Models for International Collaborative Undergraduate Engineering Programmes

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Models for International Collaborative Undergraduate Engineering Programmes: University of Glasgow-Singapore Institute of Technology and University of Glasgow-University of Electronic Science and Technology of China

The two models used to create and grow the UGS (the University of Glasgow Singapore) and the Glasgow College UESTC will be explained, highlighting how various internal and external factors contributed to their similarities and differences. Shared best practices as well as best practices that are specific to one or the other collaborative model will be described. Challenges that remain as well as new challenges that arise as each collaboration continues to evolve will be discussed.

Introduction

There has been an explosive growth in multinational collaborations in higher education recently, with a number of UK universities engaged in programmes around the world. There were approximately 571,000 students outside of the UK, enrolled in a degree programme awarded by a UK higher education institution (HEI)\(^1\). More than 50 UK universities have partnerships in Singapore with over 52,000 students enrolled in undergraduate and postgraduate degree programme\(^2\). UK HEIs are similarly active in transnational education (TNE) in China. Slightly more than 25% of all Sino-foreign undergraduate programmes involved a UK HEI as of 2013\(^3\).

The University of Glasgow (UoG) is actively contributing to this growth in transnational education. It opened the doors at its first transnational educational programme in Singapore in August 2011, in collaboration with Singapore Institute of Technology (SIT)\(^4\). Two years later, in September 2013, it launched a joint education programme in Chengdu, China with the University of Electronic Science and Technology of China (UESTC). Both campuses in Asia offer undergraduate engineering degree programmes; mechanical design engineering, mechatronics, aeronautical engineering, and aerospace systems in Singapore, electronic and electrical engineering in China. An undergraduate programme in computing science is also offered in Singapore and an undergraduate degree in nursing will start in September 2016. Already, the total number of undergraduate engineering students enrolled in the programmes in Asia is almost equal to the undergraduate engineering population enrolled at the UoG campus in Glasgow. Expansion of the undergraduate programmes in terms of both the number of degree programmes and the disciplines covered, as well as the development of graduate research are under consideration at both UGS (University of Glasgow-Singapore) and the Glasgow College UESTC, formerly known as the University of Glasgow-University of Electronic Science and Technology of China (UoG-UESTC) Joint School.

While there are similarities between the two overseas activities, there are also significant differences in the relationships between UoG and its partner institutions, the governmental regulations that must be observed at each location, the needs of the constituents of each of the degree programmes – the students, staff, and employers and the decisions that were
made internally at UoG as it established each collaboration. These and other factors led to two different organizational structures, which have influenced the approaches taken at UGS and the Glasgow College UESTC to manage the academic programmes, students, staff and partnerships.

**University of Glasgow – Singapore**

Following the successful completion of O-levels, Singaporean students have three pathways available to continue their education: 2 years at junior college leading to A-levels, 3 years at polytechnic leading to a diploma or 2 years at Institute of technical Education leading to a certificate. Over 40% of all O-level students will enter a polytechnic diploma programme which provides a strong industrially oriented education. To meet the demand for highly trained employees, Singapore Institute of Technology (SIT) was established in 2009 specifically to develop further education pathways for students who graduate from one of the five Singaporean. SIT enrolled its first students in September 2010 after creating degree programmes in partnership with five foreign universities. The University of Glasgow and SIT opened their first programme in 2011 at the Ngee Ann Polytechnic campus, where the mechanical design engineering and mechatronics programmes are offered, later expanding to the Singapore Polytechnic campus where aeronautical engineering and aerospace systems degree programmes courses are taught and the Republic Polytechnic campus where the computing science degree programme is offered.

As articulating three-year diploma programmes offered at the different polytechnics are essentially equivalent to the first two years of the four-year University of Glasgow’s Bachelor of Engineering degree, the programmes at the University of Glasgow – Singapore (UGS) are two year programmes. Students who successfully complete the UGS degree programme are awarded a Bachelor’s of Engineering (Honours) from the University of Glasgow. SIT, until recently, was not able to award bachelor’s degrees. SIT’s status changed in 2014 when it became an autonomous university – the fifth publicly-funded university in Singapore.

The University of Glasgow decided to replicate, as much as possible, the courses and laboratory facilities when developing the degree programmes at UGS. Thus, the time between the decision to offer engineering programmes in partnership with SIT to the first taught lecture was less than one year.

The academic calendar, regulations and policies at UGS are all identical to those used at the UK. A discipline coordinator was appointed at the main campus to ensure that changes to the degree programmes offered at the UK campus that would affect the degree programmes offered in Singapore would be relayed and communicated to the UGS programme director. An administrative staff member was hired to work in the UoG School of Engineering Teaching Office. This staff member coordinates the second supervision and second marking of the UGS final year projects by the UoG staff.
A programme director for each discipline was also identified and seconded to Singapore to oversee the first academic programme. As the number of programmes increased, the academic staff member from Glasgow was named the director of UGS, a responsibility that was in addition to his role as programme director. It should be noted that other than the director of UGS, all UGS staff, both academic and administrative, are not University of Glasgow employees, but are employed through UGlasgow Singapore pte. Ltd which was incorporated in 2011. Alterations to the performance and development review policies and promotion guidelines to fit the different working environment in Singapore have been developed.

There are currently twelve full time UGS academic staff members who teach approximately half of the courses in each degree programme, following the course specifications and using instructional material provided by the University of Glasgow. The remaining courses are taught by academic staff from SIT, polytechnic and industrial adjuncts. These staff also follow the course specifications and using the instructional materials provided the University of Glasgow. Thus, the teaching load of the two-year UGS programmes is shared equally between UGS and SIT staff.

There has been little deviation to the content of the programmes offered in Glasgow compared to those offered in Singapore. However, to address the weaknesses in mathematics and language skills of the UGS students, SIT has developed courses that the UGS students can take, which enables the students to earn a certificate from SIT upon graduation. These courses, however, have not been incorporated into the UoG programme specification and the final grades in these courses do not contribute towards the calculation of the UoG grade point average.

To build a sense of belonging to the University of Glasgow, the UGS students come to Glasgow for four weeks between their first and second year at UGS to take the one UGS course that is not taught at the same time as the equivalent UoG course. This is a group design project, the subject of which varies depending on the degree programme; mechatronic students have to design an autonomous vehicle that navigates a maze, aerospace systems students have to develop the flight control software for an autonomous semi-constrained quadrotor. The students are accompanied by the UGS staff, who take this opportunity to undertake professional development courses, meet with UoG staff to discuss collaborative research projects, review plans for course modifications, and to become familiar with changes in the UoG regulations and policies. Thus, it is hoped that the summer overseas immersion programme fosters a stronger relationship between the UGS and UoG staff as well.

To insure that the assessment of the courses is identical to that used at the UoG main campus, the final and resit exams are the same at both locations and scheduled at the same time and day with the exception of the group design project. Thus, the same exams is scheduled for late afternoon in Singapore and morning in Glasgow.

As the student-to-staff ratio at UGS is considerable higher than at the Gilmorehill campus, it was agreed that the UGS and SIT staff would first supervise the final year projects of all of
the UGS students, whether they are conducting their design projects on campus or at an company location. However, second supervision would be carried out by the UoG staff. This has led to some difficulties in Glasgow as the second supervision of projects has been distributed to all academic staff within the School of Engineering with the result that some staff are second supervising projects that are on topics far from their expertise. Thus, some of the UoG staff are reluctant to participate fully in the second supervision of projects, given the amount of time required for them to become sufficiently knowledgeable to contribute significantly when reviewing the initial proposals, mid-year progress reports, and final reports. It is also possible that the fact that the UGS students rarely pursue post-graduate degrees immediately after completing their undergraduate degrees and none of the students who do decide to go on for further study have applied to UoG may also contribute to the reluctance of some of the UoG staff to participate in the UGS final year project supervision.

Exam, resit, and graduation boards are organized by staff in the main campus with the participation of the programme directors and UGS staff. At these boards, the course averages and pass rates of the UGS and UoG courses are compared and the grades for the UGS courses are only finalized after UoG staff review the marking of the exams. This has been of benefit as the comparison in performance on exams has identified a number of areas in which the UGS students perform either significantly worse that the UoG students, demonstrating deficiencies in their education from a more ‘plug-n-chug’ approach to teaching at the polytechnics, or significantly better, demonstrating the emphasis on hands-on skills at the polytechnics. However, it has led to complaints about the increased workload by the UoG staff and a feeling of being a second-class academic by the UGS staff.

The UGS programmes were accredited by the professional engineering institutions licensed by the UK Engineering Council in the year following the first graduating class. While Singapore is now a signatory on the Washington Accord, full accreditation is at the M.Eng. degree. The B.Eng.(Honours) degree can only receive partial accreditation and, thus, the programmes will continue to be accredited by the UK Engineering Council.

**Glasow College UESTC**

The University of Electronic Science and Technology of China (UESTC) was formed in 1956 through the merger of the electronics disciplines from three universities: Shanghai Jiaotong University, Southeast University, and South China University of Technology. It is a ‘211 Project’ university as well as a ‘Project 985’ university and is the home institution for four National Key Labs. While delivering an excellent education in electronic engineering and related fields, UESTC has expanded to offer degrees in business and administration, medicine, foreign languages, and education.

UESTC and UoG agreed to enter into a partnership to offer a joint education programme (JEP) in Electronic and Electrical Engineering (EEE) and opened the Glasgow College UESTC in September 2013. To emphasis the fact that this was a partnership, it was agreed that the students in the programme would receive two degrees, a B.Eng.(Honours) from UoG and a
B.S. from UESTC. Moreover, half of the science, technology, engineering, and mathematics (STEM) courses in the undergraduate programme would be taught by UESTC staff and the other half would be taught by UoG staff. As there are no equivalent courses in the UoG EEE programme to the physical science and mathematics courses that are required for the UESTC B.S. degree, it was decided that UESTC staff would teach these courses. Hence, more than half of the engineering and technology courses in the EEE JEP are taught by UoG staff.

As the undergraduate programme is a four-year programme, which is the same number of years as the UoG B.Eng. programme and the UESTC B.S. programme, the students take more credits per semester than a typical UoG or UESTC student. In addition, all of the STEM courses are taught in English independent of the institution that supplies the course instructor. Thus, the students must develop reasonably high level of technical English language skills to flourish in the programme.

Rather than follow the model for employment used at UGS, the University of Glasgow decided to use a fly-in model, driven in part by issues related to arranging permanent work visas for the UoG staff. In this model, Glasgow-based staff fly to UESTC one week out of every four during the semester to teach a month’s worth of material and to supervise laboratory sessions and design projects. As a result, the UESTC-taught courses are held on a ‘normal’ schedule of roughly thrice-weekly lectures, a schedule that is regularly perturbed by the periods of intensive teaching of the UoG staff. When not at the Glasgow College UESTC, the fly-in UoG staff are expected to carry out research, provide limited support to courses in Glasgow, and participate on committees whenever their schedule allows. As Glasgow-based staff, they also second supervise some of the UGS final year projects. As the UESTC academic calendar is followed at the Glasgow College UESTC, the teaching schedules of the UoG fly-in staff are never in sync with the teaching schedules of the Glasgow-based UoG staff.

The UESTC-taught courses to our Glasgow College UESTC students are essentially the same course delivered to UESTC students, except that the language used in the delivery is English rather than Mandarin. As this meant that the courses in the programme were not identical to the courses in the EEE programme taught at the Gilmorehill campus, the UoG-taught courses have had to be modified in content to accommodate the learning from the prerequisite courses and prepare students adequately for the follow-on courses in the following semesters. In addition, it became apparent that some of the support to develop the technical English skills of the students had to be provided within the UoG-taught courses. Thus, the course content of the UoG-taught courses has moved away from that covered in the ‘same’ course taught in Glasgow. As a result of these changes in course content as well as a desire to reduce the overall credits taken by the students, particularly in the first two years when the students’ English language skills are still developing, there has been a major revision to the curriculum at the end of the 2014-2015 curriculum and another revision is planned.

Initially, the agreement was that the academic policies and regulations used would be those of UoG and the pastoral care of the Glasgow College UESTC students would be the responsibility of UESTC staff. However, some of the UoG policies and regulations,
particularly with respect to resits, have had to be adapted to incorporate aspects of similar UESTC regulations so as to meet the expectations of the two degree programmes.

Exam moderation is conducted by UoG as part of its quality assurance process and has included moderation of the exams written by UESTC staff. The different styles of assessing student learnings were very clear after the first round of exam moderation. UoG staff would like to see more descriptive questions in all exams and engineering applications used in the questions on the mathematics and science exams. Some of the UESTC staff are willing to change their exams while others have been slower to alter their style of examining students, which may be due to an unfamiliarity with the philosophy of assessment used by UoG. Similar to the processes used at UGS, exam, resit, and graduation boards are organized by UoG staff with the participation of the UESTC administrative staff and the course instructors from UESTC. At these boards, the course averages and pass rates of the Glasgow College UESTC and UoG courses are compared. There was a difference in expectations on the pass rate by staff at the two universities, which was complicated by the fact that most of the fly-in staff were recent UoG hires and who may not have aligned their own expectations on pass rates with that of the longer-term UoG staff who participated on the boards.

From an administrative perspective, there is a Dean of the Glasgow College UESTC who is a UESTC staff member, a director of the programme who is a UoG staff member, and a number of other administrative positions that are populated by either UESTC or UoG staff, where the UoG staff members are based in Glasgow. The UoG TNE coordinator who was appointed to support the UGS programmes also supervised the Glasgow College UESTC programmes. In addition to the Glasgow College UESTC administrative staff, the TNE programme in China relies on the service organizations at each University. For example, staff from the UESTC and UoG Teaching Offices interact to see that the quality assurance procedures of UoG are maintained and that the database systems at each university contain the same information. This has been an area of friction because of different schedules for data uploads and lack of familiarity with each other’s systems as well as communication issues. The two universities have duplicated staff in an effort to overcome some of these problems, leading to some inefficiencies in the process.

The Glasgow College UESTC programme has yet to have a cohort complete Year 4 and graduate. This will happen at the end of the 2016-2017 academic year. The procedures used to supervise the final year project are under discussions. The initial proposal was that UoG fly-in staff would first supervise 1/3 of all final year projects and second supervise the projects supervised by UESTC staff and any industrial projects. As planned, there will be little to no reliance on UoG staff in Glasgow. As there is a reasonable possibility that some of the Glasgow College UESTC students may apply for post-graduate studies at UoG, it is likely that the Glasgow-based staff will be willing to first or second supervise some of the final year projects as a means to independently evaluate and recruit future M.Sc. and Ph.D. students. However, first supervision of design projects remotely with no face-to-face interactions would have to monitored carefully to insure that students receive adequate guidance and feedback. A careful review of the technologies and discussions with the staff
at both institutions as well as with students who may participate will have to be carried out before remote supervision of final year projects will be encouraged.

Since the Glasgow College UESTC has not graduated any students, the programme has yet to be accredited. It is not clear at the moment which accreditation body should review the programme. China has established the Chinese Engineering Education Accreditation Association\(^6\) and has provisional status under the Washington Accord\(^7\). It has applied to become a signatory to the Washington Accord; however, the application remains under consideration.

**Summary**

The models for international collaborative undergraduate engineering programmes at UGS and the Glasgow College UESTC are very different. A significant distinction between the two sets of collaborations was type of institution with which UoG partnered. SIT was an organization responsible for partnering with foreign institutions that would offer their own programmes to allow students to complete their bachelor’s degrees, at least for the first three years of the UoG-SIT partnership. In contrast, the Glasgow College UESTC was a partnership between two highly respected universities with well-established degree programmes. A second factor is that there is a single degree awarded by UoG upon completion of a programme at UGS. Thus, the management of the programme by one institution with one set of policies and regulations has been possible. This has not been feasible at the Glasgow College UESTC, despite the original agreement between UoG and UESTC. The willingness of both institutions to adapt the UoG and UESTC policies and regulations has been crucial to the successful operation of the Glasgow College UESTC. Misunderstandings can still occur when academic and administrative staff from either institution who are not regularly engaged with the overseas programmes become briefly involved in the programmes. However, dissemination of information about the operation of the Joint School has been helpful.

While the programmes at UGS have been very similar to that offered at the Gilmorehill campus, it has taken a great deal of coordination between academic and administrative staff at both campuses to insure this. However, if one looks at the courses taken in total by the UGS students, one can see that there has been some changes made to meet the local educational needs, primarily through the addition of the elective courses taught by SIT. Thus, the programmes at UGS do share some similarities to the EEE JEP programme, which has grown increasingly different from the EEE programme offered at the Gilmorehill. It is very likely that the programmes at both overseas campuses will continue to diverge from the programmes offered in Glasgow, which is a positive direction if the result is improved student learning.

With the rapid growth of the UoG TNE programmes in Singapore and in Chengdu along with an additional TNE activity in the social sciences in Nankai, the management structure of the TNE programmes has been modified. UoG has created links between the Schools of Engineering and of Computing Science and the Vice-Principal Internationalisation. The positions of Dean University of Glasgow Singapore and Dean University of Glasgow UESTC
have been established with responsibility for research as well as the academic activities at the respective TNE sites. The directors of the UGS and Glasgow College UESTC will have a dotted line reporting relationship to a Dean as well as a direct reporting relationship with the administration of the School in which the director is housed.

Lastly, the way in which the staff who teach the UoG courses are employed and the way in which these staff interact with the UoG staff based in Glasgow is very dissimilar. Some of the reasons for the differences are associated with the location of the campus, government regulations on foreign workers and UoG policies on secondment. To date, there has been no issue with employee retention with UoG staff involved in either joint programme and no study of employee satisfaction has been conducted. Thus, there is no data analysis to say which approach is better, assuming that one approach can be adopted for the two locations.

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