Utilising Resources of the Powerhouse Museum in Teaching Science

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ABSTRACT: The Powerhouse Museum and its other public venue, Sydney Observatory, have a range of exhibition displays, educational activities and publications that interpret numerous topics of science and technology. This paper summarises a selection of current and planned museum resources that place science and technology in various historical, contemporary and broader cultural contexts. There is information about interactive and static displays, audiovisuals, daytime and evening activities, educational kits, competitions, web site and more. Note that some of the museum's decorative arts and social history objects appear as integral parts of storylines in science and technology exhibitions. In fact aspects of decorative arts and social history exhibitions can be reinterpreted to support the applied history of science context. Educators are invited to suggest ways they could use the existing resources and facilities to stimulate student interest in various subjects and to nominate new or improved ways the museum could present science.

MUSEUM RESOURCES FOR SCIENCE TEACHING

Often seeing the real thing makes a lasting impression. The Powerhouse Museum and Sydney Observatory have many exhibitions on science and technology which display a wide range of authentic historical material.

Science, technology, design, innovation

Success and innovation: achieving for Australia is an exhibition about industrial innovation - past, present and future. It places in historical and social context many of the technologies we now take for granted. The exhibition also explains that it takes more than a good idea to make a successful product. A section called *Simply the best* features outstanding Australian engineering and design including a display of Engineering Excellence Award winners. The museum has won an award for its restoration of the 3830 locomotive, built in 1949 and retired in 1967 after 1.7 million kms of travelling the rails.

The exhibition is supported by a book, *Making it*, which expands on the ideas presented in the exhibition and has detailed case studies of innovations in many fields. There is also a CD-ROM, *Know How*, which is a multimedia database of Australian innovations. Date, maker, product and subject are some of the ways to access individual items. There are also case studies, games and plenty of things to appeal to students.

Stories of steam

The Boulton and Watt engine is a lasting reminder of the Industrial Revolution. Built in 1785, it is the oldest existing rotative steam engine in the world and at over 9 metres high is an impressive sight. The engine, a technological marvel of its time, incorporates Watt's separate condenser, parallel motion linkage, governor and sun and planet gearing, all key inventions or innovations of the period. Interactive displays explain the principles of the engine's features and other displays place the engine and its makers in historical context. An informative exhibition brochure is available.

Next to the Boulton and Watt engine is *Loco No 1*, which pulled the first steam train in NSW. Dating from 1855, this historic locomotive is closely linked to the early development of railways in Australia. The exhibition explores the social and economic aspects of the train's story. The exhibition brochure

includes the story of the expensive lesson to find the right material and design of the train tracks, an example of the painful learning experience often encountered in perfecting many new technologies.

A star of the steam theme, *The steam revolution* is a major exhibition which explores how steam revolutionised the world. It explains the science and technology of various developments in steam power from the efforts of the ancient Greeks to the earliest piston-cylinder engines to the turbine era. Operating engines and interactive displays captivate all visitors. This combines with imaginative exhibition design which places the engines in working settings ranging from mills to fun fairs. The latter displays look at electricity generation and associated technologies. The exhibition is appropriately located in the original steam engine house of the Powerhouse, built in 1899 to generate electricity for Sydney's trams.

Time and the stars

Sydney Observatory, on Observatory Hill in the Rocks, offers daytime and evening activities to connect the visitor with the universe. *By the light of the southern stars* is an exciting exhibition in the historic Observatory building. It covers astronomy in Australia from pre-colonial times, looking at Koori astronomy to today's world standard research.

The exhibition has interactive displays, historic and contemporary artefacts, audiovisuals and more. Subjects covered include the solar system, stars, the transit telescope ('the biggest clock in the world') and the transit of Venus ('the biggest rule in the world'), timepieces old and new, visual and radio astronomy and views of the universe. There are also displays on the history of the site and neighbourhood and the history of the various scientific activities carried out by Observatory staff, including meteorology, surveying, seismology, magnetic readings and cataloguing the stars of the southern sky.

The Observatory is open seven nights a week for guided telescope viewings, audiovisual showings and seeing the displays. Refer to the Sydney Observatory teachers guide for more information. Also purchase *The Sydney Sky Guide 2000* as a handy reference for daily and monthly events to look for in the sky, locating stars and reading basic astronomical information.

The Powerhouse Museum's model of the *'Strasburg' clock* dates from 1889, made by clockmaker Richard Bartholomew Smith as a centenary gift to the state of NSW. This popular object gives a performance of music and movement every hour. This astronomical clock features working displays of the moon and tides, an orrery of all planets except Pluto (which was discovered in 1930), the Sydney time dial, the time in six major cities in different parts of the world, a grand astronomical dial (which shows the current time and date, rising and setting of the sun, moon and stars as well as the phases of the moon), the cycles of the sun and moon as well as cherubs, deities, apostles and more. The clock is a superb centrepiece for a lesson on astronomy, horology and the human perception and depiction of time. An informative exhibition brochure is available.

The Powerhouse Museum, of which the Observatory is a part, has a project to develop a robotic telescope. This project, which had initial funding from AT&T, aims to provide a telescope that can be remotely controlled and accessed through the Internet. School and other groups will be able to book time on the telescope and during that time they will have exclusive control of the telescope. The computer images that they obtain of objects in the southern sky will be available to the public on the Powerhouse Museum web site. In the first testing phase the telescope will be installed on the roof of the museum. Later the telescope will be moved to a dark-sky observing site in the country. The project is proceeding well. The dome is now in place and the pier and the robotic mount are ready for installation as soon as the wiring is completed.

Information technology

Universal machine: computers and connections is the new IT exhibition to grace the museum. It's a long term exhibition which will have frequent updates to keep it current with its rapidly changing subject. Yet it also contains a superb collection of historic material featuring a section on Charles Babbage, who was arguably the father of the computer. The exhibition explores how computers have become an integral part of many activities, from communications, to robotics, to image manipulation, to making music, to making and breaking codes, and more. And along with the latest technologies one will find the first models of the typewriter, telegraph, telephone and so on. It's highly interactive, totally engaging and fundamentally educational.

The *Information Technology Centre* (ITC) is an unbeatable learning facility for a wide range of current information technologies. It has two sections: 1. The IBM IT classroom is equipped with the latest multimedia personal computers and high speed Internet link; 2. The IT applications room offers leading-edge industrial, commercial and scientific information technology systems - you can capture images from weather satellites, read newspapers from around the world, manufacture products on computer-controlled lathes and sewing machines and more. Education programs in the classroom include courses on using the Internet, introduction to computers and design and creative drawing and computers.

The *SoundHouse* educational program enables students to compose and play music on computers. Education staff can show users how to view the waveform of various sounds on computer monitors and then to study the effect of changing the waveform. This facility can be used in conjunction with the *Musical instruments* exhibition to place music making and playing in a historical technological context and to make the connection to the science of sound.

Physics and chemistry

The *Experimentations* exhibition combines historic and contemporary scientific instruments and technological artefacts with numerous interactives, graphics, a few poems and even cartoons to illustrate a range of physics topics. Subjects include gravity and motion, electricity and magnetism, heat and pressure and light.

The *Chemical attractions* exhibition reveals the chemistry in everyday items and shows how apparently simple things are wonders of chemical complexity. Some history is presented but the main attractions are the topics which include the chemistry of chocolate, colour and fragrance. Popular interactive displays include one that gives out 4 flavours of chocolate chips, design your own fireworks and a range of smell experiences. Several decorative arts artefacts are displayed next to scientific instruments to point out that artists make use of complex chemistry to make and colour their ceramic, glass and other creations. An exhibition brochure is available for *Experimentations* and teaching notes cover both exhibitions.

Space technology

Space: beyond this world shows the past, present and future of space exploration. It combines real and replica objects from space programs of the USA, former Soviet Union, France, Australia and China. History is a strong element of the exhibition and one can see the beginning off rocketry in ancient Chinese weapons and the more recent experiments earlier this century of America's Robert Goddard. A wonderful book, *Space Australia: the story of Australia's involvement in space*, is available from the museum as well as an exhibition brochure.

Planes, trains, automobiles and boats

The history of aerodynamics can be made more real by discussing the design of the Cirrus moth biplane, the strange autogyro and other historic aircraft suspended from the museum's roof trusses.

The *Transport* exhibition is a departure point for thinking about the history of the science and technology of travel. There are links through history to other subjects such as how the development of train timetables was a driving force for more accurate and precise timekeeping and how railways were an early user of the telegraph though their need for even faster means of communication. The exhibition is being refurbished for an upgraded look in 2000.

Young science

The *Young scientist '99* exhibition is on at the Powerhouse from 27 October to 8 December 1999. It features winning and selected works from student entries in the Intel® Young scientist '99 Awards. Students from K-12 in NSW can enter the competition for prizes and personal acknowledgement and feedback. The categories of the competition encourage creative thinking and several students enter works which explore aspects of the history of science or technology. After the Powerhouse the display tours NSW. The exhibition is worth a look for all students and science teachers.

Australian engineering history

To mark the 50th anniversary of the one of the largest projects in Australian history, the *Snowy! Power of a nation* exhibition examines its technical innovations and how it shaped Australia, from environmental issues to multiculturalism. The exhibition content links to many subjects including hydrodynamics, electricity generation, agriculture and the effects of science and technology on a nation.

The history of contraception (on tour)

Taking precautions is an exhibition about the history of contraception right up to the present day. It places health and social issues in culturally diverse contexts as well as showing how the attitudes, practices and technology of contraception have changed. The exhibition will be in Canberra to 30 January 2000, then Wagga Wagga through April 2000. An exhibition brochure is available.

Web site and Race across time

Of course the museum's web site features news of the latest exhibitions, publications, public programs and other important activities occurring at the Powerhouse and Sydney Observatory. But it also contains an educational web based game called *Race across time*. The game has two levels of difficulty and is suitable for a wide range of students. It encourages self-motivated learning and web based research. The game requires and offers historical and contemporary information in a wide range of subjects which include plenty of science and technology. The game is part of the AT&T Virtual Classroom program. Look for the link to the game on the *For schools* page of www.phm.gov.au.

Thinking laterally

Many students will find it refreshing to consider science and technology subjects from a decorative aesthetic or social perspective. The museum's many decorative arts and social history exhibitions offer numerous opportunities to approach the past and present of science and technology from new directions. We leave it to individual educators to explore how to reinterpret these subjects to make links to the science and technology curricula.

The museum aims to use innovative means to support curricula relevant to its subjects of interest. The museum invites educators to suggest ways they could use any of the existing and proposed resources and facilities to stimulate student interest in various subjects and to nominate new or improved ways the museum could present science.