

Study abroad for science and engineering students: Barriers to students and strategies for change.

**Progress Report of the CIEE Working Party on Science Study Abroad.
17 March 2003**

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EXECUTIVE SUMMARY AND RECOMMENDATIONS

- i. The executive of CIEE-ISP recognised that science and engineering students are under represented in study abroad programs so appointed a working party mid-2001 to undertake a study to –
 - Identify barriers to study abroad.
 - Propose strategies to overcome these barriers.
 - Discuss ways to achieve a better fit between study abroad and existing curricula.
 - Identify fields in science and engineering that had most to gain from study abroad.
 - Review CIEE's activities in science study abroad.

At its first meeting (Nov 2001) the working party was directed to focus only on science and was advised that staff at CIEE study centres would be involved in the review of its science study abroad activities. This report presents progress to date on the more generic aspects of the work. It is the intention of the working party to complete the project during 2003 in conjunction with staff of CIEE study centres where science programs are offered.

- ii. *Open Doors* and NCES data show that science and engineering students represent ~14% of study abroad students and ~32% of total undergraduate enrolments. Humanities and social science students are up to four times more likely to study abroad than science and engineering students.

iii. Lack of suitable study abroad programs is not a barrier to study abroad for science students. A wide range of academic and professional activities is offered as study abroad programs for science students. This range extends from direct enrolment in courses in a science student's major (taught in English or in foreign languages), through enrolments in technical and general education electives, to fieldwork, research projects, internships, intensive language training and faculty-led study tours. Programs may result in total immersion in the life and culture of the host university or be somewhat isolated from the mainstream of academic activity at the host university.

The principal issues in relation to program availability are that –

- Large universities with strong international links can offer their science students a range of study abroad options that are acceptable to their faculty. These usually operate through affiliation agreements, reciprocal exchange or consortia.
- Many, especially smaller, universities do not have international affiliation agreements on which to establish study abroad programs. Their students are more likely to engage in direct enrolment and sponsored consortia programs (which in most cases results in direct enrolment) and use databases to select programs. Advising, course selection and approval are inefficient and time consuming when so much case-by-case work is required.
- Finding, matching and evaluating foreign courses requires time, close faculty-study abroad partnerships and accessible information. One solution would be to reduce student choice to a limited number of institutions where evaluations have been completed or where packages of courses in cognate disciplines make selection and approval a simpler process. However, to grow the field of study abroad in science will require the availability of comprehensive information on foreign courses that is accessible and presented in a standardised format. Host universities should provide this information.

- iv. Barriers to science study abroad can be overcome if there is a system-wide approach to the problem driven by an advocacy group. Barriers arise through the knowledge and attitudes of stakeholders, curriculum design and the lack of institutional commitment. The poor availability and accessibility of information on programs and the lack of an organisation to drive the process are the most serious barriers.

The most obvious barriers include –

- Lack of institutional commitment to internationalisation; study abroad not referenced in mission statements of science departments or articulated in curriculum.
- Value of study abroad – in all its forms – is not recognised and communicated.
- Inflexibility of science curricula; fitting study abroad into already full schedules; delayed planning; difficulty in finding/matching courses; credit transfer.
- Students are unaware of the value of study abroad - that it is possible and desirable; finding and matching courses; lack of language skills; anxiety over credit, extra time to graduation; competitive entry to graduate programs.
- Faculty can be unaware of the value of study abroad; may lack foreign experience and knowledge of foreign curricula; feel their work in study abroad programs is not recognised for promotion or tenure.
- Study abroad professionals frequently do not have a science background; partnerships between faculty and study abroad professionals do not exist; lack knowledge of home science curricula; finding and matching courses is time consuming and inefficient; inadequate resources allocated.
- Departmental financial issues relating to balancing exchange numbers and loss of tuition fees when students undertake programs that are not covered by reciprocity.

- v. Strategies for removing science study abroad barriers need to address –
- Carriage of responsibility to drive the agenda for change.
 - Encouraging universities to address science study abroad in their international strategies.
 - Demonstrating the intrinsic value of study abroad in the education of tomorrow's scientists.
 - Attempting to influence a change in the pedagogical framework of the science curriculum to encourage more flexibility in content and sequencing.
 - Establishing a systematic way in which information on study abroad programs and courses can be made available. In this context host universities have a major role to play.
 - Establishing partnerships between science faculty and study abroad professionals to engage faculty in study abroad, provide training in each other's fields ("cross-training") and for joint development of exchange programs.
 - Study abroad staff and faculty to prepare templates to show where study abroad can be fitted into each of their science degree programs that encourage study abroad. Templates to show courses that can (and cannot) be substituted, approved matching courses at affiliated universities (the U Minnesota model).
 - Gaining recognition for work in study abroad as a component of performance evaluation of faculty.
 - Gaining recognition of the resource implications associated with increasing participation in science study abroad programs.

- vi. Specific recommendations are to
- Establish an information website sciencestudyabroad.info to be used for distribution of generic information on science study abroad. It is suggested that CIEE be the webmaster for this site and that operating costs be recovered through a licence fee.
 - Seek collaboration of universities that host study abroad in the provision of information on their programs and courses in a form that is useful for course matching and program selection.
 - Design a template to be used to gather information on study abroad programs at host universities.
 - Establish a Science Study Abroad Steering Committee to provide leadership for the growth of participation in science study abroad.
 - Approach AMCAS to seek clarification on the standing of study abroad credit and value in the assessment of application for medical school.
- vii. The working party will collaborate with CIEE academic staff at study centres to address the more specific terms of reference regarding the development of science programs at CIEE study centres. This work will be completed before the beginning of the US Fall semester.

The report to CIEE (dated March 2003) went on to present a number of specific recommendations for action to be taken by CIEE. These have been removed from this version of the report.

INTRODUCTION

Statistical information in *Open Doors* confirms what professionals working in study abroad know to be true: Students undertaking technical/professional courses are under-represented in study abroad programs. Recognising that science and engineering students can benefit from study abroad as much as language, social science, humanities and business students – and therefore should not be denied this opportunity - the executive of CIEE-International Study Programs, with the support of the CIEE Academic Consortium Board, appointed a faculty working party to investigate and report on the state of study abroad for these students.

The working party was directed by terms of reference that were –

- i. To identify those barriers that make science and engineering students under represented in study abroad.
- ii. To define strategies that would assist in overcoming these barriers both on US campuses and in host institutions. To discuss what would be required to make study abroad programming in science fit better into the home curricula of science majors.
- iii. To identify institutions among CIEE study centres where conditions exist (or could exist) that would facilitate study abroad in the sciences and engineering. Review CIEE's existing science options and suggest ways to strengthen them.
- iv. To identify those fields in science and engineering that are most appropriate to study abroad and in which participants can obtain measurable benefit through a period of overseas study (eg. those fields where and international dimension adds value to the academic program).
- v. To suggest possible sites for other CIEE science and engineering programs.

It was proposed that the working party would meet twice per year (once each year at Council conferences) and that it would report after two years. Work began in the second half of 2001, with the first meeting held in Portland in November 2001.

The working party comprises James Boggs (Chemistry, U Texas Austin) as Chair, Paul Berry (Botany, U Wisconsin, Madison) and Lawrie Davidson (Mineral Science, Murdoch University, Australia, and a former member of the CIEE's ACB). Mike Woolf was appointed by the executive of CIEE-ISP to affect liaison between CIEE and the working party. On his resignation from CIEE during 2002 liaison was passed to Martin Hogan.

The working party met at the CIEE conferences in Portland (November 2001) and Atlanta (November 2002), and at the University of Wisconsin, Madison, in April 2002. The deliberations of the working party were greatly assisted by opportunities to discuss issues with many senior colleagues in the study abroad and science fields. We are especially grateful for the wise counsel of Al Balkcum (U Minnesota), Nigel Rogers (UK Consultant and formerly Lancaster University), Ian Saunders (Lancaster University), Ivy McQuiddy (U Texas, Austin), Joan Raducha (U Wisconsin, Madison), Joan Gore (DIS, Washington), Michelle Cumming (U Minnesota) and Urbain DeWinter (Boston University). The assistance of staff at CIEE-ISP study centres - especially Jan Gothard (Murdoch University) and Chris Hudson (U Cape Town) – is gratefully acknowledged.

Members of the working party were active participants at the Portland and Atlanta conferences and spoke with many study abroad professionals about issues relating to science and engineering students. The value of these discussions was that they brought together faculty and study abroad professionals – each in their own way learning more about the issues by seeing it from the perspective of the other. Our subsequent recommendation for “cross training” (see later) arose from realisation of the benefits of this interaction at the CIEE conferences. This was something that would not happen at conferences that are specifically in one of the fields of study of science or a conference for study abroad professionals (eg. NAFSA). CIEE-ISP is to be commended for its initiative in allowing the working party to infiltrate the conferences.

An outcome of the work undertaken at the Portland conference was the scheduling at the Atlanta of a conference track (three full sessions) on study abroad for science students and a pre-conference professional workshop on Science Study Abroad.

At the Portland meeting Mike Woolf suggested that the working party should focus its attention on the needs of science students because several well-supported programs were already in place for engineering students (eg. Global E³ and STEP consortia) and consortia of engineering deans were beginning to discuss the issues. The working party agreed that any progress made in improving the participation of science students in study abroad could have application to engineering students and vice versa. Mike Woolf also advised that he would ask CIEE staff at several study centres to address Term of Reference #3. For a number of reasons this review was not completed at the time of writing this report. We have addressed in our report some generic aspects of ToR #3. We propose to continue working with CIEE staff at selected study centres and report again later in the year.

STATISTICAL INFORMATION

The only statistics on study abroad participation by field of study are in *Open Doors* (Table 1 of this report presents selected statistics for 1999-2000 and 2000-2001). While the 2000-2001 report celebrates a 7% growth in study abroad participation across all fields of study (and 55% growth over the past five reporting periods) the relative percentage of science and engineering students is practically unchanged over the two most recent periods of reporting.

Before any analysis could be undertaken on the *Open Doors* statistics it was necessary to determine just what fields of study should be included as “science” (“engineering” was clearly delineated). This was exacerbated by the field “physical science” including the “biological and life” sciences (personal communication with Ms H Koh of IIE). Further complications arise when one tries to match fields of study in the *Open Doors* tables with those in the NCES tables for students by field of study

Table 1 - Student participation in study abroad by field of study 1999-2000 and 2000-2001*

Field of study	Study abroad 1999-2000 ¹	Numbers of students 1999-2000 ¹	Total US enrolment ² 1999-2000 ²	Study abroad 2000-2001 ¹	Numbers of students 2000-2001 ²
Engineering	2.9%	4139	5.6%	2.7%	4136
Physical Science ³	7.4%	10645	6.4%	7.1%	10970
Health Sciences	2.8%	4059	10.2%	3.2%	4894
Maths and Computing	2.0%	2849	9.4%	2.0%	3136
Agriculture	1.4%	2082	NA	1.6%	2453
Business	17.7%	25404	18.6%	18.1%	27938
Social Science	20.1%	28896	9.2%	20.3%	31302
Humanities, Arts, Languages	31.3%	44813	17.6%	31.2%	48225
Other	14.4%	20703	23.2%	13.8%	21114
Total students		143,590			154,168

Footnotes

1. Source: *Open Doors* 2001 and 2002.
2. Source: National Centre for Educational Statistics report for 2000; NCES report for 2000-2001 is not yet available. Statistics presented as percentages of total enrolment.
3. Physical Science includes Life/Biological Sciences.

In spite of there being some differences in the fields of study reported by IIE and NCES (only the 1999-2000 figures can be used because the NCES report for 2000-2001 has not been published) we feel it is reasonable to make the following observations about the participation of science and engineering students in study abroad.

- i. Physical and life sciences students make up approximately 7% of study abroad students and comprise 6% of total enrolments (of which 80% are in life sciences).
- ii. Engineering students comprise 2.9% of study abroad students and 5.6% of total enrolments.
- iii. Total “science” students (physical, life, health, computing, mathematical) comprise approximately 12% of study abroad and 26% of total enrolments.

- iv. Science and engineering students amount to 14% of study abroad enrolments but are 32% of total enrolments.

Comparison of the science/engineering data with data for social science (20% of study abroad from 10% of total enrolment), humanities and languages (31% from 18%) and business and management (18% from 19%) shows that science and engineering students are significantly underrepresented in study abroad. At a finer level of detail, the percentage of study abroad students who study physical/life science (approximately 7%) is comparable to the percentage of these students in the total enrolment (6%) but well below the participation rate of the non-technical fields of study.

It is instructive to draw attention to a trend identified in *Open Doors 2002* that with the growth in the number of students participating in study abroad there is a parallel trend towards shorter periods being spent abroad. Nearly 50% of students who undertook a study abroad program in 2000-2001 chose summer, January, internships and other short-term programs. This trend presents an opportunity that should be considered in strategies to increase the number of science students who wish to acquire some international experience in their undergraduate studies.

REVIEW OF PROGRAM TYPES

Introduction

From a review of the range of program types available it is evident that program availability should not be a barrier to study abroad by science students.

Ask science faculty who appreciate the value of study abroad to their students about programs for their students and they are likely to express a preference for one that provides a full semester (or full year) of study that slots into the curriculum and allows students to

study their discipline majors in the same class as students in the host university. If the course is taught in a foreign language and the student immersed socially and culturally, then that's even better. Mutual recognition of the academic standing of the host university by the home university and the easy transfer of credit (to be recorded as home credit) are preferred. Furthermore, if the program is supported by grants that would complete the picture of a perfect study abroad experience. Few study abroad programs meet all these criteria but this does not infer that other program models do not make effective contributions to the academic, personal and professional development of science students.

Bearing in mind the relevance of an international experience in the development of professional attributes as well as in meeting the academic requirements of a degree, our consideration of what is of valuable in study abroad activities suitable for science students includes a diverse range of programs, including –

- Academic courses –replacing and supplementing majors, electives, general interest, liberal education, fieldwork and research.
- Language study –with levels of competency ranging from near-fluency through to beginning courses that enable students t
- Faculty-led study tours and academic programs that can be as short as a month.
- Community service placements.

Study abroad programs are administered through a number of different structures so that students may –

- i. Enrol directly in a foreign university under terms of an affiliation agreement between their home university and a foreign university.

- ii. Enrol in courses at a foreign university through programs managed by exchange consortia, sponsored programs developed by education service providers, or through affiliation programs of other universities.
- iii. Participate in faculty-lead study abroad programs administered by their university or in similar programs offered by other universities and education service providers.
- iv. Participate in direct enrolment and other programs not subject to affiliation agreements and which may require approval on a case-by-case basis.

Universities invest considerable resources in setting up study abroad programs and expect their students to follow these except where there is a compelling reason not to do so (where destination or academic disciplines are not otherwise available through the university's own programs). Many of the issues arising in study abroad for science students stem from students selecting courses for individually approved programs.

Program types

In an attempt to categorise study abroad programs in science we have made the following classification:

- *Immersion programs* in which students are enrolled in regular courses of a host university; these are often administered through affiliation and exchange agreements or consortia.
- *Island programs* with courses and activities on a foreign campus or at a field/technical location of interest run exclusively for study abroad students.
- *Mixed programs* in which students may take exclusive courses as well as enrolling in host university's courses. Study centres are frequently associated with these programs.

- *Experiential programs* including internships, projects and community service administered by US universities and education service providers.

Immersion – Reciprocal exchange programs

Immersion programs are often based on bilateral exchange agreements between participating universities. In such programs there is an expectation of reciprocity to maintain a balance of in-coming and out-going enrolments over the medium term. Students register at their home university to take specified courses at the exchange partner. Provisions of the exchange agreement can provide for research projects and academic activities other than course work. Reciprocal exchanges often grow from the research interests and professional networks of faculty, but can stem from strategic alliances developed by international program offices. These exchange agreements can be at departmental level as well as institution-wide. Typically faculty involvement and support is strong.

Exchange consortia, usually involving larger institutions, have been successful in providing some excellent study abroad programs; engineering, chemistry and biology consortia are the strongest. Faculty involved in these programs – often a relatively small number but influential in their academic standing - demonstrate a high level of commitment. With this commitment comes academic control of the program to the extent that successful programs will normally have an experienced faculty member who acts as student adviser and manages liaison within the university and with consortium members. Many consortium programs are so young enough for the original faculty team to be managing activities. It remains to be seen if this commitment can be transferred to another generation of faculty – and, indeed, whether a succession path is in place.

One successful reciprocal exchange consortium program in science is TASSEP - Transatlantic Science Student Exchange Program - for chemistry majors. The TASSEP consortium comprises 11 US and 16 EU universities. Students take regular science courses to maintain normal progress towards meeting graduation requirements. The strengths of

the program are: complete immersion in a foreign culture with substantial language requirements; the accessibility and quality of information on courses; the knowledge and commitment of academic advisers; the careful selection and advising of students; and the administrative arrangements for transfer of credit that have agreements in place before the student leaves home. TASSEP, like most of the large consortia, has been established on external grants.

Other large consortia (all engineering) include –

- IEP - International Engineering Program with National Resources Centre based at University of Rhode Island.
- STEP - Student Transatlantic Engineering Program.
- Global E³ - Global Engineering Education Exchange with IIE course equivalence list.
- RAMP - Regional Academic Mobility Program.

Immersion – Co-sponsored programs

Co-sponsored programs provide services to member universities to facilitate student exchanges and direct (fee) enrolment. A large number of science courses are available through these programs, mostly through the direct enrolment. In many cases there are study centres to provide local support. Many universities, especially smaller institutions, find it advantageous to send students on co-sponsored programs because of the academic oversight exercised on these programs by the members. Historical records of course equivalence are often kept in order to facilitate course selection. Some programs do this better than others; all would benefit from better information access, especially for direct enrolment. Examples of co-sponsored programs include -

ISEP - International Student Exchange Program.

ISA - Institute for Study Abroad (Butler University).

CIEE - Council on International Educational Exchange study centres.

CEA – Centre for Education Abroad (Arcadia University)

Immersion - Direct enrolment

Direct enrolment programs place students in courses running in host universities.

Enrolment is after direct application by the student (moderated and assisted by study abroad offices and home and host campuses) or through various education service providers.

Direct enrolment provides students with an extensive choice of courses and locations.

Indeed, it could be argued that one of the problems with direct enrolment is that student choice is too wide. This results in the academic and administrative work associated with direct enrolment being labour intensive – for students, faculty and study abroad advisers.

Local study centres managed by education service providers can facilitate direct enrolment.

Databases are often used to facilitate selection of study abroad programs. These services maintain a website with searchable database that allows for selection of study abroad on the basis of country, subject and language. Many of these programs are based on direct enrolment or are within exchange agreements between US and host universities (eg SUNY College Brockport, the U Miami and the Syracuse University Abroad programs). The largest service provider of database services is the IIE (iiepassport.org). While the scope of the databases is immense (270 biology, 113 chemistry and 79 physics entries reported), what limits the value of databases is that most links are to handbook/catalogue descriptions of courses in the host university - an intimidating point at which to be dropped. While a database is an excellent way to find what courses are on offer it provides limited help in their consideration for inclusion in a study abroad program. From the viewpoints of the advisers in the study abroad office and science departments - and perhaps for the students' as well - the searchable database approach presents too much choice. Without the foreign universities offering these programs providing the information that is required for selection,

knowledge that there are 270 biological programs available is of limited value to students and their advisers who have to chase down this information themselves.

Immersion – Cognate packages

Packages of courses in cognate science disciplines offer an excellent way into study abroad for science students where these have been designed to meet a defined need in study abroad. Typically, these programs are subject to close scrutiny by a number of universities in early stages of their development. Once through this evaluation, the quality of the program becomes widely known and benchmarks for matching course equivalence are recorded. These quality checks greatly facilitate the work of student advisers, especially those in small universities. Although students taking a course package may have been forced to compromise on choice, there are benefits in not encountering approval, credit transfer or timetable problems. The host institution benefits as well by being able to focus its resources over a smaller range of activities.

Denmark's International Study Program (DIS) provides an example of a government-supported program that is deliberately limited in scope in order to provide high quality education in a structured and controlled manner. DIS provides specialised packages in medical practice and policy; Arctic biology; molecular biology and genetics; marine biology and ecology and in field geology. Courses are taught in Danish universities by Danish faculty. The language of instruction is English and concurrent courses are available in the Danish language.

Immersion – Special packages for pre-med students

One of the serious barriers to science students engaging in study abroad relates to the requirements for entry to the medical school. The perception is that intending pre-med applicants may reduce their competitive standing among applicants because of issues related to the transfer of credit and in meeting required elements of the MCAT application

process. While it appears that these perceptions are not necessarily true they are an effective barrier to study abroad. Intending medical school applicants are not prepared to take any risks.

Pre-med study abroad programs offer a package of courses designed to meet requirements in Biology, General Chemistry, Organic Chemistry, Physics and Mathematics. The pre-med programs at Sussex University and Lancaster University are examples of programs of this type. Students also have access to advanced science courses as well as courses in liberal arts and social sciences (with class timetabling being a limiting factor on choice). Opportunities for students to undertake hospital service and research projects are valuable components of pre-med packages. The MCAT can be taken at a number of foreign centres.

Island programs

Island programs are established by US universities, either exclusively for their own students or as programs accessible by cross-enrolment to students from other universities. Education service providers also offer island programs. Science and engineering island programs are located at host foreign universities, in a foreign city of technological importance and in prime field locations. Island programs are led by faculty of the home university or faculty specially appointed for the site/program. Through island programs science students have access to academic courses, fieldwork and study tours. Programs can range in length from a full semester to summer and J-term programs and short tours. Some programs offer foreign language instruction. An increasing number of science and engineering students who undertake semester-long immersion programs have previously attended a short island program.

Fieldwork and research projects in biology, earth science and natural resource management are the most popular programs for science students. Fieldwork is usually coupled with formal academic studies – often in core subjects such as ecology. These are taught by resident specialist faculty or faculty from the home university that accompany the program.

The field programs of the School for Field Studies, CIEE's Monteverde study centre, BU field geology in Ireland, UC-EAP tropical biology (Costa Rica) are successful examples of field-based island programs.

Faculty from sending institutions have expressed concern over the academic integrity of some island programs. They are "only as good as the staff on the ground" – a serious concern for sending faculty when field-based faculty are not mainstream academics and when the program review process is inadequate.

Examples of a variety of island programs run by US universities include –

- i. The UC-EAP is a comprehensive study abroad program for science students that services all campuses in the UC system. The EAP provides island programs and direct enrolment courses at partner universities for UC credit (not transfer credit). A master file of course equivalence is maintained to guide course selection. Worcester Polytechnic Institute's Global Perspective Program demonstrates a high level of institutional commitment to study abroad. Globalisation is woven into the curriculum. Most students engage in study abroad activities linked to cross-disciplinary team projects in their Junior and Senior years. WPI engages local project sponsors.
- ii. The Cornell-Nepal Study Program provides for field studies, course work and supervised research at Tribhuvan National University. Teaching in English but the program provides Nepal language training. Community service placements and academic internships are available.
- iii. Boston University Dresden Engineering and Science program is designed for the second-semester sophomores. Course are taught in English by Technische Universität Dresden faculty. There is intensive beginning German language instruction and guided excursions to industries and technical museums. This experience prepares students for overseas research projects and internships in the following summer.

Internships

Internships provide opportunities for science students to gain international experience. Good internships can provide structured learning and professional work experience. In some cases internships may be taken for credit. Summer internships with multinational corporations can provide opportunities for language training and cultural immersion.. The IEP internships sponsored by a consortium of US and EU industry is a successful program. The CIEE internship database provides information on foreign internships suitable for science students.

Summary

Because a wide range of academic and professional activities is offered as study abroad programs for science students lack of suitable study abroad programs is not a barrier to study abroad for science students. This range of program types extends from direct enrolment in courses in a science students major (taught in English or in foreign languages), through enrolment in technical and general education electives, to fieldwork, research projects, internships, intensive language training and faculty-led study tours. Programs may result in total immersion in the life and culture of the host university or be somewhat isolated from the mainstream of academic activity at the host university.

The principal issues in relation to program availability are that –

- i. Large universities with strong international links can offer their science students a range of study abroad options that are acceptable to their faculty. These usually operate through affiliation agreements, reciprocal exchange or consortia.
- ii. Many, especially smaller, universities do not have international affiliation agreements on which to establish study abroad programs. Their students are more likely to engage in direct enrolment and sponsored consortia programs (which in most cases results in direct enrolment) and use databases to select programs.

Advising, course selection and approval, and liaison can be time consuming when so much case-by-case work is required.

- iii. Finding, matching and evaluating foreign courses requires time, close faculty-study abroad partnerships and accessible information. One solution would be to reduce student choice to a limited number of institutions where evaluations have been completed or where packages of courses in cognate disciplines make selection and approval a simpler process.

BARRIERS TO SCIENCE STUDY ABROAD.

Those who have a stake in study abroad – students and their families, faculty, study abroad advisers, graduate admissions administrators and future employers – all have views on what it is that discourages science students from undertaking study abroad programs. These barriers are widely recognised around the university system. Regrettably, it appears that they are more frequently used in a rationale for doing nothing than in seeking ways to increase participation in science study abroad programs. The working party canvassed widely to build up a list of what these stakeholders consider to be barriers and arranged these to address common concerns and generic issues. From these lists it has been possible to undertake the systematic review that has allowed us to identify key issues and to propose strategies for change.

The low percentages of science (and engineering) students participating in study abroad programs are a response to the following factors –

- i. Lack of institutional (and/or departmental) commitment to internationalisation.
- ii. Inflexible science curricula and the pedagogical preferences of the disciplines.
- iii. Lack of appreciation of the benefits to science students of study abroad.
- iv. Lack of information on foreign universities and their academic programs.

- v. Lack of awareness by faculty, students and administrators of study abroad opportunities and processes.
- vi. Inadequate or inappropriate advice given to students by faculty and study abroad advisers.
- vii. Language issues.
- viii. Lack of recognition by management of the effort staff put into developing and administering study abroad programs in science.
- ix. Inadequate resources allocated for the task.

We expand on these influences in the following lists of barriers to study abroad.

Barrier 1: Limited commitment by institutions and departments.

- i. Over the past decade institutional leadership has identified internationalisation as a priority in policy development in US universities. However, although globalisation may be embedded in institutional policies, many science and engineering programs lack specific goals and strategies for the internationalisation of their students (and faculty).
- ii. Faculty attitudes towards science students engaging in study abroad programs can reflect this lack of focus and institutional support.
- iii. Universities may lack mechanisms for steering development towards international objectives. In these circumstances the responsibility for developing science study abroad programs defaults to the staff of the international office.

Barrier 2: Lack of appreciation of how study abroad can “add value” to science degree studies.

- i. Insufficient information in the form of widely available and authoritative statements and testimonials demonstrating the value of study abroad in a university education, in gaining employment and for graduate/medical school entry.
- ii. Due to lack of information different stakeholders (students, parents, peers, and professors) have different perceptions of the value of study abroad - so students get conflicting advice.
- iii. Perceptions that study abroad will reduce competitiveness in seeking admission to medical school and graduate school. (An issue here is AMCAS’s insistence that only home university credit is to be considered in applications when most study abroad credit is recorded as transfer credit).
- iv. Benefits arising from the personal challenges of study abroad and from cultural immersion – even for programs in English-speaking countries – are not widely known or are undervalued.

Barrier 3: The science curriculum is simply too specialised and sequential to allow for substitution of courses and periods of absence.

- i. Course sequencing and inflexible academic policies at home and host universities - especially content and pre-requisite knowledge - limit opportunities for study abroad for science students. Inflexibility at host university, including course quotas on study abroad students limit opportunities for US students.

- ii. Study abroad is seen as an “add-on” component rather than being integrated into the science curriculum. In this context study abroad is seen as only suitable for general education and elective courses not courses in a student’s major field of study.
- iii. There is no ideal time in the calendar in which to fit study abroad – especially when southern-hemisphere programs are being considered. Academic planning for science study abroad often starts too late to maximise benefits to students.
- iv. There is insufficient information available to allow a detailed evaluation of equivalence of science courses at foreign universities. Finding “matching” courses at foreign universities and obtaining approvals for these use is time consuming, especially when there are few limitations on students’ selections.
- v. Foreign curricula can be different in every way – calendar, structure, content, approach to teaching, what is expected of students and grading. Integrating students into foreign curricula is difficult; re-integrating returning students has its problems too.
- vi. Different academic structures in foreign degrees, earlier subject specialisation, assessment and its timing, and different levels of academic preparation and pre-requisite knowledge can put at risk US students who slot into foreign programs. Differences arising from teacher-centred vs student-centred approaches to learning can put demands on study abroad students.
- vii. Credit transfer issues – especially for students seeking to enter professional graduate programs.
- viii. Unavailability of host universities’ class timetables in time for course selections to be made before students leave US.

Barrier 4: Science students are unaware of the availability of study abroad or benefits arising from it.

- i. Many science students are unaware of study abroad programs or see it as only for language, humanities and area studies students. They do not see how study abroad can be relevant to their degree programs.
- ii. Negative attitudes towards study abroad expressed by parents, peers and professors can discourage students. “My professors do not recommend study abroad.”
- iii. “How will I match the requirements of my major with courses offered at a foreign university?” OR “I will not be able to fit study abroad into a full schedule of sequential courses.” OR “It appears that I have to do the time-consuming work to find a matching course, gain approvals, make all arrangements - and I do not have time for this.”
- iv. “I do not have the language skills needed to study in a foreign country - so study abroad is not for me.”
- v. Anxiety over grading and credit transfer. “Will my GPA be adversely affected?” “Study abroad will adversely affect my competitiveness for senior research projects; medical school or grad school admission; employment; professional accreditation.”
- vi. Misconceptions that pre-med students cannot meet core requirements, or be able to undertake hospital placements or research projects while on study abroad programs.
- vii. “A semester’s (or year’s) absence would upset my – sporting commitments; family and personal relationships; aspirations in student affairs.
- viii. “The cost of a study abroad program will add to my financial commitments and/or delay my graduation.”

Barrier 5: Faculty are unaware of the scope and benefits of study abroad for science students and the academic standing of foreign programs.

- i. While science faculty generally accept that global networks underpin their research and professional activities, few actively encourage students to undertake study abroad to build international links of their own prior to graduation.
- ii. “Science is science – a borderless branch of knowledge – so why go abroad to study it?”
- iii. Study abroad is not a tradition in science. “Study abroad is for language, humanities and area studies students who have more flexible degree structures than science students.”
- iv. “Study abroad is an extra – desirable but unfortunately not realistic in a our science curriculum”.
- v. Faculty are not aware of value of study abroad in a science degree. Many have little international experience themselves so they see no purpose in promoting study abroad or participating in the development of reciprocal exchanges.
- vi. Faculty lack of knowledge of overseas curricula or academic levels at foreign universities.
- vii. Poorly trained faculty advisers can discourage students, often undoing the good work of study abroad advisers (and *vice versa*).
- viii. Misconceptions over what happens in some study abroad programs can generate inappropriate stereotypes. Faculty hear from colleagues in foreign universities hosting study abroad that US study abroad students “ ... act as if they are here to party and travel, not study!”

- ix. “Transfer credit problems are insurmountable. AMCAS and other postgraduate admission agencies only recognise home university credit so study abroad (with transfer credit) will adversely affect my students’ competitiveness for entry to medical school”.
- x. “The way we do chemistry at U of XYZ is the best (only) way to teach chemistry.” Ignorance of foreign curricula by faculty can lead to arrogance. “Why should we encourage students to take courses that are inferior to what is offered at home?”
- xi. Structures and requirements of foreign science degrees are so different from those in the US that students will be disadvantaged and their GPAs will suffer. Study abroad is simply too big a challenge, especially in a country where English is not the language of instruction. “Study abroad will impede the progress of my best students and distract them from the main game.”
- xii. Faculty are concerned they will lose influence over of their best students or not have them available for summer research projects. There is a genuine concern – “Who will take care of my students when they are on study abroad programs?”
- xiii. “Why should I become involved in study abroad when research output is paramount for grants, tenure, promotion?” Faculty are put off by time consuming and repetitive work in the evaluation of foreign programs, matching courses and advising students. Study abroad is not a high priority.
- xiv. “Will time spent working on arranging study abroad programs, liaison with study abroad office staff and advising students be considered in my performance review? Will it attract release time? Will it attract a salary loading?”
- xv. Faculty may not support proposals to develop faculty-led study abroad programs, including field trips and summer programs, because the university does not recognise

such activity as university service in consideration of tenure, promotion, stipend and relief time.

Barrier 6: Study abroad advisers lack knowledge and understanding of science and are inadequately resourced to do additional work required to promote science study abroad.

- i. Most study abroad advisers have come into their work with a background in languages or area studies, so they lack depth of understanding of science and scientists.
- ii. The close partnerships between study abroad staff and science faculty so necessary in the development of programs for science students have not been established in many universities.
- iii. Study abroad advisers may have limited knowledge of the science curriculum at home university. Time-consuming groundwork is needed to acquire knowledge of the needs of science students and to engage science faculty in the process.
- iv. Finding and matching science courses is labour intensive with a low return for effort, especially if the process is repeated for courses at many foreign host universities.
- v. Lack of resources needed to support more costly development of science study abroad programs.
- vi. Difficulty in maintaining reciprocity in exchanges – and the financial implications for not doing so.

Barrier 7: Language proficiency is seen as an essential requirement for a successful study abroad program.

- i. Foreign language fluency is as much an objective of a study abroad program as its science content: “But engineering projects are negotiated face-to-face, person-to-person. Fluency in a second language is more than a nice thing to have; it is a key ingredient to success” Tim Corcoran, ZF Industries, CIEE Conference, Chicago, 1999.
- ii. Basic language fluency requires a minimum of four semesters’ instruction at college level, followed by in-country intensive instruction and immersion. The science curriculum does not allow time to acquire language skills without extending a degree program, with associated costs.
- iii. Few US science students have the level of language proficiency required for non-English speaking universities and the foreign work place. Study abroad programs that do not require students to acquire a working fluency in a foreign language are of doubtful benefit to students.
- iv. Language skills are essential for the full cultural and social experience associated with a study abroad program at non-English speaking location. Even though English is becoming a universal language for business communication, building relationships is best done in the language of a country.

Barrier 8: Additional costs associated with study abroad are perceived as barriers – for students, departments and study abroad offices.

- i. Higher cost involved in setting up and maintaining field/lab programs compared with study abroad programs in other fields.

- ii. High unit cost of science study abroad programs due to small numbers of students.
- iii. Reciprocity issues associated with balancing exchanges.
- iv. Departments can suffer loss of tuition fees when their students undertake study abroad that is not part of reciprocal exchanges.
- v. Students may face additional costs if study abroad extends time to their graduation. Students may have to forego opportunities to gain career-related summer employment (and income).

STRATEGIES TO OVERCOME BARRIERS

What follows is an outline of strategies that will go some way to overcoming barriers to science study abroad. In doing this we realise that some of the circumstances that create barriers to science study abroad are “internal”, that is, linked to policies that are a university’s own business. We have, nevertheless, made suggestions that may be helpful to universities committed to increasing science study abroad numbers. Other barriers we have identified have system-wide impact without impinging on internal policies. Of these, strategies that relate to the collection and distribution of information and to the carriage of the responsibility to bring about changes across the system are likely to have the greatest immediate effect.

Carriage of responsibility

To extend the work of the CIEE working party there is need to identify an organisation or establish a steering committee to take responsibility for driving the agenda for change across the system. Whereas engineering schools have formed consortia to develop study

abroad programs and groups of deans are beginning to meet regularly to facilitate change, apart from the TASSEP group there appear to be no similar interest groups meeting in the sciences. Who, then, can carry responsibility for increasing participation in science study abroad programs?

We suggest that a science study abroad steering group be formed for this purpose, drawing its membership from deans, senior faculty, international program directors and others with a stake in science study abroad. As an outcome of this report CIEE could take the lead in getting a steering committee established.

Institutional commitment

It has been apparent to us that universities with the most successful study abroad programs for science and engineering can point to articulation at the highest level of a strong commitment to integration of an international dimension in undergraduate education.

This commitment cascades down through departments - in the form of leadership directives and mission statements - to faculty. There are steering committees to support and promote the university's international efforts (eg U Texas College of Natural Sciences Study Abroad Committee), faculty "champions" promoting the value of study abroad, and experienced and well-informed advisers in departments and international centres. Resources and supportive staffing policies support universities' international objectives. Priorities set by presidents, provosts and science deans provide the necessary focus and motivation for change. Science study abroad is growing in this setting.

The proposed Science Study Abroad Steering Committee could influence the attitudes of senior executives of universities – provosts, science and medical deans, and international directors – for them to become advocates for science study abroad within their universities.

Intrinsic value of study abroad

Information must be readily available to show how study abroad programs add value to a science education. The following ideas could be developed to demonstrate the intrinsic value of a study abroad experience in science. These statements with supporting case studies would be listed on a proposed website (sciencestudyabroad.info) for general use across the system.

- Study abroad programs can provide unique experiences that cannot be duplicated at home university (eg fieldwork, special topics, internships and research projects); special locations can stimulate better learning.
- The national importance of study abroad is demonstrated in EU countries where it is a standard and expected component of science degrees; many programs have been developed and funded as EU commission initiatives.
- A global outlook and mobility encouraged early in career when people have fewer responsibilities to limit their mobility. Future benefits arise from international networking begun when a student.
- Immersion in a foreign language environment – even one where English is used widely - can put students onto the path towards second language fluency.
- Study abroad programs raise international awareness on home and host campuses. Involvement in study abroad programs can stimulate faculty interest in international collaboration.
- Enthusiastic foreign students are advocates for study abroad at host campuses and on return home. Study abroad programs can be used as an attraction in student recruitment to a university. Access to study abroad programs can be an incentive/reward for superior student performance

- Returning students often demonstrate accelerated maturity, motivation and independence that have a beneficial effect on all students. The cultural experience of study abroad promotes better understanding and compassion.
- Enhanced employment prospects in an increasingly internationalised work environment. Study abroad can give participants an edge in employment over those who stayed at home. It should also prove to be advantageous to applicants to medical school and graduate school.

Curriculum inflexibility

Such is the strength of the philosophical underpinning of the science curriculum that is unlikely that significant changes will be made to accommodate study abroad programs. The tightly sequential science curriculum has its primary focus on the acquisition of knowledge, know-how, skills and understanding. Advocates for science study abroad will need to work within the existing constraints by fitting programs into - and around - the science curriculum rather than challenging it head-on. Early planning and a good knowledge of the curriculum will help fit a study abroad program into the most crowded curriculum.

Those planning science study abroad programs should take into account the valuable professional attributes that can be developed through study abroad including: personal development (values, social conscience, mutual understanding), transferable skills (working in teams, decision making, interpersonal, communication), foreign language fluency, independent learning habits (and motivation for life-long learning), versatility and adaptability and an international outlook.

- i. Departments should be encouraged to review prerequisite skills and knowledge in course sequences, remembering that the amount students remember from earlier courses in a required sequence can be small. Some flexibility should be allowed in

the way students meet sequence and prior knowledge requirements, making more use of independent study programs, make-up activities and research papers.

- ii. Many professional accreditation processes are based on courses taken and their content. Is it possible to make adjustments to home course requirements to make matches with foreign curricula possible without loss of educational outcomes?
- iii. Formal articulation of study abroad into degree structures.

Students, faculty and study abroad professionals

- i. Information on foreign degree programs and courses must be available in a form that is both comprehensive and accessible to enable faculty, study abroad professionals and students to make informed decisions. Host universities must be partners in the provision of information on which to base course matches and selection of programs.
- ii. Study abroad professionals may, by default, be responsible for initiating programs of study abroad in science, motivating and training faculty, assessing home curricula and finding matching universities and courses. These tasks require a background in science and detailed knowledge of science curricula at their university.
- iii. Planning for science study abroad should begin in the freshman year. Only in this way will it be possible to integrate study abroad in degree programs with maximum benefit and minimum disruption.
- iv. Faculty and study abroad professionals should form partnerships to develop study abroad programs. Each can learn from the other through “cross-training” which provides study abroad professionals with a good understanding of the objectives of the curriculum and science faculty with the objectives of study abroad and its processes. Working as a team, study abroad professionals and willing faculty can review curricula, determine where study abroad can fit and seek matches for courses.

The U Minnesota for faculty engagement being developed on a FIPSE grant will have a significant impact on science faculty involvement in study abroad at U Minnesota and across the system.

- v. Templates need to be developed for each science program in which a university wishes to encourage study abroad (this is the U Minnesota model). These will show those courses that can only be taken at home, courses for which substitution is possible, the sequences that must be followed and periods when it is possible to study abroad.
- vi. Where matches have been established with specific courses at a partner university and “signed-off” as acceptable study abroad substitutes these should be recorded and made available to students and advisers. These list of equivalent courses should be posted on the central sciencestudyabroad.info website for general access.
- vii. Faculty and study abroad professional should form partnerships to develop study abroad programs. Each can learn from the other through “cross-training”.
- viii. Institutional leadership is needed to recognise the resource implications associated with development of science study abroad programs. This applies especially to the operation of the office of international programs.
- ix. Issues relating to the recognition of the value of academic work in study abroad must be resolved at institutional level.
- x. Lack of foreign language fluency in students should not be a barrier to study abroad. Planning for study abroad in the freshman year may allow time for some language instruction to be incorporated in home campus studies prior to undertaking study abroad.

- xi. Include study abroad as a stream at conferences of professional science associations (eg American Chemical Society) and invite study abroad professionals to participate at these meetings.

WHAT NEEDS TO BE DONE NOW

At this stage of our work we have identified six items for action that we would like the CIEE executive to consider. These are generic items and not specifically CIEE business. However, because the science study abroad field does not have a forum in which these matters can be discussed – and because the study was a CIEE initiative - we suggest that CIEE could continue its leadership in the field by facilitating the next steps. We believe that the implementation of the five proposals will help to make significant progress towards setting up a framework for system-wide change in how things are done in science study abroad. With these changes there will come an increase in student numbers.

The six items on which we are recommending action are –

- Setting up an information website.
- Improving access to course information.
- Designing an information template.
- Forming Science study abroad steering committee.
- Addressing some urgent pre-med issues.
- Modifying CIEE programs in science.

These matters are now discussed.

SETTING UP AN INFORMATION WEBSITE

Rationale and discussion

Throughout our work the most consistent call was for accessible information. A well-managed, dedicated website is the obvious answer. A website with a distinctive domain name (such as sciencestudyabroad.info) could form the hub through which generic information on science study abroad could be made available to students, faculty, study abroad advisers and employer. Universities could download generic information from the website to support the development and promotion of their own study abroad programs. This website would not be available as a marketing tool. Students, faculty and study abroad staff could obtain information and authoritative advice on all matters relating to study abroad. The website could provide -

- A template to be used for collection and distribution on information on programs.
- Statements from employers or professional bodies such as the American Chemical Society, on the value they attach to an international experience and outlook in graduates.
- Authoritative statements from medical schools or AMCAS explaining how study abroad experience is valued in the selection process.
- A course equivalence list linking specific US and foreign courses for use by study abroad advisers and faculty when selecting study abroad courses to match their courses.
- Reports on the outcomes of workshops, conference sessions and R&D projects addressing issues in science study abroad.

- Statements by science deans and provosts regarding policy implementation at universities that are actively working on strategies to increase the number of science students in study abroad.
- A forum (bulletin board and listserv) to promote discussion on science study abroad.
- Presentation of case studies describing how study abroad professionals have gone about getting faculty support for science study abroad and for faculty to discuss ways they have overcome barriers.
- Information and strategies to support “cross-training” programs for faculty and study abroad advisers.
- Testimonials from students and faculty involved with study abroad programs.

Registering a US domain name is a relatively simple matter (sciencestudyabroad.info was available when last checked) and quite economical. Location of a server on which to place the proposed website and its on-going management are the primary issues surrounding this proposal. Our first thoughts were to suggest that the domain name and website be located to a CIEE server; other options are to use a commercial ISP, the IIE website (as for the Global E³ engineering consortium) or a NAFSA server.

When discussing this proposal with study abroad professionals it was drawn to our attention that having CIEE as the web-host could appear to present a conflict of interest for CIEE - and even some commercial advantage. On past record CIEE has demonstrated that it can take a leading role in the development of generic aspects of study abroad without unfairly taking advantage of its position with respect to other providers of educational services or universities not supporting its programs.

We are confident that this would be the case should CIEE be the web-host for the sciencestudyabroad.info hub. We have not considered how CIEE or another agency, for

that matter, taking on the role of web-host would recover operating costs for the site and webmaster. One possibility is through a form of licence fee paid by institutions who use the website or whose services benefit from its use. Policy oversight of the website would be the responsibility of the proposed Steering Committee (see latter in report).

Recommendation

- i. A website be established to be used as a hub for the distribution of generic information on science study abroad. A suitable domain name could be sciencestudyabroad.info or sciencestudyabroad.org.
- ii. That CIEE (or IIE or similar educational service provider) be asked to consider hosting the proposed website.
- iii. A mechanism be considered for funding the operation of sciencestudyabroad.info through payment of a licence fee.
- iv. Policy oversight for sciencestudyabroad.info should be the responsibility of the proposed Steering Committee for Science Study Abroad.

IMPROVING ACCESS TO INFORMATION ON COURSES

Rationale and comment

We recognise that science professors are the gatekeepers of study abroad for science students. Without the support of professors there is little hope of significantly increasing the number of science students who study abroad. While policies on internationalisation adopted by institutions are filtering through to science departments it will take some time -

and committed academic provosts and science deans with new resources – for these strategies to bear fruit in the science disciplines. Meanwhile, strategies to increase the number of science students who study abroad should focus on the academic gatekeepers – the science professors. It is they who most influence student decisions about degree programs; they control the curriculum and whether it can include a period of study abroad; they advise students; and they decide on the equivalence of courses offered by foreign institutions and education providers. To do this efficiently professors need comprehensive information on foreign courses that extends well beyond the cryptic statements in university handbooks and course catalogues.

Through implementation of our proposal for an information database the course selection and approval process would be streamlined by providing the information faculty require to evaluate courses. Surprisingly, this information is not readily available. Even the US institutions that are most advanced in developing study abroad programs for science students have faculty and study abroad advisers spending hundreds of hours seeking “fits” for their curriculum from course and study abroad programs offered by foreign universities. This can be a hit-or-miss approach. As well as being time consuming at one university it is being duplicated elsewhere as other universities go about their evaluations of foreign courses for their students.

Within reciprocal exchange partnerships (especially those that are developed around faculty links) evaluation of courses for the purpose of developing equivalence is quite straightforward. Information can be exchanged between knowledgeable and committed faculty at each university with the support of the study abroad offices. Growth in numbers on study abroad follows this spread of knowledge and the acceptance of the program by faculty and students. Records are kept of equivalence and successful study abroad pathways mapped out and followed by future students. The specific nature of reciprocal exchanges provides the focus that ensures their success.

For the provision of comprehensive and systematic information on courses we recommend the introduction of an additional link in the information chain – the host university. While

most US universities consider study abroad in terms of the affect it has in the development of its future graduates, for many foreign host universities – especially from countries where study abroad is not a traditional component of degree studies or where costs limit reciprocal exchanges - study abroad enrolments generate income.

The current searchable study abroad databases give an enquirer the impression that comprehensive information on universities and courses is but a “mouse click” away. Host universities use these databases as marketing tools by having them linked to their home pages and handbooks/catalogues. In many instances this does no more than drop enquirers at a departmental homepage from where they must fend for themselves. Using this route to find and evaluate courses at foreign universities is time consuming and generally unsatisfactory. Extensive communication between universities follows.

It is in the commercial interest of foreign universities and other providers of study abroad programs and direct enrolment to ensure that US universities are getting all the information required to make decisions about the acceptance of study abroad programs. If a foreign institution or service provider is not prepared to provide information in the form proposed then we would expect US faculty to direct students away from these programs towards those where the appropriate information is available. We see this self-selection process as helping to identify those providers who are taking science study abroad seriously. If a university offering science study abroad is not prepared to contribute to the process then study abroad advisers should delete these institutions from their selection lists.

To be effective, information made available by host universities and education services providers must be relevant, comprehensive and in a format that is readily updated and communicated. We recognise that there is considerable work involved in the preparation of this information. It is for this reason that we propose that this should be the responsibility of host universities offering study abroad programs. We would expect that over time faculty would encourage students and study abroad advisers to focus only on those programs for which there is sufficient information.

A useful model to follow is that used by European universities for the European Credit Transfer System (ECTS) used in ERASMUS/SOCRATES exchange programs. Sheffield University is providing linked access to comprehensive information on courses in the form needed by US faculty who are attempting to match courses in study abroad programs with their own curriculum. We are also aware that many universities with extensive on-line teaching strategies maintain websites of course materials and requirements for their students. These would be extremely useful when searching for course matches but rarely is this information accessible to a guest who is outside the university's computer system firewall.

Having an accessible centralised database to store this information is probably beyond the capabilities of an endeavour that would need to be run without significant resources. What is more realistic is for the foreign providers of study abroad courses and programs to maintain information in a standardised format on their own websites. A template showing how information is to be presented would be available for downloading from a generic website (sciencestudyabroad.info) we discuss elsewhere in this report. As well being the responsibility of the providers to put their information into the required format, we would expect they would provide an easily recognised icon on the home page of their corporate websites with appropriate links to provide direct access.

While we realise that the preparation of input for the database will be a substantial task for host universities, we expect that only the most appropriate courses will be presented in the first instance. This will encourage host universities to be more selective and we would expect the quality of programs to improve.

Recommendations

- i. Host universities be invited to provide information on their courses in a standardised format.

- ii. Course information provided by host universities is to be lodged on their own web pages and be accessible through a distinctive icon on the university's home page.

DESIGNING AN INFORMATION TEMPLATE

The proposed template for systematically gathering course information will be available on the website sciencestudyabroad.info. The information on courses will be stored on the websites of host universities. The following information is required -

Course information

- Course objectives, content and curriculum framework. This is to be much more than a website reference to a handbook/catalogue description of a course. It includes course objectives, curriculum framework, an outline of weekly course content, textbook and readings, pre-requisite knowledge, prior credits taken in the area (eg 3 credit hours of introductory college chemistry). The intent here is to define the content and level of the course so that anyone reading the entry can assess its equivalence to a course in a US university.
- Teaching/learning culture (lectures, labs, tutorials, fieldwork, independent research, etc).
- Laboratory facilities, library and computing; email access.
- Teaching schedule (dates; class timetable for coming year, as soon as it is available).
- How student performance is evaluated; assessment methods used (copies of past assignments and test/exam papers to be available as pdf files).

- Is this a course taken by students of the host university? If so, where does the course fit into the relevant degree structure of the host university?
- Is the course designed specifically for study abroad students as part of an island program?
- Previous enrolment of study abroad students (numbers and home universities).
- Course credit value at host university expressed as US credit hours and ECTS credits.
- Grading procedures; how grades are distributed.
- How academic transcripts are provided on completion of course.
- Language requirements when the course is not taught in English.
- Whether there are restrictions on enrolments by international students; any special conditions that may apply.
- List of US universities that have already accepted course; course equivalence at US universities, where known.
- Whether course is part of a collection of courses in cognate disciplines that have been packaged especially for study abroad students.
- Is the course/program designed to enable students to meet pre-med requirements. Is MCAT available locally?
- Unique aspects or special strengths of the course and department.
- Cultural and social opportunities provided by the course/program.

Academic quality of university and faculty.

- Academic credentials of faculty in host department offering course; percentage with PhD; research profile of department; teaching and research profile of university; national rankings.
- Current student/faculty ratio in this course; ease of student access to professors outside of class time.
- Whether academic advising is available and, if so, who does it.

Support services and communication

- Name and email address of faculty member responsible for course at host university for purposes of liaison with US faculty, study abroad advisers and students.
- Information on the host university including: teaching and research profile; national ranking; numbers of students and percentages of international and study abroad students; whether there is an office to administer international programs and support students; housing; on-site orientation.
- Other information relevant to course.

Recommendations

- i. Establish a template for the preparation and communication of information on courses and programs available at foreign host institutions. The information template will be available on a generic website sciencestudyabroad.info.
- ii. Responsibility for putting course information into the format of template will rest with foreign universities hosting in study abroad.

- iii. Information on science study abroad courses and programs arranged to this template to be available via the home pages of most participating institutions and service providers.

SETTING UP A SCIENCE STUDY ABROAD STEERING COMMITTEE

Background

An outcome of meetings at the CIEE Atlanta conference was recognition of the need to “drive the agenda” for science study abroad – at least until its value in the education of tomorrow’s scientists can be demonstrated and study abroad is accepted as an integral component of a science degree, as it is in EU universities. Atlanta delegates asked, “How can we build on the momentum arising from the CIEE initiative?” To answer this question we are proposing that a Steering Committee for Science Study Abroad be established. The Steering Committee would provide leadership and influence in the development of policies and the implementation of strategies, and be the focus for communication on the big issues, including –

- Translation of institutional policies for internationalization into science study abroad numbers.
- Models for developing better understanding between science faculty and study abroad professionals through “cross-training”.
- Endorsement and promotion of the value of science study abroad.
- Dissemination of information.

- Gaining recognition of work in study abroad for the purposes of assessing faculty performance.
- Liaison with science professional associations, professional accreditation agencies and employers.

The membership of the Steering Committee would need to be of such standing as to be comfortable communicating with provosts and science deans, medical admissions boards, professional associations and international employers. What is proposed is to establish a group of about 6-8 senior people spanning senior university executives, science faculty, directors of international programs, the professional associations and employers. We believe it would be useful also to have representation of a foreign university that engages in science study abroad because partnerships between home and host universities must be developed in strategies to increase the participation of science students in study abroad programs. Some administrative support would be needed to ensure that the work of the Steering Committee is managed and communicated.

It is proposed that the Steering Committee would meet twice a year over two years. These meetings would be timed to run in parallel with major conferences in each other's fields so that there would be a genuine cross-over of ideas between faculty and study abroad professionals. The Atlanta experience has shown the value of this interaction. One meeting of the task force could be arranged to coincide with the CIEE conference (or NAFSA); another could be in parallel with a meeting of the American Chemical Society or similar science professional body. At these conferences the steering committee would have its own meetings as well as participating in a science study abroad track.

Funding of around \$30,000 per year would be needed to get these people to conferences that they would not expect to attend in the normal run of their professional business. It is proposed that a grant be sought from a funding agency to support this endeavor. Granting agencies that could be approached include the National Science Foundation, the Ford Foundation and the Fund for Improvement of Postsecondary Education. Another approach

could be to seek smaller grants from a number of agencies that have vested interests in the outcomes, including major international companies, smaller foundations (e.g. Camille and Henry Dreyfus Foundation), educational service providers and science professional associations.

Recommendation

- i. CIEE consider initiating a proposal for the establishment of a Steering Committee for Science Study Abroad.
- ii. Applications should be made for grants to establish and support the work of the Steering Committee.

PRE-MED ISSUES

Background

Any strategies proposed to increase the number of science students participating in study abroad must address the special requirements of “pre-med” students. Not only are these students a significant proportion of science enrolments, they are also motivated and able students. Furthermore, there is a sense that they are “different” – a perception that somehow they have more at stake in their degree studies. There are more restrictions on their courses and some uncertainty over how the AMCAS will view their records of academic achievement. The long shadow of the medical school selection process extends over the entire degree program and forces a conservative play-it-safe attitude on students and those who advise them. Yet future medical students have so much to gain from the challenge of study abroad and the broadening experience of living in a foreign country. Facilitating study abroad for pre-med students should be a priority in strategies to increase science students who study abroad.

With careful selection of study abroad programs, pre-med students can prepare themselves for the MCAT and develop portfolios of academic and personal achievement that should make them highly competitive in the selection process. There are –

- Courses in basic sciences that closely match the science requirements at home universities.
- Advanced courses in biochemistry, physiology, medical research projects, internships.
- Packages of courses directed specifically towards meeting the requirements of pre-med students.
- MCAT services in foreign centres.

AMCAS and study abroad

So what is holding back students? There appear to be two issues –

- Uncertainty or misconceptions (for students and faculty) over the value that AMCAS puts on study abroad in the ranking of students for admission.
- The rigidity with which AMCAS is applying the requirement that courses taken abroad must be recorded on the transcript of a US university or college in the same manner as for the home university's courses (that is, not as transfer credit).

The first of these issues can be resolved by AMCAS, medical deans and others who are involved in the selection process by being asked to make their views known. Statements on this matter could go onto the proposed sciencestudyabroad.info website for general access.

Transfer credit is a more complex issue. The most common arrangement in US universities and colleges is that courses taken on study abroad programs are recorded as transfer credit

even when faculty have declared the course to be equivalent to a course which would have been taken at home. Under AMCAS policies students who participate in study abroad may be putting their medical school applications at risk.

Dr Nigel Rogers suggested at the final session of the Atlanta conference that an approach be made through the deans of medical schools to the administration of AMCAS requesting a fairer assessment of the foreign credit. He proposed that if science courses taken abroad are accepted by the faculty of an accredited US college or university as equivalent to those the student would have taken had he/she stayed at home, then they should be accepted by AMCAS. Dr Rogers and Dr Uliana Gabara (U Richmond) agreed to develop the case to be put to MCAS through medical school deans. The proposed Steering Committee on Science Study Abroad (see later) could take responsibility for seeking resolution of this issue.

Recommendations

- i. Medical deans and AMCAS be asked to provide authoritative statements on the value of study abroad programs in the consideration of applications for medical school.
- ii. AMCAS be asked to reconsider its approach to the assessment of foreign credit.
- iii. A page on sciencestudyabroad.info should be dedicated to issues of interest to pre-med students.

LINKING CIEE PROGRAMS TO STRATEGIES AND RECOMMENDATIONS

Term of Reference #3 addresses CIEE study centres where science programs are (or could be) offered. It calls for a review of the existing science options at study centres and suggestions on ways in which programs could be strengthened. As indicated at the beginning of this report it was intended that resident directors would be involved in this review but for various reasons this has not taken place.

Science programs are available at all CIEE study centres that make provision for direct enrolment as well as at the Monteverde island program in biology. Most of the programs are taught in English though some are located in non-English speaking countries. To the question of whether new programs be mounted to meet the needs of science study abroad we would answer, No; at least not at this time. Our preference would be to strengthen programs currently available and to seek to increase student numbers in these. This could be done by improving information available on programs (requiring collaboration with universities that are hosts of the CIEE study centres) and developing courses in cognate disciplines as a package.

The report to CIEE (dated March 2003) went on to present a number of specific recommendations for action to be taken by CIEE. These have been removed from this version of the report.

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