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BUILDING A SUCCESSFUL TRANSATLANTIC COLLABORATION IN ENGINEERING/TECHNOLOGICAL EDUCATION. LESSONS FROM A SIX YEAR JOURNEY

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Abstract

In a progressively more interconnected world, contemporary third level students recognise the modern necessity to learn to operate effectively in different cultural contexts. Moreover, employers clearly value graduates who demonstrate the ability to operate successfully in international contexts. Hence, students want their educational institution to push beyond the boundaries of the traditional lecture theatre and lab—to look outward and create a range of relevant educational engagement and delivery models which are truly international and embrace a global perspective.

For European third level educational institutions intent on responding to such imperatives, the practical initiation, development and sustenance of along-term multi-faceted trans-Atlantic educational partnerships is not a trivial undertaking. Such a collaborative endeavour provides a multitude of strategic organisational, cultural, educational, financial and process development challenges. However, since many of the challenges are broadly common to all institutions, much useful knowledge can be usefully gleaned from the experience of those transatlantic partners who have travelled successfully and further on a partnership journey already.

In this context, this paper reflects on key learning's from the first six-years (2004-2010) of the development of a collaborative journey of two trans-Atlantic higher-educational institutions. It describes the progress towards building a sustainable and innovative international educational partnership in Engineering/Technological education between the Dublin Institute of Technology, Dublin Ireland and Purdue University, Indiana, USA.

In particular, the paper provides insight into the iterative stages of development of this relationship. It reflects on some of the key challenges and it recognises the critical enablers of success. It focuses on challenges and solutions in the following six important areas

(i) The partnership initiation stage. Key considerations and important enablers of future success
(ii) Building early "quick win" momentum in a partnership
(iii) Full-semester undergraduate exchange. Key educational and logistical challenges and solutions
(iv) Creating post-graduate opportunities.
(v) Quality assurance and standards considerations in international collaboration
(vi) Project sustainability and continuous improvement

This collaborative journey has taken these partners from "no relationship" to a situation today where they have an active, multi-faceted partnership involving both education and research; a partnership whose activities are supported by a educational budget of more than €880K to date. Currently, the educational component of this partnership includes an active "full semester accredited exchange" for European and US undergraduates, a Dual Masters degree for post-graduate students and now a burgeoning research collaboration also.

The paper is relevant to any European third level educational organisation focused on building a long-term sustainable transatlantic partnership.

1 INTRODUCTION

The aim of this paper is to describe the iterations of progress towards building a sustainable and innovative international educational partnership in Engineering/Technological education between the Dublin Institute of Technology, Dublin Ireland and Purdue University, Indiana, USA. It describes the development of the relationship under six distinct headings and reflects on lessons learned in each case

(i) The Partnership Initiation Phase

(ii) Creating Early "Quick Wins"

(iii) Developing Full Semester Undergraduate Exchange

(iv) Extending the partnership into the post-graduate area

(v) Quality Assurance and Standards Considerations

(vi) Project Sustainability and Continuous Improvement

2 THE PARTNERSHIP INITIATION PHASE

In 2005, Senior Academics from the College of Technology at Purdue were interested in finding appropriate, attractive and available European academic partners with whom they could develop long-term mutually beneficial academic partnerships. To this end, they visited many academic institutions in Europe including a number in Ireland. In the Dublin Institute of Technology, they found an Engineering faculty with a strong history of applied Engineering/Technology courses (similar to Purdue) and with 5 Schools which had a lot of similarity to the 6 Departments in the College of Technology. DIT, at that time, while focused on their own core competency were also interested in providing more international opportunities for their students and with developing strength in education and research collaboration. The good "academic fit" between the two institutions was certainly a necessary pre-requisite in the decision to move the relationship forward. In March 2005, DIT and Purdue jointly signed a Memorandum of Understanding committing themselves to partnership and co-operation

However, while the formal signing of paperwork was a clear institutional signal of intent, this formality alone did not of itself drive the partnership forward. Ultimately, the partnership was moved forward by the engagement and commitment of management and "champions" within the academic community.

In retrospect, a very important lesson in the project's development was that a key enabler that contributed significantly to developing momentum in the institutional relationship was the warm personal relationships that developed between the Academic Management and key academics in each institution. The simple fact that people said "We like these people; we can do business together" mattered hugely in getting the partnership established.

Of course, the development of a climate of goodwill, trust and excitement about the possibilities for future collaboration required an investment of time and effort by the institutions and their management; particularly in the 2005 and 2006 period. In retrospect, this investment in 'getting to know you' which didn't necessarily bring 'immediately visible' results, was very beneficial to the "medium term" results and to establishing the partnership on a sound academic footing-in a way that went well beyond "the formal paperwork". It is clear that those institutions who ignore or who don't afford sufficient time to cementing these important interpersonal building blocks in the early stages of partnership building do so at their peril in the medium term.

During this first eighteen month period, the Dean's at both Institutions (Dean Murphy and Depew respectively) supported their staff in formal organisational engagement. A number of key Heads of School and Department Heads from both sides of the Atlantic undertook short visits to the partner institution, met and got to know their colleagues in the USA and became broadly familiar with the programmes and the people. This engagement of Academic management with their transatlantic colleagues was a very important building block and important 'relationship-building' exercise. It helped

align the academic units understanding of their trans-Atlantic partners and in so doing specific "quick win" opportunities for collaboration emerged.

The institutions did not begin with a Master plan laying out collaborative activities they would undertake in a given sequence and to any specific timeline. They began with the awareness that there could be many strands of mutual cooperation in different parts of their organisations though they didn't know which specific opportunities would emerge and the exact sequence in which they would be undertaken. However, given the fit between the activities in each organisation, there was a commitment and belief by the Deans and Heads of School that there were many possibilities and that these would emerge in due course. As management engaged and then in turn got key academic staff engaged, specific opportunities began to emerge, be envisioned and explored.

One important lesson we learned at this stage was the importance of understanding the precise use of language in the partner institution. Though we all spoke English, we used many of the same terms in very different senses. Hence, there were very many opportunities for misinterpretation of the messages received even when academics on both sides of the Atlantic were each committed to sharing details about their organisation. We discovered as we engaged that to really understand the partner organisation, it was important to be fully aware of the sense in which they used different terms on the other side of the Atlantic. One might by default assume that the terms were used in the same sense as you were familiar with them. However, this was often not the case. For instance, in Ireland what we referred to as "modules" were "courses" in the USA. Some Europeans may have understood "courses" as having the same meaning as "programmes" in the United States. "Faculty" has a different meaning in the USA and Europe. In fact, "College" in US terms meant "Faculty" in Ireland and "Faculty" in US terms often mean "Academic staff" in Ireland. There were many other similar examples of opportunities for misinterpretation in language even when all were committed to communicating the detail. In Ireland, when we talked about "the exams", we meant formal end of semester and "out of class" exams -proctored by independent personnel. There was no similar concept operating in the US system. End of semester exams happened 'in class' and in fact, very many courses were predominantly "continuous assessment" based where final exams did not count so much. Similarly, there were very many differences in how credits were understood. This will be explored later in this paper.

3 CREATING EARLY "QUICK WIN" MOMENTUM

Continuing momentum in the development of the partnership required that "quick wins" were identified, supported and executed. These "quick wins" emerged from the engagement of management and academic staff in the early phases. Essentially, this was an experimental stage as partners grappled together with developing and implementing processes that would work. There are four quick win initiatives as follows which will be considered

(1) Short Term Lecturing Exchange Pilots (2) Joint Undergraduate Projects (3) Short Term Student Exchange (4) Joint Academic Papers

3.1 Short Term Lecturing Exchange

One "quick win" opportunity that emerged at the Project initiation stage was the possibility of developing a Short-Term lecturing Exchange. Professor Matthew P. Stephens (Purdue University) from Purdue University expressed a particular interest in coming to Dublin Institute of Technology to lecture. His colleague at DIT with the equivalent academic interest, Donal McHale, also was interested. Therefore, with the support of their Deans and Heads of School, an asynchronous exchange was successfully planned and undertaken.

Professor Stephens came to the Dublin Institute of Technology in April 2005 for a two week period. As part of their normal lecture sequence, Professor Stephens lectured to a Final Year Degree Class in Manufacturing Engineering in the area of Quality and Six Sigma.

In September 2005, Donal McHale from DIT undertook a similar short-term lecturing assignment at Purdue University. This lecturing exchange was successful from the lecturing perspective. More importantly, it had the added benefit of affording these academic staff members get to know one another very well and allowed them develop great insight into the culture and operational norms of the partner institution. It also allowed them investigate (often informally) the opportunities and possibly

challenges of undertaking additional collaborative work. Following this exchange, many of the critical questions in relation to the development of a student exchange programme had been considered

Mark McGrath also attended Purdue University for a number of days in June 2006. Whilst there Mark sat in on final year Electrical Technology student project presentations and got involved in other activities which illustrated the workings of the College of Technology.

In addition, one of this project's key participants from Purdue, Professor Michael Dyrenfurth spent a semester sabbatical at DIT to advance the linkage and learn more about the specifics of European transitions in higher education.

3.2 Joint Undergraduate Project

As a consequence of short-term faculty exchange between Purdue and DIT faculty early in the academic year 2004/2005, Professor Miletta Tomovic, a faculty member from the Mechanical Engineering Technology Department at Purdue and Mr. Michael Ring, a faculty member from the School of Manufacturing and Design Engineering at DIT jointly developed and agreed a proposal for a common Engineering design project to be incorporated into the curriculum of work of a team of students and jointly undertaken by two transatlantic student groups. 5 Purdue students in fourth year technology programs at Purdue volunteered to participate together with 4 students in the third year of the product design program at DIT. Four distinct project elements were defined i.e. design, manufacture, analysis and marketing. Students communicated at the outset of the Design task by video-conference and subsequently travelled across the Atlantic to actually finish the joint Design project. Through the use of video conferencing and e-mail, the groups regularly updated each other on progress. Each team was responsible for the production of a project report and make a final project presentation to the other group and their faculty co-ordinators. A similar project was run in the 2005/2006 academic year

3.3 Short Term Student Visits

A number of successful short-term student initiatives were undertaken. Prior to developing full-semester exchange, 3 DIT undergraduate students spent time at Purdue University during their Easter break in the 2006 academic year; not in any formal capacity but just to experience the college and the approach to education at Purdue. They did attend some lectures and it afforded DIT students for the first time an opportunity to experience the US educational culture and it afforded DIT management an opportunity to test some of the processes that would be necessary to support full-semester exchange

Similarly, in May 2008, a small cohort of Purdue students spent a week in Ireland where they were hosted at DIT at part of a Maymester visit.

3.4 Joint Academic Papers

4 papers (two with joint authorship from DIT/Purdue staff) were presented at the American Society of Engineering Education conference 2006 (ASEE 2006) as a means of dissemination of the collaboration work to that point and two further papers were presented at the ASEE 2007 conference.

In addition, Martin C. Jischke, President of Purdue University also accepted an invitation to speak at the Dublin Institute of Technology in July 2007.

4 DEVELOPING FULL SEMESTER UNDERGRADUATE EXCHANGE

From 2005 onward, the goal of full-semester student exchange was in focus. It was necessary to try to initially establish a pilot framework which could serve as a learning tool for the eventual provision of full-semester exchange.

Building on earlier ‘quick wins’ established through faculty exchange, Professor Dr. Matthew P Stephens, (Professor and Interim Department Head, Department of Industrial Technology, Purdue

University) and Mr. John Lawlor (Head Of School, School of Manufacturing and Design Engineering DIT) in partnership with Mr. Robert Simpson (Head of Department, Department of Manufacturing Engineering DIT) co-ordinated a full-semester fully accredited transatlantic exchange involving students from their respective schools/department during the Spring semester of the academic year 2006/2007. At DIT, the participating students were from year three (Semester 6) of the four year undergraduate degree program entitled "B.E. (Honours) Degree in Manufacturing Engineering" while the Purdue students came from both the Industrial Technology (B.S) and the Industrial Distribution (B.S.) four year degree programs managed by the School of Industrial Technology.

Students at the relevant stage of their programs were advised of the transfer opportunity at each site during the previous Autumn Semester. It had already been determined from previous engagements that students in year three of the four year program were suitable candidates to undertake such an exchange and that the exchange was best undertaken in the Spring semester. Interested students of good academic standing at each of the participating departments were selected to participate.

DIT has a prescribed set of six courses for semester five of its "B.E. (Honours) Degree in Manufacturing Engineering" program. The student accrues 5 ECTS credits from the successful completion of each module. The department engaged in a careful process of determining a feasible and realistic "Study Plan" which would provide a good match at the right level to the courses they would have undertaken at DIT. It was decided that the pursuit of 15 ABET credits was a realistic equivalent goal given that this is the usual number of credits undertaken per semester by students at a similar stage of a Purdue program See 7.3 for more detail on the equivalence of learning blocks in the partnering institutes.

4.1 Academic Calendar Mismatch

DIT's decision to move all courses to a fully modularised and semesterised system in 2005 significantly improved alignment of the colleges for cooperation in full semester exchange. Notwithstanding this, a key logistical challenge foreseen prior to establishing the undergraduate exchange was the fact that any exchange would have to work within the constraints of a "mismatched academic calendar" between institutions. Table 1 outlines the nature of the semesterised calendar in Purdue University and DIT (approximate dates used for illustration only).

Table.1: Semesterised Calendar in DIT & Purdue University

	Dublin Institute of Technology (DIT)	**Purdue University**
Semester 1	15 Weeks Sept 21st – January 22nd	XX weeks
Semester 2	15 Weeks Feb 1st – May 28th	XX weeks

A challenge for any proposed DIT students travelling to Purdue for a Spring semester was that DIT Fall semester examinations were scheduled to take place in January at a time when the Spring semester had already begun at Purdue. Alternatively, it was foreseen that travelling to Purdue for Fall semester required the student to begin their study about a month ahead of the usual start date. However, these potential hurdles were overcome. DIT students took their DIT exams at Purdue at the beginning of the semester. These exams were proctored by Purdue personnel. Students travelling to the US in the Fall were happy to begin the semester one month early and in some cases combined the study abroad in the Fall with a Summer work-trip to USA.

4.2 Sustaining the Undergraduate Exchange Process: Funding Streams

The European-Union United States Atlantis programme, jointly administered and funded by the Fund for the Improvement of Postsecondary Education (FIPSE) and the European Commission's Directorate General for Education and Culture, provides grants for up to four years to add a European Community-United States dimension to international curriculum development and related student exchange. The European Union-United States Atlantis Program have an annual grant competition conducted cooperatively by the U.S. Department of Education's Fund for the Improvement of Postsecondary Education (FIPSE) and the European Commission's Directorate General for Education

and Culture (DG EAC). The purpose of this competition is to promote a student-centred, transatlantic dimension to higher education and training in a wide range of academic and professional disciplines. One action within the Atlantis grant framework is “Excellence In Mobility” projects. These projects primarily support student exchange provided there are two US and two European partners involved. In order to apply for Atlantis funding, Purdue and DIT jointly created the DETECT Exchange Mobility proposal. On foot of the co-operation in creating a successful full-semester student exchange in 2006, in Spring 2007 an application for funding under Action 2-Excellence (Follow-up) Mobility Projects of the Atlantis programme 2007 was made jointly by the Dublin Institute of Technology and Purdue University. Each also brought a second partner in their local area ‘on-board’. Hence, the 2007 grant application sought funding over four years primarily to promote transatlantic student exchanges between four leading Engineering, Design and Technology Education institutions (Dublin Institute of Technology, Dublin, Ireland and the University of Applied Science, Darmstadt, Germany; Purdue University and the Pennsylvania State University, USA). The project sought to exchange students and mutually recognize their transatlantic learning in local programs. The application was successful and the funding received ($180K over four years in USA and €180k over four years in Europe) has stabilized the student exchange project and facilitated a huge increase in the number of participants in exchange. Between Fall 2007 and Fall 2009, this project has enabled more than 24 undergraduate students from both sides of the Atlantic experience full-semester transatlantic exchange. The European Union-United States Atlantis programme funding has been a critical enabler of this level of exchange activity.

4.3 Housing

The availability of secure, cost effective housing close to the college campus is obviously an important element of any student experience. In the case of exchange, students like to be able to plan their housing before they travel to the partner institution. Indeed their parents like to be aware of their housing arrangement up-front.

In the case of Purdue, there is a significant level of on-campus student housing. It is possible for exchange students also to avail of this housing. Housing planning is therefore simplified when European students go to Purdue. Also housing is close to college. This means that it is quite normal for students to return to their houses (often no more than a ten minute predictable commute) between lectures.

However, in DIT’s case, there is no equivalent “on-campus housing”. Effectively, students typically independently secure housing in Dublin, albeit with some support from the Accommodation Office at DIT. Also, the typical commute times from housing to the Dublin Institute of Technology campuses are typically much longer than at Purdue. The commute times are often 40-50 minutes or even more. Returning to your house “between lectures” is not something the vast majority of students can do.

To assist Purdue students, DIT found it necessary after year one to develop specific links with student housing providers upfront. DIT worked with these providers to secure student housing prior to the arrival of Purdue students in Dublin.

In the first exchanges of Purdue students to DIT, amongst the greatest “problem” the students recognised compared to home was the typical commute times which were often longer and more unpredictable in a fast-growing city than they were used to at their home institution. Given their awareness of how this impacted students more accustomed to very short commuting times, DIT personnel worked to secure housing upfront that was visible to the students ‘online’ prior to the travel abroad and that minimised the commute time for these exchange students. This item probably more than any other improved the experience of exchange students.

4.4 The Impact of Cultural Differences in the Academic Environment

Every academic institution has its own cultural norms influenced by its history and the society in which it operates. Exchange students in their transition to the partner institution become acutely aware of these differences as they try to adjust to life in a different place. As the DIT-Purdue partnership progressed with full-semester exchange, the management of the exchange programme developed a much more acute awareness of these differences and were therefore able to better prepare students for these differences in their pre-orientation.

The following is an account of some of the important differences that students had to grapple with. In the United States, while there is a specific programme of study for a given award, there is typically a good deal of flexibility built into the modules/course that students will take. While there are typically pre-requisite modules required to take a higher level module, there is also often flexibility in the overall sequence in which modules are taken There is usually also some options for the student in terms of what modules/courses he/she will take on the programme. For instance, it is not untypical to have 1-2 elective options that a student may take in a given semester. Also, popular modules/courses may be timetabled to run multiple times in a given week. The net effect is that students on the exact same programme will not always attend lectures together but will tailor their courses around their own individual needs and preferences. Therefore, in a given lecture, it is not untypical to have students from very many different programmes.

In the case of DIT programmes, typically all the students in the programme take the exact same courses in each year and they are timetabled to take these at the same times. This means that the students effectively progress through the programme as a cohort. Typically, their fellow attendees at lectures (particularly in the latter years of their programme of study) only comprise of their fellow students in the same year of the equivalent programme. The effect of this is that students in a given programme tend to develop a close and tight-knit circle of friends within the programme and they are not typically used to other students outside of their programme taking one specific module only in their programme. However, in attempting to match US students' home course of study with equivalent courses in DIT, it was necessary to examine courses in all years of a number of different programmes. Therefore, US students coming to the Dublin Institute of Technology tended to take a specific suite of courses to match their needs; but often for a specific inbound student, these modules or courses were across different programmes and programme years. The net effect was that Purdue students coming to the Dublin Institute of Technology often found themselves attending a number of modules with different cohorts of students; in each case where the existing class cohort all already knew one another for a number of years and were closely bonded. This was a different experience to the one Purdue students were used to at their home college. Therefore, it was also important that the lecturer was made aware upfront of the presence of the exchange student and that every effort was made to integrate this student into the existing student cohort.

For typical courses at DIT, a formal “closed book “examination outside of the classroom is undertaken at the end of the semester. While the contribution of continuous assessment undertaken is increasing, right now this formal examination often accounts for 70-80% of the overall marks for the course. Typically, this means that students tend to significantly increase their module focus and work rates as the final exams approach. This concept of an “end of semester exam” which accounts for a very significant percentage of the overall module marks was new to US students and the “exam preparation” phase and its associated stress levels were a new challenge for US students.

There were also cultural adjustments required of DIT students who travelled to the United States. Amongst these were the following. At Purdue University, every “lecturer” in DIT terms is known as a “Professor”. More importantly, every professor is addressed as “professor” whereas the norm at the Dublin Institute of Technology is to address all lecturers by their first name. Though students at DIT are very familiar with attendance monitoring at their home institution, when DIT students attended Purdue University, they had to adapt to what was “in Irish terms” a very rigorous enforcement of “module attendance requirements”. In some Purdue courses, missing any more than two lectures in the semester meant that the student would automatically fail the course.

In addition, Dublin Institute of Technology students had to adjust to greater levels of continuous assessment when attending courses at Purdue University. While the continuous assessment element of courses in DIT is typically about 30%, at Purdue this was often twice that. The effect was that students attending class in the USA often had to adjust to doing significantly more homework at night than they were used to doing at Dublin Institute of Technology. Again as we developed improved pre-orientation, students’ expectations prior to travel were clearly aligned to these challenges. This helped to mitigate their impact. In particular, speaking to previous “exchange students” was of great assistance to students in emphasising to them the kinds of challenges they were likely to face.

4.5 Managing the Student Experience

Initially, when establishing the student exchange process, the key focus of the endeavour was on understanding the various processes required and the timelines that needed to be met to “get the

exchange" up and running. This included visa requirements, housing requirements, academic course planning, financial arrangements, flights and cultural activities. This required significant focus from academic management and staff. Processes were executed and much care was taken to get the detail right.

However, after Year 1, it became clear that it was not enough just to "get the exchanges done" in a timely fashion. As the student was centre-stage, it was very important that the student experience was proactively managed both prior to travelling and after arrival at partner site. In particular, it was important that the student's expectations were managed "upfront" prior to travelling to the partner site.

By default and in the absence of any other information, student expectations of housing, academic classes and social activities are formed from their existing college experience. However, given the differences between academic and social life on both sides of the Atlantic, it is likely that students will either be disappointed or have to adapt their expectations significantly if they leave home with expectations that it's going to be largely the same abroad. We recognised in particular the need for significant pre-orientation prior to departure. After Year 1, at DIT we significantly increased our pre-orientation activity. Students were always given the opportunity to talk to previous "study abroad" students. In the weeks and months prior to travelling, students were also strongly advised of the differences from the home institution in cultural norms, housing norms and academic norms that they could expect. This pre-orientation activity helped significantly in ensuring that students were already mentally prepared for differences and not surprised or disappointed by these differences. In addition, the DIT International office significantly upgraded their Orientation program for incoming exchange students to include consideration of all aspects of life in Ireland.

5 EXTENDING PARTNERSHIP INTO THE POSTGRADUATE ARENA

By the 2008-2009 period it was clear the partnership was working very well. 18 undergraduate students had benefitted from the DETECT full semester student exchange programmes at the end of 2008. DIT and Purdue had in place a stable full semester student exchange process which was working well. We also had in place a working set of partners who had demonstrated that they could work together on the planning and execution of plans with sufficient flexibility; a transatlantic team with a strong mutual trust, who were very comfortable interpersonally and who had the clear support of their management in the execution of their plans. Therefore, building iteratively on previous successes, the partners began to envision more ambitious plans; other opportunities which they now believed could be executed successfully.

5.1 StiMasters

Over the latter part of 2008 and early 2009, the partners began to envision the creation of a dual-Masters degree in academic areas of interest which were now strategically important to both institutions. The partners saw this as a logical advancement of their co-operation to date. In fact, many of the processes established and tested during the "Undergraduate Exchange" programme could be clearly be leveraged in the establishment and operation of a Dual Masters Degree.

This led to the creation of the STIMasters proposal which was submitted in Spring 2009 for Grant Approval under the United Statees-EU Atlantis programme. The project proposed a four semester International programme of study for a minimum of 48 mobile students over the four year project life; 24 European students and 24 students from the United States The participating institutions were Purdue University, College of Technology, West Lafayette Indiana, USA, the Dublin Institute of Technology, Dublin, Ireland and the Universitat Politècnica de Catalunya, Barcelona, Spain. It was necessary to include two European Institutions for funding purposes and the partners believed the Universitat Politècnica de Catalunya, Barcelona could bring additional value to the proposal.

The proposal envisioned students taking a set of suitably integrated courses (subset of a pre-existing suite of courses) focused on the areas of Technology, Innovation and Sustainability. Graduates from the Programme will obtain a Dual Masters Degree (M.Sc./MS.), one from the Europe Institution through which they entered the program and one from the United States partner Institution, Purdue University. In July 2009, this Dual Msc./Ms. Degree was granted joint funding by the Europoean Union for €404K and the United States Department of Education ($404K).

5.2 Research collaboration

The development of the partnership into the post-graduate area in 2009 was not limited to the STIMasters project only. In March 2009, a very successful research workshop was undertaken at DIT where Purdue College Of Technology researchers and DIT researchers shared much of their current research activity. This was followed up with very specific “quick-wins” in the Research area.

In fact between July and September 2009, one DIT PhD degree research student began a three month research collaboration with a number of faculties at Purdue University while in November 2009, another PhD student travelled to Purdue to discuss collaboration in the biosensor field. It is clear that this collaboration in the Research arena is now also developing increasing momentum.

7 QUALITY ASSURANCE AND STANDARDS CONSIDERATIONS

Prior to actively embarking on a collaborative partnership which involves undergraduate as well as postgraduate student mobility and transfer it is beneficial that investigation of various aspects of programme development and delivery in the proposed partnering institute is undertaken. In some circumstances the path to full transferability is smoothed by the commonality of approaches adopted within the partner institutions, however, it may be a significant issue in others. It is imperative that transferring students are placed in modules which are at a suitable level as well as meeting the professional requirements of their programme award. Operational problems can be minimised if clarification is sought from partners on a number of key areas such as; programme accreditation practices, academic-level frameworks, the nature of learning blocks/modules, commonality of academic standards of stages and modules, and credit transfer and mobility possibilities. This section will discuss these issues and illustrate how these applied to the transatlantic partnership developed in this particular case study.

5.3 Programme Accreditation

Accreditation of 3rd level educational programmes by a suitably recognised professional body is of particular relevance in relation to all branches of engineering and technology. The successful completion of a sequence of modules which leads to the attainment of this professionally recognised award is viewed as integral to the undertaking. It is therefore important that modules taken by students in another country, which involve alternative accreditation procedures, are sufficiently comparable with modules in the home institute. A succinct overview of accreditation of engineering programmes in the USA and in Ireland is included here in addition to identification of the common themes.

In Ireland accreditation of engineering and technology programmes is undertaken by Engineers Ireland (EI) which is the primary professional body within the sector. This process is carried out on a five yearly basis. EI specify programme outcomes which provide the framework within which the third level institutions may build their engineering programmes. These generic outcomes outline the skill-sets which a student can expect to acquire through successful participation on the programme. These outcomes, coupled with relevant programme area descriptors, lay the foundations on which to build programmes which may ultimately result in successful accreditation. This ensures that the accredited programmes are of the required high level and that ultimately, and most importantly, graduates are being produced that can perform at the required level. The accreditation process, which includes preparation of documentation followed by a visit by a panel which consists of independent academic and industrial personnel, is as specified by EI [1]. Programme documentation includes detail on all aspects of the programme such as programme objectives, module descriptors, facilities available to run the programme, staffing and support. The panel visit ends with the production of a report which outlines detail in relation to the programmes performance under a range of headings as outlined in [1].

In the US ABET, formerly known as ‘Accreditation Board for Engineering and Technology’, provides professional accreditation of engineering and technology programmes. ABET also accredits programmes outside of the US. As in Ireland accreditation is a voluntary peer-review process which is undertaken periodically to ascertain if certain key criteria are being met. The accreditation standards are set by professionals within the sectors through collaborative partnerships between ABET and professional and technical societies. ABET also specify programme criteria for each branch of engineering which is beneficial to the accreditation process [2]. Documentation providing internal evaluation of the programme followed by an evaluative visit of technical and academic volunteers forms the basis of the process. Accreditation is granted for a maximum period of six years.

All programmes involved in this partnership on both sides of the Atlantic have been accredited by either EI or ABET. Therefore, consistency in high level programme delivery can be assured by all participants.

5.4 Academic-Level Framework

Most countries make engineering and technology awards to students who successfully complete programmes at numerous levels, namely, apprenticeship, certificate, B.Eng.Tech. (Associate) degrees, Bachelor (hons) degrees and so on. Transferability of students is eased through their placement in modules at appropriate levels where pre-requisite learning has taken place.

The National Quality Assurance Authority of Ireland (NQAI) proposed the National Framework of Qualifications (NFQ) through the Qualifications (Education & Training) Act [3]. It is a system of levels, 1-10, that incorporates learning at all levels as shown in Fig. 1.

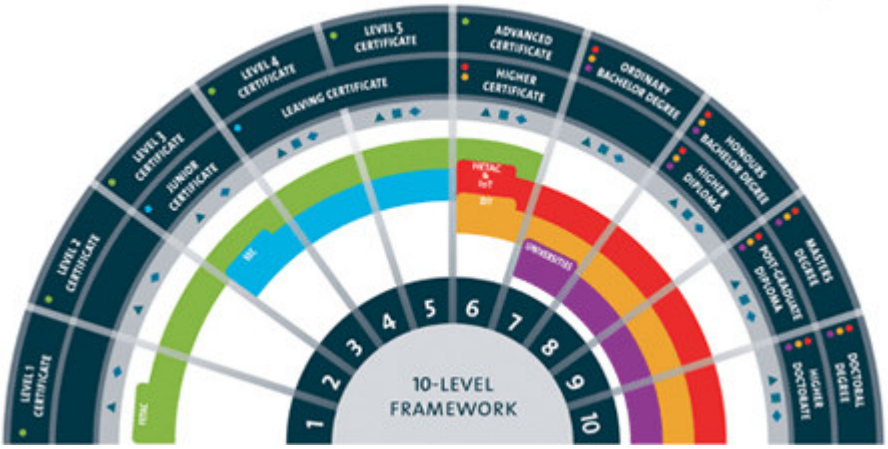

Fig. 1: NFQ Levels [3]

This collaboration involved student mobility between programmes at level 8 so the majority of the discussion pertains to this. Level 8 degrees in DIT (4 year degree or B.Eng.Tech + 2 years) are equivalent to Bachelor's degrees (4 year degree or Associate + 2 years) in the US so placement of students in modules appropriate to their learning level is relatively straightforward. All modules in the DIT system have a programme stage association which identifies the timing of modules within the particular programme. Purdue University modules have a similar system which eases module selection prior to student travel i.e. a stage 3 module on a Level 8 programme in DIT should be suitable for a year 3 student on a Bachelor's programme in Purdue University.

5.5 Nature of Learning Blocks/Modules

It is important that students embarking on studies in new environments are made aware of the level of effort and expected participation rates required for successful completion of modules within the particular institute. This can be achieved through comparison of the documented descriptors of the modules in addition to some knowledge on how learning credits are assigned in each case.

7.3.1 Modules and Credit Systems

The Faculty of Engineering within DIT works to a semesterised calendar, each stage of the programme consisting of two semesters each of which consists of 15 weeks. Each stage of the programme constitutes 60 ECTS credits (European Credit Transfer and Accumulation System [4]). The ECTS ensures higher education students can earn academic credits in a member state and have them count towards awards in another (e.g. in home state). It also serves as a very useful comparison framework for simplifying transfers between member and non-member states. In DIT all modules within all programmes have a 5 ECTS credit rating or a multiple of this. 5 ECTS credits constitute 100 hours (which includes contact and non-contact time) of student/learner effort. Contact hours generally constitute 3 to 5 contact hours per module per week. The module descriptors contain all information relevant to the module including aims, learning outcomes, syllabi, teaching methods, assessment

methods and reading lists. Access to this information is essential so that staff and students considering transfer can make informed decisions on the suitability of a module.

In the US the Bachelor's degree involves 4 years of study and a minimum number of credit hours, which usually varies from 120 to 130 [5]. Credit hours are the number of instruction hours that are scheduled per week. Purdue University follows a semesterised calendar (the fall and the spring). Students usually take up 15 credits per semester. On average, each course (module equivalent) has 3 credits or more depending upon the number of hours per week. Contact hours generally constitute 3 to 4 contact hours per course per week.

5.6 Credit Transfer and Mobility

A module in DIT equates very well with a course in Purdue University (Section 1.3.1.) In addition professionally-accredited engineering/technology Level 8 programmes in DIT compare well with professionally-accredited engineering/technology 4 year bachelor's programmes in Purdue University. This constitutes a sufficient basis for credit transfer between programmes in Purdue and Dublin whilst maintaining programme integrity and standards on both sides of the Atlantic. Therefore, mobility of students between the two educational institutes in this case study is relatively trouble free. Grading systems in third-level educational institutes can differ so it is wise to make students aware of the appropriate grade-conversion system in advance of travel.

Communication, preparation, and the development of good working relationships are the keys to streamlining the process and ensuring transferring students are placed in modules at the appropriate level and relevant to their particular study programme.

6 CONTINUOUS IMPROVEMENT AND PROJECT SUSTAINABILITY

In order to ensure that there was independent monitoring of the DETECT and StiMasters projects, the team have made use of the services of experienced independent consultants in educational assessment and evaluation. Barnes and Associates International have monitored the progress of the EU-US government backed DETECT project versus its goals and it is intended that they will provide similar feedback for the StiMasters project. Dr. James L. Barnes from Barnes Technologies International interviews students before and after their exchanges and provides annual feedback on progress to the Principal Investigators. This feedback helps ensure there is continuous improvement in the project

It is clear that from small beginning in 2004, the Dublin Institute of Technology and Purdue University have built a multi-faceted collaborative relationship. Time was spent in the early years building strong relationships between key management and academic staff at both institutions. Then, "Quick Win" projects were identified and successfully undertaken. Subsequently, more ambitious projects were iteratively undertaken founded on the confidence emanating from the success of the earlier projects

Today the collaborative relationship involves many different strands. These strands include full-semester undergraduate exchange, a dual masters degree, joint-research activity and indeed full-semester staff exchange. The breadth and depth of co-operation continues to grow. There will be many challenges ahead for the partnership. Amongst these will be how we develop and sustain long-term funding models to ensure we can continue the various joint-projects after our grant-aided projects conclude. We feel confident that challenges will be addressed and overcome with the same vigour and innovative spirit which has built and sustained the relationship up to now.

References

[1] 'Accreditation Criteria for Engineering Education Programmes' http://www.iei.ie/

[2] http://www.abet.org/

[3] http://www.nqai.ie/

[4] http://ec.europa.eu/education/index_en.htm

[5] http://www.usaeducation.us/EduSystem/credit/