Contributions of Amateur Astronomy to Education

Mario Motta
19 Skipper Way, Gloucester, MA 01930

Abstract I discuss various ways that amateur astronomers can contribute to science education in their local school districts, focusing on using astronomy as a hands-on way to teach observational and applied science, mathematics, and science reporting and writing. I also discuss projects, telescope building, lectures, planetarium studies, and star parties. The AAVSO project "Partnership in Astronomy" is featured.

1. Introduction

The importance of teaching astronomy to children is much more than the teaching of astronomy facts and data, exciting as they may be. Astronomy is useful because it appeals to children of all ages and captures their attention and imaginations on many levels. Young minds are excited by the images of far-off new worlds. Imaginations soar and horizons expand to encompass the concepts of an immense galaxy, an expanding universe, and the age-old questions reaching back to our earliest ancestors and Greek philosophers of who we are, where did we come from, and the ultimate destiny of the universe at large. Once their minds are captured, students can appreciate astronomy on many levels, from "pretty photos" superficially, to questioning how the universe functions, how stars form and evolve, and how planets and the Earth itself were created.

Teachers can then utilize this curiosity to develop an interest in science and the scientific method in general. This focus will also help develop math and writing skills. Astronomy is ideally suited to the above. Students are taught the scientific method: they must collect observations of a physical process such as a variable star and thus hone their observation skills and ability to collect and record data. This same data must then be reduced and analyzed, bringing into play math and graphical skills. Finally, students need to present their data, thus composition skills are developed. These skills then form a foundation for all other science and math studies, teaching children that science is not a dry collection of rote facts to memorize, but an exciting discovery process, with skills useful in any field that they may eventually choose.

2. Forming partnerships

Amateur astronomers and teachers can form partnerships to help develop astronomy education. Amateurs bring enthusiasm and a love of the subject, and frequently special equipment that most schools cannot afford to fund, such as telescopes. Students are captivated by the technology displayed (i.e., telescopes, computers, CCDs, etc.), and by spectacular views seen of the universe at large.

Teachers bring their skills to play by motivating students to do special projects such as variable star observations, data reduction, and presentation.

Interested teachers and school administrators can search out local astronomy groups to work with them. A fairly complete list is available on the world wide web at *Sky&Telescope* magazine (www.skytonight.com), or the AAVSO (www.aavso.org) can also be of help. Another source is "Project Astro" through the Astronomical Society of the Pacific. Interested amateurs can ask local school systems if they would like to have volunteers help with astronomy teaching to enrich the school's program; most schools would welcome this. The program "Partnership in Astronomy" grew out of just such a collaboration.

I am a physician, but have a lifelong interest in astronomy, and also in bringing this interest to others, especially children. I began by asking teachers if they would be interested in having a guest lecturer available for an astronomical topic. I gave general talks to various grades on astronomy, gearing the talks to "pretty pictures" for very young grades, basic astronomical information to middle grades, and more advanced technical talks, such as stellar evolution, to older grades. These talks became quite popular and I was repeatedly invited back for more. I then offered "star parties" with friends from the Amateur Telescope Makers of Boston. These parties became immensely popular, with hundreds of children and entire families attending.

In addition, I arranged to have field trips for the children to my observatory, where the children were able to view the Sun in H-α light. I was able to give special presentations at the Boston Museum of Science Planetarium, where I used the "guest host"-type format to give the children a participatory experience. My approach was to walk about the planetarium with a laser pointer and have the children "find" constellations and planets, and even deep-sky objects, then show a photo of an object located. The Museum director felt that this approach was so successful that the planetarium was redesigned to include audience participation.

3. Partnership in Astronomy

Dr. Janet Mattei, director of the American Association of Variable Star Observers (AAVSO), was able to secure a grant from NASA to aid and augment this volunteer effort, and thus the "Partnership in Astronomy" project was created. With the aid of the grant, supplies could be obtained and a formal program developed to guide teachers and other amateurs. The funds were used to develop a manual for teachers to teach astronomy and the scientific method. A list of projects for students are included in the manual. First, students are asked to make a "Starbow" out of a yardstick, wood, and string. This gives them a measuring tool to use with many of the projects. One of these projects involves charting the motion of the moon against the sky every night, using the starbow, with accuracy to one degree. Another such project is to note the position of the setting sun every night for a year. Another involves following the variable star δ Cephei and charting the brightness

of the star in comparison to neighboring fixed-magnitude stars. This last project in particular illustrates the aim of this program. The students are asked to observe and then correlate their data. They must then reduce the data to a usable form, and then graph them against time, and then study and analyze their data and deduce the period of the star. Finally, they must present their data in the form of a paper and possibly a talk. This type of hands-on experience teaches the scientific method, but also shows students that science can be fun. These skills will serve them well in all endeavors in the technological world we live in.

As a special project, eight mirror-making kits were purchased, and the school selected sixteen advanced children from the 5th and 6th grade to work on making their own telescopes. Two students were assigned to each telescope. I volunteered every Friday afternoon after school for two hours in a workshop classroom with the children, and with some help from the teachers. Over the course of a school year, the children ground their own telescope mirror to exacting tolerances and produced exceptionally fine telescope mirrors. I taught, advised, and tested, but all the work was performed by the children. The rest of the telescope was then crafted. We chose a simple Dobsonian design. I cut all the large wood pieces and parts, but the children had to finish, sand, paint, and assemble all the various parts. In the end, eight exceptional-quality 6-inch telescopes were made that now form the basis of the school astronomy club, are available for loans to students, and can be used for special projects. Teachers, parents, and the students were all very proud of their accomplishment.

4. Conclusion

Such partnership programs are a win-win situation for all concerned. They enrich a school's curriculum. They engage students in critical thinking and creative enterprises. They teach students multiple new skills, and build a community's sense of and pride in the schools. Students learn confidence by being a "do-er." The scientific method teaches analytical skills, and builds student pride. Amateurs gain an outlet to share their love of astronomy. They gain the admiration of students and their local community. They may gain new members for their local astronomy clubs. Finally, they are assuring that their skills get passed on to a new generation, and help make society as a whole more scientifically literate.