Attaining Overseas Experience for the Majority of Engineering Students

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Abstract

The Engineering School at the National University of Singapore (NUS) admits more than 1,500 freshmen each year into its nine undergraduate engineering programs. By the time the students in each cohort graduate, more than half would have participated in some form of overseas program. This paper discusses the various overseas opportunities that are available to NUS engineering students.

Keywords: International collaborations, Globalization, Engineering, National University of Singapore

1. Introduction

As an island nation of about 710 sq km without natural resources, Singapore has transformed itself to become a nation characterized by a strong economy in Southeast Asia, with a per capita growth exceeding that of many industrialized countries in the world. Singapore’s oldest and largest public university, the National University of Singapore (NUS), has evolved in tandem [1] with the nation into a global institution of recognized international standing. In addition to undergraduate and graduate programs, NUS offers research opportunities spanning a broad range of disciplinary and multidisciplinary areas. NUS was ranked 22nd in the “World Reputation Rankings” and as one of the top two in Asia in 2012-13 by the Times Higher Education [2].

NUS is a comprehensive University with sixteen schools at three campus locations in Singapore. It offers undergraduate and graduate degree programs in disciplines such as medicine, architecture, engineering, computing, law, sciences, social sciences, etc, to over 30,000 students. A key goal of NUS is to nurture a global mindset in students, by forging strategic relationships with various institutions around the world, and expanding the number and variety of overseas programs students can participate in. NUS’ perspective of delivering a transformative education, incorporates programs such as student exchange, entrepreneurship-focused internships [3] at its NUS Overseas Colleges around the world, as well as double degree and joint degree programs with some of the world’s top universities. A student’s learning experience is complemented by a vibrant residential life, with avenues for artistic, cultural and sporting pursuits. By academic year 2011/2012, more than 60% of NUS students had participated in overseas educational programs, which include semester or year-long student exchanges and joint degree programs with partner Universities overseas, to shorter stints overseas, such as summer programs, internships, research attachments, study trips and community service projects.

2. About the NUS Faculty of Engineering

The NUS Faculty of Engineering is one of the largest schools in NUS, with over 6,000 undergraduates, 3,000 graduate students and 300 faculty members. Its vision is to be “a leading Engineering School that innovates for a better future”, and towards that end, its mission is “To nurture Engineer-Leaders and to address global challenges through Research, Innovation, Inspiration and Influence”.

Of the more than 1500 freshmen the NUS Faculty of Engineering admits each year into its nine undergraduate engineering programs, more than half will have some form of overseas exposure, with the majority going for a student exchange at partner universities. In addition to semester or year-long student exchange, this paper discusses summer programs and overseas internships, as well as a special program established with several universities around the world, to enable NUS students to work in start-up companies located within highly entrepreneurial environments in the US, Europe and Asia, while continuing their studies at a partner university. The paper also examines various factors that continually need to be addressed to ensure that students continue to benefit from overseas exposure. One aspect is that the education system in Singapore, and at NUS, uses English as the language of instruction. Hence, it is a challenge to encourage students to consider going on exchange to a university in a country where English is not the language of communication, particularly in Asia and Europe. To overcome this, foreign language programs are available, to teach students European, Asian and other languages, and freshmen are strongly encouraged to enroll in them. Other factors include managing partnerships with overseas universities, encouraging students at partner universities to come to NUS to sustain a two-way
flow, special arrangements to enable students to cope with rising/fluctuating costs, and global issues such as safety and security threats, or health alerts. The paper will also present some experiences in dealing with special/unexpected situations, such as major earthquakes in Japan and New Zealand.

3. The NUS Student Exchange Program

The Student Exchange Program (SEP) is the largest program at NUS that provides an overseas experience for students; it involves, about 300 partner universities in 40 countries around the world [4]. In academic year 2011/2012, NUS sent more than 1600 students on various exchange programs, and also received over 1600 students. Among the schools at NUS, the Faculty of Engineering sends the most students on the SEP, with more than 400 participating in 2011/12. Under the SEP, students spend either one or two semesters at a partner university, while earning credit towards their NUS degree. Tuition fees are waived by the host universities and outgoing students continue to pay tuition fees to NUS. The students are responsible for finding the means to pay for other costs associated with the SEP – e.g. miscellaneous non-tuition fees that host universities may charge, accommodation, travel, daily expenses, visa procurement, etc.

The SEP offers students a once-in-a-lifetime experience to broaden their minds and experience a culture that is different from theirs. Students learn to be more independent, gain confidence and pick up inter-cultural relationship skills that will serve them well in an ever-changing globalized world. Students are usually selected for the SEP in their second year of study, and embark on exchange in their third. Students are advised to carefully select their overseas university destinations, based on what courses are offered and their schedules. Other considerations are their ability to cover living and travel expenses. Students can apply for partial financial support from NUS for SEP or other overseas programs. Applications are made via an online system, which collates information on students’ choices of overseas universities and other details. Although there are more than 160 partner universities for engineering students to choose from, there are certain universities in North America, Europe, Australia, and Asia that most students are particularly interested in going to, and consequently, competition is very intense for places at these universities. Hence, students undergo a rigorous selection process that involves interviews where not only academic ability, but also other attributes and contributions outside their field of study, such as community work, general knowledge and an aptitude for accommodating change and embracing learning are noted. Students work together with specially-appointed Department advisors, who provide inputs and approve their study plans at partner universities. The grades students obtain overseas will not be included in their NUS CAP (Cumulative Average Point) score calculations. (Details on SEP for NUS engineering students can be found at http://www.eng.nus.edu.sg/sep/)

Together with the NUS International Relations Office, our school has dedicated administrative staff who engage with partner universities overseas and respond to special situations, in order to assist NUS students who have gone abroad and also incoming overseas students. During the last major earthquakes in Japan and New Zealand, these staff kept in close touch with NUS students who were there, or who were about to go there. They had to work out special arrangements for students to return home or to continue with their exchange at other partner universities.

4. NUS Overseas Colleges

The NUS Overseas College (NOC) program aims to cultivate dynamic and resourceful entrepreneurs by immersing selected groups of students in dynamic entrepreneurial-academic environments of major entrepreneurship hubs around the world, which include Silicon Valley (California) and Bio Valley (Central/Greater Philadelphia area) in the USA, and other high-tech hubs in China (Beijing and Shanghai), India (Bangalore), Israel and Europe (Stockholm, Sweden). Seven colleges, established at these locations, host up to 150 NUS students a year. Instead of “comfortable and traditional” internships at established companies and multi-national corporations, students are placed as interns at start-up companies selected by the NOC office at those respective locations. They intern for up to a year and learn from the very best by interacting with the founders of these companies. They imbibe a great sense of motivation from learning about starting up and running a company. While interning, they take entrepreneurship-related and technical discipline-based courses at a top partner university in the vicinity of their internship. For example, at Silicon Valley, students study at Stanford University. At their graduation, these students are conferred a Bachelor in Engineering degree with a Minor in Technopreneurship. (More information on the NOC can be found at http://www.overseas.nus.edu.sg/)

5. Joint Degrees with Overseas Universities

NUS also offers opportunities for students to pursue concurrent/double/joint degree programs with universities overseas. These are special arrangements with premier universities and provide NUS students with an academic experience that combines the distinctives of two education systems, and exposes them to a different culture at the same time. Students are expected to spend substantial time at both NUS and the partner university, and their project work is jointly supervised by academic staff from both universities.

Some of such programs currently available to NUS Engineering students are:

- Double-degree programs with seven French Grandes Ecoles, culminating in the award of a Bachelor of Engineering and a Master of Engineering from NUS, as well as a Diplôme d’Ingénieur from one of the

- Double-degree program with Technische Universiteit Delft (TUD), resulting in a Master of Science degree in Hydraulic Engineering and Water Resources Management from NUS, and a Master of Science (Civil Engineering) with Hydraulic Engineering, or a Master of Science (Civil Engineering) with Water Management from TUD
  - Joint PhD Degree Program with Ecole Supérieure d’Electricité.
  - Joint PhD Degree Program with Imperial College London.
  - Joint PhD Degree Program with the Indian Institute of Technology (IIT) Madras.
  - Joint PhD Degree Program with Technische Universität Eindhoven.
  - Joint PhD in Chemical Engineering Degree Program with the University of Illinois at Urbana-Champaign.

Much time and effort have gone into negotiating and working out the details on these special degree programs with the overseas partner universities; some of the programs started out as student exchanges. Besides working out the structural details of the degree programs, including the grading system to be adopted, etc., these programs need approvals from the highest authorities at NUS and the partner universities. Once the programs are established, the administrative and related mechanisms to support them are put in place to ensure their sustained and successful operation.

6. Overseas Educational Programs

NUS students typically participate in short-term overseas educational programs during the university vacation periods of May-August and November-December, with the former being more popular, as it coincides with the summer vacation periods of universities in the northern hemisphere, when many summer programs, research attachments and internship opportunities are offered. Summer programs offered by NUS’ non-English speaking partner universities in East Asia, Europe and Latin America, provide students with short-term academic immersion. Such experiences give them a deeper appreciation of the culture and lifestyle of the host country. Certain summer programs are offered jointly by NUS and a partner university, an example being one by the NUS Faculty of Engineering and Georgia Institute of Technology (GIT). The program is open to students from both NUS and GIT, and its curriculum is taught jointly by academic staff from both universities. It takes students to two locations – Singapore and Beijing – and offers NUS students not only a different kind of academic and cross-cultural experience through interactions with GIT students and faculty members, but also exposes them to the business environment in Beijing, as field trips to industry are included.

Many NUS undergraduates also participate in research attachments, ranging from 8 weeks to 3 months, under the mentorship of top researchers at universities renowned for science and technology, such as the Massachusetts Institute of Technology (MIT), California Institute of Technology (CalTech), Imperial College of London, and Zhejiang University. Students have the opportunity to gain hands-on laboratory experience and conduct research in a different academic/research environment.

NUS also collaborates with industry partners to offer overseas internships. These prepare students for the demands of an increasingly globalised economy and an interconnected international community. Students are exposed to different cultures, international business ideas and practices, and cutting-edge technologies. Such internships also make available networking opportunities and the experience of living and working in different global settings and communities.

7. Global University Networks

In addition to academic collaborations with partner universities via bilateral arrangements, NUS is also an active participant of several established global university networks [5]. At the university level, it is a member of the following:

- International Alliance of Research Universities (IARU)
- Association of Pacific Rim Universities (APRU)
- ASEAN University Network (AUN)
- Universitas 21 (U21)
- Asia-Pacific Association for International Education (APAIE) and Asia Pacific Leaders (APL)
- Association of Southeast Asian Institutions of Higher Learning (ASAIHL)
- Southeast Asia & Taiwan Universities (SATU)
- Association of Commonwealth Universities (ACU)

At the faculty level, the NUS Faculty of Engineering is a member of:

- The Association of Engineering Education in Southeast and East Asia and the Pacific (AEESEAP)
- ASEAN University Network/ Southeast Asia Engineering Education Development Network (AUN/SEED-Net)
- Global Engineering Deans Council

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Through these networks, NUS is able to leverage on the resources and diverse programs of other member universities to enhance its menu of overseas programs. There are many exclusive programs that are only available to students of member universities, such as the APRU Doctoral Students Conference, AUN ASEAN Youth Cultural Forum, IARU Global Internship Program, U21 Summer School and others.

8. Challenges of International Collaborations

Although NUS has enjoyed a good measure of success with its overseas programs, they are not without challenges. As NUS expanded its international network rapidly over the past decade, the large number of partnerships established resulted in a strain on the University’s resources, especially with regard to on-campus accommodation and making available to incoming exchange students, the courses they wish to pursue. Prior to 2011, some of the incoming exchange students had to be housed in accommodation located off-campus, as on-campus housing was insufficient. Since 2011, this problem has been alleviated to some extent by the opening of the new NUS University Town (a campus extension) that saw the addition of three new student residences.

Besides housing, some incoming exchange students also face the situation of not being assigned courses or modules they would like to read at NUS. As a result of the flexible modular system adopted by NUS, both NUS and exchange students are eligible to apply to read modules from any faculty/school, as long as they satisfy the prerequisites of those modules. This has resulted in a very high demand for some modules, especially those related to business studies and economics, which the NUS Business School and the NUS Faculty of Arts and Social Sciences are unable to assign to exchange students, because they are constrained to give priority to students enrolled in their own schools. Consequently, there have been instances where students applying to come to NUS on exchange have withdrawn their applications, as they are unable to read all the modules they intended to. This is an issue that is still being worked on. Some measures that have been adopted to alleviate such situations include mandating that incoming exchange students take at least 70% of their modules from their host faculty/school. A list of the 50 most popular modules is made known to exchange students to moderate their expectations, and incoming students who do not major in business or economics are encouraged to refrain from applying to read business or economic modules.

In addition to resource constraints, another challenge is achieving and maintaining a balance in the number of exchange students. At one end of the spectrum, universities in English-speaking countries like Australia, United States and United Kingdom are extremely popular with NUS students, but because students from these countries are often generally unaware of or unfamiliar with Singapore and/or NUS, the number of incoming exchange students is usually much smaller than what NUS sends out. At the other extreme, because of primarily language barriers, NUS students tend to shy away from universities that offer only a limited number of courses taught in English, such as those in France and China. Hence, this results in NUS receiving more students from these countries than the number going to them.

To help attain an exchange balance in this area, NUS works at encouraging and stirring up interest in students to consider going to “non-western” countries like China, France, India, etc, for their overseas programs. This is done through different activities, such as exhibitions, talks and sharing sessions by students who have gone on exchange to these destinations. Concurrently, NUS also actively participates in study-abroad fairs and organizes information-dissemination sessions at popular destination partner universities, to encourage students there to come to Singapore. NUS also offers alternatives to students from partner universities; these are in the form of summer programs or research attachments, which are usually of shorter duration than semester-long exchanges. The objective is that a shorter time commitment and a reduced financial obligation would enable more students to come. Student participation in these alternative programs is also considered when calculating student exchange balances.

With many partners and limited resources, NUS has concluded that it is best to focus on ensuring meaningful relationships with its partners. Thus, an exercise to consolidate its partnerships was undertaken in 2009, to enable deepening of interactions with a more manageable number of partners. For instance, the University of Illinois at Urbana-Champaign (UIUC), USA, is not only a student exchange partner but has also established a joint doctoral degree in Chemical Engineering with the NUS Engineering Faculty. The Engineering Faculty also invites UIUC students to participate in its annual Summer Design Program and Summer Research Attachments.

9. Concluding Remarks

The overseas programs described provide NUS students valuable insights and experiences in terms of student life in another country, and help them learn to be a global citizen. This contributes towards their personal development, because undertaking education in a different culture, environment and system, instills in them flexibility and adaptability, as they take classes by professors in another institution and establish friendships with students at their host universities.

Even more options are now available to students, as they can gain access to unique courses offered via international programs. For instance, students participating in the summer programs by Technológico de Monterrey are able to read courses on Mexican culture and the Spanish language, both of which are not offered at NUS. Students interested in nuclear power learn more about this topic at the Summer Nuclear Engineering Institute at the University of Texas at Austin.

While a large number of NUS students spend some time abroad, there are also students who are unable to go overseas for various reasons. For these students, the presence of incoming exchange students to NUS helps bring the rest
of the world to them. These incoming students add to the diversity of the NUS student population and contribute further to a culturally vibrant learning environment.

References

Biography
Victor P.W. Shim is a Professor of Mechanical Engineering at NUS, and also Vice-Dean overseeing External Relations for the Engineering Faculty. He pursued his Bachelor's degree at Auckland University (1973-76) through a scholarship from the New Zealand government. He then returned to Singapore to fulfil three years of military service and served as an officer in the artillery. Thereafter, he took on an academic tutor appointment at NUS, and concurrently did research in sheet-metal forming for his Master's degree. In 1982, he went to Cambridge University on an NUS scholarship and pursued his PhD in Impact Mechanics, returning to a faculty position at NUS in 1986. He has been a Visiting Scientist at the Tokyo Institute of Technology and a Visiting Scholar at UC San Diego. He is a registered Professional Engineer and a Senior Member of the Singapore Institution of Engineers. He has received numerous awards for Teaching Excellence and Innovative Teaching, and has held several senior university appointments, such as NUS Director of Corporate Relations. He established the Impact Mechanics Laboratory at NUS and continues to be active in research in the areas of dynamic stress analysis, dynamic material behaviour, impact absorption, ballistic penetration of protective fabrics/structures, and the response of products/components to shock/impact loads. He is also an Associate Editor of the International Journal of Impact Engineering.