

INTERNATIONAL ASTRONOMICAL UNION

Commission 46 - Teaching of Astronomy

NEWSLETTER

No. 6. February 1980

C46

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EDITORIAL

It was a great pleasure for me to meet so many members of Commission 46 in Montreal. It was an excellent time to renew old friendships and make new ones. It was a great pleasure to hear of so much excellent work on the teaching side. May I use this editorial to ask all members of the Commission to put pen to paper and write a short article about any part of the teaching of astronomy which they believe will interest their colleagues. I welcome all articles, informative, argumentative, thought provoking, abrasive (see for example the informative article by C. Iwaniszewska in this issue). Suggestions for projects are particularly welcome. News of innovations and changes are of great interest, no matter how locally based they may appear. Has anyone got a flair for puzzles (with answers - the Editor can be very obtuse at times)? I have no offers of cartoons and looking around at Commission 46 I am sure there must be someone with a pen dipped in acid! Is there anyone burning with a desire to smash the arguments of the untowardly long editorial of the last issue and take issue with any or all of the contents of our one day meeting on Astronomical Teaching while in Montreal?

I look forward to receiving contributions from you over the next few months to keep up a lively debate. You will see from this issue that the debate over Piaget continues. One notices that Dennis and Jay may be moving a little closer. But don't let it become a two cornered issue, weigh in with a few broadsides and blast them both.

I wish the members of Commission 46 and all readers of this Newsletter a happy, prosperous and successful New Year.

Please circulate this newsletter. To receive additional copies or to place additional names on the mailing list, please write to Dr. D. Wentzel (Astronomy Program, University of Maryland, College Park, MD 20742, U.S.A.)

Presidential Letter

"I wish to thank my predecessor, Dr. E. Kononovich, for his thought and effort invested in the last three years' activities of this commission. The minutes of commission meetings in Montreal, reproduced in this newsletter, attest to his influence on the commission projects.

I have found the "National Reports" particularly instructive. (They may be obtained from any National Representative to the Commission or from Dr. E. Kononovich, Sternbergh Astronomical Institute, Moscow University, Moscow, USSR 117234). The reports show that the different educational systems of the member countries require a great variety of teaching methods. Some systems are very rigid, some are quite flexible; some countries manage to introduce astronomy in the schools, for others astronomy is a topic for university education; for some countries astronomy is a physical science to be appreciated by the layman, especially the poet, while for others astronomy provides a chance at thorough advanced training; in some countries, astronomy is taught integrated with other sciences, yet elsewhere astronomy is the exemplary science integrating others.

This diversity makes commission meetings difficult, because each of us tends to extol one's own ways of teaching, though perhaps not applicable to others. I suspect that our meetings in Montreal were too oriented toward the US system of education, which is rather at one extreme of the teaching spectrum.

Our diversity also provides a tremendous opportunity to learn from others how they teach astronomy. None of us will adopt totally what someone else is doing; all new ideas will require adaptation to local conditions. Each of us interested in making our teaching more effective must select from many teaching methods and ideas. However, we cannot select without a presentation of the ideas. This interchange of ideas is a prime goal of this Commission. It can occur in many ways, for instance through the newsletter, through regional astronomy conferences and through planning of specific topical discussions at the next General Assembly.

The Newsletter must become more international. It will cease, unless there are more contributions on "how I do it", especially from astronomers in countries with little astronomy. There is a natural reluctance to publish "look I just re-invented the wheel", but astronomy education is not at that stage. If astronomy education in your country has progressed with (or despite) limited resources, this is a major accomplishment. Many others will want to know how this occurred, especially astronomers in astronomically developing countries whom this Commission is intended to support.

Regional astronomy conferences are becoming more numerous. They tend to include countries with more nearly similar educational systems. When I hear of such conferences, I hope to encourage organizers to allot time for discussion of teaching problems.

Our International Schools for Young Astronomers have been supported by the IAU and UNESCO. I believe the newsletter and regional teaching conferences can attract financial support if supported actively by commission members. I invite your active support".

D. Wentzel, President.

Piaget Again

In response to Jay Pasachoff in the previous Newsletter, Dennis Schatz replies as follows:

"I read with interest Jay Pasachoff's article in the last newsletter

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and am happy to see that the materials from Effective Astronomy Teaching and Student Reasoning Ability have generated such interest in the topic. That is certainly one of the underlying goals.

I hope that most readers will have the opportunity to read the articles Jay cites. Two of the articles (Phillips and Kelley, and Goodwin) are mainly personal opinion statements rather than serious studies of the validity of Piaget's theory of intellectual development.

The Cohen, Hillman and Agne article, however, does deal with a study to determine whether there is a correlation between student reasoning ability (as determined by Piaget style questions) and final grades in several courses. They find little correlation between final grades and reasoning ability, thus questioning the need or desirability of altering course presentations to cater to the students' reasoning abilities.

However, they clearly missed the point in their argument concerning final grades. Many final grades these days are based on multiple-choice questions requiring only a good memory, or even more absurd criteria such as attendance records or term papers which can be as unrelated to science as an artistic rendition of the veil nebula. I only mention this last one because I have such an expression on my wall from a course in which I was a teaching assistant. It is quite nice but clearly the final grade that drawing effected had nothing to do with the student's reasoning ability. Newsletter readers should look for an upcoming article in the Journal of College Science Teaching by Anton Lawson, "Relationships Among Level of Intellectual Development Cognitive Style and Grades in a College Biology Course". It looks more scientifically at the correlation between reasoning ability and final grades where the final grade did depend on questions that required the use of the students' reasoning ability. Lawson concludes:

'In short, when grades in a college biological science course are awarded on the basis of students' ability to respond with higher order cognitive processes, a significant relationship exists between final grades and students' level of intellectual development as assessed by Piagetian style "physical science" test items. This result implies three things: (1) Some college students are indeed operating at the concrete operational level, at least within the realm of the biological science; (2) Responses to Piagetian style "physical science" test items such as those used in the present study do, in large part, meaningfully predict level of intellectual functioning within the biological sciences; and (3) the college science course modifications suggested by Arons and Karplus, Collea et al, Renner and others should be given serious consideration'.

The following are the references related to point 3 for those who wish to explore this topic further.

Arons, A.B. and R. Karplus. "Implications of Accumulating Data on Levels of Intellectual Development". American Journal of Physics 44 (4): 396; 1976
Collea, F.P., R.G.Fuller, R. Karplus, L.G.Paldy and J.W.Renner. Workshop on Physics Teaching and the Development of Reasoning American Association of Physics Teachers, Stony Brook; 1975. Renner, J.W. and A.E.Lawson "Intellectual Development in Preservice Elementary School Teaching: An Evaluation. Journal of College Science Teaching" 5 (2): 89-92; 1975, Schatz, D., Fraknoi; A., Robbins, R.R., Smith, C.D. Effective Astronomy Teaching and Student Reasoning Ability. Lawrence Hall of Science, University of California, Berkeley, 1978.

Lawson also has an article soon to appear in the American Journal of Physics "Comment on Cognitive Level and College Physics Achievement" which specifically

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analyzes the article by Cohen et al.

An excellent comparison of different theories of intellectual development has recently been published in the 1979 AETS Yearbook: The Psychology of Teaching for Thinking and Creativity. Information on how to receive this publication is available from the Association for the Education of Teachers in Science (AETS), c/o National Science Teachers Association, 1742 Connecticut Avenue, NW, Washington, D.C. 20009.

There are few people who believe that Piaget's theory of intellectual development is the final word on how an individual's reasoning ability develops. However, most science education researchers would agree that no matter whose theory of intellectual development is closest to being "right", there is a need to introduce topics to the student at a level which can be accommodated by his/her present reasoning strategies, and then to progress to concepts that demand a higher level of reasoning.

Few courses I have attended and no astronomy text I have read consistently consider the reasoning ability of students in their style of presentation. One cannot expect every page or class presentation will accomplish this, but it cannot but help for instructors to be more sensitive to the reasoning ability of their students. Piaget's theory of intellectual development as presented in Effective Astronomy Teaching and Student Reasoning Ability is a useful, if not perfect, structure for doing this.

Finally, Jay concludes his article by stating "I personally agree with the Harvard psychologist, Jerome Bruner, who holds that you can teach anything to any child at any age if only you go about it right".

Bruner actually stated ... "there is no reason to believe that any subject cannot be taught to any child at virtually any age in some form". (The Process of Education, Jerome S. Bruner, Vintage Books, N.Y. 1960, p.47) It is an excellent book, but the key element is the last three words, "in some form". The most appropriate form to introduce a concept is in a manner which builds on the individual's present knowledge and reasoning ability, and then progresses to more complex explanations.

Jay Pasachoff replies as follows:

"I agree with Dennis in large part, but we disagree on whether the workshop should explicitly deal with the question of whether Piaget's theory is correct. I attended one of the workshops, and felt that the ratio of indoctrination to consideration was too high.

As for Bruner's theory, as mentioned at the end of his letter, I think that Dennis and I mean basically the same thing. I think that teaching implicitly involves an understanding of your students' capabilities. This, in turn, involves limiting the depth to which you go on a given subject. I felt that the workshop presented too much of a formula to be used unthinkingly by teachers. (The Workshop is reproduced in "Effective Astronomy Teaching"). Since most people who teach astronomy on the college level in the U.S. are not formally trained in astronomy, they should be given more guidance than simple instructions on evaluating teaching and teaching materials on one or two basic points.

Editorial Comment on Schatz and Pasachoff

I have enjoyed this exchange and think it a useful model for further contribution to this Newsletter. However, both Dennis and Jay worry me quite a lot. There seems to me to be a great danger in getting "down" to "the level of the student". I do not believe that this should be the aim

of a university teacher. It is axiomatic that if one is trying to teach basic arithmetic, one must know precisely the level ones pupil has attained and begin there. A university student is a different animal. Some years of pre university preparation have been expended and at university or college one should aim to expand horizons. The student should be expecting to face a challenge. There is, of course, great debate about where to begin. Clearly, if there is no common ground between teacher and taught, any expanding exercise is fruitless. However, a level of common ground should be quickly established and the teacher should then push the student from there. However, I think we should concentrate on the upward push and not on a downward search for common ground. Teaching, as Jay says, implicitly involves an understanding of ones students - some of us are more understanding than others it is true - but to put it as succinctly as possible "to spare the rod perhaps does spoil the child". (New Year resolution of the Editor now in small pieces!).

NOTICE TO ALL COMMISSION MEMBERS

Commission 46 has formed a Working Group on the Education of Astronomers from Developing Countries. It is to discuss the training of astronomers in countries with little or no formal astronomy. It is planning to enquire about interest in astronomy in a few countries where such interest may exist, and, during 1980, produce a draft of the one or two most practicable proposals that the IAU might support. Its deliberations should include the Swedish proposal at Montreal to establish a number of fellowships and/or grants for students from such countries.

The working group seeks comments from any interested IAU members.

Address: Dr. S. Ferraz-Mello
Universidade de São Paulo, Departamento de Astronomia
Caixa Postal 30647
01000 São Paulo S. P., Brazil.

Other members of the working group are B. Hidajat, J. Kleczek, S. Okoye, Aa. Sandqvist, J. Delhaye and M. Kaftan.

IB

Training Teachers in Poland - C. Iwanszewska, Astronomical Observatory,
N. Copernicus University, Sienkiewicza 30, Torun, Poland.

"University teaching for future teachers of various specialities usually takes four or five years. Astronomy is being taught for those who choose geography or physics as their main subject.

Geography students who will become school teachers must well bear in mind all astronomical facts important when teaching first geographical notions to children. A special course entitled "Astronomical Basis for Geography Students" is therefore obligatory in the curriculae for the first year students. The programme comprises 15 hours of lectures and 15 hours of exercises. The most essential problems introduced are: spherical astronomy (geographical and celestial co-ordinates, time, motions) as well as the Earth and its atmosphere. The structures of stars and of other celestial bodies are presented in a more sketchy way. As these students are by no means skilled mathematicians - the introduction of co-ordinates on a sphere, the explaining of relations between sidereal and solar time, etc. - are problems requiring much time and a skilled teacher.

Physics students will in future teach physics in the ten-year obligatory school, started in September, 1978, where astronomy will enter as a section of physics in the last school year. A special 30 hours lecture course in "Astrophysics", together with 30 hours of laboratory exercises is obligatory for these students in their fourth year. In this course much more emphasis is put on a good understanding of the structure of different celestial bodies, on the structure of the whole Universe, considered as a huge physical laboratory, where physical conditions are such as can never be attained in a terrestrial laboratory.

There is, however, another group of students who are learning while actually working, or teaching in schools. These teachers' studies are much encouraged as there exists a general rule to have in the near future secondary school teachers with Master's degrees only. The students attend special evening classes, or - more frequently - they attend special lecture courses given for three days once a month. Longer sessions are usually organised during winter or summer holidays. However, one must well bear in mind that the time allocated for each subject in these studies is about 30%-50% of that of the ordinary curriculae. Therefore, students are obliged to work much more at home, after they finish their ordinary work at school. They must buy the necessary text books or monographs, as they have no time to work at various University libraries.

One must further mention the great difficulties in attending such classes while working experienced by those people who live in small towns or even villages from where they have no good train connections to their respective universities. When one has to change trains or buses, the journey is likely to take a whole day, or a whole night and travel expenses may become high.

In these teachers' studies astronomy enters in the curriculae of both the geographers and physicists, but the teaching is still more difficult as the necessary time allocated is reduced to about 40% of that in the ordinary studies.

Nothing has been told as yet on astronomical university studies prepared for future teachers. These are being run at five Polish universities and they last five years. Besides mathematics, physics, astronomy, students get some basic knowledge of pedagogical methods during their fourth year and they undergo a practical monthly training at secondary schools where they have to give a few lessons of astronomy and physics by themselves. Graduate astronomers may teach physics and astronomy in secondary schools, but usually some 70%

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prefer to work at various scientific institutions.

The existing Polish planetaria are prepared to help astronomy teachers. The largest planetarium at Chorzow organises regular teachers' summer courses. The teachers get better acquainted with the latest progress in astronomy. Planetaria organise special lessons for older children or secondary school pupils. Astronomical university observatories are also open for school groups.

Finally, let me mention the work done by the Polish Amateur Astronomers Society. Regional sections of this Society organise lectures connected with school programmes; professional astronomers may then present another point of view on problems worked out at school lessons. The Society monthly popular magazine "Urania" publishes popular accounts of the latest developments of astronomical ideas and sometimes also some astronomical exercises".

Items of Interest

The Association of Astronomy Educators publishes a Newsletter called Astronomy Education. This digest includes an awareness section on current investigations into teaching astronomy. The Editor is R.S. Tomkins, Science Education Center, Physics Building, University of Iowa, Iowa City, IA 52242, USA.

Members in Equatorial Africa, south of the equator, in central India should note an eclipse of the Sun visible on 1980 August 10 in South America between latitudes 10° and 20° South. The track of this eclipse lies mostly over the Pacific Ocean.

A problem which is always identified when Commission 46 meets with teachers is the need to obtain good illustrative material. Slides are not always easy to obtain and may not come up to catalogue expectations. Explanatory notes of any pedagogic value frequently do not accompany the slides. However, a recent book, Catalogue of the Universe, (by P. Murdin, D. Allen and D. Malin: CUP, 1979, £9.50) puts this to rights by giving a fine set of archtypal photographs with thumbnail sketch text. It is a book which should be a mine of source material for teachers and give a good starting point from which to seek further resources.

The Royal Astronomical Society (Burlington House, London, W1V ONL) also publishes a booklet "Astronomy" (40p post free), which has a set of useful photographs of celestial objects outside the planetary system.

Collaboration between Commission 46 and the Solar Physics Division of the American Astronomical Society has led to the publication of three sets of 20 slides each concerning the Sun. The majority of the pictures are from Skylab. Each slide comes with a brief description, a few lines long. Source: Hansen Planetarium, 15 South State Street, Salt Lake City, Utah 84111, USA. Write for their listing of the "Solar Slide Sets". Cost outside the USA including shipping: US \$ 0.75 plus \$ 7.50 per set (less for a larger order). Hansen Planetarium also sells slides from the Hale Observatories.

A seminar on Science in Society will take place in Paris March 23-28, 1980. The next meeting of the Committee on Teaching of Science will take place in Malvern, UK, March 29-30, 1980.

COMMISSION 46: TEACHING OF ASTRONOMY (ENSEIGNEMENT DE L'ASTRONOMIE)

Report of of Meetings held in Montreal

PRESIDENT: E. Kononovich. SECRETARIES: J. Pasachoff,
A. Fraknoi, D. DuPuy, D. Wentzel

Session I, 14 August 1979

I. REPORT OF COMMISSION AND NATIONAL REPORTS

The President's report on Commission activities 1976 through 1978 was approved. National reports were received from 26 countries. The reports, together with analysis of the answers on a commission questionnaire and a short list of publications on astronomy education by commission members, are available from E. Kononovich. The length of the reports generally conformed to the decisions made in Grenoble.

II. MEMBERSHIP

With a view to avoiding proliferation of membership (see Grenoble report), the following was approved:

President: D. G. Wentzel

Vice-Presidents: L. Houziaux and M. Rigutti

Organizing Committee: W. Buscombe, C. Iwaniszewska, J. Kleczek, E. V. Kononovich (ex officio), L. Mavridis, S. E. Okoye, B. F. Peery, A. Ringuelet.

National Representatives:

Argentina	Dr. A. E. Ringuelet	Israel	Dr. R. Steinitz
Australia	Dr. A. W. Rodgers	Italy	Prof. E. Proverbio
Austria	Dr. H. F. Haupt	Japan	Prof. N. Owaki
Belgium	Prof. L. Houziaux	Korea (Rep.)	Prof. Kyung Loh Yu
Brazil	Prof. S. Ferraz-Mello	Mexico	Dr. S. Torres-Peimbert
Bulgaria	Dr. N. S. Nikolov	Netherlands	Dr. H. Hubenet
Canada	Dr. D. L. DuPuy	New Zealand	Dr. N. A. Doughty
Chile	Dr. H. Moreno	Nigeria	Dr. S. E. Okoye
Czechoslovakia		Norway	Dr. O. Elgarøy
	Dr. J. Kleczek	Poland	Dr. C. Iwaniszewska
Denmark	Dr. H. E. Jørgensen	Portugal	Prof. J. Osorio
Finland	Dr. K. Lumme	Roumania	Prof. N. Dinulescu
France	Dr. L. Gouguenheim	Rep. of South Africa	
Germany DDR	Dr. H. Zimmermann		Prof. A. H. Jarrett
Germany FDR	Dr. H. Scheffler	Spain	Dr. M. A. Catala-Poch
Greece	Dr. L. Mavridis	Sweden	Dr. A. Sandqvist
Hungary	Dr. M. Marik	Switzerland	Prof. B. Hauck
India	Dr. K. D. Abhyankar	Taiwan	Prof. Chun Shan Chen
Indonesia	Dr. B. Hidayat	Turkey	Dr. S. Hazer
Ireland	Dr. T. Kiang		

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United Arab Rep.	Dr. A. S. Asaad	U.S.S.R.	Dr. E. V. Kononovich
United Kingdom	Dr. D. McNally	Varican City	Dr. J. Casanovas
U.S.A.	Dr. J. M. Pasachoff	Yugoslavia	Prof. Dr. F. Dominko

Members: H. L. Andriolat, I. Atanasijevic, K. A. Barkhatova, V. Barocas, L. Bottinelli, H. Campins, S. Codina, J. M. Chamberlain, D. Clarke, E. A. Dibai, D. R. Fawell, M. Gerbaldi, N. P. Grushinski, A. Hayli, V. V. Ivanov, J. E. Kennedy, H. Lambrecht, J. C. D. Marsh, H. G. Miles, E. A. Müller, B. Onderlicka, W. Osborn, N. W. Ovenden, J. Percy, V. V. Porfirev, R. R. Robbins, A. E. Roy, T. Schmidt, B. M. Sevarlic, E. v. P. Smith, S. K. Trehan.

Consulting members: K. P. Addoli, M. L. Aguilar, J. Ebdon, F. Egger, D. M. J. Fubara, N. T. Jiwaji, D. Khaltar, T. Murtagh, F. N. Okeke, L. I. Onuora, K. A. Portzevskij, C. Roslund, E. Schmitter, J. Siroky, A. E. Troche Boggino, R. H. Wilkinson, D. V. Zaitschek.

We should make an attempt to find members from countries not represented on the commission. All interested persons are welcome at commission meetings and may request commission publications, such as the newsletter.

III. NEWSLETTER

Editor McNally reported that five newsletters have been published since the last General Assembly, starting in June 1977. They are published in June and December/January. The print run is about 300. McNally pointed to the developing controversy in the newsletter about Piaget. He hopes that more such controversy will develop. Kononovich proposed that McNally continue as editor, a proposal that met with general approval. McNally thanked Wentzel and the University of Maryland for undertaking the production and mailing costs.

The members agreed with McNally that the newsletter is valuable. Schatzman said that the name "newsletter" is misleading, that it is more of a journal. He said "Sooner or later this will have to be turned into a journal." A journal on the teaching of physics is being launched in Europe. The "American Journal of Physics" already exists in the USA.

Excerpt from Discussion Paper: The prime aim of the Newsletter is to provide a means of communicating between members of the Commission and others interested in the teaching of astronomy. The newsletter is open to all IAU members to submit their ideas, suggestions and views concerning teaching of astronomy. The newsletter will remain interesting only if the contents become more international. The editor should actively seek guest editorials. Also, more contributions from commission 46 national representatives are greatly needed.

IV. RELATIONS WITH ICSU, UNESCO, COSTED AND OTHER BODIES

Report of L. Houziaux. The ICSU Committee for Teaching of Science met in Nijmegen (Netherlands) April 1978 and Paris, March 1979. It has issued a series of booklets "Learning Strategies in University

Science", edited by D. McNally, since it appeared that university science teachers were less aware of many innovative schemes and ideas than their colleagues in other levels of education. Another series of 23 pamphlets, in preparation, concerns the cooperation between teachers of mathematics and teachers of other sciences. They are intended primarily for teaching of science at the school level. The Committee has also issued a Newsletter which reports on the activities of the teaching commissions of the various unions. Three have been issued; the second mentioned our newsletter. The Committee is also participating in the preparation of an international conference on Science and Society in order to show the contributions of science and technology to development in changing societies.

Sources: Learning Strategies in University Science, University College, Cardiff Press, PO Box 78, Cardiff, United Kingdom; 9 pounds for all ten booklets.

Newsletter of ICSU Committee on Teaching of Science, also booklet "The Importance of Education and Training", 23 pamphlets when finished and Integrated Science Education Worldwide (\$5, report on International Council of Associations for Science Education, Nijmegen, 1978): Dr. John L. Lewis, ICSU-CTS, Malvern College, Malvern, Worcestershire, United Kingdom.

COSTED is concerned mainly with problems specific to developing countries. It holds seminars mainly in South East Asia and provides grants for scientists for science education purposes.

Houziaux thinks that it is important for the IAU to be represented in the ICSU committees in order to promote the teaching of astronomy among the various disciplines and to obtain the support of UNESCO for the various activities of commission 46. (See ISYA, below).

President Kononovich felt that the IAU and Commission 46 can be of great value to the other organisations. He recommended that Dr. Houziaux remain our representative. He asked Houziaux to give more frequent reports on the relations to the other organisations.

Session II, 18 August 1979

V. TEACHING SESSIONS AT REGIONAL ASTRONOMY MEETINGS

The following recommendation was sent to the Executive Committee:

Whereas the IAU supports the organisation of regional astronomy meetings, Commission 46 further recommends that the IAU urge the holding of sessions on the teaching of astronomy at such conferences. The members of Commission 46 are available to assist.

Such teaching sessions may well be specific to the main conference topic.

VI. INTERNATIONAL SCHOOLS FOR YOUNG ASTRONOMERS

The report of the school in Nigeria was circulated. During 1976-1978 two schools were held, in Brazil and Nigeria. Both were very successful and fully justified the support given by the IAU.

The ISYA in La Laguna, Tenerife, Spain from 10 to 22 September 1979 will be supported by IAU funds and by a UNESCO contract through ICSU, each \$4000, as well as by Spanish sources. There will be 36 participants from Spain, Portugal, Canary Islands and five Latin-American countries.

The 11th school is being prepared for 17 September to 10 October 1980 at Island Hvar, S. R. Croatia, Yugoslavia, with the topic of the physics of the solar system and the stars, for students of Mediterranean and Balkan countries. Funding includes contributions from IAU funds, from UNESCO and from the Scientific Council, S. R. Croatia.

Requests for future schools should go to D. Wentzel and J. Kleczek. Iraq, East Africa, French-speaking Africa, and Venezuela have been mentioned as possibilities.

Amendment of rules for ISYA: The rules for Commission 46 as approved at Grenoble were amended by the addition of a paragraph to rule 1. This rule now reads:

1) The President, Vice-President(s), Secretary of ISYA and Past President will constitute a sub-committee of Commission 46 to regulate the organisation of the ISYA. The Secretary of the ISYA will be the Secretary of the sub-committee and will keep the sub-committee informed of all proposed ISYA, the details of their organisation and evaluation. The President of the Commission will inform the General Secretary of the Union of the programme for each proposed school only when approved by the sub-committee.

The sub-committee approves the preliminary programme, then the President of the Commission informs the General Secretary. The final version of the programme must take into account the Executive Committee recommendations together with those given by sub-committee members.

VII. ASTRONOMY EDUCATION MATERIALS

Only the Slavic-language portion was available at the meeting. It was prepared by E. Kononovich. Dr. B. Peery is currently writing the English-language material, based on a print-out of all English-language materials by the computer services of the U.S. Library of Congress (but which is too extensive and needs to be evaluated for our purposes). A telegram from Dr. L. Mavridis indicates the material in other languages is ready for distribution.

The collation of material suitable for AEM continues to be the most difficult aspect. Kononovich and Peery agreed to continue collating their parts. Prof. Houziaux is to investigate possible help through his government. If possible, all three parts of AEM are to be published together, in a single format, with a view to commercial publication of subsequent issues. They should no longer be called Addendum, since the original volume is out of print and largely outdated. Thus some permanent sources, for instance of visual aids, should be repeated in each edition.

D. Schatz mentioned that a good beginning list of astronomy education materials is included in the workbook "Effective Astronomy Teaching and Student Reasoning Ability" available from the Astronomical Society of the Pacific (address below), \$3 for IAU members.

A. Fraknoi summarized the activities of the Astronomical Society of the Pacific (1290 24th Ave., San Francisco, CA 94122, USA). These include i) "Mercury" magazine, which has a regular feature on astronomy education, ii) an internationally syndicated weekly newspaper column on astronomy (500 words) available for newspapers everywhere, iii) a series of resource materials for teachers including bibliographies, iv) a mail order catalogue of educational materials.

The association of French teachers in Physics publishes "Les Cahiers Clairaut", which provide exercises, review papers, etc. in astronomy for science school teachers.

VIII. PROJECT CONTRATYPE

M. Gerbaldi reported on her pilot scheme, in the period 1975-76, of distributing slides from a collection of 56 slides, at cost, from the Institut d'Astrophysique, Paris. The greatest success in reaching the developing countries was obtained from an announcement in the Courier de l'UNESCO, June 1976, which yielded 37 letters from developing countries, mostly from South America (plus 25 from developed countries other than France). She suggests two problems must be overcome: i) While there are commercial slides available, teachers from developing countries do not have the foreign exchange. There exist "UNESCO coupons". ii) The range of slides is huge and of variable quality, so that a critical analysis is needed, which could appear in our newsletter and be announced in the UNESCO bulletin. M. Gerbaldi agrees to start the analysis.

M. Gerbaldi and L. Gouguenheim have assembled two sets of 24 slides each, on the subjects of gravitation and of spectral analysis. Each set comes with a booklet of 40 pages. The booklet gives not only a description of the slides but an analysis from a physical point of view, which they consider their most important contribution. The booklet is in French. Can UNESCO provide translations so that wider distribution is possible? Source of the slides:

Centre National de Documentation Pédagogique
Service de Vente des Publications de l'Education Nationale
13 rue du Four
75006 PARIS - FRANCE

Serie: Diatheque Sciences Physiques

Astrophysique I: la loi de la Gravitation dans l'Univers.

Astrophysique II: Connaissance des Astres par leur rayonnement.

Kononovich in the discussion paper on Project Contratype emphasized the need of a complete treatment of slides from both an educational point of view and practical usage in the classroom, possibly through special publications in one of the well known astronomy magazines.

IX. VISITING PROFESSORS PROJECT

Dr. Rigutti commented that little interest exists for the project in its present form of merely listing opportunities for visits.

A sub-committee of Kononovich, McNally, Wentzel and Okoye formulated the following recommendation to the IAU Executive Committee:

Commission 46 having regard to the need a) to introduce astronomy widely throughout the world, b) to strengthen developing and existing teaching in astronomy, and c) to enhance awareness of the place of the Earth in the solar system and the wide universe, proposes that the IAU establish an Annual Visiting Lectureship.

The lecturer should be an astronomer of scientific distinction. He/She should also be particularly gifted and interested in public appreciation of astronomical topics. Cognisance should also be taken of fluency in the appropriate language of the country to be visited. The programme for a typical visit might involve 3 public lectures and 1 scientific seminar, during the course of 1 month duration in the country. Where possible, the visiting lecturer should be based at a local university or institute of higher learning. The lectureship should be used to promote knowledge and understanding of astronomy, particularly in the countries having little or no formal astronomy.

The cost to the IAU should be limited to a) transportation, b) subsistence, and c) a small honorarium to the lecturer. It would be hoped that the subsistence would usually be met through local hospitality.

The proposal should be seen as falling within the auspices of Commission 46 and the Visiting Astronomers Program of Commission 38. Both commissions are to be consulted over choices of lecturer and venue.

It was suggested that perhaps a portion of funds for Commission 38 could be used for this purpose.

The proposal is to be considered also by the working group on education of astronomers from developing countries (see below).

X. EDUCATION OF ASTRONOMERS FROM DEVELOPING COUNTRIES

Dr. Sandqvist (Sweden) asked the commission to support the resolution to the IAU General Assembly by the Swedish National Committee, which is to encourage fellowships for astronomy students from developing countries. Dr. Rigutti (Italy) urged that this be supported by funds from IAU and possibly UNESCO. S. Ferraz-Mello (Brazil) pointed out that the mere training of students without a supporting home institution might not succeed in fostering astronomy in a developing country. After some discussion, President Kononovich summarized that it was the sense of the meeting that the Commission approves in principle.

A working group on the education of astronomers from developing countries was formed (See below).

XI. FUTURE MEETINGS OF THE COMMISSION

Incoming President Wentzel thanked Dr. Kononovich for all his hard work as President and noted in particular the very informative collection of National Reports. Several countries now hold meetings

and workshops to help teachers to include more and better astronomy in their classes. The topic of teaching astronomy to teachers may be a good one for a session at the next General Assembly.

Session of Working Group on Education of Astronomers
from Developing Countries, 22 August 1979

The working group is to consist of S. Ferraz-Mello (Brazil) as chairman, B. Hidayat (Indonesia), J. Kleczek (Czechoslovakia), S. Okoye (Nigeria), Aa. Sandqvist (Sweden), and two members from Commission 38, J. Delhaye (France) and M. Kaftan (Iraq).

The working group is to discuss the training of astronomers in countries with little or no formal astronomy and by August 1980 produce a draft, with justification, of the one or two most practicable proposals that the IAU might support. The deliberations should include the Swedish proposal referred to Commission 46 by the IAU Executive Committee. The President of Commission 46 will seek comments upon the draft, so that the working group can present a revised proposal by December 1981.

Address for comments on these topics: Dr. S. Ferraz-Mello, Universidade de Sao Paulo Departamento de Astronomia, Caixa Postal 30627, 01000 Sao Paulo S. P., Brazil.

Discussion among group members (with B. Wood, D. A. MacRae and D. Wentzel also present) stressed the great variety of needs that might apply to various countries. It was decided first to enquire among sympathetic individuals in a small number of countries as to their local possibilities for introducing astronomy in their countries.

Session III, 22 August 1979
Teaching Astronomy at the University Level

An all day meeting was held to discuss the teaching of astronomy at the university level. Attendance was approximately 100-125, with good representation from a broad range of countries.

Four invited speakers participated. First, G. Abell (U.S.A.) presented "An Overview of Astronomy Education" with an emphasis on the goals of teaching graduate students, e.g. preparing some graduate students expressly for teaching in small, non-PhD granting institutions. He also stressed the opportunities for astronomers to reach large numbers of non-science students, through radio/TV programs as well as university and community college courses. The next invited speaker was H. Eichhorn (U.S.A.) who spoke on "Teaching Astrometric Concepts." He emphasized teaching astrometry by tying it in with astrophysics.

The third invited speaker was J. Chamberlain (U.S.A.), who spoke on "The Use of the Planetarium in Teaching University-Level Astronomy." He discussed non-credit astronomy courses taught by planetariums, and instruction versus entertainment in planetarium shows. The final

invited speaker was D. Clark (Scotland), who spoke on "Teaching Observational Studies;" he illustrated his presentation with examples from his highly successful teaching program at Glasgow.

Fifteen contributed papers were presented by teachers from eight different countries. Among these, Sandqvist (Sweden) demonstrated his innovative umbrella/star chart, and he described an impressive program in teaching astronomy to the public in Sweden. Pierce (U.S.A.) described how teaching astronomy in a community college (virtually unknown in most other countries) differed from the more usual university course. Two representatives from the University of London (Doretsky and McNally) described a student spectrograph, and mathematics in teaching astronomy. Iwaniszewska (Poland) reported that astronomy is a required course in secondary schools in Poland, and Kononovich (U.S.S.R.) described secondary school astronomy in the U.S.S.R.

13 August 1979
Session With Canadian School Teachers

About 35 teachers attended, 50% from Ontario, 30% from Quebec; others from as far as Saskatchewan and British Columbia.

Opening remarks by Dr. Kononovich included an outline of the role of astronomy in the school curriculum of the USSR and a summary of "Tendency of Astronomical Education", results of an international survey (available with the National Reports, see item I). Dr. J. R. Percy (University of Toronto) discussed the place of astronomy in high school curricula and the role of astronomy in the Canadian high school education. As a comparison, Miss L. Gouguenheim (Observatoire de Paris) presented a paper on teaching of astronomy in French schools. Dr. R. L. Bishop (Acadia University, Canada) introduced the role of the Royal Astronomical Society of Canada in teaching of astronomy.

Practical aspects were presented by Dr. R. Robbins (University of Texas, USA) on audiovisual materials, Dr. W. Osborn (Central Michigan University, USA) on observational activities for school teachers, with emphasis on observations with simple, inexpensive equipment, and Dr. J. Holzinger (Franklin and Marshall College, USA) on laboratory experiments in astronomy. Parallel sessions concerned telescopes for teaching in schools with specific examples (in English) and astronomy in the Quebec curriculum (in French). D. Levy (Canada) reported on teaching young children in summer camps, using color slides and taped commentary.

The meeting concluded with discussions based on the Piaget Workshop with applications in teaching of astronomy, as organized by D. Schatz (Pacific Science Center, USA).