Part 5. Workshop on Astronomy Education

Preamble

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The place of natural sciences in modern education is still limited with respect to more classical matters, forming the so-called human sciences and this for several reasons evoked below. Astronomy in particular, occupies in most countries a very tiny place in educational programs, if any. The discoveries of the twentieth century, which are no longer working hypotheses but ascertained facts, tell us the real background of the human being, of the solar system, and of the Galaxy. These findings situate humankind at its true place in the Universe. Nevertheless these basic elements of scientific knowledge are not conveyed as part of the normal contemporary culture, leaving room for very many irrational beliefs.

Even if the tools of astrophysics and cosmology may appear impossibly complex, the results of these disciplines are accessible to most educated people. Their basic concepts are indeed intelligible to everybody. The lack of interest or even reluctance to teach and learn astronomy as an autonomous science such as chemistry or biology may be explained only by historical reasons, an inheritage of classical studies, and possibly by religious considerations.

One main difficulty in the popularization of astronomy is the insufficient training of the teachers themselves. Even if they received some astronomical education in the past, the explosion of new discoveries due to space research and access to new-generation large telescopes necessitates a continuous and rapid updating of their knowledge in this field with its fast receding frontiers. Thus, at this meeting, the main topics we want to address are the possible curricula that could be implemented at the various school levels and their updating. We would also like to present the best didactical tools developed around the world.

The head of the Department of Education of Valais State, S. Sierro was rejoiced by the venue of the AAVSO meeting. He stressed the importance of astronomy popularization, considering the low level of scientific background of the population, even among educated people who are easily satisfied with superficial.... He addressed the problems of teaching the sciences in his welcoming speech at the special education session. Some extracts of his talk are recalled here, in French, in order to preserve the flavor of the language:

"Je me réjouis particulièrement de la venue en Valais de groupes comme le vôtre qui contribuent, non seulement au progrès des connaissances, mais aussi à

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leur diffusion. Et c'est une chose importante si l'on considère le niveau d'ignorance où se trouve la très grande majorité de la population en matières scientifiques, y compris parmi les gens qui ont fait des études. Je me compte d'ailleurs, avec regret mais avec franchise, au nombre des personnes qui n'ont pas acquis seulement les rudiments d'une culture qui devrait être pourtant largement diffusée."

And further about scientific illiteracy and its causes:

"J'ai eu maintes occasions de vérifier qu'au-delà de leurs études, la plupart des gens considèrent qu'ils en savent assez lorsqu'ils sont capables d'énoncer quelques banalités sur la formation des nuages ou la tectonique des plaques, lorsqu'ils parviennent, dans une conversation de salon, à attribuer à son auteur légitime la formule $e = mc^2$.

"Cet illetrisme constitue évidemment un souci pour le mandataire politique que je suis, responsable de l'instruction publique. Je m'interroge, comme beaucoup d'autres bien sûr, sur ses causes et sur sa persistance.

"Je ne suis guère disposé à croire que les matières scientifiques sont a priori moins séduisantes pour l'esprit de l'enfant, que les matières littéraires, qu'elles stimulent moins son imagination, son goût du jeu, sa curiosité.

"Je croirais plus volontiers à une sorte de perversion culturelle très ancienne qui tendrait à présenter les mathématiques et les sciences expérimentales comme de véritables casse-tête.... A l'époque où je fréquentais les bancs d'école, on cultivait volontiers cette image, tant chez les professeurs de sciences humaines que chez ceux qui enseignaient les sciences exactes. C'est comme si, pour atteindre le paradis de la maturité, il eût fallu nécessairement franchir le purgatoire des sciences exactes.

"Je sais que cette attitude n'était pas générale, mais elle était répandue dans la plupart des institutions. Je sais aussi que les choses ont évolué de manière positive au cours des deux ou trois dernières dizaines d'années et que certains professeurs transmettent avec efficacité le goût de la matière qu'ils enseignent.

"Mais tous les blocages ne sont pas levés. Tant s'en faut. Et je me demande s'il n'y a pas lieu de remettre en cause de manière importante la façon dont nous abordons les sciences à l'école, le contenu, la méthodologie, la didactique.

"Ce qu'a dit George Charpak sur ce sujet précisément, m'a conforté dans l'idée que nous devions réexaminer notre approche pédagogique, procéder vers l'abstraction par de nouveaux chemins, et notamment en tirant un meilleur parti de notre environnemment physique immédiat. Car si nous ne le faisons pas, nous encourons le risque d'enseigner les éléments constitutifs de la matière, par exemple, à des enfants qui s'avèreront simultanément incapables de distinguer entre un érable et un pin sylvestre—entre un arbre à patates et un arbre à spaghettis!"

The teaching of exact and natural sciences, and in particular astronomy, is a challenge well perceived by Valais authorities. There is no doubt that an astronomical education at school with practical exercises, at telescope when possible, will not only bring the presently missing information, but also be an excellent way to train the student's scientific skill for the real world.

We hope that this session will be a stimulating opportunity in which diverse experiences will be shared and be a starting point for collaborations between teachers, amateurs, and

scientists who are already working out the curricula and the relevant didactical tools. We expect to identify...and ways to implement them in a near future.

Translation of the French text:

I am particularly pleased that Valais is the venue for groups like yours who contribute not only to the progress of knowledge but also to its dissemination. This is an important thing, when one considers the level of ignorance one finds in the great majority of the population regarding scientific matters, including among educated people. I count myself, moreover, with regret but with frankness, among those who are not acquainted with even the rudiments of a culture which should be always widely spread.

And further about scientific illiteracy and its causes:

I have had many occasions to verify that, beyond their studies, most people consider themselves scientifically knowledgeable if they can state trivialities about the formation of clouds or the motion of tectonic plates, or in casual conversation, attribute the formula $e = mc^2$ *to the correct author .*

This illiteracy constitutes a concern for the political agent such as myself who is responsible for public education. I ask myself, as I am sure many others do, about its causes and its persistence.

I am hardly disposed to believe that scientific topics are automatically less appealing to the spirit of the child than literary subjects, that they stimulate the imagination less, or the sense of play, or curiosity.

I prefer to believe in a sort of very old cultural perversion which tends to present mathematics and the experimental sciences as a veritable headache... When I was in school, one voluntarily cultivated this image, as much with the professors of the social sciences as with those of the exact sciences. It was as though, to reach the paradise of maturity, one had to cross the purgatory of the exact sciences.

I know this attitude was not common, but it was present in a majority of institutions. I also know that things have evolved in a positive direction over the last two or three decades and that certain instructors pass on with efficacy a taste for the subjects they teach.

But all the impediments have not been removed. Far from it! And I wonder if it is not necessary to question the way in which we approach the subject of science in school—the content, methodology, and the didactic.

As George Charpak has said on precisely this subject, I am comforted by the idea that we have had to re-examine our pedagogical approach, proceed towards the ideal in new ways, and especially create a better role for our immediate physical environment. Because otherwise, we encourage the risk of teaching basic elements of a matter to children who prove incapable of making any kind of distinction, whether between a maple tree and a pine tree, or between a fairy and a unicorn!