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DETECT: Developing Sustainable Pathways towards Innovative, Sustainable Collaboration between Four Engineering, Design and Technology Education Institutions

Michael Dyrenfurth
Purdue University

Mike Murphy
Technological University Dublin, mike.murphy@tudublin.ie

Donal McHale
Technological University Dublin, Donal.McHale@tudublin.ie

See next page for additional authors.
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Authors

Michael Dyrenfurth, Mike Murphy, Donal McHale, Richard Hayes, Robert Herrick, Dhushy Sathianathan, Heinz Schmidt-Walter, Eugene Coyle, and Robert Simpson

**GC 2008-203: DETECT: DEVELOPING SUSTAINABLE PATHWAYS TOWARD
INNOVATIVE, SUSTAINABLE COLLABORATION BETWEEN FOUR
ENGINEERING, DESIGN AND TECHNOLOGY EDUCATION INSTITUTIONS**

Michael Dyrenfurth, Purdue University

Mike Murphy, Dublin Institute of Technology

Donal McHale, Dublin Institute of Technology

Richard Hayes, Dublin Institute of Technology

Robert Herrick, Purdue University

Dhushy Sathianathan, Pennsylvania State University

Heinz Schmidt-Walter, Hochschule Darmstadt

Eugeue Coyle, Dublin Institute of Technology

Robert Simpson, Dublin Institute of Technology

DETECT: Developing Sustainable Pathways Toward Innovative, Transatlantic Collaboration Between Four Engineering, Design and Technology Institutions

1.0 Overview

This paper describes the goals and progress made in Year 1 of a 4-year project (December '07 to November '11) entitled the DETECT Exchange Mobility project. The project is one of two funded by the European Commissions/US Department of Education under the EU-Commission's Atlantis "Excellence in Mobility" Action 2007.

The project is funded to promote translational exchanges between four leading Engineering, Design and Technology Education institutions namely; The Pennsylvania State University, USA, Purdue University, USA, the Dublin Institute of Technology, Ireland and the Hochschule Darmstadt, Federal Republic of Germany.

The overall objective of the project is to respond to the increasing demand for innovative Engineering and Technology design environments by, among other ways, increasing awareness of international/multicultural perspectives. The project seeks to address this demand by exchanging students and staff who will benefit from this collaborative, cross-cultural project enabled by the networked global digital environment.

2.0 Project Context

Engineering and Technology educators worldwide are acutely aware of the 21st century imperative; that the roadmap to industrial transformation in both Europe and the USA requires the transfer of ideas into innovative products and processes with the highest possible efficiency. Increasingly, this 21st century reality means that innovative Engineering Design is being accomplished by multidisciplinary knowledge integration undertaken in a collaborative, cross-cultural, networked, global, digital Engineering environment.

Notwithstanding this reality, Engineering and Technology students have not historically been given the opportunity to engage with learning in a truly global cultural context. Traditionally, students have operated in the cultural context of their college's geographic hinterland only.

Engineering education leaders in attempting to respond to the challenge of more appropriately enhancing the knowledge, know-how and skill of their students and faculty are motivated to change the Engineering landscape and transcend former boundaries in order to put in place sustainable and collaborative educational environments appropriate to modern realities. The DETECT project represents a transatlantic collaborative response by a consortium of leading Engineering, Technology and Design educators to these 21st century realities. The FIPSE-EU Atlantis program funding has already been of significant assistance in enabling these educators increase the breath, speed and impact of their response. Key concepts of the project are depicted in Fig. 1.0.

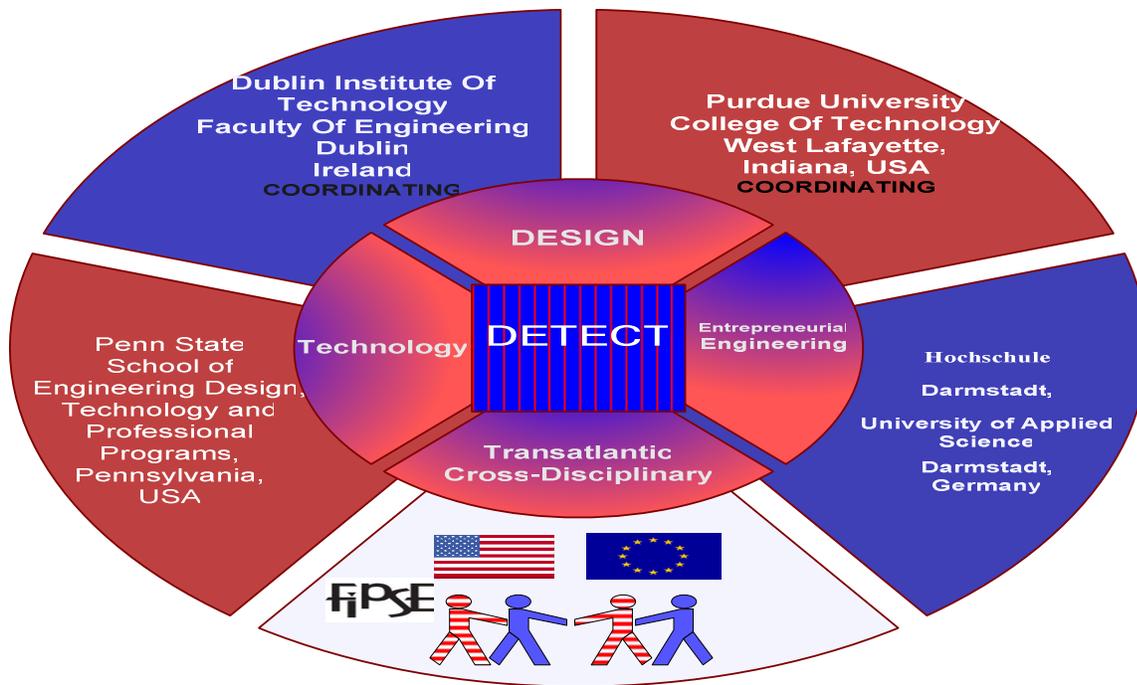


Figure 1.0: DETECT Mobility Exchange Project Participants

In order to appreciate the Year 1 progress made on the project, it is necessary to also be cognizant of the matrix of pre-existing relationships, i.e., the baseline, among the transatlantic partner institutions prior to commencement of the DETECT project as shown in Table 1.0 below.

	Purdue University, USA	The Pennsylvania State University, USA
Dublin Institute of Technology, Republic Of Ireland	Memorandum of Understanding signed March 2005. Multiple short and long term exchange visits by deans, department heads and faculty. One 'full-semester' accredited student exchange partnership undertaken and one collaborative student-project completed.	No prior student or faculty exchange collaboration
Hochschule Darmstadt, Federal Republic of Germany	No prior exchange collaboration	No prior exchange collaboration

Table 1.0: Collaborative Status Of Partner groupings at the Outset of the DETECT Project

Note that much of the developmental work of the Purdue/DIT relationship to date has been documented in previous ASEE papers¹⁻⁸ as outlined in the bibliography.

3.0 Project Aims and Objectives

This project has two strategic aims:

- To advance sustainable full-semester student exchange between the European DETECT project participants and their US counterparts and in parallel to advance sustainable full semester student exchange between the US DETECT project participants and their European partners.
- To accelerate the development and support of collaborative cross cultural, multi-disciplinary, Engineering and Technology learning environments focused on innovative Engineering, Design and Technology and to mutually recognize the student learning between partner organizations.

3.1 Enabling Objectives

The DETECT Mobility Exchange Project has four principal objectives:

- To support and increase the number of sustainable transatlantic “department” and “school” partnerships from within the participating institutions who jointly develop, implement and sustain full semester student exchange programs between their respective organizations.
- To develop the proficiency of students to operate effectively in transatlantic Engineering, Design and Technology exchange environments and to formally mutually accredit learning in partner organizations.
- To undertake Faculty exchange aimed at increasing the number of “department” and “school” partnerships who jointly collaborate on the development of sustainable common innovative Engineering, Design and Technology projects undertaken in cross-cultural, collaborative, multi-disciplinary learning environments by student teams from more than one participating organization.
- To share, adopt and disseminate amongst the partners and the wider educational community the sustainable innovative management, learning and teaching and assessment best practices associated with the delivery of the project’s strategic goals at the module (course), program and systems level.

4.0 Program Development

In summary, the DETECT consortium committed themselves to the following Year 1 goals in support of the project goals described above:

- In the case of the three institutional partner-pairings (i.e. those with no history of accredited full-semester exchange), the agreed goal was to develop and deliver a ‘pilot’ student exchange

- In the case of the more developed DIT/Purdue partnership, it was agreed to develop the breadth of the student exchange engagement within the more established DIT/Purdue partner pair. In addition, within this specific partner pair, it was agreed to strengthen and better formalize (as necessary) the operation and interaction between key supporting processes taking cognizance of opportunities previously identified.
- Explore additional opportunities for relevant academic collaboration.
- Develop and implement appropriate evaluation models for continuous improvement purposes and disseminate widely the results of the project

5.0 Organizational Engagement

During the course of year 1, the partner institutions signed a multilateral memorandum of understanding (and associated student exchange agreements) which gave formal recognition of the organisations' commitment to the collaborative initiatives being pursued within this FIPSE/Atlantis project.

The project was initiated by key academic management personnel (Dean's and/or their designates, Head's of Schools and/or principal investigators) from both European partner organizations meeting their US counterparts 'face-to-face' in a series of meetings at both Purdue University and Pennsylvania State University during late October 2007.

During the final quarter of 2007, Professor Matthew Stephens from Purdue University completed a visit to Hochschule Darmstadt to evaluate the match of their to the Purdue College. In December 2007, Mrs. Lucia Koch, Head of the International Office at Hochschule Darmstadt visited Purdue University during December 2007 in order to familiarise herself with the International work of Purdue University which in turn assisted in the development of planned student exchanges.

In addition, 'face to face' meeting of key principal investigators from both sides of the Atlantic at an FIPSE/EU Atlantis project director's conference during February 2008 facilitated partners organizations in sharing information and 'best practice' expertise in project management, curriculum development and project evaluation.

During the first quarter 2008, key academic management and program directors from Penn State visited the European campuses of their collaborators.

From the outset, the four partners also established and integrated the use of 21st century communications technologies into their engagement processes. For instance, following the 'face-to-face' kickoff meetings, a suite of meetings undertaken using collaborative web-conferencing and on-line collaboration (enabled by the Adobe Connect Product) between all four partner sites have continued every four to six weeks to monitor and ensure clarity on progress.

In parallel, the consortium has established and populated a website where all relevant information, contacts and associated documents will reside. All institutional participants have been given designer access to that website.

6.0 Student Exchange

Table 2.0 below overviews the specific Year 1 full-semester student exchange numerical planning goals by department which were established during the initial meetings to give concrete expression to the program development goals outlined above.

Receiving Institution & Host Department/School → Outbound Student's Institution and Department/School ↓	DIT School of Manufacturing and Design Engineering	DIT School of Electrical Engineering Systems	DIT Faculty Of Engineering	Purdue. Department of Industrial Technology	Purdue University, Department of Electrical Engineering Technology	Fachhochschule Darmstadt Department Of Electrical Engineering	Pennsylvania State University School of Industrial and Engineering Technologies
DIT. School Of Manufacturing and Design Engineering				2			
DIT. School of Electrical Engineering Systems Students					2		1
Purdue. Department of Industrial Technology	1						
Purdue. Department of Mechanical Engineering Technology	1						
Purdue. Department of Electrical Engineering Technology		1				1	
Purdue Technology. Ph.D Candidate			1				
Hochschule Darmstadt Department Of Electrical Engineering					1		1
Pennsylvania State University School of Industrial and Engineering Technologies		1				1	

Table 2.0: DETECT Project Full Semester Accredited Student Exchange Planning Numbers (Year 1)

While Year 1 of the project concludes on December 1st 2008, the consortium are 'on-track' to deliver on the Year 1 overall numerical exchange goals agreed above.

The key developments milestones in full semester accredited student exchange on course to be achieved in Year 1 are as follows.

- Undertook the first student full semester accredited exchange between Fachhochschule Darmstadt and each of the two US partner institutions, the Pennsylvania State University and Purdue University (and vica-versa)
- Undertook the first student exchange between Penn State University and DIT
- Expanded the Purdue/DIT exchange portfolio to include the very first full-semester accredited transatlantic learning undertaken by students from programs of the DIT School of Electrical Engineering Systems; and similarly expanded on the Purdue side to include students of programs within the Department of Electrical Engineering Technology at Purdue.
- Facilitated the first full-semester European research sojourn at DIT for a Purdue PhD candidate.
- Involved students from the Department of Mechanical Engineering Technology at Purdue in Full Semester accredited exchange with DIT for the first time

7.0 Project Management ---Process Development

Management and academic staff commitment is an essential ingredient in piloting academic or student exchange. It is a particularly critical factor at the initial pilot stage where staff may have to develop or modify processes to support new situations.

However, while it is always possible to undertake student exchange on a ‘once-off’ or short term basis through the commitment of individual academic staff members, the development of transatlantic-institutional collaboration contexts sustainable over time cannot be built solely on the commitment of individual staff members.

A positive ‘study-abroad’ experience for a student is dependant on robust, transparent processes executed professionally to a well-defined, well-understood timeline.

Regardless of the academic merit of the course of study or collaboration in an exchange or ‘study abroad’ process, a pre-requisite and key building block for sustainable, efficient institutional exchange collaboration is the development of stable supporting processes smoothly integrated between institutions i.e. defined, well understood, proven, transparent and comprehensive processes which have ‘well defined ownership and ‘as they evolve’ become ‘part of normal business’ for the institutional partners; processes which take cognisance of each institutions’ (and their funding agencies) requirements and which are stable, easily accessible and transparent to academic partners; thereby more easily facilitating new academic partners or students who want to access and use them (built on pilot process learnings)

While such processes are developed over time, there is a need to cogently map these processes and to concisely document the required steps (and associated

agreed timelines as necessary) from the perspective of the overall program.

Process maps acts as a ‘roadmap’ for institutional and academic partners groups not yet formally engaged in exchange. They also support continuous improvement and assist in the wider adoption of Accredited Exchange Processes as demonstrated by Figure 2.0 below.

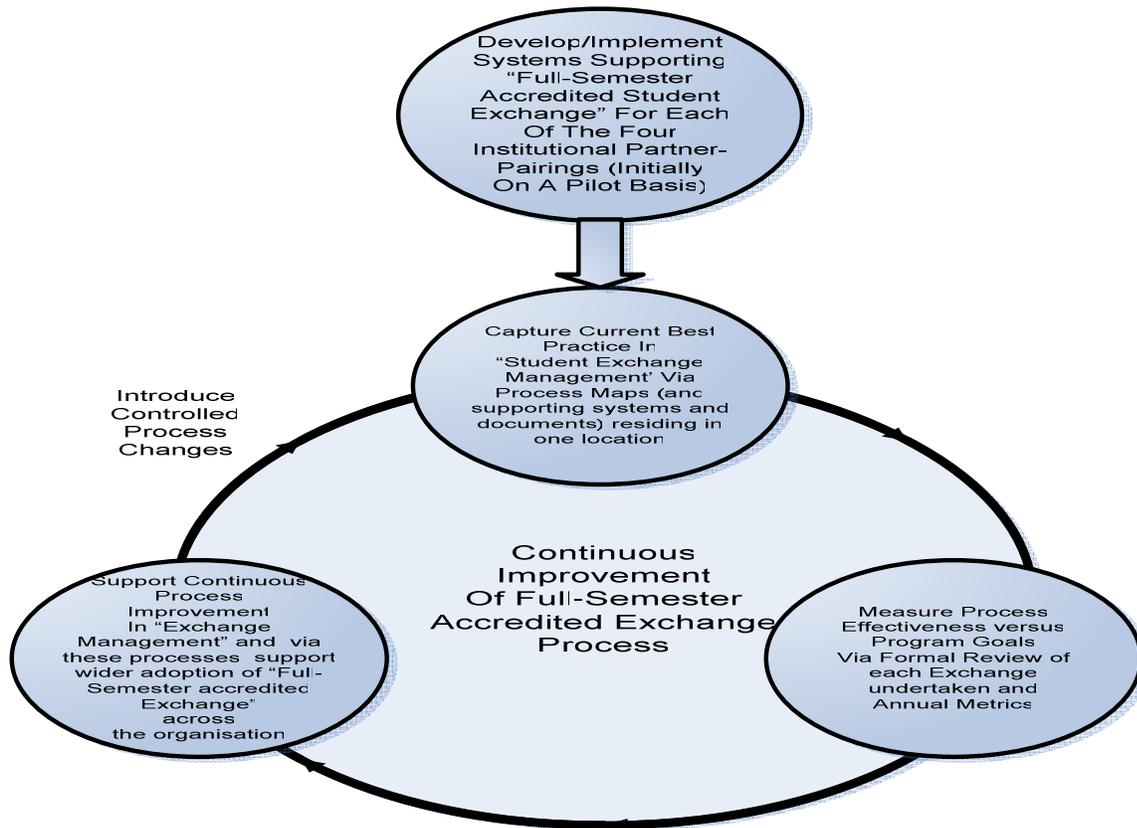


Figure 2.0: DETECT Project Full Semester Accredited Student Exchange Continuous Process Improvement

This is part of the development work which the Atlantis team have been undertaking in Year 1, particularly in relation to the Purdue/DIT exchange partnership which at Year 1 is much better established than the other relationship-sets.

The Atlantis partners have recognized a minimum of 27 supporting steps and/or processes which are necessary/appropriate to undertake even a single student exchange. Many of these steps are critical and require many sub-steps

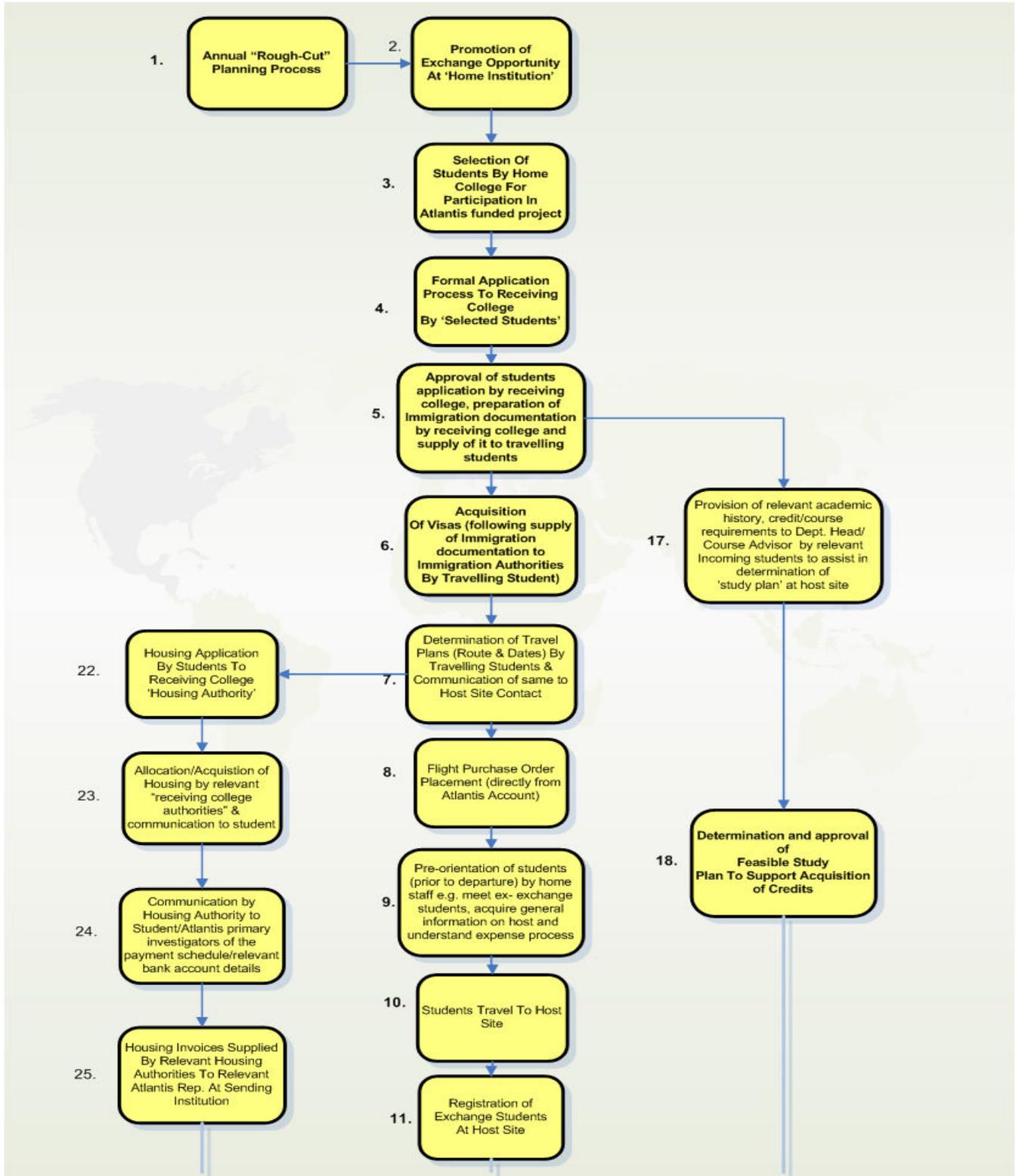


Figure 3.0a: DETECT Project Student Exchange Operational Processes

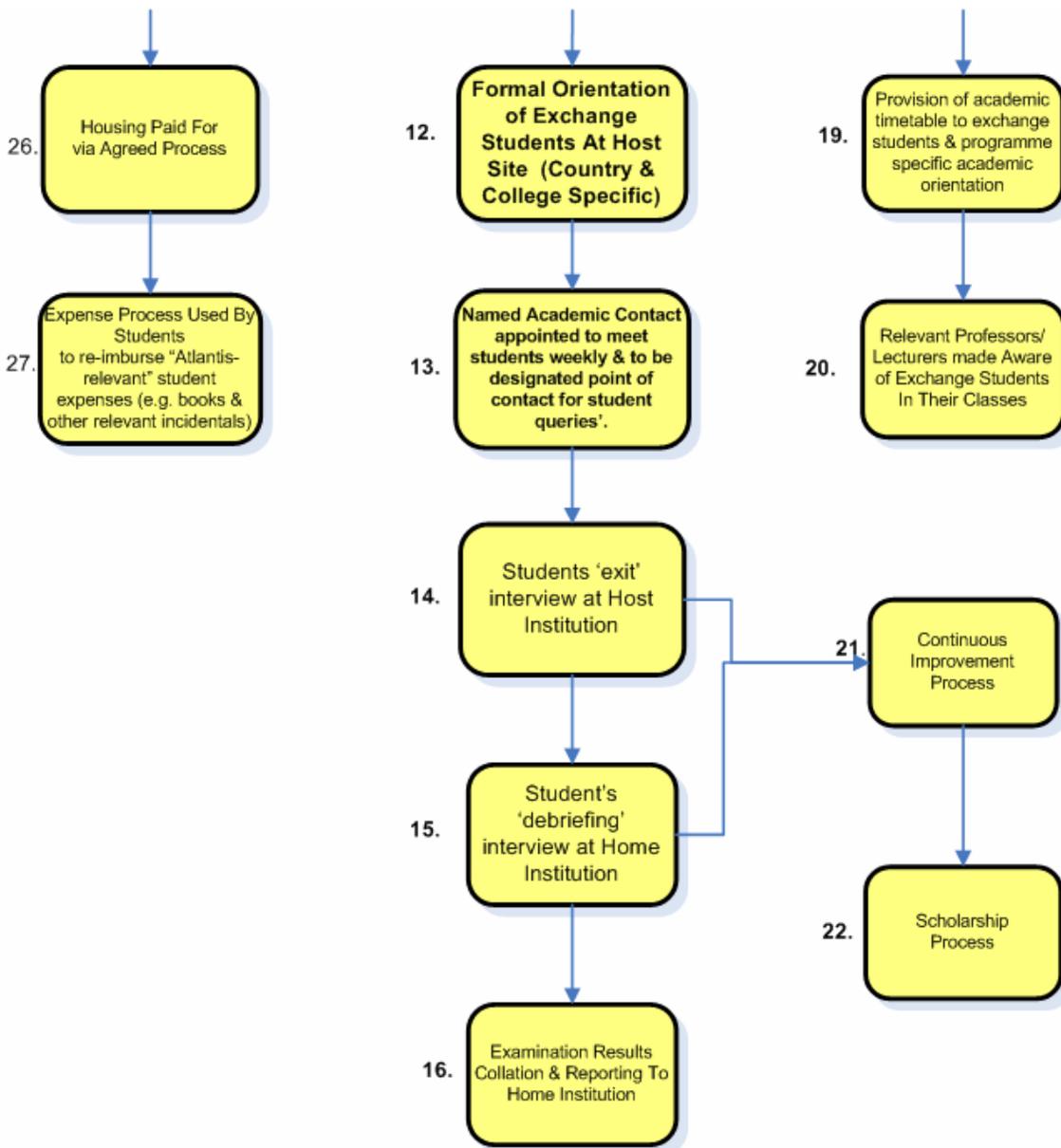


Figure 3.0a: DETECT Project Student Exchange Operational Processes

The DETECT partners made progress in cogently documenting the processes and also in developing supporting material to appropriately standardise the management of these processes particularly in relation to the Purdue/DIT relationship.

For specific numbered processes outlined above, the following lists developments made and also lessons learned in support of process development.

- The team have determined the need to have their overall strategic goals translated into specific initiatives within and between specific transatlantic inter-departmental teams. This was put in place at the outset of year 1 and was subsequently planned and delivered upon [1]
- To better support sustainable promotion (and particularly promotion of the opportunity amongst US students), ‘student to student’ promotional material was created. For instance, DIT created short videos (narrated by DIT students) showing a snapshot of their college/college life and inviting US students to avail of the exchange opportunity in Dublin. Equally, following a short-term exploratory trip to Ireland of two Purdue Mechanical Engineering Technology created a short speech-enabled powerpoint presentation on Ireland. Both Darmstadt and DIT personnel met and discussed the Exchange opportunity with a group of interested Purdue students during October 2007. Additionally, the consortia have documented in detail the likely student costs at each site (to support student planning). [2]
- Each Institution has determined selection process for identifying participants from the applicant pool. These criteria included: study year in degree program, GPA, department enrolled in, overall maturity, rationale for participation, and prior international experience. [3]
- It is important that an application process designed for the receipt of exchange students is comprehensive in the acquisition of sufficient and appropriate student related information to facilitate seamless subsequent processing of their entry into the country, the university and all aspects of life. Repeated ‘requests for information’ are unhelpful. In some cases, partner institutions have further develop their entry processes to better meet this ideal [4]
- Cognisance must be taken of immigration paperwork timelines in the overall processing timeline. In the case of entry to USA, visa receipt is a pre-requisite for booking of flights and must be considered in the overall timeline [5]
- Timely and detailed orientation is critical to ensuring a smooth transition into the receiving college. During the year, DIT significantly developed their orientation processes; specifically developing detailed ‘information packs’ which provide incoming students with comprehensive information tailored to their specific needs. Additionally, DIT’s International office formally engaged with the Atlantis projects delivering a formal orientation evening for visiting students
- Amongst the most challenging, iterative and time-consuming steps in the student exchange process are the processes supporting the determination and approval of feasible study plans for exchange [18,19]. In particular, it is a new logistics challenge for institutions whose programs normally operate with very specific, deterministic study plans by program year (with semester timetables supporting this model) to appropriately integrate exchange students whose credit needs (at the home institution) may require them in a single semester to simultaneously take courses across multiple programs/years.

Similarly, from the perspective of the home institution, it needs to ensure that the ‘program of study’ meets the student’s needs from an ‘credit acquisition’ perspective. Figure 4.0 below is a more detailed workflow model of step developed to give partners access to these processes [19]

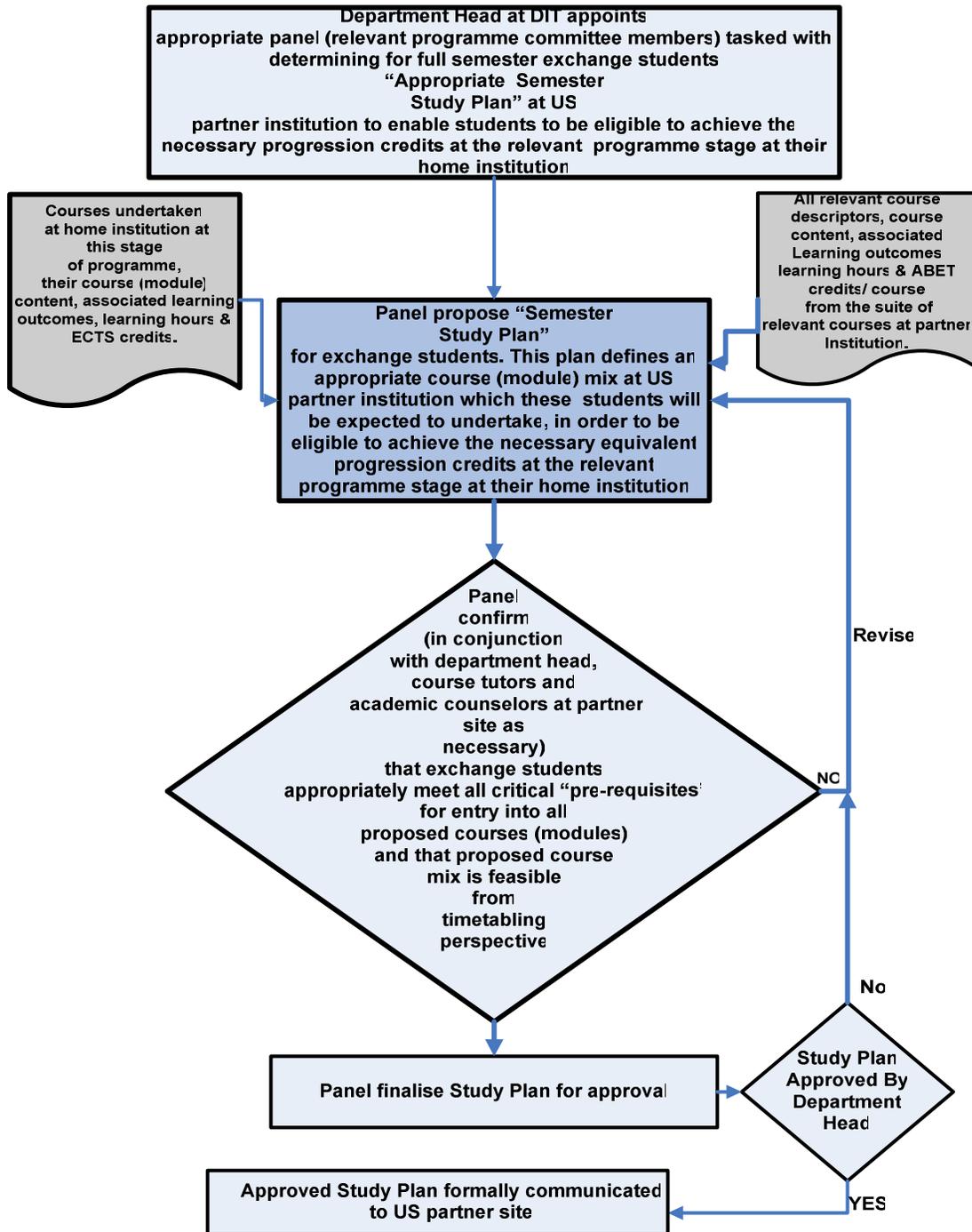


Figure 4.0: DETECT Student Exchange ‘Determination and Approval of Feasible Study Plan’

- The importance of regular and frequent communication among all members of the partnership is not to be underestimated. We have found that Internet-based desktop video conferencing is a valuable addition over mere email and telephone; all vehicles are useful.
- In planning for systematic student exchanges in projects such as the EU-FIPSE Atlantis ones, and given the requirements of US fee based institutions, it is critically important to allocate student exchange numbers among the partner institutions and even to specify the directions of the exchange so that parity of the exchange is maintained. Also planning is necessary to spread the participation of departments across each institution.
- Student orientation, both at the sending institution and subsequently at the receiving/host university, is vital because it manages expectations and it provides students with necessary survival skills in the sensitive first few weeks. Orientations must include cogent addressing of student and faculty cultures both at the sending and at the host institution. Things like expectations for attendance and the weight of a final exam in the final course grade/performance assessment must be addressed in addition as to how the grades are to be reported.
- Throughout the exchange program planning and execution an attention to the minute level of detail, such as “where and how do I get a bus card” is critical to making the experience successful to each student. Other examples include recognizing and accommodating different semester starting and ending dates, exam patterns, and payment details including scheduling, power of attorney or auto-deposit in some cases, and even credit card company notification of intended international usage.
- Do not assume that students and faculty have cell phones that work across the Atlantic or that have billing plans that are not exorbitant.
- Prearrange for computer network access at the host university for your exchanging students and also teach students how to access webmail.
- Exchangee student to exchangee student communication between the host and sending institutions is very beneficial.
- Within each participating institution exchangee allocations among its constituent departments will greatly facilitate planning.
- Immigration details must be attended to very carefully. Admission letters, for example, must clearly address the requirements of each receiving country’s immigration rules.
- When institutions have Study Abroad offices and/or people they must be included in the communication loop. They possess a wealth of experience and they are also often the first point of contact in cases of emergency.

- Students often need help with even the rudiments of travel such as booking, security, carry-on allowances and the like.
- The principals at each exchanging department must explicitly communicate their requirements and expectations for student performance reporting, formats, times, recipients of this information and the like. In the USA, FERPA regulations must be considered.
- Generally it is easier and more efficient to issue a flat payment from project funds rather than to reimburse expenditures.
- Each receiving institution must clearly designate an available and willing faculty mentor/contact person who must be available to exchange students (for contact at least) around the clock.
- Third party evaluators are most beneficial when involved in project planning and operation rather than just end-of-year assessment. They constitute a critical component of the project's continuous improvement mechanisms.
- Project principals need to start early and be continuously looking for supplementary sources of funding to continue the project activity after the EU-FIPSE stimulus runs its course.
- Each institution must establish a selection process to pick exchangees from the applicant pool. Typical criteria for this might include: Student year in program, GPA, department enrolled in, overall maturity, rationale for participation and prior international experience.
- It is useful to consult carefully with financial aid and university business officials to maximize monetary return to each student and to minimize tax and financial aid consequences.

8.0 Staff Exchange/Joint R&D

A number of initiatives were taken in this area. In November 2007, Professor Matthew Stephens undertook a short term teaching assignment at Dublin Institute of Technology teaching course material in Design of Experiments, Six Sigma and Process Control to Senior Undergraduate students from the School of Manufacturing and Design Engineering. Dr. Carl Kleinmann from the Hochschule Darmstadt partner visited Purdue during the early part of 2008 to evaluate opportunities for joint research projects. As a consequence of Professor Stephens visit, he is initiating a collaborative course development work in Advanced Quality Engineering topics with an Industrial focus. John Blood (a PhD student at Purdue University College of Technology) is currently undertaking some European research in the area of Technology Transfer while based at DIT.

9.0 Future Challenges

There are many challenges and future opportunities. There is a need to improve the coping mechanisms for the mismatch between academic calendars and also on the European side to examine the potential for dedicated housing for exchange students. Over the lifetime of the project, having established strong supporting processes, the consortium is focusing on increasing the complexity of their engagement contexts. This includes the development of joint projects, embedding exchange students in joint projects, considerably expanding the participation of students in collaborative projects across the Atlantic as facilitated by web communication and collaborative software. In time, opportunity exists to examine the potential for the development of a joint degree.

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