

Astronomy Teaching in the Astronautics Club

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1. Introduction

There is no necessity to argue about a vital need of an extension of astronomy and space knowledge equivalent to a modern state of the natural sciences. Astronomy teaching both professionally and for amateurs in the form of general courses is particularly needed nowadays because of the spread of various forms of mysticism in Russia.

The main goal of astronomy teaching is to help students to become aware of the place of humanity in the Universe. In this connection it is necessary to study not only astronomy but also other relevant courses simultaneously. Such complex astronomy study plays a significant role. It is necessary to show a close interaction of astronomy with other sciences such as traditionally mathematics, physics, chemistry and also biology and psychology, which just begin to be integrated in the field of space sciences. One cannot disregard other aspects of science development - the philosophy of science and the morality of any scientific research. These notions must be discussed with future scientists from the first steps in their education. Thus the association of astronomy and other subjects is rewarding. This purpose has been realized successfully in the Titov's Astronautics Club.

The Astronautics Club at the Sankt-Petersburg Palace of Youth Creativity is a supplementary education form for middle and high school students. This Club was founded after the space flight of the second Russian astronaut German Titov in 1961 and will celebrate in October its 35-year anniversary. Students attend the Club classes after school hours. The Club unites students who are interested in the study of space exploration and research. Such a specific audience permits us to combine two directions in astronomy teaching into the unified system. On the one hand, through astronomy we bring the scientific picture of our world to children. On the other hand, we start from early ages to teach the students who will specialize in astronomy. The connecting links between the general and special teaching are the history of astronomy and computer-assisted instruction.

2. The curriculum

Training in the Club is based on the three year system. In the first year, we usually have about 60-80 students in 4 groups. During the first year in the Club, the students acquire knowledge of the general astronomical notions, such as the celestial sphere, coordinate systems, apparent and real motion of the celestial objects, the grounds of the celestial mechanics such as Kepler's laws. A large part of the time is devoted to the history of astronomy. Students receive the minimum which all people should know about astronomy. This general astronomy course is taught for all first-year students in the Club along with the similar general aviation and astronautics courses.

After the first year, students make a choice of specialty according to their interests. There are two main directions: astrophysics-astronautics and aviation groups. In each group the students acquire deeper knowledge in these disciplines. The most important astrophysical topics are covered, such as

- Sun and the solar system;
- structure and evolution of stars;
- nebular physics;
- basics of cosmology.

The astrophysical course is taught along with the same astronautics subjects, such as rocket technics, theory of space flight, psychology.

At the end of the year students visit the Main Astronomical Observatory of the Russian Academy of Sciences, Pulkovo. Evidently some simple observations could help to understand better the topics studied theoretically. Unfortunately, at the present time the Club has no possibilities for this due to several reasons. Moreover, the Club is located in the historical center of one of the largest cities in Russia, so the conditions for observations are very poor.

3. The main purpose of the theoretical course.

There are several goals which the curriculum reaches. They are the following:

- creation of the terminological basis for further education;
- development of the skills required for work with astronomical literature (how to find an answer to your question in a book);
- development of creative thinking (suggest your own ideas, propose new explanations and hypotheses);
- getting experience in following a lecturer and writing notes on the subject of the lecture;
- development of a student's ability to give a short summary of a lecture with the emphasis on the main ideas. The practice shows that students under 13-14 years old cannot yet do this.

4. Different forms of knowledge checking

Our students pass tests twice a year. The forms of these tests are different.

The primary test is held in the form of individual oral answers to the preliminary given list of questions followed by a general discussion. Since there are 4 groups on the first year, we hold the second part of the annual test in a form of a common competitive game after the primary tests in each group separately.

Two computer systems are developed for use in a training process. One of them, "ASTREN", is practically complete. This system is designed for checking of the general theoretical knowledge. ASTREN is developed as a training system based on the widespread principle "check-and-point". The system contains various questions on the topics learned, and a student has to choose the correct answer from the five possibilities. "ASTREN" can be filled by questions on any subject wanted. The second system called "STARM" is planned to be more creative. It will include a choice of a space flight to real cosmic objects and several subsequent calculations tasks from the fields of celestial mechanics and astrophysics. The first system can be used after the first year of study. The second one requires deeper theoretical knowledge.

After three years of learning, the students write a paper on a chosen topic or give a talk at the traditional annual scientific conference "Human Being and Space" which the Club holds for school children from Saint Petersburg.

5. Conclusion

At the end of each school year, the students fill out a form. The suggested questions have much broader impact than just astronomy. In particular, I used to take an interest in science fiction which children read. It seems to me that the best of the world science fiction written by Bradbury, Lem, Asimov, Clarke, brothers Strugatzkie, Verne and Wells has a merit to be known and loved by future scientists. One of the main goals of the primary astronomy education is not only scientific training but widening the view on the world in general, on the human being and its place in the Universe. Astronomy is a very attractive science. I think, we have to prepare not only well-educated scholars but also people who are really devoted to the romantic spirit of astronomy. Otherwise, our science will be in trouble.