot by 22.8 % of the respondents (in 2000).

(Falk et al 2007)

Learning in Science Centres

There is a vast literature about learning in museums and science centres.

A review by Bitgood et al. (1994) of 150 articles showed that there are intellectual, emotional and physical impacts of informal learning in science museums. Traditional tools of experimental design are often inappropriate for studying informal settings.

George Hein's classic monograph Learning in the museum (1998): learning occurs!

Learning in Science Centres (2)

The review by Garnett (2002), commissioned by a group of 13 science centres around the world, summarized 180 reports on impact by science centres.

The review indicated that 87 % of these reports and studies related to personal, i.e. learning and educational, impact.

Of the personal impact, 54 % related to science learning, 18 % to attitudes, 14 % to enjoyment and 7 % to career choice.

Learning in Science Centres (3)

The authoritative and extensive review on informal science learning provided by the U.S. National Research Council (2009) concludes that there is compelling evidence of learning in designed settings, such as science centres:

- There is evidence of excitement and positive emotional responses.
- There is clear evidence of learning science content.
- There is evidence of engagement and reflection.
- There is evidence of integrating science learning with values and identity.

Learning in Science Centres (4)

The report prepared by Frontier Economics (2009) for the British government contains a literature review supporting similar conclusions:

- Science centres may improve people's understanding of scientific issues,
- change people's attitudes, and
- encourage children to pursue careers in science.

Creating Memories

“Museum experiences, both exhibitions and programs, are remarkably memorable. The vast majority of visitors to museums create durable memories of some aspect of their experience.

The persistence of museum memories is one indicator that museum experiences promote learning.”

(Falk & Dierking 2013)

Remembering

In his study on long-term effects of visits to the Launch Pad at the Science Museum in London, Stevenson (1991) observed that visitors were able to recall single exhibits 6 months after the visit. 26 % of the answers contained reflections on the phenomena observed and 14 % related to feelings.

Medved & Oakley (2000) looked at how adults remembered exhibits after a science centre visit and observed that one third of the persons interviewed were able to relate the exhibit content to everyday occurrences.

Bamberger & Tal (2008) studied students visiting a museum in Israel. After 16 months the students retained details of the experience and indicated a contribution by the visit to their knowledge.

Interest in Science

Interest in science is generally generated at an early age, before Middle School (Maltese & Tai 2009).

In an American survey by the National Science Foundation, people with science-related careers reported visits to museums and science centres as their most memorable informal science experiences as children (Sladek 1998).

Motivation

As Salmi (2003) points out, a science centre visit is short. Motivation becomes important. In his studies on motivation, he found that science centre visits had a positive effect on the motivation of students in all age groups. Results were most positive among primary school pupils.

School students having intrinsic motivation gained both better cognitive results and tended to apply deep-learning strategies in the learning process.

Gifted students seemed to get more motivated than others during the science centre visits. However, students with learning difficulties also got more motivated.


4.

Perspective and Awareness

Falk et al. (2004) focused on the types of short- and long-term learning that resulted from the use of interactives in two Australian institutions.

The major learning outcome over time was a positive shift in visitors' perspective and awareness.

The vast majority (73 %) of visitors could articulate an outcome after several months of elapsed time. Most of them reported that they gained new perspective and awareness on science.

Reflection and Attitudes

British studies (Frontier Economics 2009) interviewing science centre visitors report that

- 59 % learnt more than expected
- 43 % evoked thoughts about science
- 12 % reported change of attitudes towards science

International Science Centre Impact Study

In an extensive international study on the impact of science centres, Falk et al. (2014) collected data from 17 centres in 13 countries, interviewing 13 558 persons.

The results support the contention that individuals who used science centres were significantly more likely to be science and technology literate and engaged citizens.

The more frequent, the longer and the more recent the science centre experience, the stronger the correlation for all outcomes.

ISCIS (2)

The study shows clear correlations between science centre visits and

- science and technology knowledge and understanding
- interest and curiosity in science and technology
- engagement with science and technology related activities
- confidence in science and technology.

Cognitive Effects

Salmi (2003) conducted, inter alia, knowledge tests on groups of students visiting and not visiting science centres. He found clear positive cognitive learning effects from using science centre exhibits.

Miller (2004) found that the informal learning resources (which included science museums and science centres) contributed to civic scientific literacy in the United States.

Falk & Needham (2011) studied visitors to the California Science Center in Los Angeles during a decade after its opening in 1998. Results suggest that the science centre has had an important impact on the science literacy of greater Los Angeles. Self-report data by visitors indicate that the centre strongly influenced their understanding of science and technology.

Interest and Careers

The evaluation of the Informal Science Education Program of the U.S. National Science Foundation (Sladek 1998) shows that

- Of people with science careers, 85-92.9 % indicated as their most memorable informal education activity from their childhood visits to planetariums, aquariums, zoos, science museums or natural history museums.

- Among sources of ideas learned in youth and still used, people with science careers listed visits to science centres and museums as the most frequent (51.6 %).

- Among early education activities that initiated connections with school, science centres and exhibits top the list (50 %).

Science Centres and Career Choices

Coventry (1997), working in Perth, Western Australia, and Salmi (2003), working in Finland, were able to show a relation between science careers and science centres. Both surveyed university students, and both showed that 80 % of students in natural sciences had visited science centres, whereas in Perth only 64 % of the students in other subjects had. In Finland, a factorial analysis indicated the involvement of the Finnish science centre Heureka in patterns influencing career choices.

The results show that informal learning resources such as science centres have an effect on the career choices by university students.

Visitor Behaviour

Barriault and Pearson (2010) developed a visitor engagement model at Science North, Canada, by observing visitors' behaviour at specific exhibits.

The behaviours can be grouped in three categories that reflect increasing levels of engagement and learning: initiation, transition and breakthrough.

In Science North, transition is typically reached by 20-80 % of the visitors and breakthrough by 20-60 %.

This provides direct evidence of learning occurring in the exhibition halls.

Collective Evidence

The collective evidence strongly indicates that science centres

- strengthen science learning
- enhance interest in science
- strengthen motivation to learn science
- affect attitudes towards science and technology positively
- increase confidence in science
- influence career choices by young people.

Science centre visits may result in long-lasting memories, indicating a strong personal impact on visitors.

References

Bamberger, Y. and Tal, T. 2008. The experience for the lifelong journey: the long-term effect of a class visit to a science center. *Visitor Studies,* **11,** 198-212.

Barriault, C. and Pearson, D. 2010. Assessing exhibits for learning in science centers: a practical tool. *Visitor Studies*, **13**, 90-106.

Bitgood, S., Serrell, B., & Thompson, D. (1994). The impact of informal education on visitors to museums. *Informal Science Learning. What the research says about television, science museums, and community-based projects*, 61-106. Research Communications Inc., Dedham, USA.

Coventry, V. 1997. *Major influences on career choice: a study conducted on behalf of Scitech Discovery Centre.* Scitech Discovery Centre, Perth, Australia. 4 pp.

Falk, J. 2009. *Identity and the museum visitor experience.* Left Coast Press, Walnut Creek, California, 301 pp.

Falk, J. and Dierking, L. 2010. The 95 percent solution. *American Scientist*, **98**, 486-493.

Falk, J. and Dierking, L. 2013. *The museum experience revisited.* Left Coast Press, Walnut Creek, California, 416 pp.

Falk, J. and Needham, M. 2011. Measuring the impact of a science center on its community. *Journal of Research in Science Teaching*, **48**, 1-12.

Falk, J., Needham, M., Dierking, L. and Prendergast, L. 2014. *International science centre impact study. Final report.* John. H. Falk Research, Corvallis, Oregon. 45 pp.

Falk, J., Scott, C., Dierking, L., Rennie, L. and Jones, M.C. 2004. Interactives and visitor learning, *Curator*, **47**, 171-198.

Falk, J., Storksdieck, M. and Dierking, L. 2007. Investigating public science interest and understanding: evidence for the importance of free-choice learning. *Public Understanding of Science* **16,** 455-469.

Flexer, B. and Borun, M. 1984. The impact of a class visit to a participatory science museum exhibit and a classroom science lesson. *Journal of Research in Science Teaching* **21,** 863-873.

Frontier Economics 2009. *Assessing the impact of science centres in England.* Frontier Economics Ltd., London. 73 pp.

Garnett, R. 2002. *The impact of science centers/museums on their surrounding communities: summary report.* Questacon, Canberra. 14 pp.

Hein, G. 1998. *Learning in the museum.* Routledge, London. 203 pp.

Maltese, A. and Tai, R. 2010. Eyeballs in the fridge: sources of early interest in science. *International Journal of Science Education* **32,** 669-685.

Medved, M. and Oakley, K. 2000. Memories and scientific literacy: remembering exhibits from a science centre. *International Journal of Science Education* **22,** 1117-1132.

Miller, J. 2004. Public understanding of, and attitudes toward, scientific research: what we know and what we need to know. *Public Understanding of Science* **13,** 273-294.

National Research Council 2009. *Learning science in informal environments: people, places and pursuits.* Board on Science Education, National Academies Press, Washington, D.C. 349 pp.

Persson, P-E. 2000. Science centers are thriving and going strong! *Public Understanding of Science,* **9,** 449-460.

Salmi, H. 2003. Science centres as learning laboratories: experiences of Heureka, the Finnish Science Centre. *International Journal of Technology Management*, **25**, 460-476.

Sladek, M. 1998. *A report of the evaluation of the National Science Foundation's informal science education program.* National Science Foundation, Washington, D.C., 26 pp.

Stevenson, J. 1991. The long-term impact of interactive exhibits. *International Journal of Science Education* **13,** 521-531.