

CURRENT DEVELOPMENTS IN ASTRONOMY EDUCATION

Applications to the Developing Countries

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1. Introduction

Education is a necessary part of the development of astronomy, both to train astronomers and teachers, and to increase public understanding and appreciation of our science. In all countries (and particularly the developing ones), astronomy can attract young people to science and technology. Much is known about how to teach astronomy effectively, at all levels, both in and out of school. The problem is to publicize and implement this knowledge.

From time to time, countries "re-discover" the importance of science and math education, and an "education initiative" results. This has happened in the US in the past decade or two; there has been generous funding available through the National Science Foundation, and NASA. This is already having an impact on the best students, at the best schools. The challenge is to create effective change, to evaluate projects and programs, to form efficient partnerships and networks, to break down barriers between disciplines, and between organizations, and especially to reach the under-served.

2. Effective Teaching and Learning

It is known that students (and adults) have deep-seated misconceptions about astronomical topics, which must be identified and overcome through effective teaching. Effective teaching means age-appropriate content, inquiry-based learning, with simple, hands-on materials, and appropriate evaluation. In principle, we know what to teach, and how. The fact that "less is more", and the emphasis on simple equipment is good news for the developing countries, but classical methods of teaching are even more ingrained in those countries than they are elsewhere. A useful project would be to develop a basic "unit" on astronomy, with a "kit" of simple, hands-on materials; it could be translated (by the UN?) and adapted by local teachers for effective, appropriate local use.

3. Preparing and Supporting Teachers

Teachers have misconceptions about the teaching of astronomy, and probably about astronomy itself. Astronomers can help through partnerships, coalitions, and networks. There are proven models for astronomer-teacher interactions; French astronomers and teachers have taken the leadership in this respect. Partnerships make especially good use of the limited human resources in the developing countries - if the political barriers can be overcome.

4. University-Level Astronomy

It is known that problem-based teaching and learning, with opportunities for practical activities and research projects, are highly effective. The lecture, textbook, and examination approach persists in most countries. Professors receive little or no training in teaching, and many of them are not interested in teaching, or supervising undergraduates. The job outlook for graduates is not good. It is not surprising that, especially in countries like China and the former Soviet Union, the best students are opting for business training and careers. In North America, there is a movement to broaden the training of science specialists, so that they are prepared for careers outside academe. In all countries, astronomy students who leave for other careers should be given opportunities to

continue to contribute to our science, through astronomy clubs and their education and research activities.

5. Informal Education

Both students and the general public are profoundly affected by what they "learn" from the mass media, so astronomers must work more closely with the media. Planetariums, science centres, and public observatories play an important role. The trend has been away from static exhibits, to participatory (hands-on) exhibits, to exhibits and programs which reach out, beyond the usual museum-going elite, to traditionally under-served groups. Small, inexpensive facilities are possible, and some developing countries have used partnerships, entrepreneurship, and political "savvy" to establish such facilities. These same approaches are increasingly necessary in the industrialized world. In my own province, the transition from pure public funding, to partnership with the private sector is the main issue facing these facilities today.

Amateur astronomers play a special role in public education, and this can be especially important in the developing countries, where there are very few professional astronomers. Often, these people have useful connections with government, business, and the mass media - newspapers and TV. In universities without astronomy courses, the astronomy club may be the focus of astronomical activity.

6. Impact of Electronic Information Technology

Information technology is having an increasing impact on education throughout the world, through Internet-based information and activities, multimedia, remote and/or robotic telescopes, and communication by e-mail. Developing countries are in danger of being left behind. Internet connectivity must be a first priority for them. It can provide them with direct access to a "world" of information, data, and personal contacts. Information technology makes it possible to provide databases such as *HIPPARCOS*, *IUE*, and the Palomar Sky Survey on CD-ROM at a cost of a few tens of dollars. Astronomers and students with a PC and a CD-ROM drive, anywhere in the world, can now have realistic access to these databases. One new IAU initiative is to provide workshops on how to use these databases; such hands-on workshops should be a feature of future IAU International Schools for Young Astronomers, and UN/ESA Workshops.

7. In Summary

Many governments which supported science and education generously in the past are now asking for justification and accountability. Astronomers must understand the local political system, whatever it may be. They must form effective partnerships and networks, break interdisciplinary barriers, develop entrepreneurship, and instill these processes in their younger colleagues and students. The future of astronomy education can be bright or dark; it is up to us.

8. Tribute

Whether or not the developing countries have benefitted directly from recent developments in astronomy education, their astronomy education achievements are remarkable: ISYA's, VLP's, and UN/ESA Workshops hosted, observatories and planetariums developed, preservation of astronomy in eastern Europe, the Baltic, the former Soviet Union, and Yugoslavia. So often, these achievements are due to the work of a very few individuals - or sometimes a "lone astronomer" - working in difficult circumstances. They deserve our congratulations and support.