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An Investigation of the Perception of Gains from Undergraduate International Exchange Programs: The Tale of Atlantis

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AC 2011-1347: AN INVESTIGATION OF THE PERCEPTIONS OF GAINS FROM UNDERGRADUATE INTERNATIONAL EXCHANGE PROGRAMS: THE TALE OF ATLANTIS

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Donal McHale is an academic staff member in the College of Engineering and Build Environment at the Dublin Institute of Technology, Dublin Ireland. Donal's background includes sixteen years in transnational Engineering and Engineering management roles in the mass-media products sector. Holder of an MBA and BE from the National University of Ireland, he is co-principal investigator of a Transatlantic Dual Masters Degree project (STiMasters) and a Excellence in Mobility project (DETECT), both four-year projects funded by the Atlantis programmean EU-US cooperation programme in Higher Education and Vocational Training. The DETECT project promotes trans-national undergraduate student exchange between two European Engineering, Design and Technology Educational lnstitutions (Dublin Institute of Technology and the University of Applied Science, Darmstadt, Germany) and two US counterpart institutions (Purdue University and the Pennsylvania State University). The StiMasters project is a transatlantic dual Masters degree project with participant institutions including the Dublin Institue of Technology, Purdue University and the Universitat Polytechnica De Catalunya, Barcelona Spain.

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An Investigation of the Perceptions of Gains from Undergraduate International Exchange Programs: The Tale of Atlantis

Abstract

In this paper, we provide the quantitative results collected through a two-column survey instrument with which students recorded their perceptions of their educational experiences, and then summarize the qualitative study findings to outline the benefits of being immersed in different educational settings through study abroad experiences. Given the current resource constraint environment in higher education settings, we hope to help our community in making better decisions relevant to developing and sustaining study abroad programs.

Introduction

Given the projections[1] that (1) the pace of technological innovation will continue to be rapid, (2) the world in which technology will be deployed will become progressively more interconnected, and (3) designers, manufacturers, distributors and users will be increasingly diverse and multidisciplinary; our graduates will need to develop a global awareness and the ability to operate effectively in different cultural settings; settings where members potentially from various countries and regions with different traditions of work and personal relations will endeavor to effectively collaborate. For undergraduate institutions and specifically Schools of Engineering, Design and Technology intending to respond to the challenges of these increasingly important global contexts, a key emerging question is how best to prepare students for such settings while continuing also with engineering fundamentals and the increasingly complex technological subject matter.

Clearly there can be several approaches to develop students for multi-disciplinary, international collaboration settings focused on engineering problem solving. These approaches range from "course level" technology enabled virtual international collaborations through to full-student exchange programs where the experience of an adaption and total immersion in a different cultural setting is possible. In general, the key drivers of the choice of approach are: (1) Availability of funds to sustain the programs, and (2) Faculty buy-in. Given the impact of global recession on many educational budgets, it is imperative to understand the actual benefits in total immersion programs in comparison to international virtual collaboration efforts. Indeed, a review of the literature did not provide conclusive evidence. For example, while there are several papers discussing the benefits of exchange programs[2], authors, in general, do not use comparisons completed by validated instruments.

Literature Review

It was reported that over 200,000 US students studied abroad in 2004/2005[3], which presented an 8% increase over the previous year. Over the past five years since then, engineers have comprised 2.9% of study abroad students[3] while they typically comprise about 4.5% of the undergraduate population[4]. This trend continues: a recent study found that "*Engineering students are underrepresented within university study abroad programs*."[5]. Welker and Kenney[6] reported, however, despite the minority status of women in engineering (~ only 20% or less), they make up the 65% of the student body participating in study abroad programs.

On the outset, faculty and administrators seem to agree that study abroad has a positive effect on students, and limited assessment data also support this (e.g., Lalley et al.[7]). A recent survey of the 19 engineering schools in U.S., on the other hand, indicated that: (1) there is an

increase in short programs and alterative study abroad experiences (e.g., Engineers without Borders), and (2) due to the rigid curriculum structure of engineering students, the trend toward short programs and summer study abroad opportunities may be the most appropriate focus[8]. These two points might limit the growth of future study abroad programs, giving way to mostly short term summer programs.

We assert that dramatic shifts at this time may be premature in that necessary assessments documenting the differences of students are not done to an adequate level. Attesting to this, Welker and Kenney[6, pg. 7], upon their review of the existing work [9-13], deem the existing assessment on study abroad to be *in its infancy*.

There are several models in existence to assess the success of a study abroad program. These models fall into two main categories: academic indicators, and self-assessment of growth. Academic indicators include grade point average (GPA) and graduation statistics, such as time to degree completion. Because there are many factors that might impact GPA and time to completion, these indicators may not be as helpful. Some authors also adopted the use of typical end-of semester course evaluations as a means to get at the evaluation of the study abroad courses (e.g., Hornfeck and Gohr[5]) along with an additional set of program administration questions.

Student self-assessments focus generally on intellectual, cognitive and interpersonal development. For example, the Institute for the International Education of Students Model Assessment Practice (IES MAP) includes these self assessments as well as program level measures in a framework for compiling this information into a rigorous assessment process[11]. Welker and Kenney[6] report using IES MAP at Villanova University but no results were revealed. One other tool that is frequently used is the Intercultural Development Inventory (IDI). While this tool is widely used and robust, the major disadvantage is its proprietary nature: the institution needs to pay a fee each time the instrument is administered. One other drawback in using this tool is that it may not give the full picture about the learning experiences of our students while abroad.

Given this review, we assert that assessment of study abroad programs in a comprehensive way is necessary but has not been done to a sufficient degree. Assessment tools exist on cultural sensitivity (e.g., IDI), however, results on these alone do not reflect the growth in knowledge our engineering students need to have, and show to justify the expense directed into these programs. To fill this void, we develop an assessment instrument and show its application in order to paint a more comprehensive picture on the impact of study abroad for engineering students.

Survey Development & Data Collection

We specifically focus on the curricular experiences as experienced by students (program emphases, the extent to which programs focus on developing professional and problem solving skills, instructional approaches, and assessment practices), and ask the students who have international exchange experiences to record their perceptions about the programs they have experienced. The open ended portion of the study seeks to discern the value of these experiences.

Subjects of the study

The subjects of the study are the student participants in the DETECT Exchange Mobility project. The DETECT project is a four year project running until November 2011; one of two

Exchange Mobility projects selected in 2007 for funding by the US Department of Education and the European Union under the Exchange Mobility Action of the EU-US Atlantis program. The EU-US Atlantis program is a program of co-operation in Higher Education and Vocational Training between the US and the EU. The DETECT Exchange Mobility project is designed to promote transnational 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, W. Lafayette, IN, and The Pennsylvania State University, PA). Funding is predominantly used to support full-semester transatlantic student exchange. Overall, the project aims to support a minimum of 48 full semester exchanges over its lifetime. At the time of this study, the transatlantic exchange program was 75% complete; 36 students had completed full semester exchanges already.

In order to increase the sample size, the target population of DETECT project students (n=36) is augmented by students from Penn State, who participated in study abroad programs – not just the DETECT. These students are uniquely positioned to provide comparative insight into differences in transatlantic teaching practices which influence student learning.

Research questions development

At the outset, four general themes of enquiry were proposed. These are as follows:

1. To examine the perception of transatlantic exchange students pertaining to the general differences in teaching styles experienced between their home institution and their study abroad transatlantic institutions.
2. To examine transatlantic exchange students' perception of the general differences in assessment practices and other important "course related" variables between the home continent and their study abroad continent.
3. To examine transatlantic exchange students' perception of differences in the degree of emphasis (if any) on "soft skills" critical to the development of Engineering and Technology professionals.
4. To understand transatlantic exchange students' perception of the most important value-adding elements in transatlantic exchange.

Following the development of general themes, semi-structured one-to-one interviews of about 20 minutes were undertaken with three of the survey participants with whom the academics had established a strong rapport. Open ended questions were used and careful notes were taken which helped to point the researchers towards factors worth exploring under the general inquiry themes. These interviews allowed probing and clarification of certain variables especially under theme two. As an output of this process, specific objectives with specific research questions emerged under each of the four themes. Under theme one, the specific objectives and research questions established were as follows:

Theme One Objective: To describe and compare the opinion of "US & European" transatlantic study-abroad exchange students on the differences (if any) in teaching styles between both continents, the nature of those differences and the influence of those differences on learning.

Theme One Research Questions:

1. Did transatlantic exchange students believe that teaching styles were generally different between their "home institution" and their "study abroad" institution?
2. What were the key differences as perceived by US & European students?

3. Did these transatlantic exchange students believe that the teaching styles encountered abroad were more effective in supporting learning than those at home?
4. What changes in style (at home and "study abroad" institution) do they believe could be adopted as a result of their experience?

In the case of theme two, as an output of the semi-structured interviews, five important "course related" variables emerged as being of interest and worth exploring further. These variables were:

a. The amount of course related "homework" typically employed.
b. The amount of "self directed learning" undertaken.
c. The extent of the credit weighting for "continuous assessment".
d. The degree of enforcement of attendance at lectures and laboratories.
e. The extent of participation in "Problem-based Learning".

These variables formed the basis of the development of the objective and four specific research questions for theme two, which are provided below.

Theme Two Objective: To describe and compare the opinion of "US & European transatlantic study-abroad exchange students on the differences (if any) in assessment practices and other important "course related variables" between their North American and their European institution, the nature of those differences and their influence on learning.

Theme Two Research Questions:

1. What degree of difference did transatlantic exchange students believe existed between courses at their "study abroad" and their "home institution" in relation to the following course related variables, presented above (a-e)?
2. What was transatlantic exchange students' opinion on the relative value of different assessment methodologies in terms of their ability to:
    a. Influence students' motivation to learn, and
    b. Accurately assess students "real learning".
3. Did study abroad students believe the amount of self-directed learning was appropriate in their study abroad programs?
4. To what extent did differences in the enforcement of the attendance requirement (if any) affect students' motivation to learn?

Similarly, an objective and associated specific research questions were established for theme three. These were as follows:

Theme Three Objective: To undertake a comparative examination of the emphasis on four key non-technical skills of Engineering emphasized by Professional Engineering and Accreditation bodies in the approval and recognition of Engineering and Technology programs.

***Theme Three Research Questions*:** What are the perceptions of transatlantic exchange students on the difference in the degree of emphasis between "home" and "study abroad" institution on the following skills and behaviors (which are recognized as important in the development of Engineering careers?)

(i) Good Health and Safety Practice

(ii) Good Environmental Practice

(iii) Effective Communication Skills

(iv) Behavioral Integrity

An objective for theme four was established and it focused on a single research question as follows:

***Theme Four Objective*:** To examine the perception of transatlantic exchange students in relation to which element of their study abroad experience they believed was most valuable to them in preparing for careers as 21st century engineers/technologists.

Theme Specific Research Question: Overall, which of the following components of the study abroad experience do "study abroad students" perceive as having been the most valuable in terms of its effectiveness in developing the skills, attitudes and behaviors required by the 21st century engineer/technologist? (a) The academic learning undertaken in prescribed courses, (b) The skills and competencies developed by having to experience and adopt to living in a different culture and institution, (c) The social skills developed by social engagement with new people, (d) Meeting Friends and acquaintances from very different backgrounds, (e) Exposure to the work culture as presented in class or experienced during fieldtrips.

Preparation of Survey Questions & Pilot Testing

The survey questions (a sample of these can be seen in the appendix) based on the specific research questions was initially drafted using best practice approaches established from a number of texts[14, 15, 16, 17]. Factual questions were positioned before questions about opinions and beliefs. Three questions were also included to capture personality type information from participants. Five point scale ranked responses utilizing balanced categories were predominantly though not exclusively employed. This gave rise to a number of ordinal variables for analysis.

Questions were developed and honed over a number of iterations in an effort to ensure the questions were attractive, accessible and robust. Input was sought from a number of team members. Questions were modified to improve simplicity. In particular, the transatlantic and international nature of the survey required that a careful review to ensure the words had consistency in meaning for all participants and to reduce ambiguity (from both a US and European perspective). Where open ended opinions had been sought, modifications were made to ensure additional space for provided for these answers. Questions were revised, shortened and appropriately reordered based on feedback.

The 31 question questionnaire was then constructed using the Survey Development software on the internet site www.surveymonkey.com. This software facilitated complex branching and skip routines. Each question and the questionnaire were evaluated rigorously before final administration to test for meaning, redundancy and flow. Filter questions were tested to ensure skip patterns directed the respondents throughout the questionnaire as intended.

Administering the Questionnaire

All the relevant email addresses were sought out and found for the DETECT participants. Students were pointed to the survey link via an email. German students were emailed their link in German and a two week period allowed the students complete the survey. For the Penn State students, a database for students who participated in study abroad programs was used to identify, and then access students' contact information. Students completed the

questionnaire anonymously though it was clearly possible to track their home and "study abroad institution" and the year of their 'study abroad".

Results

We present the findings organized around the research themes, below.

Theme 1

Figure 1.0 below classifies all respondents by home institution. It summarizes "study abroad" students' perception of the degree of difference in teaching style between their home institution and their study abroad institution. Specifically, it is clear that 100% of the European respondents attending US colleges perceived the US teaching styles as significantly different to the teaching style at their home institution. Given that all institutions are committed to implementation of best practice approaches to teaching and learning, this perception is notable. In the case of Purdue students & Penn State students studying at the Dublin Institute of Technology and the Hochschule Darmstadt, more than 83% saw the teaching style in Europe as either "significantly different" or "somewhat different" to home.

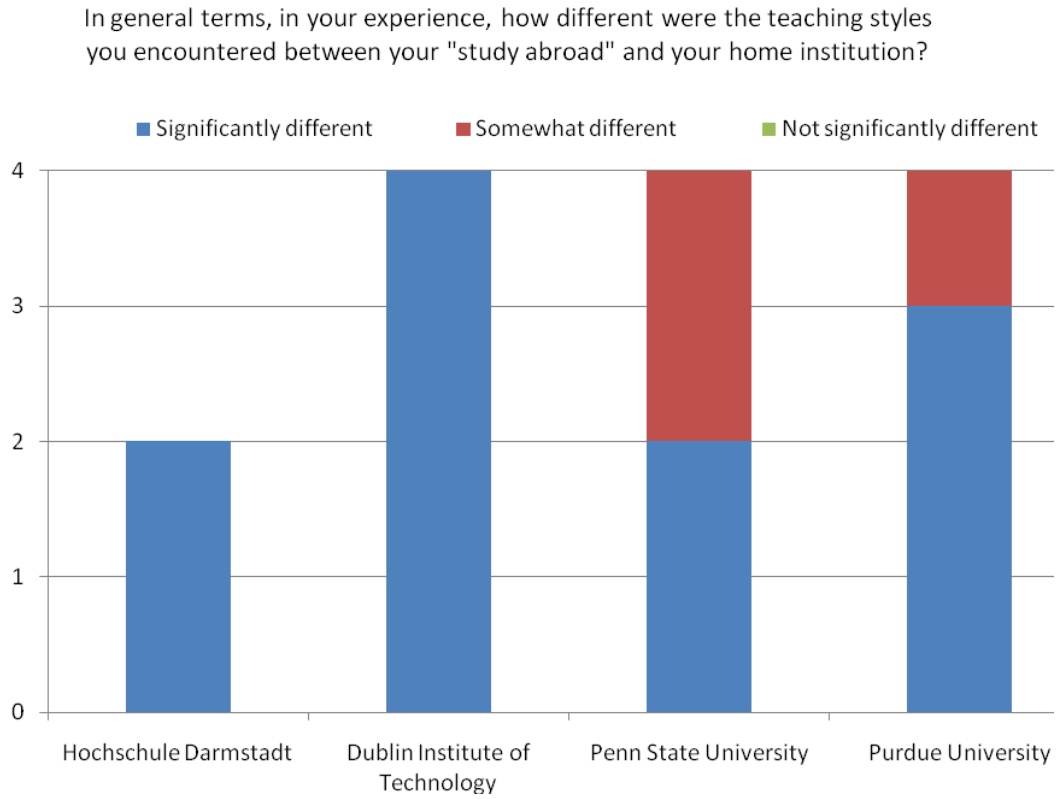

Figure 1.0: Perception of "study abroad" students (by home institution) of the degree of Teaching Style differences at "Study Abroad" Institution

Differences in Europe cited by US students include the "use of professors lecture notes in place of textbooks, "less/no homework", "no quizzes" and "course undertaken in larger weekly blocks". Key differences in the US cited by European students included "more interactive interesting classes", "regular exams and quizzes, "a large continuous assessment component", "mandatory attendance" and "more collective homework assignments". One European student commented that in the US, they were "less focused on an individual

learning how to learn and research, and more focused on learning specific things" while another commented that "the professors at the US study abroad institution were more invested in whether the student learned or not than at home."

Figure 1.1 below summarizes transatlantic exchange students' beliefs on whether the teaching styles encountered abroad were more effective in supporting learning than those at home. Given five ranked choices, the most popular choice amongst the overall cohort of respondents was that there was little difference in effectiveness between home and abroad. However, no Purdue respondents who came to Europe saw the European teaching style as more effective and no Hochschule Darmstadt respondent who went to the USA believed their teaching style was more effective. In fact, three quarters of Purdue University respondents who travelled to Europe for study-abroad believed the European teaching styles were somewhat less effective or much less effective than the teaching styles at their home institution.

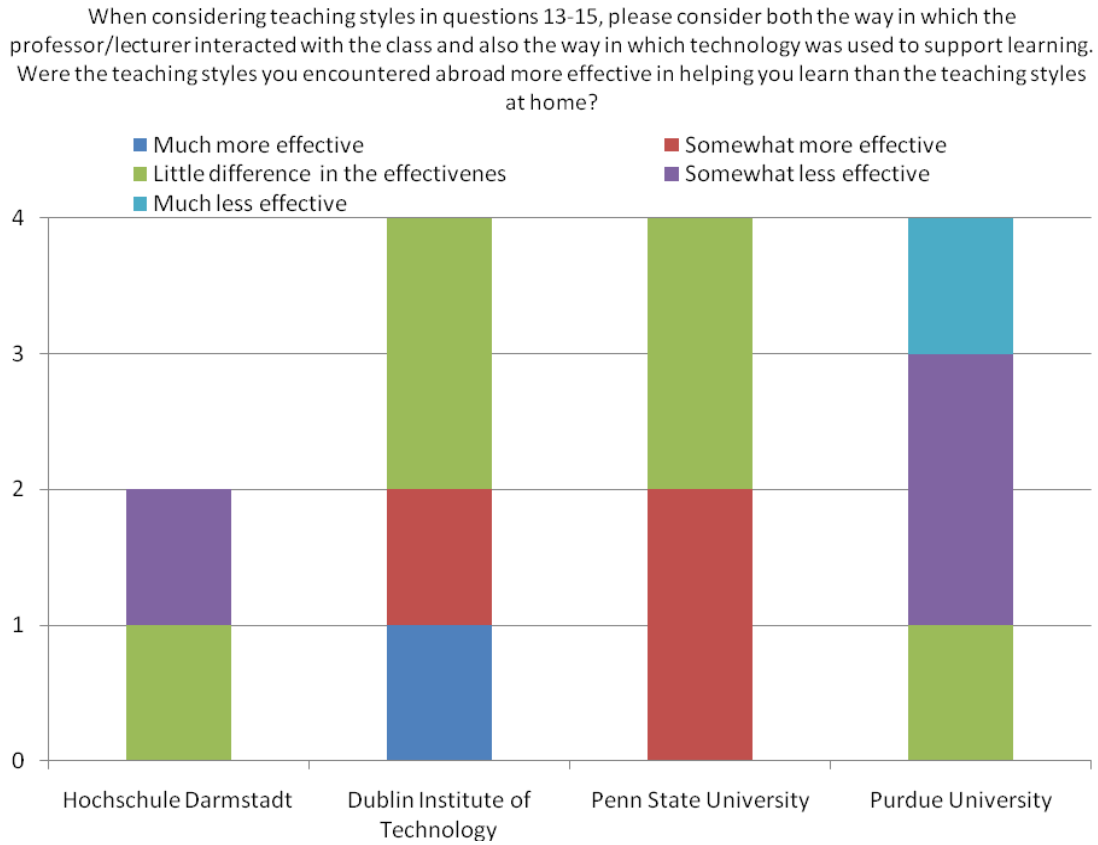

Figure 1.1: Perception of "study abroad" students (by home institution) of effectiveness of teaching style at their "study abroad" institution relative to home institution

Based on their experience abroad, European students cited 14 distinct items they believed would be useful to adopt at their home institutions. Frequently cited was the level of sophistication of the laboratories and the practical nature of the laboratory exercises used. They also cited the level of engagement and enthusiasm of professors, the use of "interesting and inclusive methods", the way "true life experience" was associated with a course and the class participation levels US professors engendered. In the case of what they believed the US courses could adopt, a number of European students believed that more theoretical background could be presented in courses at their study abroad institution. More emphasis on

“individual rather than rote learning” was also cited as a useful adoption as was teaching through the use of notes/knowledge as opposed to textbooks. Only one European student suggested that the US professors should do “less multiple choice exams”.

When US students were asked to cite changes that could be usefully adopted at their European “study abroad institutions”, the vast majority of the suggestions related to additional assessments throughout the full semester to ensure students were grasping the material rather than “trying to cram a full semester’s worth of information” into one exam. Shorter class periods were also suggested, or tea breaks in three hour periods. One student suggested that European institutions need to “become more strict” and another suggested that lectures need to be “more entertaining/stimulating”. With regards to what they believed that US colleges could learn from Europe, the use of “lecturer notes” was also cited as a useful adoption. Interestingly, one respondent suggested “more opportunity to learn on your own and not be given ‘busy work’. This response was similar to a European student’s comment previously.

Theme 2

It was clear that transatlantic exchange students saw significant differences in the amount of homework required between European and US educational settings. All European students encountered “somewhat more” or “far more” homework when they went to the US and this clearly happened in reverse for Purdue students studying in Europe. The Penn State data points complicate this picture since some of the data points are for study abroad outside of Europe and their study abroad location is not easily discernable. However, we can clearly see the degree of difference in relation to the amount of homework undertaken.

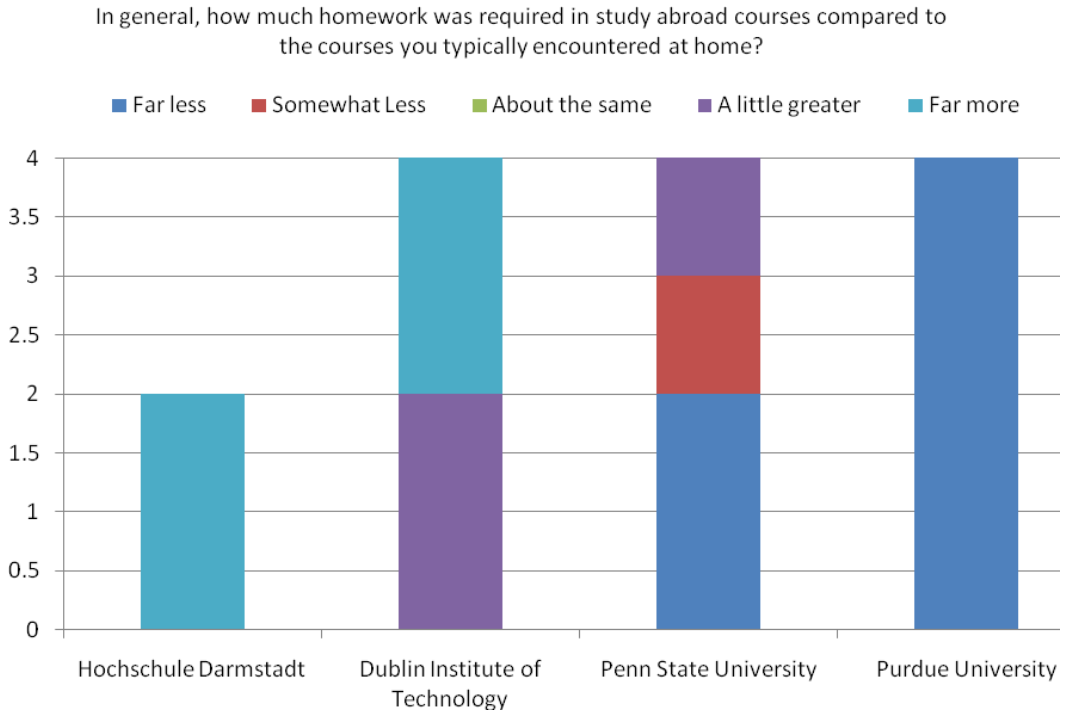

Figure 2.1: Perception of “study abroad” students (by home institution) of the amount of homework in “study abroad” courses compared to courses at the home institution

As can be seen in Figure 2.2 below, no European respondents doing study abroad in the US reported encountering a greater level of self directed learning in courses abroad than at their home institution. In fact, 87% of respondents report ‘a little less’ or ‘much less’ self-directed learning in US courses undertaken than in courses at their home institution. This difference is noted in reverse by Purdue students studying in Europe as can be seen in Figure 2.3.

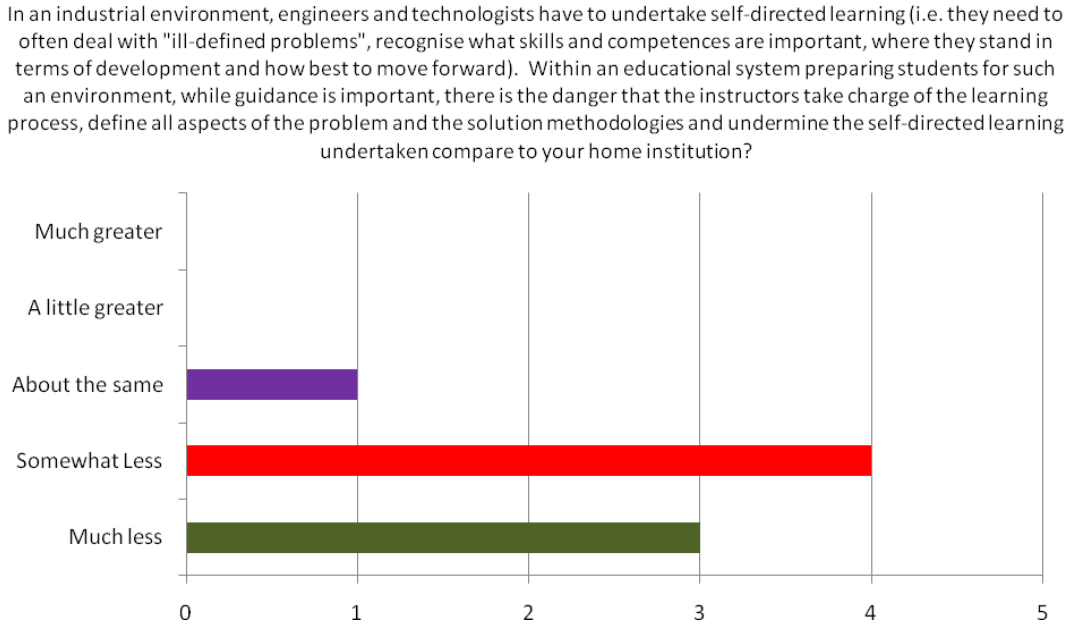

Figure 2.2: European students’ perception of the amount of “self directed” learning in US “study abroad” courses compared to courses at their home institution

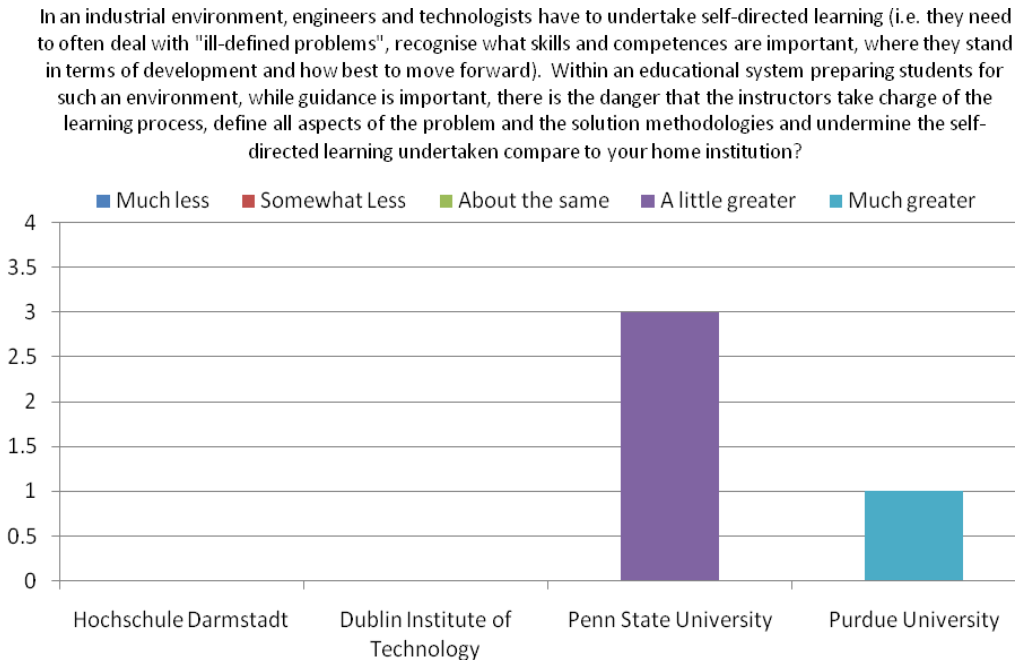

Figure 2.3: Purdue students’ perception of the amount of “self directed” learning in European “study abroad” courses compared to courses at home.

Study abroad students' (by home institution) perception of the extent of credit weighting for "continuous assessment" at their study abroad institution relative to their home institution is summarized in Figure 2.4. US students' responses all cluster towards the left of the graph while European student responses are all featured on the right-hand side. 87% of European respondents stated that there is much greater credit available from continuous assessment in US based courses. No US respondent found greater levels of continuous assessment in Europe than in courses at home. In fact, 80% of US respondents found that credit bearing continuous assessment was less or much less at their study abroad institution.

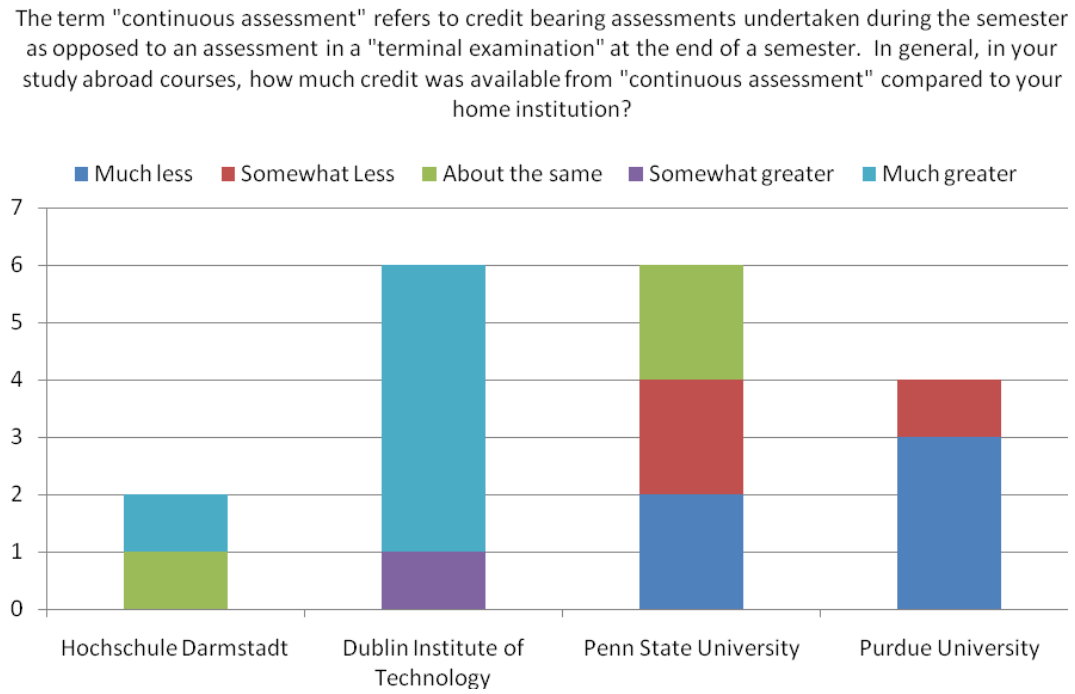

Figure 2.4: Perception of Study Abroad students (by home institution) of the amount of credit available from continuous assessments in "study abroad" courses compared to courses at their home Institution.

It is clear from Figure 2.5 below that all European "study abroad" students reported that attendance at lectures and laboratories was enforced much more rigorously (75%) or somewhat more rigorously (25%) abroad than at their home institution home. So as expected, Purdue students who travelled to Europe found that attendance at lectures and laboratories was enforced much less rigorously (75%) or somewhat less rigorously (25%) than at their home institution. By contrast, the Penn State data does not trend in any one direction. This is likely due to the fact that the study abroad locations for these Penn State students are varied across the globe including Canada, and hence classroom policies are varied.

Figure 2.6 summarizes study abroad students' (by home institution) perception of the extent of participation in "Problem based Learning (PBL)" during their "study abroad" experience. The data does not suggest a clear trend in the use of PBL between continents. However, no Purdue University students who did "study abroad" in Europe reported participating in greater levels of PBL in Europe than at their home institution. The Hochschule Darmstadt data points tell us that PBL was used in US courses at about the same level or somewhat more often than at their home institution while 66% of DIT respondents reported that PBL was used less often than at their home institution.

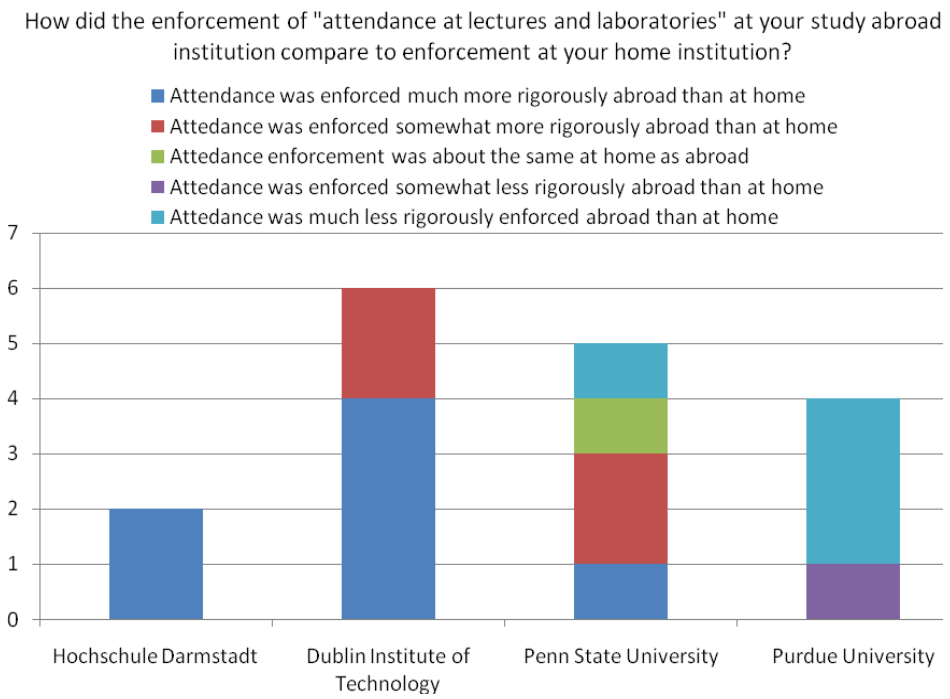

Figure 2.5: Study Abroad students' perception (by home institution) of the enforcement of attendance at study abroad institution relative to enforcement at the home institution

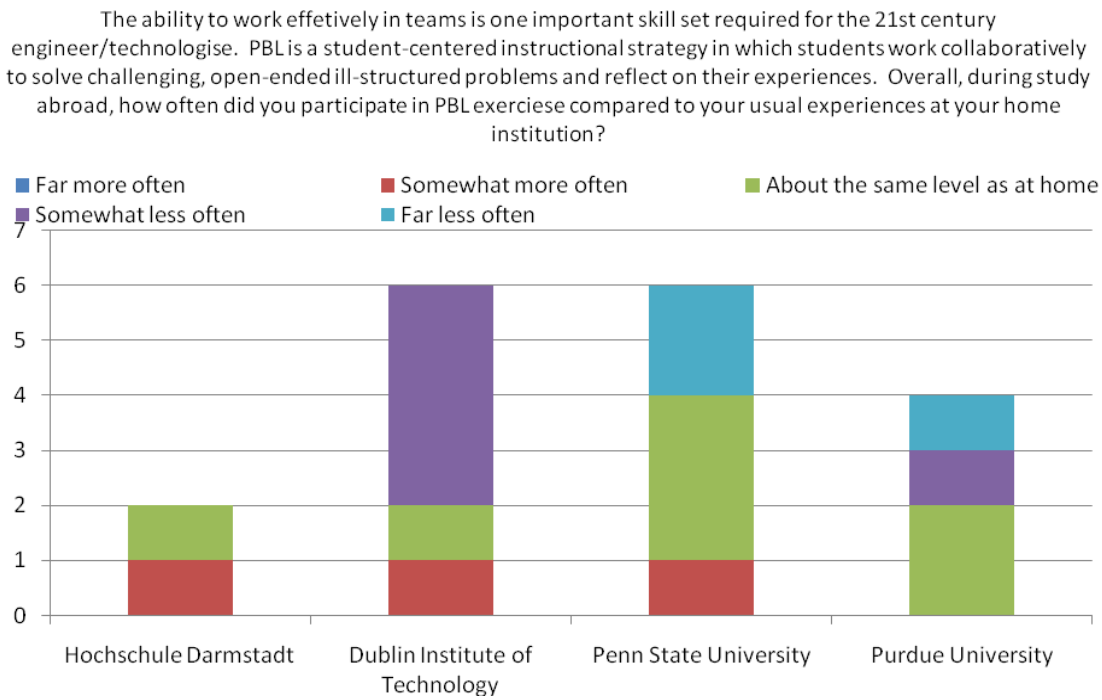

Figure 2.6: Study Abroad students' perception (by home institution) of the use of problem-based learning at the study abroad institution relative to the home institution

Dublin Institute of Technology students and Darmstadt students reported that in relation to assessment, relative to their home institution, there were more multiple choice exams (some with an “open book” format), more mini-exams, and more projects at home where marks could be obtained on a week to week basis during their study abroad experience. 66% of the DIT group stated that this had a positive or very positive influence on their usual motivation to learn. No DIT students reported that this difference in assessment methodology had a negative influence on motivation though all Darmstadt students stated that assessment differences had little overall effect. By contrast, 50% of the Purdue respondents stated that the difference in assessment methodology in Europe had a somewhat negative or very negative effect on their usual motivation to learn.

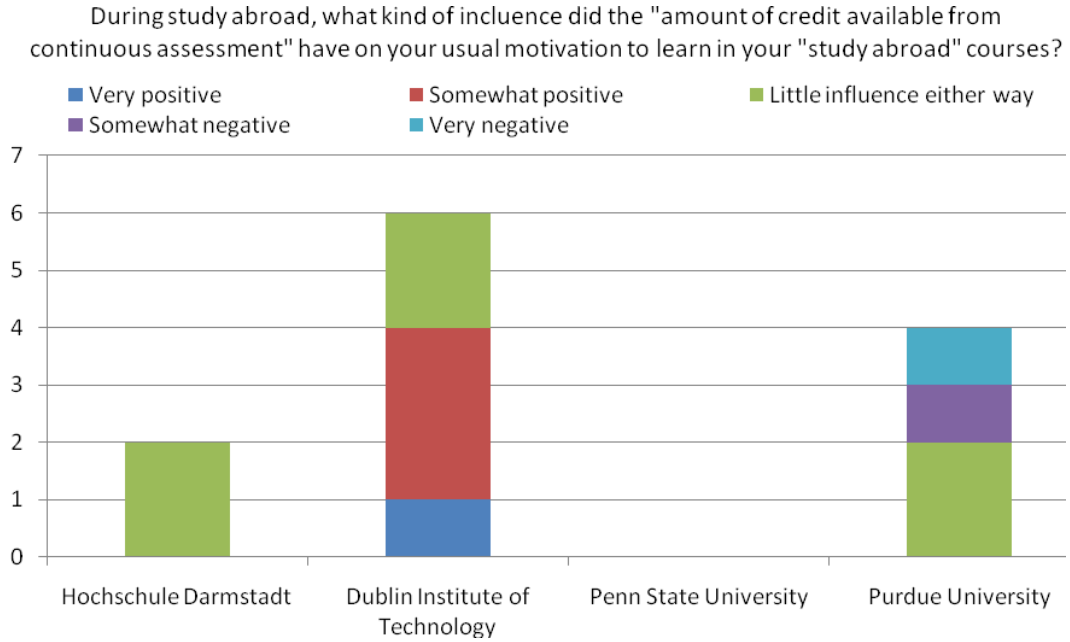

Figure 2.7: Study Abroad students’ perception (by home institution) of the use of Problem-based learning at the study abroad institution relative to the home institution

With regards to whether the assessment methodologies at the study abroad institution were better or worse in terms of their ability to assess students’ real learning, it is clear from Figure 2.8 that 50% of Dublin Institute of Technology respondents believed that the assessment methods used in the US were “somewhat better” or “to a great extent better”, and no DIT students believed them to be worse. Similarly, 75% of the Purdue respondents believed that the assessment methodologies used in Europe were “somewhat worse” or “to a great extent worse” in terms of their ability to assess the students “real learning”. All Hochschule Darmstadt respondents believed that the assessment methods encountered in the US made little if any difference to the assessment of “real learning” while only 16% of the Penn State respondents believed that the assessment methodologies encountered on study abroad were better (relative to home) in their ability to assess the students real learning.

While 61% of all respondents believe the amount of self-directed learning was appropriate in their study abroad programs, it is however notable that all of those who believed that the amount of self-directed learning was not enough or far too little in their study abroad programs were all European students studying in the US. In fact, 50% of European student responders believed that the amount of ‘self directed’ learning in their “study abroad” courses was either “not enough” or “far too little” as can be seen in Figure 2.9 below.

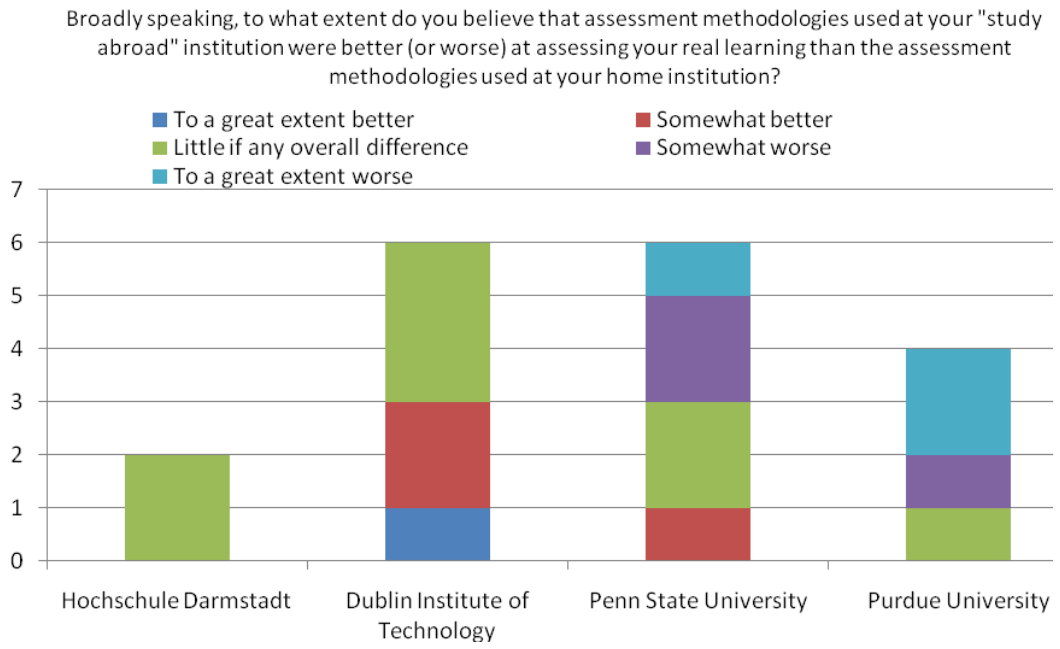

Figure 2.8: Study Abroad students' perception (by home institution) of the ability of the assessment methodologies used at the study abroad institution to assess real learning (relative to the home institution)

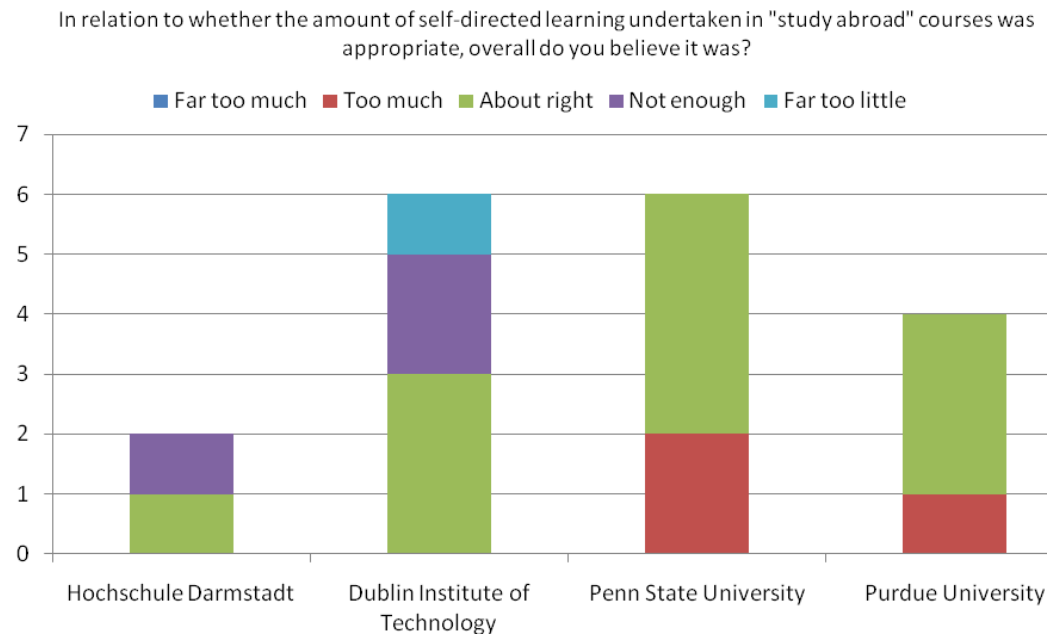

Figure 2.9: Study Abroad students' perception (by home institution) of whether the amount of "Self Directed Learning" used at the study abroad institution was appropriate

One third of DIT "study abroad" students reported that the stricter enforcement of the lecture attendance requirement had a very great effect on supporting their learning and another third stated that it made a significant difference to learning. By contrast, all of the Hochschule Darmstadt students stated that this stricter enforcement made little if any difference to their motivation. We can only surmise as to what factors influenced this perception difference; it may be related to differences in intrinsic motivation levels of each cohort of students.

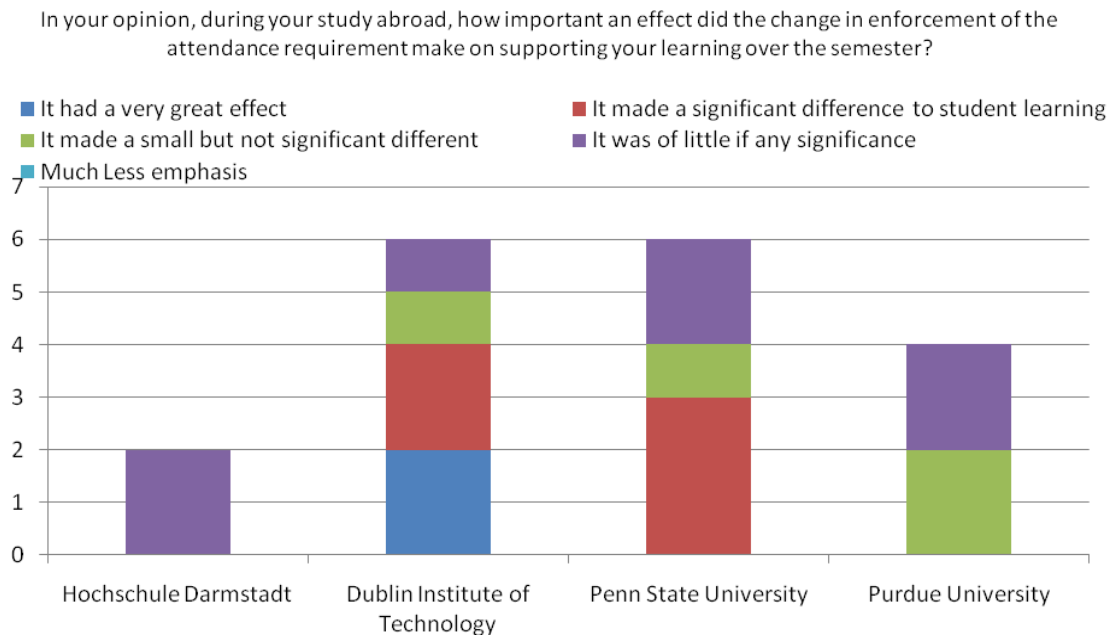

Figure 2.10: Study Abroad students' perception (by home institution) of the importance of the change in enforcement of the attendance requirement as a means of supporting student learning

Theme 3

In relation to the relative importance of Health and Safety in courses, as can be seen in Figure 3.0 below 55% of respondents believed the emphasis was about the same as at students' home institution. Notable is that 50% of Penn State respondents believed that there was lesser emphasis on Health and Safety in the study abroad institutions compared to their home institution. Confirming this, all Hochschule Darmstadt respondents believed there was a somewhat greater emphasis on Health and Safety in their US courses than in courses at their home institution. For DIT students, there was a wide range of opinion and no clear agreement with regards the Health and Safety emphasis compared to their home institution.

In relation to the relative importance of Environmental matters in courses, from Fig 3.1 it can be seen that 100% of Purdue and Hochschule Darmstadt respondents believed the emphasis on these matters in study abroad courses was about the same as at their home institution. For DIT and Penn State students, there was a wide range of opinion and no clear agreement appeared on the Environmental and Sustainability emphasis compared to their home institution. Understanding the drivers of these opinion differences would require further study, perhaps with qualitative means.

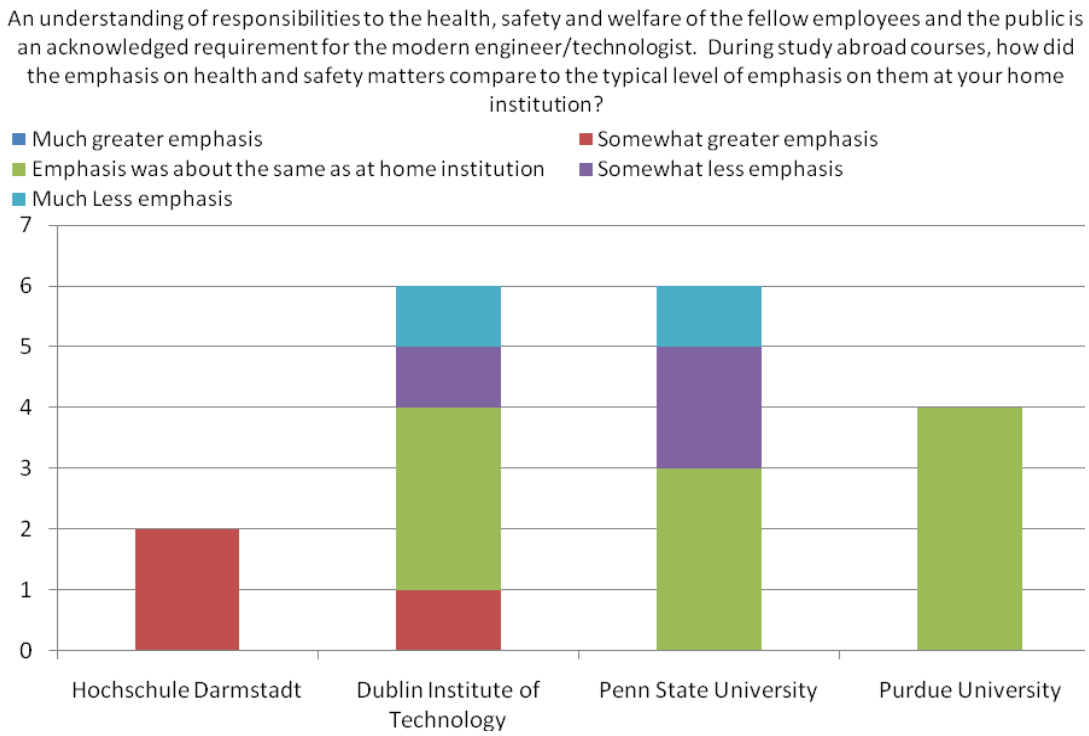

Figure 3.0: Study Abroad students' perception (by home institution) of the emphasis on good Health & Safety Practice compared to the typical level of emphasis at home institution

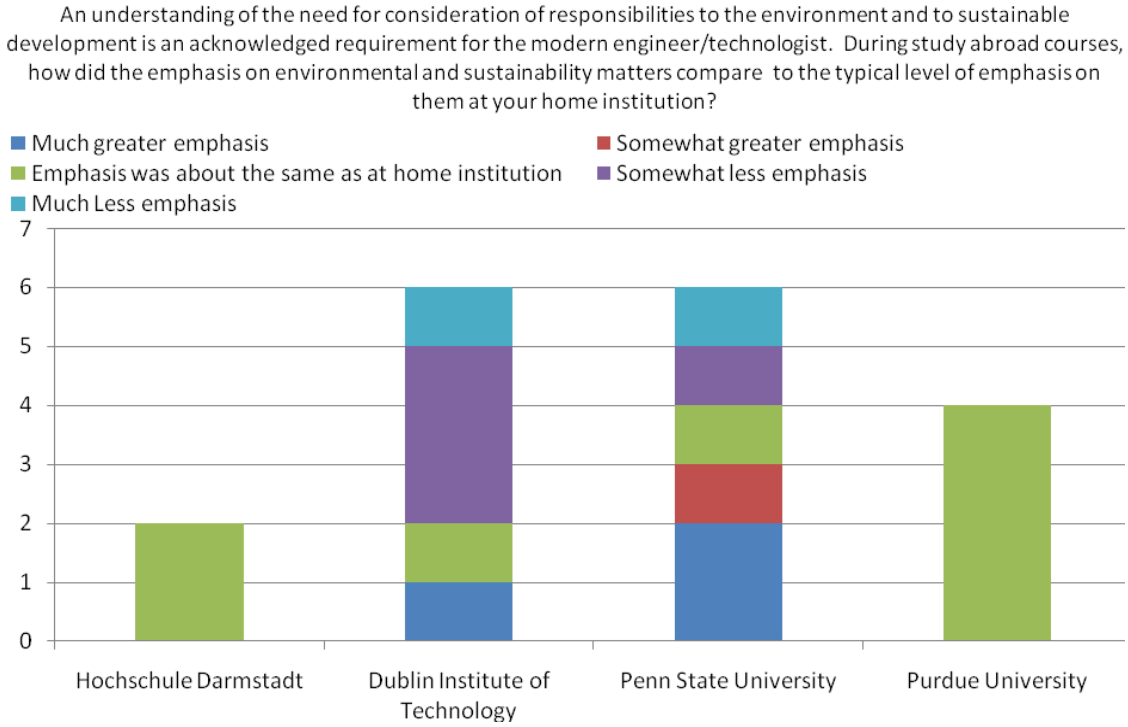

Figure 3.1: Study Abroad students' perception (by home institution) of the emphasis on environmental matters & sustainable development compared to the typical level of emphasis at home institute

In relation to the relative importance of communication skills, 61% of respondents believed the emphasis was about the same as at home institution although 30% of DIT students and 30% of Penn State study abroad students believed there was somewhat less or much less emphasis on communication skills compared to their home institution. Backing this up, one DIT respondent had commented that there were fewer presentations required during their study abroad experience.

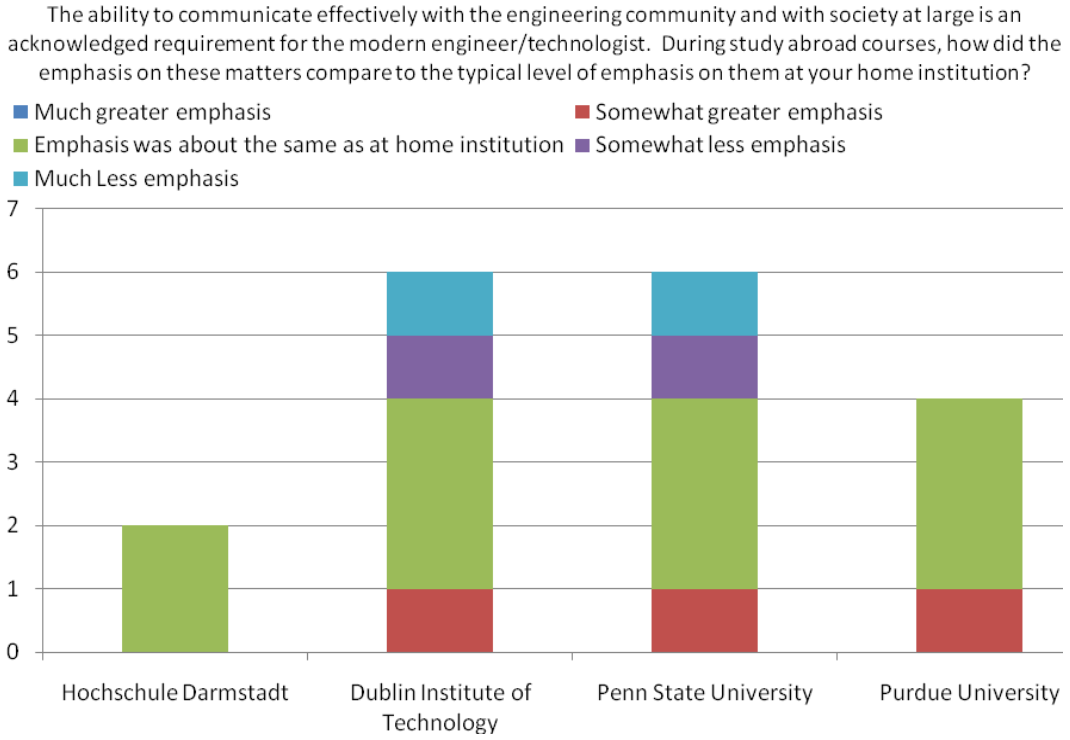

Figure 3.2: Study Abroad students' perception (by home institution) of the emphasis on Effective Communication skills compared to the typical level of emphasis at home institution

In considering the relative importance of behavioral integrity in "study abroad" courses, per Figure 3.3 below, it is seen that more than 77% of respondents believed the emphasis was about the same as at home institution. No trend by institution is apparent for the other respondents.

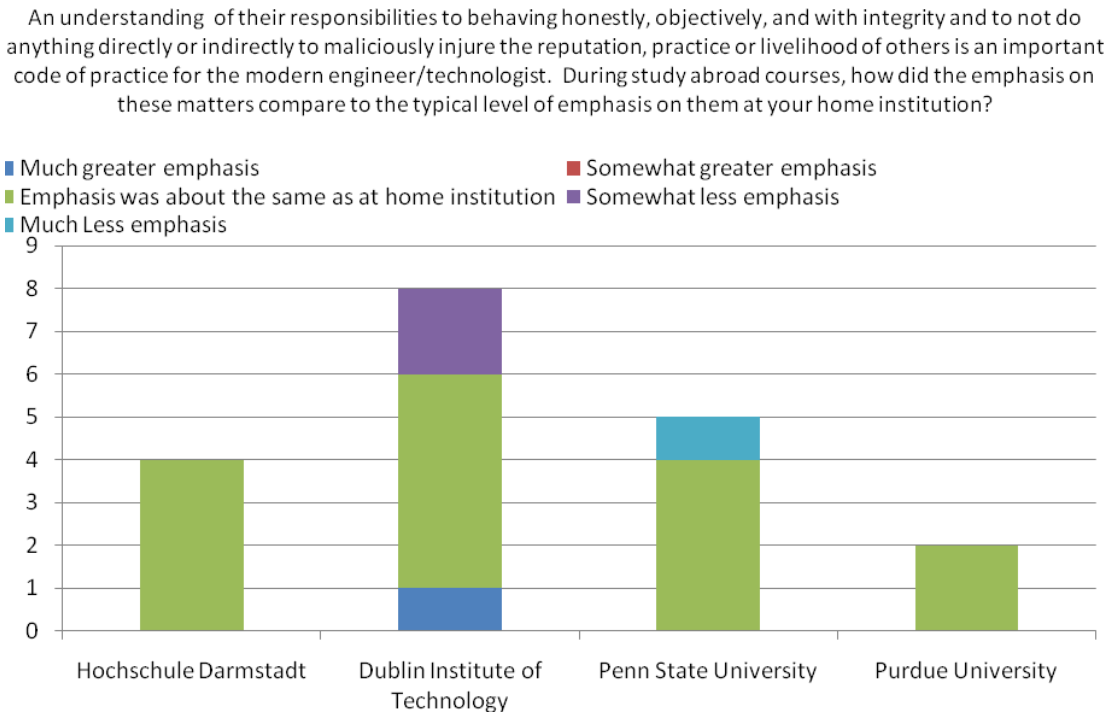

Figure 3.3: Study Abroad students' perception (by home institution) of the emphasis on behavioural integrity compared to the typical level of emphasis at home institution

Theme 4

As is evident from Figure 4.0 below, when given five options, most (more than 55% of all students responding to the survey) selected "The skills & competencies developed by having to experience and adapt to living in a different culture and institution" as the component of the study abroad experience perceived as having been most valuable in terms of its effectiveness in developing the skills, attitudes and behaviors required by the 21st century engineer/technologist. This cultural adoption experience was clearly perceived as the most valuable by the majority of respondents. By contrast, interestingly, less than 6% of respondents perceived that the academic learning undertaken in prescribed courses was the most valuable component of the experience. The value of the academic learning in the overall experience was last in the pecking order.

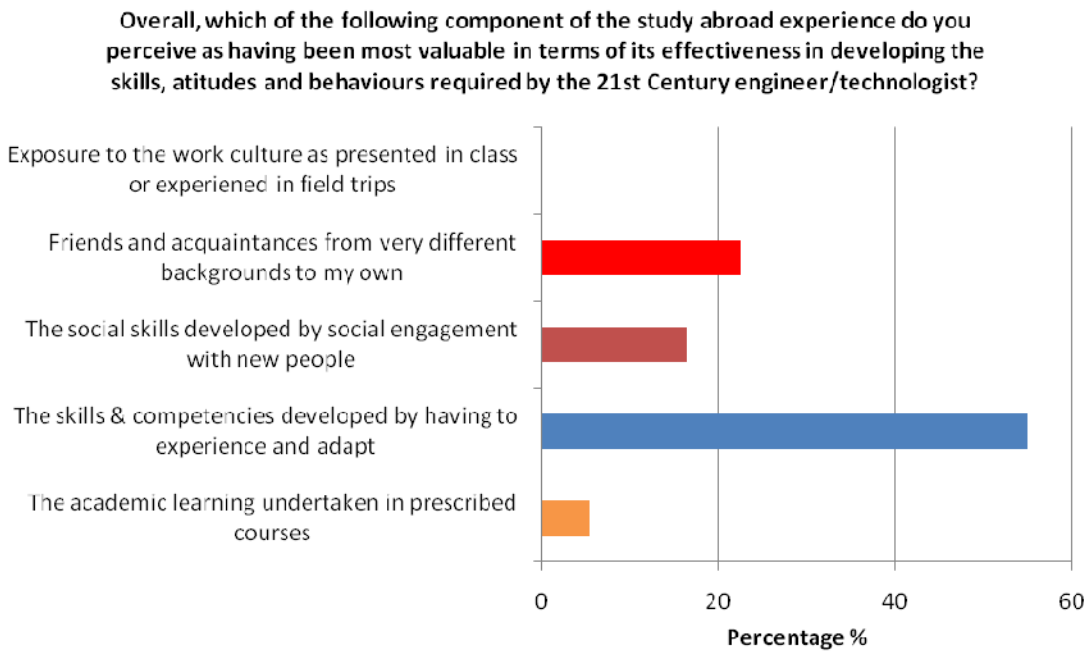

Figure 4.0: Respondents perception of the most valuable component of the study abroad experience

Conclusions

We provide the following conclusions as per the study results.

1. Given five options, 55% of "study abroad" students selected "the skills & competencies developed by having to experience and adapt to living in a different culture and institution" as the component of the study abroad experience they perceived as having been the most valuable in terms of its effectiveness in developing the requirements of the 21st century engineer/technologist. Only 5% of responders' believed that the academic learning was the most useful component of the "study abroad" experience.

2. 100% of European responders' attending US colleges believed that the teaching styles they encountered in the US were significantly different to those in Europe and more than 83% of US students studying abroad in Europe stated that the teaching styles in Europe were either significantly different or somewhat different to home.

3. Key differences reported about the US courses relative to Europe were a significantly larger continuous assessment component. This typically involved regular exams, quizzes and collective assignments. 66% of DIT student responders' reported that this had a positive or very positive influence on their usual motivation to learn. In addition, there was mandatory class attendance (unusual at European institutions). For 66% of the DIT "study abroad" responders, mandatory attendance had a very great effect or a significant effect on their learning. By contrast, Hochschule Darmstadt students believed it to have little if any significance to their learning.

4. European students saw benefit in their home institution adopting more sophisticated laboratories like their US counterpart institutions. They noted that US classes tended to be more interactive in teaching style, and also would like to see adoption of greater levels of inclusive classroom engagement by European professors such as they encountered in the United States.

5. Three quarters of Purdue students who came to Europe to study abroad believed that the teaching styles there were somewhat less effective or much less effective compared to their home institution and their most frequent suggestion is that European institutions need to adopt greater levels of interactive teaching styles.
6. Some evidence emerged that European students found less self-directed learning in their "study abroad" courses in the US. Only European responders' believed that the level of self-directed learning was insufficient and in fact 50% of European student responders' believed that the amount of "self directed learning" in their study abroad courses was either "not enough" or "far too little". In addition, European students believed that more theoretical background material would have been useful.

Overall, it is clear that through study abroad experiences, engineering students are exposed fundamentally different teaching styles, reward systems and facilities. For their preparation as an engineer equipped with professional skills, these experiences are important in that they will have an understanding of their international peers' background in future multi-national design and problem solving settings.

Acknowledgment
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Appendix

SELECTED EXTRACT FROM THE QUESTIONNAIRE

11. In general terms, in your experience, how different were the teaching styles you encountered between your "study abroad" and your home institution?
    1. Significantly different
    2. Somewhat different
    3. Not significantly different

12. Describe the key differences in teaching styles noted.

13. When considering the teaching styles in questions 13-15, please consider the way in which the professor/lecturer interacted with the class and also the way in which technology was used to support learning. Were the teaching styles you encountered abroad more effective in helping you learn than the teaching styles at home?
    1. Much more effective
    2. Somewhat more effective
    3. Little difference in the effectiveness compared to home
    4. Somewhat less effective
    5. Much less effective

14. List (in order of priority if more than one) any beneficial teaching style "encountered abroad" you would like to see adopted more in courses at your home institution.

15. List (in order of priority if more than one) any beneficial teaching style typically used at your home institution you would like to see adopted more in courses at your "study abroad" institution.

16. In general, how much homework was required in study abroad courses compared to the courses you typically encountered at home?
    1. Far Less
    2. Somewhat less
    3. About the same
    4. Somewhat more
    5. Far more

17. The term "continuous assessment" refers to credit bearing assessments undertaken during the semester as opposed to an assessment in a "terminal examination" at the end of a semester. In general in your study abroad courses, how much credit was available from "continuous assessment" compared to your home institution?

    1. Much Less
    2. Somewhat less
    3. About the same
    4. Somewhat greater
    5. Much greater

18. During study abroad, what kind of influence did the "amount of credit available from continuous assessment" have on your usual motivation to learn in your "study abroad" courses?
    1. Very positive
    2. Somewhat positive
    3. Little influence either way
    4. Somewhat negative
    5. Very negative

19. Outside of differences in the weighting of credit available for continuous assessment components, in general, what were the key differences (if any) between the types of assessment methodologies typically

used at your “study abroad” institution compared to your home institution (i.e. more project based assessments, more presentations etc.)

1. Much less
2. Somewhat less
3. About the same
4. Somewhat greater
5. Much greater

20. At your study abroad college, how did the differences you cited in the previous question (Question 19) influence your usual motivation to learn over the course of the semester?
    1. Very positively
    2. Somewhat positively
    3. Little influence either way
    4. Somewhat negatively
    5. Very negatively

21. Broadly speaking, to what extent do you believe the assessment methodologies used at your “study abroad” institution were better (or worse) at assessing your real learning than the assessment methodologies used at your home institution.
    1. To a great extent better
    2. Somewhat better
    3. Little if any overall difference to home
    4. Somewhat worse
    5. To a great extent worse

22. In an industrial environment, Engineers and Technologists have to undertake “Self-Directed Learning (i.e. they often need to deal with “ill-defined problems”, recognize what skills and competencies are important, where they stand in terms of development and how best to move forward). Within an educational system preparing students for such an environment, while guidance is important, there is a danger that the instructors take charge of the learning processes, define all aspects of the problem and the solution methodologies and undermine the self-direction of the learner. Overall during study abroad how did the proportion of self directed learning undertaken compare to your home institution?

`
    1. Much greater
    2. A little greater
    3. About the same
    4. Somewhat less
    5. Much less

23. In relation to whether the amount of self-directed learning undertaken in “study abroad” courses was appropriate, overall do you believe it was?
    1. Far too much
    2. Too much
    3. About right
    4. Not enough
    5. Far too little

24. How did the enforcement of “attendance at lectures and laboratories” at your study abroad institution compare to enforcement at your home institution?
    1. Attendance was enforced much more rigorously abroad than at home
    2. Attendance was enforced somewhat more rigorously abroad than at home
    3. Attendance enforcement was about the same at home and abroad
    4. Attendance was somewhat less rigorously enforced abroad than at home
    5. Attendance was much less rigorously enforced abroad than at home

25. In your opinion, during your study abroad, how important an effect did the change in enforcement of the attendance requirement make on supporting your learning over the semester?
    1. It had a very great effect
    2. It made a significance to student learning
    3. It made a small but not significant difference to student learning
    4. It was of little if any significance

26. The ability to work effectively in teams is one important skill set required to for the 21st century engineer/technologist. Problem-based learning (PBL) is a student-centered instructional strategy in which student work collaboratively to solve challenging, open-ended, ill-structured problems and reflect on their experiences. Overall, during study abroad, how often did you participate in PBL exercises compared to your usual experience at your home institution?
    1. Far more often
    2. Somewhat more often
    3. About the same level as at home
    4. Somewhat less often
    5. Far less often

27. An understanding of the need for consideration of responsibilities to the environment and to sustainable development is an acknowledged requirement for the modern engineer/technologist. During study abroad courses, how did the emphasis on environmental and sustainability matters compare to the typical level of emphasis on them at your home institution.
    1. Much grater emphasis
    2. Somewhat greater emphasis
    3. Emphasis was about the same as at home institution
    4. Somewhat less emphasis
    5. Much less emphasis

28. An understanding of the need for consideration of responsibilities to the health, safety and welfare of the fellow employees and the public it is an acknowledged requirement for the modern engineer/technologist. During study abroad courses, how did the emphasis on health and safety matters compare to the typical level of emphasis on them at your home institution.
    1. Much greater emphasis
    2. Somewhat greater emphasis
    3. Emphasis was about the same as at home institution
    4. Somewhat less emphasis
    5. Much less emphasis

29. An understanding of their responsibilities to behaving honestly, objectively, and with integrity and to not do anything directly or indirectly to maliciously injure the reputation, practice or livelihood of others is an important code of practice for the modern engineer/technologist. During study abroad courses, how did the emphasis on these matters compare to the typical level of emphasis on them at your home institution?
    1. Much grater emphasis
    2. Somewhat greater emphasis
    3. Emphasis was about the same as at home institution
    4. Somewhat less emphasis
    5. Much less emphasis

30 . The ability to communicate effectively with the engineering community and with society at large is an acknowledged requirement for the modern engineer/technologist. During study abroad courses, how did the emphasis on these matters compare to the typical level of emphasis on them at your home institution?

    1. Much greater emphasis
    2. Somewhat greater emphasis
    3. Emphasis was about the same as at home institution
    4. Somewhat less emphasis
    5. Much less emphasis

31. Overall, which of the following components of the study abroad experience do you perceive as having been the most valuable in terms of its effectiveness in developing the skills, attitudes and behaviors required by the 21st century engineer/technologist?
    1. The academic learning undertaken in prescribed courses
    2. The skills and competencies developed by having to experience and adopt to living in a different culture and institution
    3. The social skills developed by social engagement with new people
    4. Friends and acquaintances from very different backgrounds to my own
    5. Exposure to the work culture as presented in class or experienced during fieldtrips