



International Science Study for Undergraduates Needs, Values, Opportunities, Problems, Models

Arne van der Gen

Introduction

TODAY'S VIEWS about science are largely built on positivism, the concept that positive knowledge is based on natural phenomena and their properties and relations as verified by the empirical sciences. Although these ideas mainly stemmed from the last century, they have evolved through the years. Thus, the neopositivism or logical positivism, which can be considered as starting with the Manifesto of the Wiener Kreis in 1929, was a real interdisciplinary effort to stipulate the requirements for scientific methodology. As such, it has played an important but often underestimated role in the struggle against the dogmas and decrees of totalitarian regimes, such as communism and emerging national socialism.

After World War II, there evolved a need for new principles. In particular the question "What is the role of science in the rebuilding of devastated economies and the reconstruction of our society?" was thought about by scientists and politicians alike. The idea of solving problems through international cooperation emerged, and we only have to remember the impact of the Marshall plan on the revival of Europe to realize how successful such an effort could be. Also negative experiences, in particular with regard to environmental pollution (Chernobyl, carbon dioxide emission, destruction of the ozone layer) has made us realize that the problems in today's world are to a large extent global problems, and that they can only be solved by generations that have been thoroughly "internationalized." Thus it is our task to educate our students, not only in the natural sciences but in all domains of science, to think worldwide. This task is certainly a formidable one. The road will be long and arduous.

This paper takes a reconnaissance tour along some of the programs that have been successful in the recent past and may serve as models for future efforts.

1 The International Student Exchange

Program (ISEP)

The International Student Exchange Program (ISEP) is a membership organization of more than two hundred institutions of higher education around the world. ISEP serves its member institutions by facilitating affordable, university-level student exchanges on a reciprocal basis. ISEP was established in 1979 under authority of the Fulbright-Hays Act. ISEP is dedicated to the principle that a period of study in the United States ought to be available and affordable to all students, no matter what institution they attend or what their financial status may be.

Each year, member institutions nominate participants for the program. The ISEP staff, who have

expertise in the academic systems of participating countries, carefully match the qualifications and site preferences of nominees with available openings at each institution. Each member institution determines the fee that it will charge its outgoing ISEP participants. This fee is based on the usual fees and living expenses at the home institution and enables it to host an incoming participant. By paying the fee, each participant outside the United States creates a place and a set of benefits for a U.S. student. In turn, each participating U.S. student covers the cost of tuition, room, and board at the home institution and creates a place and a set of benefits for the incoming student. The ISEP fee in the Netherlands is currently Dfl 900. per month (about U.S. \$550). More information about ISEP is available at the central office, which is located at Georgetown University in Washington, D.C., and by the designated coordinators at each member institution. Until now, ISEP has had only a limited impact on internationalization of science education at Leiden University. This is most likely due to the success of two other programs that will now be described.

2. The Undergraduate Summer Research

Exchange Program in Chemistry

The chemistry department at Leiden University has been conducting a summer exchange research program for undergraduate students with a number of colleges and universities in the United States for more than a decade. The exchanges usually start via a mutual research interest or cooperation between a member of the staff in Leiden and one at an institution of higher education in the United States. The exchange is based on reciprocity, but this is not strictly adhered to, and parity is seen as a worthwhile long-term endeavor. Every year about ten students leave for the United States, usually around the first of June, to work with a U.S. research advisor during a period of ten weeks. During the months of June, July and up to the middle of August, our students are involved in laboratory work on a project that has been carefully prepared at the host institution. The students receive anywhere from \$1,800 to \$2,400 for their effort. Whether they have to pay for a room depends on the local situation. Experience has taught that this amount is sufficient for subsistence in the United States and will, in fact, also cover the cost of round trip travel. Most of our students profit from the occasion to spend some additional time, to imbibe the atmosphere and the natural splendor of the United States. Likewise, a similar number of U.S. students comes to Leiden to carry out research in the summer months. Unlike the situation in the United States, the daily supervision is usually in the hands of a senior Ph.D. student. The American students receive Dfl. 2500 for the ten weeks, and a room free of charge. Actually, the U.S. students live in rooms that have been vacated by the Leiden students that went to the United States. This allows us to minimize the costs and to send as many students as possible on the limited budget that we receive from the faculty. In the United States, our colleagues usually have to apply for a grant from an external granting agency. There is much interest in this program among the students, and every year many more apply than can be sent. Students are selected on the basis of their academic record, their personality and their ambition.

3. ERASMUS-SOCRATES

ERASMUS was adopted as an action plan of the European Community in June 1987 in order to promote student mobility and cooperation between institutes of higher education within the twelve member states. Participation in ERASMUS was extended to the countries of the European Free-Trade Association (EFTA) in the academic year 1992/93.

The Key Objectives of the ERASMUS Program are to

- achieve a significant increase in student and staff mobility between European institutions of higher education;
- promote broad and lasting interinstitutional cooperation;
- contribute to the concept of a people's Europe;
- contribute to the economic and social development of Europe through the creation of a significant number of higher education graduates with direct experience of intra-European cooperation.

Financial Support for Higher Education Institutions

Interuniversity Cooperation Programs (ICPs): Financial support to higher education institutions within ERASMUS encourages higher education institutions of different eligible States to establish Interuniversity Cooperation Programs (ICPs) through one or more of the following activities:

S M student mobility programs

T S teaching staff mobility programs

C D joint development of new curricula

I P intensive programs

Financial support is channeled to the universities through the NGAA's (National Grant Awarding Agencies). In the Netherlands, that is NUFFIC (Netherlands Universities Foundation for International Cooperation). The budget for 1995 was 180 MECU (1 ECU corresponds to about US\$ 1.20) for the 15 participating countries. Fifty-five percent of this sum (100 MECU) was spent on higher education. It was divided as follows:

Action I (ICPs) 30

Action II (student stipends) 70

Mobility Grants for Students: Under the terms of ERASMUS, student mobility grants are awarded to students who carry out a recognized part of their higher education in another eligible country. The support for individual students varies somewhat with the host country and was on the average 100 ECU/student/month for an ERASMUS student from the Netherlands in the academic year 1994/95. It should be noted that student mobility grants are only intended to assist with the extra costs involved in study abroad. They cannot be expected to cover the costs that would normally incur at the home institution.

Important Ground Rules in the ERASMUS Program are:

*the results obtained at the host institution must be fully recognized by the home institution, both with regard to credits and to grades. To facilitate this process, a special credit transfer program was started five years ago.

-the host institution is responsible for providing adequate housing at a reasonable price.

-the student shall not pay tuition fees at the receiving institution. He/she continues to pay the regular fees at the home institution.

*there is a requirement for reciprocity. This does not mean exactly symmetrical cooperation, but involves an overall balance in the relationship between partner institutions.

The new phase of the European student exchange program will be called SOCRATES. A major change will be that SOCRATES will be working under ECTS (vide infra).

Let us now have a look at what ERASMUS has meant for Leiden University. Leiden is a picturesque town with 100,000 inhabitants, close to Amsterdam, Rotterdam and The Hague. Leiden University was the first one to be founded in our country (1575). It is a fully-accredited, government-financed university with an enrollment of over 18,000 students. The number of students participating in exchange programs has rapidly increased (from 65 incoming and 85 outgoing in 88/89 to 549 incoming and 570 outgoing in 92/93). About two-thirds of the total mobility was supported by the ERASMUS scheme. Most students exchange in the faculty of law and the faculty of arts, which are the largest faculties, with approximately 6,000 students each. The faculty of mathematics and natural sciences plays only a modest role in the total numbers (8 percent of the incoming students and 7 percent of the outgoing students), but this should be seen in relation to the total number of students in this faculty, which is about 9 percent of the university total.

Comparing the Programs

If we compare the two major exchange programs in chemistry we see the following differences:

United States	Europe	duration:	10 weeks	3-10 months	content:	laboratory work	laboratory work
and/or lecture	courses	credits:	none	full	recognition	financial support:	host university
Erasmus	grant	projects:	choice of available	choice of available	research projects	curricula	components

Common to both programs, however, is the careful selection of students interested in participating. This probably has contributed to the very few failures that have occurred in these programs up to now.

4. ECTS: the European Credit Transfer S y s t e m

ECTS is a system for the granting and transfer of academic study credit points that has been developed as a pilot project involving 145 universities in the EU and EFTA countries. The system aims at expediting the procedures involving academic recognition, between European partner institutions by means of efficient and generally applicable mechanisms. ECTS offers a practical model for the organization of academic recognition because it improves the insight in study programs and the results obtained by the students. ECTS has, by itself, no regulating influence on the contents, the structure or the equivalency of academic programs. These are quality aspects that have to be agreed on by the universities themselves, to form a satisfactory basis for cooperation in international networks.

Basic Principles

The most important principles on which ECTS is based, are the following:

*credit points are granted to course units on the basis that a regular academic year counts 60

course credits;

*the institutes of higher education offer host students complete information packages in English, containing a detailed overview of the courses that are offered and the number of credits that they will provide;

Obefore departure, a formal agreement is signed by the home university, the host university and the student. In this contract, the study program of the student at the host university is accurately described;

*upon leaving, the student receives a formal document from the host university, listing all components for which a passing grade was obtained with the corresponding number of credits;

*the home university recognizes the granted credit points, which replace credit points that the student would have received in a comparable study period at the home university.

Grading under ECTS

For the transfer of marks, ECTS has developed the ECTS grading scale.

ECTS grading scale

ECTS percent of successful students normally achieving the grade

Definition Description

A 10 excellent outstanding performance

B 25 very good above average

C 30 good generally sound

D 25 satisfactory fair

E 10 sufficient meets minimum criteria

FX - fail some more work needed

F fail considerable more work needed

F r o m E C T S t o G C T S ?

In the author's opinion, the extension of the European Credit Transfer System to a Global Credit Transfer System (GCTS) would give an enormous boost to internationalization in the natural sciences.

Concluding Remarks

Housing should always be provided by the host institution. Saying that assistance will be given in finding a proper place to stay, as some of our colleagues in the United Kingdom tend to do, is not enough and should not be accepted.

The language of the positivistic sciences is English. That may seem evident to many, but you should realize that the beautiful texts that you are producing in English are translated all over the world. This is beneficial only for the publishers. It is counterproductive for the internationalization of science education.

More emphasis should be given to language education in non-English speaking countries. Lack of communication caused by insufficient knowledge of the English language continues to be one of the major inhibiting factors in internationalization.

And last but not least: internationalization is a very labor-intensive process, both for the coordinating scientists and for the supporting administrative staff. Higher authorities, both in the government and in the universities, do not always seem to be aware of this.

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