

Ideas concerning a new type of Postgraduate School (PS)

Outline

We propose the establishment of a new type of postgraduate school (PS). The necessity of such a PS is a consequence of the recognition of the fact that a new type of scientist is needed for the solution of the serious problems facing mankind today.

The goal of the new PS then is to take specialists in branches of science beyond their specialization, by teaching them the basic methods and ideas of several natural and human sciences outside their specialization.

To achieve this goal, the PS would be based on the idea of research project. These projects would be rather long-term enterprises and would be supplemented by short courses (of the "recyclage"- or summer-school-type) on special topics related to the projects and of general interest.

The research projects are directed towards the solution of socially important problems. To carry them through successfully, it will be necessary to adopt an interdisciplinary approach and also to resolve some scientifically interesting problems. To ensure the success of such an enterprise each participant must be willing and able to acquire a basic understanding of all disciplines engaged in the project. Thus the necessities of the research itself provide the participating scientists with the incentive for going beyond their specialization.

The new type of PS is not intended to replace existing post-graduate (or similar) schools but rather to complement them.

A project would require the participation of four to five professors and eight to fifteen students. The students would be recruited from among (i) gifted graduates, (ii) postgraduates, (iii) men with a deeper professional experience (presumably in industry). The duration of the project would in general exceed the duration of the participation of a student. The project would therefore be organized in a way that would allow a student to arrive to partial conclusions and thus to give his participation a relatively closed form. (In collaboration with existing Universities it would therefore also be possible to reward the successful participation in such a project by a grade.)

The new PS should be specially interested in problems of the developing nations. Research projects devoted to these problems should involve citizens of such countries and should go very far into the study of the practical implementation, in the country and by the citizens of the country, of the conclusions reached in the project.

The short courses (one week to three months) that would be organized besides the projects would cover subjects of human and natural sciences related to the projects. Either some participants of a project would teach their colleagues a topic in which they are specialized, or all participants of a project would like to learn in a concentrated way about special aspects of their problem. In both cases additional professors and students from outside would be called upon to participate in these courses.

This new type of PS would imply a new close relationship between research and teaching, research and learning. The professors would teach, and the students would learn, what the professors as yet do not know. It would also reestablish strong bonds between the commitment to a socially important problem, the acquisition of knowledge, and the utilization of knowledge.

We think that this new type of PS is a true challenge for Battelle. The goal is to educate a type of men that is capable (i) to perceive the scientific problems posed by the needs of mankind, (ii) to contribute to their solution, and (iii) to deal with the complex process of implementing the results of research in the societal reality at all levels. The means adopted, i.e. the nuclear idea of an integrated research project and in consequence the interdisciplinary approach, reflect the Battelle-experience. We believe that it may come to full fruition in the proposed post-graduate school.

In the establishment of the PS, Battelle could act as promoter and catalyst. Various other institutions would undoubtedly be interested in actively supporting this idea.

Comments

1. About the projects

The Postgraduate School (PS) is based on the idea of research project and is organized accordingly.

The advantages of a research project should be preserved, the disadvantages should be avoided.

The disadvantages are essentially related to the narrowness of scope of many research projects in consequence of the very particular and partial interest of an ordinary sponsor. Other disadvantages may be found, but in this note we want to bring out the advantages. Let us however avoid an abstract discussion of what an ideal research project should be and rather proceed by way of examples. The examples chosen are intended to be realistic, i.e. possible candidates for research projects for the PS. But they are chosen to illustrate the principal qualities that a PS-research-project should have.

Let us then consider the following two examples :

- (i) Metallurgy for (given) developing countries.
- (ii) Non-linear models.

a) These two projects represent two extreme types of project. The project (i) is of the converging type, the project (ii) is of the diverging type.

In project (i) all scientific disciplines that are relevant for a given goal are brought into action. In the example chosen these disciplines may include geology, metallurgy, ethnography, sociology, educational sciences, economics, politology (e.g. knowledge of international organisations). The problems that have to be dealt with

in anyone of these domains are largely determined by those arising in adjacent domains.

In Project (ii) the relevance of the mathematical notion of nonlinearity for a variety of important problems, in physics, biology, behavioral sciences, sociology, economics, etc., is recognized. Methods are developed whereby the implications of that idea in the various domains are given an operational (not purely verbal!) form. Through the common, mathematical language the ideas from one domain may become fertile in another domain.

b) The two projects are directed toward the solution of important problems. The criterion of importance is extra-scientific (social).

The problem of the development of basic industries in a developing country, according to local needs and possibilities and within a given international configuration, is an important one. Metallurgy is but an example. Petrochemistry may be one from among other realistic examples.

The problem of understanding the essential features of change and stability in complex systems is an important one. On the one hand, humans are parts of such systems on the social level (and in several ways). On the other hand on the biological level, a human being contains several interacting complex systems.

c) Both projects have a scientific nucleus. The advancement of science is necessary for the advancement of mankind. It is not

sufficient however. There must be a constant awareness of the needs, present and future, of mankind and, as a result, an active adaptation to these needs. Therefore the whole mediation between a determined need of mankind and the scientific problems under investigation, between the scientific results obtained and their social implications within a given frame, is an integrant part of the project.

d) The scientific problems arising when such a point of view is adopted are interesting par se.

Thus the most advanced metallurgy of the most advanced countries, for several reasons, cannot be transplanted to a, say, central-African country. But it is also not possible to simply introduce there the metallurgy of the 19th century. Therefore new problems arise that require mastery of the most advanced aspects of metallurgy.

Similarly the mathematical problems arising from the study of complex systems are interesting in themselves.

e) It becomes clear from the above considerations that the research projects chosen for the PS cannot be classified in terms of pure or applied; they are both pure and applied. One could call them integrated. (Indeed one should not think of project (i) as applied and project (ii) as pure.)

f) The two projects require an interdisciplinary approach. Today the word interdisciplinary is very much used -- and abused. It is obvious that several disciplines are needed to solve complex problems. Experience shows that to insure the success of such an enterprise, each participant must be willing and able to acquire a basic understanding of all the disciplines involved. Only thus may each participant gain an overview of the whole problem, and this is necessary for the successful accomplishment of the project.

It is also the only way to go beyond specialization. Specialization must be accepted, since our lives depend on it. However, the complexity of the problems that the world faces at present requires that a sufficient number of specialists be willing to go beyond specialization.

Integrated research projects such as those we are discussing here should provide both the necessary stimulus and the frame for such a development. To be sure, at any good university one may find all the ingredients necessary for the overcoming of specialization. What one does not find there is the motivation for doing so. Here the motivation is the consequence of the commitment to a common goal, the important of which has been recognized.