STARLAB AS AN ASTRONOMY TEACHING TOOLS IN SCHOOLS: AN ENGAGING CURRICULUM

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Abstract

How planetariums educate young people effectively about the wonders of the universe? Traditional way has led teachers and students to present themselves at the planetariums that provide astronomy related exhibitions, full dome star fields and astronomical shows, as well as special informal educational programs. Their experiences at planetariums are expected to be delivered back to the classroom upon returning school. Starlab is a portable version of mini planetarium that allows astronomy experiences to be taken to the distant or rural areas especially to those underserved teachers and students who could not afford to tolerate the travel expenses to visit planetariums. The Starlab plays a significant role in astronomy and space science education. It serves as an introduction to systematic study of the sky and thus to study science as a whole. For this reason, Planetarium Negara is planning to rent out the existing Starlab for expanding its usage at schools level and to enrich current school lessons at least in astronomical content. This paper describes the use of the Starlab as an astronomy teaching tool in schools.

Keywords: portable planetarium; starlab; astronomy

Introduction

Astronomy and space science is an important part of science curriculum for primary and secondary schools in Malaysia. But how planetariums play an important role in educating young people about the universe most effectively? Teachers, however, have often found the teaching of astronomical concepts difficult because of the complex nature and also meet the difficulty in teaching astronomy in a classroom environment in the daytime.

Some schools teachers will organize visit trip to Planetariums because of their ability to reproduce the evening sky in daytime and present astronomical concepts in a way not possible in the classroom. But there is only 5 permanent planetariums in Malaysia, namely Planetarium Negara, Planetarium Sultan Iskandar, Terengganu Science and Creativity Centre, Al-Khawarizmi Complex and Melaka Planetarium. Not all the schools in Malaysia have chance to organize visiting trip to the planetariums.

Due to the difficulty and limitations of permanent planetariums in Malaysia, Planetarium Negara is planning to rent out the existing Starlab to schools for expanding its usage and to enrich current schools lessons at least in astronomical contents.

Gary (1997) had done a study to identify educators' perceptions of the impacts of the Starlab on teaching and learning tool among Starlab users around the world in year 1997. With the results of this study, one could easily demonstrates the effectiveness of Starlab as an

important, viable teaching and learning tool that could generate student excitement and love for learning.

In 2003, the Houston Museum of Natural Science, in collaboration with Rice University has organized an outreach program taking portable digital planetarium to schools and community sites for over five years. Research by Sumners, Reiff and Weber (2008) showed that subjects taught with more than one modality (hearing, seeing) can be learned more effectively than using one modality alone, and that learning through discussion and experience are more effective than just through hearing or seeing. The study showed that the Starlab plays a significant role in astronomy and space science education. It served as an introduction to systematic study of the sky and thus to study science as a whole.

This paper will describe the overview on how to use the Starlab by educators as an astronomy teaching and learning tool in schools.

What is Starlab?

Starlab is a small portable planetarium made of fabric, which is inflated by a fan and can accommodate about 35 children or 25 adults. A star projector recreates the sky, including the Sun, the Moon and the planets' position on the dome, for any time or place on the Earth. There is very little doubt in the minds of anyone who steps into the Starlab dome, that it has a unique ability to draw everyone into a wonderful and magical world of astronomy. The sky we see every night reveals many mysteries of our existence. By changing the projection cylinder, the projector can also produce constellation outlines, a globe of the Earth or a diagram of a human cell.

Starlab equipment fits into three small cases and a duffle bag. It is easily transportable, when folded up, the dome and associated equipment can fit into a minivan. It can be easily setup in 20 minutes. It can also be easily operated by a single classroom teacher and can be used by classes of every level.

Components of Starlab

The Starlab consists of an inflatable dome (4.8m in diameter and 3.2m ceiling height), a projector and a high volume fan that is used to inflate the dome.

1. Project
2. Projector/cylinder Travel Case
3. Projection Cylinders
4. Dome Duffel Bag
5. Blower
6. Blower Travel Case
7. Astronomy and More Curriculum Manual
8. Planetarium Activities for Students Success
9. Slide Set of the Planets, Stars and Galaxies
10. LED Arrow Pointer
11. Accessory Box with Replacement Bulbs, Planet Set, Moon Set
12. Tours of the Night Sky (Tapes and CD)
13. STARLAB Newsletter

Figure 1. The Starlab system and its accessories.

Before Setting Up the Starlab

Before setting up the Starlab, the following factors should be taken into accounts:

Room Requirements

A minimum ceiling height of 3.4m is needed with a cleared floor space of 6.4m.

Floor Surface

The Starlab should be set up on a carpeted floor, wood floor or tile floor. The floor must be cleaned because grit and dirt on the floor can cause damage to the dome. Gym mats, canvas and carpet can also be placed to cover the floor beneath the dome.

Electrical Requirements

The Starlab fan and projector are designed to plug directly into a regular 120 volt, 60 cycle grounded AC outlet. A separate power cord with an outlet strip inside the dome can also be used.

Temperature

The Starlab has no climate control of its own, so should be setup in the room temperature. The dome should neither be setup under skylights nor next to windows where direct sunlight can shine on the dome.

Noise Level

The Starlab should be setup in a room that can be closed off from other classes so that they don't interfere with each others.

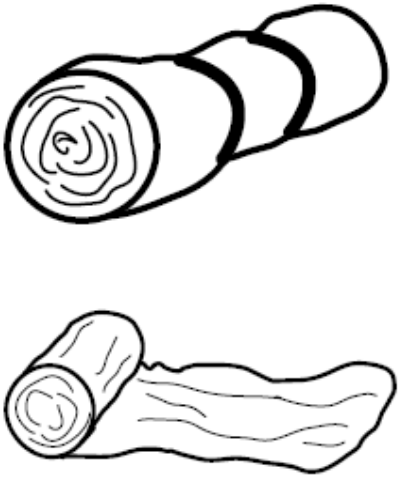
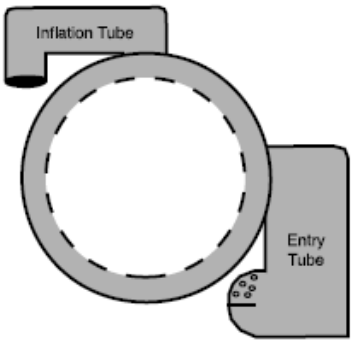
Set Up Time

It takes about 30 minutes in setting up the Starlab.

Setting up the Starlab

Steps to setting up will be explained in Table 1 (Gerald, 1990).

Table 1
Steps to setup the Starlab

No	Steps	Photo
1	Unrolling the dome across the floor where the setup is planned.	
2	Connect the fan to the dome (inflation tube) securely and inflating the dome	
3	Setup the Starlab projector in the centre of the dome and place it on carrying case (as a stand)	

4	Attach cylinder on the projector by four magnets carefully	
5	Adjust the projector brightness to the desired conditions	
6	Set the projector to the desired date and time	
7	Set projector to the desired location by adjusting the latitude	
8	Starlab ready to be used as an astronomy teaching tool	

After Using Starlab

After completed presentation in the Starlab, users should remove all planet projectors and moon phases from the Starfield cylinder and put them back into accessory box. Take the Starfield cylinder off the projector and slide it back into compartment in the casing. Turn off the projector and place it on the floor. Exit the dome and turn off the fan. Unplug the fan and projector and place them back into carrying case. Then roll and pack the Starlab dome.

Starlab for Teaching Astronomy

Astronomy topics included day time and night time skies, Moon phases, the rising and setting of the Sun, constellation identification, use of star maps and much more which can be easily presented by the Starlab.

Teachers Tips on Using Starlab Projection Cylinder

There are 3 main projection cylinders that can be used as an astronomy teaching tools, namely starfield, constellations and deep sky (Gary, 2008).

The starfield cylinder simulates the night sky at any time, season or location on the Earth. Over 3000 stars are projected to a limiting magnitude of 5.5 with the brightest stars individually lensed to produce intense pinpoint images.

Besides that, the starfield cylinder has twelve magnetic light blocks around its circumstances. These light blocks mark the position of the Sun along the ecliptic and when one is removed, it shows where the Sun would appear in the sky for each month of the year. We will be able to observe the elevation of the Sun, location of sunrise, sunset and the relative amount of time it

takes to across the sky for each month of the year making it easy to demonstrate the reasons for the seasons.

Because the Moon normally travels close to the ecliptic and since it has the same apparent diameter as the Sun in the sky, the same light ports used to project the Sun can be used to project the Moon in the sky. Two identical sets of 5 magnetic moon phase inserts included can be used to show the phases of the Moon. One set of inserts can be used to show the waxing phases while the second set can be used to show the waning phases.

Planets can be displayed to the night sky by using the planet projectors. The planet projectors have same type of magnetic attachment system as the moon phases and they use the same light ports on the starfield cylinder. Set the starfield cylinder for the desired date and time and then locates the position in the sky where the planet should be.

The constellations cylinder features the 48 major constellations, the ecliptic and celestial equator, colorfully displayed for the ultimate visual retention. The applications include star identification, planetary positions as well as the path of the sun and moon.

Meanwhile the deep sky cylinder shows variable and double stars, open clusters, nebulae and galaxies. Detailed identification numbers/symbols and the object's location in right ascension and declination, as well as its relation to a nearby constellation, are shown.

Correlation of Starlab Cylinders to the Malaysia Integrated Curriculum for Primary and Secondary Schools

The various Starlab cylinders that were used with the analog standard projectors were developed with the concept of participation as a central theme (Gary, 2008). The following Table 2 showed three main Starlab cylinders (Southern and Northern) can be used to help students meet each of the Malaysia Integrated Curriculum for science subjects in primary and secondary schools in the field of astronomy and space science.

Table 2

Correlation of the Starlab cylinders to the science subjects in Malaysia Integrated Curriculum for primary and secondary schools.

Science Year 4: Investigating the Earth and the Universe						
The Solar System	**NS**	**SS**	**NC**	**SC**	**ND**	**SD**
Understanding the Solar System	√	√				
Understanding the relative size and distance between the Earth, the Moon and the Sun	√	√				
Appreciating the perfect placement of the planet Earth in the Solar System	√	√				
Science Year 5: Investigating the Earth and the Universe						
Constellation	**NS**	**SS**	**NC**	**SC**	**ND**	**SD**
Understanding the constellation	√	√	√	√		
The Earth, the Moon and the Sun	√	√				
Understanding the occurrence of day and night	√	√				
Understanding the phases of the Moon	√	√				
Science Year 6: Investigating the Earth and the Universe						
Eclipses	**NS**	**SS**	**NC**	**SC**	**ND**	**SD**
Understanding the eclipse of the Moon	√	√				

Understanding the eclipse of the Sun	√	√				
Science Form 3: Astronomy and Space Explorations						
Stars and Galaxies	**NS**	**SS**	**NC**	**SC**	**ND**	**SD**
Understanding the stars and galaxies in the Universe	√	√	√	√	√	√

Abbreviation:
NS – Northern Starfield
SS – Southern Starfield
NC – Northern Constellation
SC – Southern Constellation
ND – Northern Deep Sky
SD - Southern Deep Sky

From the Table 2, we can know which of the three Starlab cylinders can be used to help educators and students to meet each of the Malaysia Integrated Curriculum for primary and secondary schools in term of astronomy in the science subject. So teachers or educators are encouraged to rent out the Starlab from Planetarium Negara as a teaching and learning tool. The teachers who are interested will be trained in using the Starlab.

We provide the teachers in the program with background knowledge in basic astronomy. Then we teach them how to involve their students actively in the planetarium lessons. Finally they are trained in the use of Starlab. After training, these teachers then can rent the Starlab to use in their own school. The result is a partnership between teachers and National Planetarium, with the students as the main beneficiaries.

Conclusion

The Starlab is an important and viable teaching and learning tool especially for teachers or educators that could generate students excitement and love for learning astronomy It also served as an introduction to systematic study of the sky and thus to study science as a whole.

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