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Science Education in a Planetarium

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Abstract: This paper discusses the role of the planetarium as an indispensable means of teaching astronomy and as an increasingly popular way of teaching science.

1. Introduction
The meaning of the word planetarium has changed significantly since the planetarium projector was first invented. In the late twenties and early thirties it was conceived as a room which holds a device for projecting celestial objects, giving an almost perfect illusion of being out in the open on a starry night. Today, however, the planetarium is seen more broadly as an influential and important component of the educational process of the society, capable of carrying out not only astronomical activities but also forming an important link between science and the community.

2. The Philosophy of a Planetarium
Most people come to a planetarium to be entertained rather than to be lectured. They expect the hour or so they spend beneath the stars to be a memorable adventure into space which combines drama with education. Such dramatic shows are necessary to encourage the audience to make repeated visits. On the other hand, while the dramatisation of science is sometimes necessary, the basic scientific facts should not be distorted or dishonestly presented.

Hence, to ensure a proper balance between what is regarded as 'glitzy' and what is perceived as 'boring', careful consideration has to be given to planning planetarium shows.

It is also important to incorporate the local culture into the shows in order to minimise the alienation of a scientific subject such as astronomy. The planetarium should, therefore, be a focal point not only for educational enhancement but for cultural enrichment as well.

The planetarium has an environment that is truly unique. The quiet planetarium setting with stars gliding overhead gives the audience an opportunity to contemplate. People are inspired by the infiniteness of space and their spirits are uplifted. Planetarium shows must, therefore, be liberally punctuated by gaps which allow time for effective contemplation.

3. Astronomy Education
The planetarium projector is an extremely powerful tool for teaching astronomy. Celestial motion requiring time lapsed of thousands of years can be simulated within the one hour the audience is seated under the dome. Immense distances can be traversed within minutes. The planetarium is indeed a unique medium offering a host of capabilities. The versatility of a planetarium which is coupled to special-effects projectors is sometimes so extensive that every program requires careful preparation to avoid overwhelming the audience.

(a) Developing a program
Planetarium shows fall into three broad categories (Hagar 1980):
(i) Traditional—this type of show is usually repeated year after year because it describes the sky in a particular season.
(ii) Topical—this kind of show focuses on a particular topic in astronomy. There is a wide range of topics to choose from, e.g., Moon, planets, cosmological theories.
(iii) Timely—this category includes programs about a current spectacular celestial event such as Halley's comet, eclipses, supernovae.

The standard planetarium program normally consists of five parts (Keller 1980). The first few minutes are designed to settle the audience: to get their eyes adjusted to the low light levels and to put them in a quiet mood. When this is done the pace of the dialogue may be quickened and in the second part the audience is introduced to the various fundamental tenets of astronomy.

Motions of the celestial objects are introduced in the third section followed by a detailed discussion of the main topic of the program, be it on Halley's comet or supernova 1987A.

The last part normally consists of the winding down of the pace. For the remaining minutes it is vital for the audience to be inspired and for their emotions to be stirred.

There are, of course, variations to this sequence. In terms of the dramatisation, lecturers are limited only by their imagination. The content depends to a great extent on the philosophy, goals, time and budget of the planetarium.

The program developed could be targeted for the layman, the specialist audience or students. Each group has special requirements but while the specialist and the student may equally enjoy the show created for the layman, the reverse is not necessarily true. The lay audience usually craves to be liberated from the drudgery of everyday life and the humdrum of everyday thoughts. They want to experience the infiniteness and timelessness of space. A careful blend of cinematographic techniques, background music and narration will instill in the audience an appreciation of the immensity of space. Public and especially school planetarium programs are more a question of psychology rather than just science.

There is, however, a danger of making a show too glitzy and we therefore pass up a chance at really educating the public. As stated before, a balance between dramatisation and education is essential. The objective of the planetarium is, after all, for the public to be educated, albeit in some cases somewhat unwittingly.

(b) Space travel in a planetarium
People long to be free of the shackles of gravity. In a planetarium they are transported into space with the greatest of pleasure and ease. Simulation of space travel is greatly expedited by the development of fast computers and special effects projectors. Modifications to the planetarium projectors as well as the tilt of the dome makes the simulations more realistic.

The modification to the planetarium projector mentioned is the separation of the planet projectors from the main star projector. Because the planet projectors are physically apart, they can be used independently and this allows them to be used in a more versatile fashion. One example is to use them to simulate a bright constellation, such as Orion. A feeling of flying towards this constellation may then be achieved by making the stars of
Figure 1 – Equipment layout diagram for a planetarium system
the constellation change their positions relative to one another as the constellation is approached during space travel.

Space travel is felt more realistically with the advent of the tilted dome. Within such a dome, stars may be seen below the normal horizon which gives one a feeling of actually being in space. This, coupled with special effects projectors that spin, flash and gyrate images, makes the presentation more dramatic. An example of some of the equipment available for a planetarium system is shown in Figure 1.

4. Presenting the Sciences in a Planetarium
The planetarium can be viewed as a theatre but it also usually includes an exhibition hall, seminar rooms, a library and an observatory which increase its versatility. Recently more planetaria see themselves as science education centres where astronomy is just one of the sciences presented.

Some of the examples of scientific shows that may be presented are:

- **Meteorology**: clouds, atmospheric phenomena
- **Mathematics**: space orbits, navigation, celestial coordinates
- **Physics**: gravitation, tidal phenomena, telescopic optics, relativity
- **Chemistry**: molecules in space, nuclear energy
- **Geology**: surfaces of planets and satellites, the Earth
- **Biology**: evolution, extraterrestrial life

Even history, geography, literature, poetry, art and music may be fitted into the planetarium format. The possibilities are unlimited and are perhaps only constrained by policies, goals, budget and staff versatility.

5. Other Functions of a Planetarium
A planetarium may act as an important link between science and the community because it can 'soften' hard science by including elements of drama and style. Scientific concepts may be built around local folklore, local heroes and local environmental factors.

Another important function of the planetarium is to act as an information centre where all members of society may channel their queries regarding astronomy. It should, therefore, maintain close links with the international astronomical community.

A planetarium can be a focal point for astronomical activities, bringing together the amateurs, the educationists and the professionals. With the help of these people it can conduct courses, hold exhibitions and plan observing programs for the different levels of interest that exist. A good public relations and marketing philosophy will ensure that the community is informed of events at the planetarium as well as developments in astronomy in general.

A planetarium should also involve itself with environmental issues since astronomy and the environment are very much interrelated. This involvement will expand the breadth of its programs and in turn extend the circle of people coming to the planetarium while at the same time exposing the fact that astronomy is in many ways relevant to the society.

6. Challenges for a Planetarium
The planetarium today is faced with the challenge of attracting people who have at their disposal a gamut of audio-visual aids that tease and tantalise their senses. The planetarium must present its programs in an educationally sound and yet interesting and dramatic environment. It has to inspire its audience. The planetarium director who has to be a scientist, teacher, administrator, engineer, showman, orator, marketing manager all rolled into one must surely be able to accept this challenge with a real sense of purpose.