

Coping with a New Curriculum: The Evolving Schools Program at the Carter Observatory, New Zealand

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1. Introduction

Carter Observatory is the National Observatory of New Zealand and was opened in 1941. For more than ten years the Observatory has maintained an active education program for visiting school groups (see Andrews, 1991), and education now forms one of its four functions. The others relate to astronomical research; public astronomy; and the preservation of New Zealand's astronomical heritage (see Orchiston and Dodd, 1995).

Since the acquisition of a small Zeiss planetarium and associated visitor centre in 1992, the public astronomy and education programs at the Carter Observatory have witnessed a major expansion (see Orchiston, 1995; Orchiston and Dodd, 1996). A significant contributing factor was the introduction by the government of a new science curriculum into New Zealand schools in 1995 (*Science in the New Zealand Curriculum*, 1995). "Making Sense of Planet Earth and Beyond" comprises one quarter of this curriculum, and the "Beyond" component is astronomy. As a result of this exciting innovation, within just a few years, astronomy will be taught at almost every school in New Zealand – from entry primary school through to final year secondary – at eight distinct levels. This, in turn, will eventually lead to the emergence of one of the most astronomically-aware nations on Earth.

In 1995 the Ministry of Education also introduced competitive funding for museums, science centres, observatories and other institutions wishing to offer "Learning Experiences Outside the Classroom", and the Carter Observatory was successful in negotiating a three-year contract. As a result, a second full-time Education Officer was appointed, and the Observatory's schools program was totally revised in order to cater to the evolving needs of students, teachers and trainee teachers under the new astronomy curriculum. In addition, other programs and resources, such as "Overnight Extravanzas", Astro-camp Booklets, and special holiday programs, were introduced to enrich the after-hours astronomical education experiences of school students, while a number of training programs were introduced for teachers and trainee teachers aspiring towards astronomical literacy.

This paper focuses on new resources developed for school visits to the Carter Observatory and other initiatives that have been taken to support the new curriculum.

2. Schools Program

There are two quite distinct components to the Carter Observatory's schools program: visits by groups to the Observatory, and outreach visits by Observatory staff to schools. Those visiting the Observatory can take full advantage of the facilities in the Visitor Centre, including the Zeiss planetarium and, on evening visits, the historic 23cm Cooke refractor (see Andrews and Budding, 1992; Orchiston *et al*, 1995).

One of the aims of the new astronomy curriculum is to assist students and teachers "... to investigate and understand relationships between planet earth and its solar system,

galaxy and the universe"; this is typically achieved by using a combination of class discussion, practical demonstrations, selected videotape excerpts, slides, audio-visual shows, and planetarium programs. Material in the Observatory's Resource Centre is freely drawn on in preparing classes, and Unit Booklets are often used during the classes themselves. Information on both of these appears below.

2.1. *Unit Booklets*

In response to demand, a decision was made to develop Unit Booklets that could be used by teachers as a basis for planning their classroom work in astronomy. Furthermore, because of the novelty of astronomy as a discipline, and its perceived "difficulty" (e.g. see Richter and Fraknoi, 1994), it was decided to adopt a cross-curricular approach and demonstrate how astronomy could be imaginatively linked with other curriculum areas (c.f. Whitehouse, 1994). The first batch of Unit Booklets focussed on linkages between astronomy and other physical sciences, and between the astronomy, mathematics and technology curricula. Work is now in progress on developing Unit Booklets from a Maori and Pacific Island perspective, in order to recognise the *tangata whenua* (original pre-European inhabitants) and take account of New Zealand's unique multicultural ethnic mix.

As at 1996 June, 45 different Unit Booklets had been produced, and each of these deals with a particular topic at a specified curriculum level. Between them, the 45 Booklets span a wide range of topics. In each Unit Booklet the curriculum objectives are clearly defined, and a range of options and guides for implementing the unit are given. Any necessary background information is included. The intent of these Booklets is to take the drudgery out of planning astronomy lessons and where possible to instil creativity in the teaching. We also prepared three associated Assessment Booklets and these have photocopyable pages, which make the task of setting up assessment schedules far less arduous.

All of the Unit and Assessment Booklets were produced in-house on the Observatory's computers, and then photocopied. Unit Booklets range in length from 6 to 17 pages and are sold at \$NZ3:50 each. They have been very well received by New Zealand teachers and by colleagues in a number of overseas astronomical institutions.

2.2. *The Resource Centre*

In order to provide a diverse range of resource material for Observatory staff, teachers, and students undertaking our training programs we have been building up a Resource Centre. This contains the following range of material, drawn from national and international sources:

- books, booklets, leaflets and pamphlets
- reprints and photocopies of articles on astronomy and astronomy education
- teaching and resource material developed by overseas observatories, science centres, planetariums, etc.
- kits, toys, and equipment
- slides
- videotapes
- computer programs
- CD-ROMs and video disks

As at 1996 June, material in the Carter Observatory Astronomy Education Resource Centre occupied the equivalent of one four-drawer filing cabinet, and about 40 linear metres of bookshelf space. Carter Observatory in-house publications in the Resource Centre include the latest *Astronomical Handbooks*; full sets of Unit Booklets, Astrocamp

Booklets (see below), Activity Booklets and selected Information Sheets (see Orchiston *et al.*, 1997). We are eager to expand further the number of non-New Zealand items in the Resource Centre and would welcome the offer of material on an exchange basis.

During the building up of the Resource Centre, staff have also made a point of identifying items suitable for sale in the Observatory's Space Shop, and details of these reach schools throughout the country via our Summer and Winter Mail Order Catalogues.

3. Other Related Initiatives

3.1. *Holiday Programs*

In 1995 the Observatory ran two different two-week school holiday programs for 5-11 year old children (see Leather *et al.*, 1997). One focussed on Mars and the other on the Sun. Enrolments were limited to 30 children per day, and most days were fully subscribed. In addition to providing the children with astronomical games, quizzes, video screenings, art and craft activities (including mural painting), story-telling, drama sessions, and practical and design projects, staff also prepared two different 12-page Activity Booklets titled *Spaceship Mars and Journey to the Sun* (after the names of the respective holiday programs). These contain basic information and an assortment of activities, games, puzzles, and astronomical recipes, and were sold at cost (\$NZ3 each).

Although both holiday programs were highly successful, staffing limitations and space constraints led to a much regretted decision not to schedule any further programs in the foreseeable future.

3.2. *"Overnight Extravaganzas"*

One of the Carter Observatory's most successful innovations are the "Overnight Extravaganzas" (see Orchiston and Andrews, 1995). On average these are held fortnightly, on a Friday evening, and groups of pre-teenage children and accompanying adults spend a night at the Observatory and sleep under the stars in the planetarium chamber (after the chairs have been removed).

The evening to some extent follows the program set out for the Observatory's twice-weekly "Public Nights", with two different planetarium programs ("The Southern Night Sky" plus whatever happens at the time to be the current feature program), the current audio-visual show, videos and discussions on astronomy, and sky-viewing through the 23-cm refractor (weather-permitting). The "Orbits" computer program is also popular. An additional optional activity towards the end of the evening program is a 10-minute walk through the Wellington Botanic Garden to view an area crowded with glow-worms.

Since their introduction in 1993 November "Overnight Extravaganzas" have proved extremely popular, and attracted groups from all over New Zealand. There is a strong demand to expand the client base by including teenage and adults groups, but the limited number of staff available for "Overnight Extravaganzas" thus far has precluded this.

3.3. *Astro-camp Booklets*

School camps and camps organised for brownies, cubs, scouts, guides and other groups are particularly common in New Zealand, and over the past few years Carter Observatory staff frequently have been asked to supply night sky information and suggest observing projects and other activities.

In responding to this obvious demand, during 1996 May and June one of the authors (K.L.) prepared six different Astro-camp Booklets. These deal, respectively, with general projects, constellations and mythology, galaxies, the Sun, and the Moon (two different

Booklets), and were produced in-house on the Observatory's computers and then photocopied. They range in length from 18 to 28 pages, and are sold "at cost" (i.e. from \$NZ5:50 to \$NZ7.00).

The *Astro-camp Booklets* are an important addition to the Observatory's range of publications (see Orchiston *et al.*, 1997 for details of others), and are now listed in our twice-yearly Mail Order Catalogues. As a new, unique type of astronomical education resource specifically designed for New Zealanders, they are proving popular.

Given the continuing demand, further *Astro-camp Booklets* will be produced as time permits.

3.4. Training

With the introduction of the new astronomy curriculum, large numbers of secondary science teachers and primary school teachers suddenly faced the challenge of becoming "astronomy experts" virtually overnight. The Carter Observatory has responded to this demand by introducing a number of different training options.

After experimenting with an introductory astronomy course in 1995, we decided to replace this with four specialised courses, all set at about first year university level. They are:

- Hitchhikers Guide to Cosmology
- Hitchhikers Guide to our Galaxy
- Hitchhikers Guide to the Solar System
- Observational Astronomy

All involve eight successive 2-hour weekly evening classes, and provide up-to-date largely descriptive overviews. And in order to provide a national perspective, research by past and present New Zealand astronomers is introduced, where relevant. These courses are taught by three of the authors (F.A., R.H., and W.O.), and "lecture guides" with text, half-tones and line-drawings are prepared for most sessions. Students have access to a "loans section" of the Resource Centre, which contains an extensive collection of journal articles and other relevant material. Although actual observing sessions are encouraged and slotted into the program as optional extras, at least one lecture in each course is held in the Observatory's planetarium in order to circumvent the vagaries of Wellington's weather.

Students can take each course on a stand-alone basis, or by paying a surcharge and successfully passing set assessment work they can complete all four courses and obtain a Carter Observatory Diploma of Astronomy. All Diploma students undertake two different library-, observation-, or laboratory-based projects, and present their results in the form of essays and/or reports.

At the time of writing (1996 June), both the Cosmology and Solar System courses had already been taught (in 1995 and 1996, respectively), and the Observational and Galaxy courses were due to be piloted during the second half of 1996. Around 20 students enrolled in each of the completed courses, although most of them were amateur astronomers or those with a general interest in science rather than teachers or trainee teachers. Feedback received from the teaching profession indicated that teachers were "shell-shocked" by the new curricula and other educational restructuring, and lacked the energy or commitment to undertake evening courses, no matter how useful they may prove to be. We anticipate that this situation will improve with the passage of time, and that we will witness increasing teacher support for our courses.

Two other training initiatives specifically for teachers were introduced. In 1995 and 1996 the first two authors offered a number of 2-hour seminars that examined possible linkages between the new astronomy curriculum and other curricula (*technology, math-*

ematics, social studies and English) at mainly primary and intermediate teaching levels. Relevant resource material was examined and discussed, and appropriate teaching methods were explored and evaluated. These seminars generated considerable teacher interest, but because they were conducted after school hours and at personal expense, they too received less than satisfactory patronage.

Finally, in 1996 one of the authors (R.H.) began offering planetarium-based workshops designed to introduce teachers and other astronomical beginners to the night sky, as seen from New Zealand. The emphasis was on learning the main constellations, and learning about notable stars (including double and multiple stars), spectacular clusters and appealing nebulae. Four different suites of workshops were planned, dealing with summer, autumn, winter and spring skies respectively, with four different 2-hour evening sessions for each season. The summer and autumn workshops are now over, and once again teacher patronage has been minimal, even though surveys reveal that this is precisely the sort of practical program most needed by New Zealand teachers!

4. CONCLUSION

Since its restructuring in 1992, Carter Observatory has developed a range of dynamic education programs for school-age students, teachers and trainee teachers, as well as amateur astronomers and members of the general public. Further initiatives are planned as additional funding and space become available.

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