

Running a School Astronomy Club: A Guide for Australian Teachers and Astronomers

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Abstract

A school-based astronomy club is an effective vehicle for promoting science to students outside the classroom. These clubs require support from the astronomical community, and this community needs to know how to best support these clubs. This paper outlines a model for a high school astronomy club, discusses the motivations of students in this context, presents a number of successful activities, and informs how to support these activities.

Introduction

Astronomy is arguably the science most universally embraced by the general public. This is evident through the sustained relatively high profile astronomy enjoys in the mainstream media. This high level of general interest can be channelled to foster enthusiasm towards science among school children through a school astronomy club.

As with any school extracurricular activity, there are significant difficulties in running an astronomy club. Teachers and school resources are fully occupied delivering lessons to students that are required by the curriculum. There is little time or funding available to develop extracurricular activities. It is for these reasons that I have chosen to write this paper. I hope that I can assist teachers in knowing where to find assistance and to inform members of the astronomical community on how to best assist teachers.

The Astronomical Community

Astronomy is the oldest of the sciences and one of the most dynamic. It is no wonder that the body of knowledge in the subject is vast, and that teachers often feel intimidated by the subject. It is for these reasons that the astronomical community needs to provide teachers with as much help as possible in the teaching of astronomy. This assistance may vary from physical resources, to educational research or face-to-

face contact. All these activities will enable more students to be exposed to and enthused about science.

The astronomical community includes professional astronomers, amateur astronomers and astronomy educators. The members of this community already do an enormous amount to educate the public through publications, lectures, observatory and planetarium tours, observing nights, and many other activities. The value of their assistance to teachers is highlighted by the success of programs like project ASTRO, run by the Astronomical Society of the Pacific (ASP). Their website indicates that this project has facilitated professional and amateur astronomers to provide educational experiences to over 200,000 students across the US since 1994. This involvement of the astronomical community in school children's education has undoubtedly brought an increased diversity and quality of experience to many students.

The involvement of both amateur and professional astronomers in a school-based astronomy club is extremely important, if not essential, for its effectiveness and longevity. Many schools do not have the equipment or funds required to run viewing nights. Many teachers do not have sufficient subject knowledge to cover some topics in depth and answer students' questions that follow. It is for the abovementioned reasons that it would be an excellent

idea to involve people from right across the astronomical community.

Professional Astronomers

Despite the demands of professional astronomy, many astronomers devote a significant amount of time to outreach, in one form or another. I would encourage any teacher who is close enough to a university or professional observatory to contact these institutions for assistance. In my experience, there has always been someone more than willing to help. Visits from professionals are extremely valuable as they add a level of relevance to astronomical topics, promote careers in science and allow students to interact with the outside world.

A more formal arrangement for astronomers to assist teachers is the Scientists in Schools program, run by the Australian Federal Government. Any scientist can express their interest to be involved and teachers can apply to be assigned a scientist via the website (www.scientistsinschools.edu.au). Astronomers wishing to assist teachers may find helpful resources through links provided in this paper. A good first stop would be the paper by Mayo (2002) which was written to inform U.S. space scientists on how to run or support an after-school astronomy club.

The involvement of astronomers within schools is not only beneficial to the students involved, the exposure to astronomers is also an excellent professional development opportunity for science teachers. Contact with professionals is a great chance to broaden one's astronomical knowledge, and this will assist with the significant astronomy content of the NSW Science and Physics syllabi. Face-to-face contact with students also promotes astronomy and science as a career choice. For astronomers based within universities, it may also be a great opportunity for them to promote their institution to prospective students.

Amateur Astronomers

A recent survey by Storksdieck *et al* (2002) of over 1100 amateur astronomers in the United States indicated that two-thirds of this group were actively involved in public outreach and education. More than two thirds of these respondents said that this involved outreach with school groups (Berendsen *et al* 2007). This suggests that there may be significant numbers of amateur astronomers throughout Australia who would be willing

to assist school teachers. Despite this level of support, two-thirds of amateurs who indicated that they are involved in educational outreach also stated that they needed more activities, resources and materials to assist their outreach activities. Suggested resources listed in Appendix A may aid in addressing this problem.

The main outreach activity of the amateur astronomer is the provision of telescope viewing (Storksdieck *et al* 2002). This is a vital role that amateurs can play in supporting a school astronomy club, however I would suggest that amateurs have much more to offer. Berendsen (2005) clearly showed that, on average, many amateur astronomers have a level of astronomical knowledge comparable with university graduates in astronomy, astrophysics and physics. Therefore, it is clear that amateurs could easily assist teachers with information, advice and in supporting activities.

In every school's local community, it is highly likely that there is someone who has more than a passing interest in astronomy. This person could be a parent, a member of a local astronomy club or even a professional astronomer. These people can, not only provide their expertise and equipment, they also present a great example of life-long learning, and an excellent model for the relevance of science and its enjoyment in everyday life. From my own experience, I know that many amateurs gain immense satisfaction from showing the universe to others, so I would encourage teachers to contact them for assistance.

Astronomy Educators

If you live in the vicinity of a public observatory or science museum, these institutions may be able to assist you, by running an outreach program and visiting your school. They may also serve as an opportunity for an excursion, and offer a range of activities. Many observatories or museums are also the site for meetings of public astronomy clubs or hold public lectures on astronomy, which will be useful to many. This may provide an avenue for teachers to contact amateur astronomers for assistance.

The SGHS Astronomy Club

I have been running a school astronomy club at Sydney Girls High School (SGHS) for the last four years. As I am an amateur astronomer, with formal training in astronomy, and work at an observatory, I have been

able to provide a wide range of activities. I am fully aware that this is not possible for many teachers and it is for this reason that I write this paper.

SGHS is an academically selective state girl's high school that attracts gifted and talented students from across Sydney. The challenges an astronomy club faces in a more typical school would be much greater than at SGHS, but I am confident that some level of interest amongst students and teachers can be found anywhere. This was evident in my schooling experience at a state non-metropolitan comprehensive co-educational high school, where there also was an astronomy club. It all boils down to having a teacher on staff that is willing and able to facilitate those interested to explore astronomy.

The level of interest in the student body of SGHS has been amazing. The club has, for four years, maintained a membership of over 100 students. Club activities are open to all students, and membership is free and non-compulsory. The club is organised and run by an elected student executive of about 10 to 15 students. An incentive for participation is the chance to gain points in the school's student recognition scheme. This requires attendance at more than 50% of meetings and operates on member and elected position levels.

Meetings are held weekly at lunch time, and alternate between executive and general meetings. The competition for students' time means that attendance to meetings varies. I decided to run the club at lunch times because my students are involved in many activities outside school hours. This has led to meetings and activities involving groups of approximately 12 to 120 students at a time, depending on the activity. The most attended activities have been lectures by myself or visiting astronomers. Topics covered by lectures frequently overlaps well with the physics syllabus in NSW. This has helped with the numbers attending meetings and compliments classroom teaching. For an overview of the club's activities please visit our website listed in Appendix A.

Student's Astronomical Interests

Every child I have ever asked has had some question about astronomy. It is evident that the universe captures everyone's imagination in one way or another, but it is also clear that peoples' interests are diverse. This diversity led me to realise that, in order to run an

astronomy club, I must first survey my audience. When I initially setup this club, I also wanted my students to feel a sense of ownership, so the club is run by students and for students. Activities are decided by a poll each year for the following year's activities. The top 5 requested activities over the last four years are listed in order below:

1. Observatory excursion
2. Lectures on selected topics
3. Workshops
4. Telescopic viewing
5. Team challenges and group activities

While implementing activities for the club over the last four years, I have learned many lessons on students' interests. The general trend is that the most popular activities are those that are entertaining. Lectures on students' chosen topics of interest are the most popular, followed closely by hands-on activities and workshops. The least attended meetings were those focusing on analysing real astronomical data, however, students who did attend these meetings were totally engaged. Bearing in mind the student preferences and responses, I have tried to maintain a mix of activities ranging from a focus on entertainment to scientific enquiry. This has resulted in fluctuating attendance but I believe it has served the students well.

Activities

A brief description of some of the activities I have trialled with my students is listed below:

Team-based Engineering-style Competitive Activities

I have run two major activities where student teams compete to design, build and test a vehicle. One activity is a PET bottle rocket activity, and the other is a Martian lander (egg drop). Students enjoyed these activities immensely and many have participated several times over the years.

Lectures

Each year students have received a number of lectures from me or from visiting astronomers. Topics have included a career in astronomy, special relativity, astronomical images, astrophotography, observing the night sky, using a planisphere, black holes, moon rocks, radio astronomy, and the life cycle of stars.

Discussion Forums and Question and Answer Sessions

I have run several discussion sessions on topics, such as cosmology, where the main idea of the topic is introduced, and students then ask questions or discuss their knowledge. Other sessions have focused on students asking questions on astronomy in general or trying to stump me to win prizes. A variation on these activities was an activity where students searched the internet for a number of astronomical images that they would like explained. In a subsequent meeting each image was explained and I then answered their questions.

Student Presentations

Students who have done work experience in astronomy have given brief presentations to the club. These have included the research they have performed and their findings. Other students have given talks on topics of their choice. One example was a lecture on calculating the diameter of the Earth using a stopwatch and the rising Sun. Student presentations offer a level of relevance to their peers that a teacher may not be able to match, and it is a great experience for the presenter. These activities are very popular amongst students, however, it is best to assist students with their presentation before-hand to ensure a good standard of presentation.

Multimedia Presentations

Several meetings have been a combination of explanation, video, vodcasts, podcasts or PowerPoint presentations. One example introduced members to the Hubble Deep Field image. This included a vodcast and short video clip. Students have also expressed an interest in making astronomy related podcasts themselves, and there are certainly many examples available for download from around the world. Making podcasts involves a reasonable amount of technology, but is certainly not beyond the average high school or the average student.

Observing Sessions (Day and Night)

Observing sessions proven very popular. Day sessions involving solar viewing have been well received during lunch. It is also great to capitalise on interest in events like transits and eclipses when possible. Viewing in the evenings after school can either be done as a stand-alone event or as a shorter session on a night when

students are at school for another event. Stand-alone nights usually start with a short session on observing techniques, using binoculars, making and using a planisphere and an introduction to some of the objects we will see with a PowerPoint presentation. After a break, students then watch an astronomy video as they wait for twilight. Once twilight starts, we set up and begin observing. Outside daylight saving time is best for these nights as students do not need to stay up as late or wait as long for night fall. An excellent source of information on running an observing night can be found on the ATNF outreach website and is listed in the resources in Appendix A.

Workshops

I have run many workshops for students, teaching them how to do astrophotography, image processing, or making a planisphere. Students enjoy these practical activities and can often apply their new skills at home. Similar workshops were conducted when students worked with images from the Faulkes telescope in Hawaii. Students were introduced to the processes used by astronomers to analyse images. They would then analyse images of star clusters and nebulae to determine their age. These activities are available from my webpage, and the ASISTM project they were a part of is listed in Appendix A.

Hands-on Activities

A series of practical activities were undertaken in 2007 as a member of the trial schools for NASA's Beyond Einstein Explorers program. Many of these activities were successfully completed without financial outlay but some were avoided due to the cost of the equipment. These activities are set in the context of the future challenges astronomy faces in exploring phenomenon beyond Einstein's theory of general relativity.

Resources

A list of some resources that would be suitable for a school astronomy club is included in Appendix A. The changing nature of the internet and of the body of astronomical knowledge means that, in order to properly facilitate teachers, this list needs to be dynamic. These links are available online with this paper for ease of access and I will endeavour to update and expand this list over time.

Education Today and Student Motivations

School today is probably a very different place than it was for many of the people reading this article. It is therefore important that people coming into schools are aware of how education has changed. Modern educational philosophy recognises that student's prior conceptions are very important. It is therefore desirable to gauge an audience's understanding on a topic initially, so as to help you identify where to begin and what to focus on. Science education today also involves much more than simply the presentation of facts. It involves evidence-based self-discovery that relates the concept at hand to a student's personal experience. It is active, and engaging, involving skills like critical thinking and evaluation. Students make comparisons, ask questions and participate in far more hands-on activities. It is good to keep these abovementioned ideas in mind when planning an activity, as it will lead to a more effective experience.

Motivations

For astronomers working with school children, it is also important to consider their motivations. Modern society has conditioned the average student to expect entertainment. There is a tendency for educators to have to compete with media, such as television, and to cater for an attention span that has developed through exposure to this media. One way to address this is to make presentations visually stimulating, and to break any session into 10 or 15 minute activities. This is not always possible, however, these are good ideas to keep in mind.

Another major consideration is a student's inclination to socialise. In this context, presenters will most likely be dealing with students who have a particularly keen interest in astronomy, they will probably be well behaved and attentive, however, it is important to understand that students may be tempted to chat. This is when a presenter needs the assistance of the teacher involved to maintain an acceptable level of discipline. One way to cater for social tendencies is to include activities that require social interaction, such as group work. This might involve students having a short discussion in groups on what they think about a certain topic or using a role play to illustrate a concept.

Students today also value relevance in what they are learning. If you can convey why the topic you are

discussing is important, students will usually be more receptive. It may be that you can convey relevance through your personal story and how it relates to the subject. It might also be a good idea to link the topic to what they have already learnt in school or will learn in the near future. A teacher can tell you prior to a school visit exactly what a child in each year could be expected to already know and this may help guide the level of your presentation.

Working in Schools

In addition to the changing nature of educational practice, the regulations and procedures that must be followed have also evolved. Any extracurricular activity outside school hours will need some form of approval from a senior member of a school's staff. If these activities take students off school grounds there will also need to be a written risk assessment and relevant approval obtained. If astronomers are going to work with students without direct supervision from school staff then a prohibited employment declaration must be signed. Despite all these hurdles, I encourage anyone interested and able to engage in these activities as they are certainly worthwhile and fulfilling.

Some final considerations that I would recommend include managing your expectations of how much material you can get through in a single session. It is easy to expect to get through more activities than you actually will in the time allocated. Generally, I plan to go a little under the allowed time and leave room for questions. Another consideration is the technology involved in many modern presentations. Availability of technology varies widely from school to school, so this is something to check before entering a school. If you need to access the internet within a presentation you will need to check that this will work, as in many schools you would require a login and there are many layers of security to negotiate. These are all issues that can be addressed with a little prior planning and discussion.

Conclusion

Astronomy is a stimulating context in which to explore science. Outside the confines of the mandatory curriculum, there is much scope to provide students a glimpse into an exciting world. Professional and amateur astronomers alike have much to offer teachers and students, and vice-versa. I would encourage teachers to bring astronomers into their schools to

enrich the experiences of their students. I would also encourage astronomers to support teachers in any way they can and bring the field that they love to students across Australia. Setting up a school astronomy club may not be for everyone, but as we approach the international year of astronomy in 2009, I hope that I can encourage those who can to give it a try.

References

Berendsen M 2005 Conceptual Astronomy Knowledge Among Amateur Astronomers *The Astronomy Education Review* Issue 1 **4** 1-18

Berendsen M, Gibbs M, Kaler J, Koke J, Levy D, Reynolds M, Roberts S, Slater T, Storksdieck M and Zevin D 2007 *Science Educators Under The Stars. Amateur Astronomers Engaged in Education and Public Outreach*. Ed. M G Gibbs, M Berendsen and M Storksdieck (San Francisco, CA: The Astronomical Society of the Pacific)

Mayo L 2002 *Running an After School Astronomy Club* *Mercury* **31** No. 6

Storksdieck M, Dierking L, Wadman M and Cohen Jones M 2002 *Amateur Astronomers as Informal Science Ambassadors: Results of an Online Survey. Technical report* (Annapolis, Maryland: Institute for learning Innovation)

Appendix A

SGHS Astronomy Club

<http://www.sghs.nsw.edu.au/Co-curricular/Astronomy/index.html> Our internet page

Activities and Resources

<http://afterschoolastronomy.org/index.html> Resources and networking for school astronomy clubs

http://spaceplace.jpl.nasa.gov/astro_clubs/ A newsletter for astronomy clubs

http://www.astrosociety.org/education/astro/project_astro.html ASP's Project ASTRO and links to many resources

<http://nightsky.jpl.nasa.gov/> A support network for amateur astronomy clubs to assist them in public outreach

<http://universe.nasa.gov/education/BEEP/> NASA's Beyond Einstein Explorers resources

<http://www.astrosociety.org/education/publications/tnl/tnl.html> A free newsletter for astronomy educators

<http://www.cfa.harvard.edu/seuforum/exhibit/resources/CQEdGuide.pdf> Astronomy activities

<http://www.seeds2learn.com/rocketSoftware.html> Water rocket software

<http://mysci.net/pages/physics1/Labs/The%20Great%20Egg%20Drop%20Debacle.doc> Mars lander (egg drop) challenge

<http://www.astronomy.mq.edu.au/asistm/index.html> Faulkes telescope ASISTM project

<http://www.jeffstanger.net/Science%20Teaching/faulkestelescopeproject.html> SGHS Astronomy Club Faulkes telescope

Observing nights

<http://outreach.atnf.csiro.au/education/teachers/viewing/> Tips for holding a viewing night

<http://www.skymaps.com/> Monthly skymaps

<http://www.seds.org/messier/indexes.html> Information on messier objects you may observe

Astrophotography

<http://www.jeffstanger.net/Astrophotography/astrophotography.html> How to articles

Discussions - Astronomy news services can stimulate discussions on certain topics or give you ideas.

<http://www.universetoday.com/>

<http://www.space.com/>

<http://www.abc.net.au/science/news/space/>

<http://www.nasa.gov/news/highlights/index.html>

<http://skyandtelescope.com/Default.asp>

<http://spaceflightnow.com/>

<http://cfa-www.harvard.edu/hco/astro/edlinks/news.html>

<http://antwrp.gsfc.nasa.gov/apod/astropix.html>

Quizzes

<http://library.thinkquest.org/J001665/quiz.html> An example of quiz questions online

Podcasts – These news services are audio or video and can be used as resources

<http://www.abc.net.au/newsradio/programs/STARSTUFF.htm> ABC News Radio's StarStuff

<http://www.learnoutloud.com/Podcast-Directory/Science/Astronomy/Ask-an-Astronomer-Video-Podcast/19736>

Ask an astronomer videos

<http://www.esa.int/SPECIALS/ESApod/index.html> ESApod

<http://www.slackerastronomy.org/wordpress/index.php> Slacker Astronomy

<http://www.astronomycast.com/> Astronomy Cast

Podcasting - You can get your students to produce an audio show for the ipod.

<http://podcasts.yahoo.com/publish> A good place to start for information

<http://www.firstgov.gov/webcontent/technology/podcasting.shtml> More information

<http://www.apple.com/itunes/podcasts/> The most popular podcast management software