UNIVERSITY MUSEUMS AND FORMATIVE EXPERIENCES IN NATURAL HISTORY

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Abstract

Many people who develop a passion for natural history report formative experiences from their youth while exploring creeks and woodlands in their local area. With the advent of the internet and increased urbanization in the western world, these opportunities now often are lost to the current generation of young people because of the pressure of alternative leisure activities and reduced geographic availability.

University science museums can have a role in fostering formative experiences by building elements of experiential learning into education programs for young visitors. This is particularly relevant to universities in a suburban or "green belt" location that preserve remnants of the original environment.

These programs also instill positive attitudes toward increasingly important issues, such as biodiversity and ecological sustainability. Some of the education programs from Macquarie University's Earth Science and Biology Museums are outlined in this context.

Introduction

Many modern museums of natural history will consider that imparting knowledge and content to their various constituent audiences is only a fraction of what they are trying to communicate. Viewing a museum of natural history as a repository, or warehouse, of scientific knowledge only grudgingly shared with an inquisitive public is an antiquated perspective reminiscent of a bygone age. This "Temple of Knowledge" model is derived from the early days of national institutions such as the British Museum of Natural History.

The focus of museums, which has shifted from collections to audiences, is documented by Kotler & Kotler (2000). While collections remain the foundation of museums, they are no longer merely the "attics of a society" (Braun & Mares 2001). Instead, they are used in proactive ways to wield influence on social issues (Butler 2000). The engagement of audiences to impart values and attitudes is now a legitimate and vital museum function.

Davis (1996) challenged natural history museums to raise awareness of an environmental ethic. For these museums, raising awareness about biodiversity and ecological sustainability is a critical issue that requires attention from curators and museum educators. In a university setting, education programs that seek to impart values and attitudes in visiting audiences about these issues have the advantage of a background framework of significant multidisciplinary scientific knowledge and expertise.

All museum educators know that it is extremely difficult to control learning through museum education programs, regardless of whether it is geared towards imparting knowledge, attitudes, values or skills. Instead, it is the role of the educator to provide many opportunities for learning, in different ways, through the thoughtful structuring of activities around the knowledge base of the museum (Edson & Dean 1994). Understanding the social context of the audience is essential for the development of learning strategies through education programs (MacLulitch 2000).

This paper focuses on the education programs of Macquarie University's two small science museums in Sydney, Australia—the Biological Sciences Museum and the Earth Sciences Museum. These are the public face of a range of scientific facilities at the University that also includes outdoor teaching areas such as the Biology Teaching Gardens, the Earth Science Gardens, the University Fauna Park and the Macquarie University Ecology Reserve.

Linking these museums with the scientific expertise of the university and applying the principles of experiential learning can produce powerful education programs with the potential to alter attitudes and values. The following sections outline the rationale behind the formulation of these education programs.

This model could be adopted and adapted by other university natural history museums, particularly those in green belt locations, to foster good community education linkages with the potential for long-lasting attitudinal outcomes.

What Makes People Passionate About Natural History?

Any museum, regardless of its focus, wants to enthuse audiences about its subject matter. Natural history museums want visitors to gain a heightened awareness and knowledge about nature and natural systems. In considering ways to engender this enthusiasm, while keeping the importance of social context clearly in mind, we need to deal with the broader issue of what makes people interested in natural history in the first place.

Anecdotal evidence suggests that people who develop a passion for natural history usually can recall some formative experience, either from their childhood or during their young adult years, that acted as a catalyst to develop their interest. It is instructive to examine these formative experiences and seek common threads. Discussions with natural history enthusiasts associated with the Department of Biological Sciences and regular visitors to the Biological Sciences Museum at Macquarie University informed the following list of the most common formative experiences:

- Reading a book
- A television experience
- A museum visit
- Listening to a speaker
- An early field experience

First, it should be noted that these results are anecdotal and not derived from a specific research investigation. A formal questionnaire seeking information about formative experiences in natural history is being developed and will be given to a sample of staff and visitors as part of Macquarie University's Museum Studies program during 2004. Secondly, the group under investigation consists largely of the demographic range of those over the age of 35. It therefore does not represent the target group for museum education programs through the university's science museums—namely, school-age children.

These cursory investigations show that, although one experience might be interpreted as of singular importance, a series of experiences as interest deepens is the key to sustaining a lifelong passion for natural history.

Books that were nominated as having a strong impact included *My Family and Other Animals* by Gerald Durrell. Television experiences included the *Life on Earth* series by David Attenborough.

Inspirational museum visits seemed always to include early visits to the Australian Museum in Sydney. This is Australia's first and preeminent natural history museum. The impact of early museum visits has been investigated elsewhere (Falk & Dierking 1997).

Inspirational speakers that had an impact on shaping attitudes included the Harvard naturalist Stephen Jay Gould and the Canadian geneticist and environmentalist David Suzuki.

Overwhelmingly, however, early field experiences consistently were nominated as having the biggest impact on interest levels by the most number of people. Typically, nature enthusiasts recall early childhood experiences exploring local woodlands and waterways. Easy access to relatively unspoiled environments was obviously a more readily available option for those who grew up 20 or 30 years ago.

This phenomenon would seem to be similar in other parts of the western world. In a recent radio interview (ABC On-line 2003), David Suzuki noted that his childhood was a time of bonding with nature through camping and fishing excursions around Vancouver. He rated these experiences as being fundamental in developing his attitudes and interest in the natural world.

Much has been written about the power and poignancy of experiences in nature for shaping future attitudes towards nature (e.g., Smit 2000). The inspiration that the intersection of science and nature can provide is perhaps best encapsulated in these words of Carl Sagan:

> In its encounter with nature, science invariably elicits a sense of reverence and awe. The very act of understanding is a celebration of joining, merging, even if on a very modest scale, with the magnificence of the Cosmos. (qtd. in Asma 2001)[1]

In terms of developing cognitive frameworks, it is clear that most children appear to benefit from being outdoors. The infinite and diverse sensory qualities of the outdoor world stimulate brain development and function (Sebba 1991; Rivkin 1997). Young children especially need the broad experiential base provided by being outdoors. The knowledge they gain there is foundational to literacy and science learning. It has been argued that, unlike some childhood experiences, those related to the outside world appear to be lasting and formative (Chawla 1994). Other authors have noted that a lasting benefit is that children can and do learn to care for the environment if provided with numerous positive outdoor experiences (Carson 1998; Wilson 1996).

The Changing Social Context of Young Audiences

There are dual pressures of environmental degradation and lack of time conspiring against the children of today, inhibiting their opportunities for enjoying some of the formative outdoor experiences available to their parents and grandparents.

Increasing urbanization in the western world has meant a dramatic reduction in the availability of formative outdoor experiences for young people. The movement of people from rural and regional towns to urban settlements over the last three decades has been a highly noticeable trend associated with globalization.

Australia's population in 2001 was estimated to be 19.3 million (SoEARC 2001). The pattern of settlement is characterized by high rates of urbanization into low-density cities. Most Australians (about 60.7 percent) live in the five largest cities. Significant coastal non-metropolitan urban growth is also occurring. Over the next 10 years, the population growth rate is expected to decline slightly from 1.1 percent to 0.9 percent per annum (SoEARC 2001). The pattern of human settlement is not expected to change greatly, although urbanization is expected to increase. The five largest

cities are expected to contain 61.6 percent of Australia's population in 10 years time (SoEARC 2001). Similar patterns and trends have been documented globally.

David Suzuki noted that the places around Vancouver where he used to fish with his father have now become the victims of population growth and urban expansion:

> Today when my grandchildren call me begging to take them fishing, I can't. The places still exist but the fish don't. People all around the world have similar recollections of childhood swimming holes that are now too polluted to swim in or fishing streams that are now without fish and this refutes the popular claim that—there is plenty more where that came from. (qtd. in ABC On-line 2003)

Rivkin (2000) commented on the changed nature of childhood:

> Despite the benefits of outdoor experiences, and in contrast to earlier agrarian, pre-automotive times, children now spend most of their time inside buildings or vehicles. As most adult activities are indoors, so now are most children's, perhaps in large part from the need for supervision. Children seldom experience unsupervised outdoor play. Adult fears regarding traffic, firearms, kidnapping, injury, ultraviolet rays, insect-borne diseases, and pollution of various sorts lead them to keep children indoors. Additionally, especially in many urban areas, few places remain for children to play.

Leisure time that, in an earlier age, would have involved exploring the local environment is now largely consumed by a range of indoor activities. The growth of the internet and the access to computers in most western households consumes an increasing amount of time. For older children, the expansion of the education system and the demands of academic learning also reduce the opportunities for formative outdoor experiences.

The advent of the Information Age over the last two decades also has had a dramatic effect on the way young people learn. The rapid access to unbounded quantities of instantaneous information is considered a high time-consuming priority (Frand 2000). It promotes a "Nintendo learning culture" (Watson *in litt.* 2003), where learning through problem solving is reduced to repetitive trial and error actions, thus militating other more holistic and logical learning strategies.

Open-Ended Investigations in Education Programs

In this section, the philosophy and structure of education programs through the Division of Environmental and Life Sciences museums at Macquarie University are outlined. Macquarie is in the fortunate position of being located in a green belt region some kilometers northwest of the main urbanized hub of Sydney.

Experiential learning, involving practices of reflection, hypothesis, evaluation and problem solving (Kolb 1984), is a model for building cognitive processes that emphasises individual and group choice of strategies and self-directed outcomes. It is the process whereby knowledge is created through the transformation of experience.

Kolb's four modes of experiential learning are:

1. Concrete experience—intuitive preference to learn through direct experience that is reality-based and immediate.
2. Abstract conceptualization—preference for learning by thinking in theoretical terms.
3. Reflective observation—learning by watching
4. Active experimentation—learning by doing and judging its practical value.

In framing education programs for Macquarie's science museums, we utilize access to modified and unmodified environments on campus and incorporate as many of Kolb's modes as possible. We therefore view the campus environment as a natural extension of the museum environment.

For younger school children, this has been done by using the Biological Sciences Teaching Garden, with a focus on Mesozoic plants, to develop a "Dinosaur Walking Trail" to investigate the food of herbivorous dinosaurs (Kolb's Modes 1 & 3). This is linked with a replica of the Winton Dinosaur track-way in the Biological Sciences Museum and Jurassic fossil ferns in the Earth Sciences Museum. For slightly more advanced students, the Earth Sciences garden is used to explain biogeographic principles. The garden is divided by a pathway known as Wallace's line, which separates plants of Laurasian and Gondwanan affinities.

For senior high school students, problem solving and open-ended investigations are developed in a number of ways. The most popular program runs for an entire half-day and focuses on a biodiversity investigation of an unmodified environment on campus (Kolb's Modes 2 & 4).

Students are informed that there is a proposal for a housing development nearby and they have been hired as an environmental consultancy to undertake a biodiversity assessment of the area in question. Students then go through the following four phase investigation. The museum educator acts as a facilitator by guiding discussions on problem solving strategies but allows the students to develop their own conclusions about key methodologies and findings in the investigation.

1. Planning Discussion

Students discuss the issues involved in the task and devise a strategy for carrying out biodiversity sampling

in the area. This session is particularly useful for empowering the students as problem solvers. They are responsible for realizing the equipment and information needs to complete the task. It also allows them to explore the issue of what data means in a scientific investigation and its relevance to specific theories and hypotheses. It also reveals, at an initial stage, many simplistic preconceptions about biodiversity and the scientific method.

2. Sampling

Students are lead to the field area to sample leaf litter, investigate pre-established pit traps, test physical and chemical parameters of waterways and collect any other data that may be required. The concept of random sampling of leaf litter is one that often provides the biggest theoretical challenge. Students almost always agree that a random sampling regimen is required for an objective analysis, but few know how this should be constructed correctly.

3. Documenting Data

Students inevitably agree that for the investigation to yield a truthful result, accurate recording of information is required. In group work such as this, the individual tasks of correctly measuring environmental parameters (with a datalogger—a small handheld piece of scientific equipment that can record such variables as temperature, and Ph simultaneously) and recording sampling positions and results usually are negotiated among a number of investigators.

4. Laboratory Analysis

Samples collected in the field are brought back to the museum where they can be compared with reference specimens. Students have also employed the facilities of Macquarie University's Biotrack unit. This unit images specimens and compares them with a vast parataxonomic database of plants and animals from various local environments as an aid to identification. At the completion of this phase, students must think about their findings and consider the importance of the information revealed in the biodiversity analysis.

A New Role for Some University Natural History Museums

A cursory analysis of these Macquarie museum education programs indicates an emphasis on the following features:

1. They are open-ended and essentially driven by individual and group student curiosity.
2. They take place outdoors, providing an opportunity for formative experiences in the development of positive attitudes about issues of biodiversity and sustainability.
3. They are supported by a framework of cross-disciplinary academic knowledge typical of an advanced and complex research and teaching organization.
4. They, therefore, provide opportunities that increasingly are denied to many young people in the modern world, as previously demonstrated.

Although there has been no quantitative research on whether these types of programs through Macquarie University's science museums actually have a measurable beneficial effect on long-term environmental behavior or understanding of environmental issues, they are well received by the participants.

There has been much research into the subject of environmental education and its relationship to improved environmental behaviors (Zelezny 1999). While most research concurs with the precept that there is widespread concern for the state of the environment and the general assumption that greater awareness through education will bring more responsible behavior, there is some debate on the best ways to achieve this.

Much of this research is constrained by specific methodologies and research questions, and has lead to variable generalizations. For example, Disinger (1982) suggests that environmental education in non-traditional settings outside the classroom is more effective than environmental education in the classroom. Others (e.g. Volk et al. 1984) argue that little change can be achieved without actively engaging students in environmental issues. Others (e.g. Dresner & Gill 1994) argue that long-term exposures, rather than short, compartmentalized experiences, are more effective.

Some researchers have argued that those who do not experience nature during their early years are at risk of becoming cynical towards environmental issues in the future (e.g. Finger 1994). As indicated previously, there is now a rapidly growing cohort of people who fall into this category. Other researchers (e.g. Schultz 2000) focus on the importance of developing empathy as the key to attitudinal change. Open-ended learning in natural environments provides a ready template for empathic experiences.

Birney (*in litt.* 1986) has documented the effects of museum-based programs and reported increased awareness of conservation issues. This would indicate that a positive influence on behavior is being generated, perhaps through some empathic connection between audience and objects. However, the process lacks the power of formative outdoor experiences in natural, unmodified environments.

The general community benefits of having areas of relatively high biodiversity in urban spaces have been outlined previously (Niemela 1999). This is clearly not possible for all campus museums. Those located in green belt regions with ready access to unmodified environments can more readily adapt the program features elaborated above. Those without easy access,

however, still can have their education programs benefit from access to modified environments (Simpson 1999).

Genoways (1999) outlined the major challenges to university museums of natural history. He concluded that recognizing education as the primary role of a campus museum was fundamental. Perhaps we can add developing positive attitudes about environmental issues to this. We need to exploit every opportunity that allows our education programs to have a positive long-term impact on visitors.

There are 36 Australian Universities listed in the 1998 report *Transforming Cinderella Collections* (University Museums Project Committee 1998). Of these, 18 could be classified as having reasonably easy access to relatively unmodified environments. Of these 18, however, only 10 list natural history collections in their care (University Museums Project Committee 1998). While no firm figures are available, it is clear that because of the fiscal pressure on the tertiary education sector (e.g. Simpson 2003), very few universities have outreach education programs for school groups. The potential of this type of education program is, in Australia at least, largely undeveloped.

In conclusion, I argue that if more widely adopted, this type of program would deliver positive community engagement seeking appropriate social goals that represent a responsible, proactive platform for the tertiary education sector. It may be argued, particularly at times of fiscal stringency, that a university's primary focus should be restricted to research and the education of undergraduate and postgraduate students. Increased scrutiny of the societal role of universities, however, should compel these institutions towards programs of civic engagement that are responsible, sustainable and capable of delivering positive long-term goals. The same social pressures are evident where corporations are urged to engage in processes that demonstrate good corporate citizenship. University museums are capable of contributing significantly to this agenda.

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Notes

[1] Asma notes that this experience of transcendence is available to everyone—even atheists.

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