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Annual Reports

Teaching Fellowships

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2015

## DIT Teaching Fellowships Reports 2014-2015

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# **DIT Teaching Fellowship Reports 2014-2015**

**College of Arts and Tourism**

**College of Business**

**College of Engineering and Built Environment**

**College of Sciences and Health**

**Supporting the Strategic Themes of Diversity,  
Modularisation and E-learning**



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# Foreword

This publication provides a collation of reports of research conducted as part of the 2014-2015 DIT Teaching Fellowship scheme. The DIT Annual Teaching Fellowships were established in 2009 as part of Cycle II of the HEA's Strategic Innovation Funded Enhancement of Learning (EoL) strand of the Dublin Region Higher Education Alliance (DRHEA).

The aim of the DIT Teaching Fellowships is to support key college based educational research projects linked to the Institutional Learning, Teaching and Assessment strategic priorities. (See Appendix A for the DIT Learning, Teaching and Assessment Strategy Framework, approved in December 2014). The title of "Teaching Fellow" is awarded to an individual or a team, nominated by the college and who would undertake a research project to support the enhancement of learning and/or curriculum development at a programme, school or college level over a one academic year period. It is intended that evidence gathered from the studies will be utilised to inform relevant policy, practice or similar institutional research activities into the future. (See Appendix B for Teaching Fellowships Evaluation and Feedback.) This is of particular relevance in this year, as we look forward to the imminent merger between Dublin Institute of Technology, Institute of Technology Blanchardstown and Institute of Technology Tallaght, Dublin and the application for University status as a Technological University in the future.

The establishment of Teaching Fellowships has been a very successful venture for the DIT and the projects are now financially supported by the DIT. However, this would not have been possible without the generous support provided through the Directorate of Research, Enterprise and Innovation Services and the four institutional Colleges. This funding has enabled the successful completion of 42 Fellowship projects over the last four years with the resultant research outputs helping to inform both policy and practice across the Institute. This level of success is, in part, due to the enthusiasm and dedication of all the award recipients and the DIT staff who have supported the Fellowship projects throughout each academic session. I would also like to thank the College Heads of Learning Development and/or local Awards Contacts, my Learning, Teaching and Technology Centre colleagues who have supported the Fellows over the last year, and Dr Claire McAvinia who has been responsible for collating this report publication.

**Dr Jen Harvey, Head of the DIT Learning, Teaching and Technology Centre**





# Summary Overview of 2014-2015 Projects

## College of Applied Arts and Tourism

Jennifer Hamilton: **Conservatory of Music and Drama**



### ***Acting for Opera Singers***

As the majority of classically trained singers will earn a significant part of their living in the opera profession, it is vital that DIT is able to provide fit-for-purpose education for these trainee artists. With the increase in popularity of live cinematic opera relays along with the expectation that all live theatre needs to be as dynamic and visually compelling as TV and Cinema, there has, over the last thirty years, been an increase in the expectation that opera singers should be equally skilled actors. Previously, that expectation was not a priority. Therefore, the objective of my Teaching Fellowship project would be to identify and clarify the range and detail of acting and performance skills required of opera singers today, in order to be able to compete successfully in the international opera industry. The purpose of the prime research will be to interview Directors, Performers, Conductors, Teachers and other members of the profession working internationally and in Ireland. This is in order to identify any possible curriculum gap and also to arrive at a summary of what skills and resources are expected of singers in this field both at audition level and in performance. The conclusions of the research will inform the content and delivery of my own teaching of these subjects and also form the basis for a future publication.

Theresa Ryan, Ziene Mottiar, Bernadette Quinn, Catherine Gorman, Kevin Griffin, Ruth Craggs, Deirdre Quinn:  
**Hospitality Management and Tourism**



### ***Students in Action Initiative***

The Students in Action Project is a student focused tourist destination project which seeks to establish deep and meaningful engagement between destinations, industry, community and DIT (staff and student) partners. It is run by a team of lecturers in the School of Hospitality Management and Tourism in DIT. The key objectives of this project are to offer support to a tourism destination and its related organizations over the course of an academic year in the form of focused project work and research, and in so doing to provide students with 'real life' experience which enhances their educational experience and skills development. As part of this project approximately 200 students, from six different modules, will be visiting Wexford during this academic year and addressing project work on issues such as the tourism product in the town, evaluating the heritage of Wexford as a tourist attractor, investigating the whole area of events in Wexford, collecting the views of tourists in Wexford, coming up with ideas of how Wexford could engage in e-tourism, and developing new business ideas. The best of this work will be presented back to Wexford to help them in their future plans for the area. In addition to the positive outcomes in terms of student experience, and the data and perspectives that the destination gains, the project also involves the submission of a book chapter and conference paper on this topic. Thus this project has multiple benefits and outcomes in terms of teaching and learning, engaging with industry and community, and research outputs.



## College of Business

Maeve O'Connell: **School of Accounting and Finance**

Lorraine Sweeney: **School of Retail and Services Management**



### ***An Action Plan for Implementing the Principles for Responsible Management Education in College of Business Programme Learning Outcomes***

As part of its mission, the College of Business at DIT is committed to being recognised for contributing to the wellbeing of the community through the education of outstanding responsible managers and corporate leaders. In support of this commitment the project will seek to develop an understanding of the range of options available to the College of Business to embed principles for responsible management across all aspects of the College's education portfolio. Related to this the project will develop a set of criteria by which programmes can be assessed and by which learning outcomes can be developed with evidence of mission achievement relating to responsible management education capable of being measured and assured. The project will review best practice identified under the Principles for Responsible Management (PRME), which were developed in 2007 by an international task force under the coordination of the UN Global Compact. This task force developed a set of six principles which lay the foundation for the global platform for responsible management education and supports shared learning between PRME signatories.

## College of Engineering and the Built Environment

Niall Holmes, Una Beagon: **School of Civil and Structural Engineering**



### ***Introducing PBL into Civil and Structural Engineering***

The objective of this project is to introduce Problem Based Learning (PBL) into two second year modules on the DT004 and DT024 degree programmes. The benefits of PBL are a deeper understanding of lecture material by students which will greatly enhance their educational experience in DIT to develop problem solving and collaboration skills. This approach has been successful in other Irish Civil Engineering courses as it departs from the traditional 'what I am told I need to know' to 'what I need to know to solve the problem' promoting self-directed learning. Lecturers in turn transition from the giver of information to the facilitator of learning through support, guidance and monitoring. The applicants have met with Professor Tom Cosgrove from the University of Limerick who uses PBL in almost all of their Civil Engineering Undergraduate programmes. It is therefore proposed to introduce an active learning element into two Concrete Technology modules by replacing traditional laboratory exercises with a project requiring students to design, test and report on a series of concrete mixes and aggregate samples in the context of a real life assignment. Previously the concrete mix, what tests to perform and the methodology were all supplied. This project, carried out in groups, will require students to apply the theoretical knowledge from lectures thereby increasing their understanding of the material, developing their learning and teamwork skills and appreciating the context in which engineers work. Both applicants currently deliver these modules which will be sustained in future years after this project is complete.

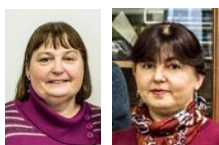


## College of Sciences and Health

Aidan Meade, Aaron MacRaghne, Elizabeth Gregan, Izabela Naydenova, Fran Pedreschi: **School of Physics**



### ***Exploring technology enhanced instruction and assessment in the advanced physics laboratory***



Laboratory instruction is a hugely important component of teaching and learning in the experimental sciences, particularly so in physics. This project will remodel senior physics laboratories to adapt to changing skillsets required in the workplace and to instil the graduate attributes necessary for flexible employment in physics and related disciplines. The objective of the project is to foster an enquiry-based model which has been shown to help engage the students with their subject and to foster expertise in their subject area. Furthermore, peer-cooperative learning has been demonstrated to increase learning gains, retention of knowledge, and engagement. This fellowship application will use e-assessment methods to foster and incentivise the collaboration between students in a senior laboratory environment, while allowing individualised development of laboratory experimentation skills. The project will implement electronic documentation of student work, collaboration and reflection within an online environment. This form of electronic data recording further complements the skillset required in the workplace and in further study. A number of evaluation techniques are proposed to measure the impact of these changes.

Sara Boyd: **School of Food Science and Environmental Health**



### ***DIT International: Development of an International Study Abroad Ireland Public Health Module***

The overall aim of this project involves the research and development of an International Study Abroad Module in Public Health in the College of Sciences and Health. It is envisaged that this module will be validated as and be available on the international educational market. The first project objective includes the research and development of the module content. The module will be structured into three core areas. These include cultural, heritage and public health. It is hoped that this module template could be utilised and applied across DIT. The cultural and heritage aspects of the module would remain constant whilst the third area could be developed by each School or Department in accordance with the expertise in their chosen area. For the Teaching Fellowship the module will focus on International Public Health Issues. The second project objective includes the compilation of a business plan for the module to include the costing, delivery and promotion of the validated module. The development of such an International Study Abroad Module will further enhance the international identity of DIT and should appeal to a wider educational audience with regards to development of their understanding of Public Health issues along with the gaining a positive international experience in Ireland.

Catherine Barry-Ryan: School of Food Science and Environmental Health



***TrackEngage: Tracking student engagement in learning resources and its correlation to their performance***

Student attendance has a minimum requirement in a number of Science based modules, both in DIT and ITB. This has led to staff developing their own laborious recording methods for student attendance. Student numbers have grown substantially, and a number of modules are co-taught with other courses (90+ in some modules). Also there has been a large evolution in teaching and learning methods employed in recent years such as Problem Based Learning and group work etc which all require student attendance. Most of the modules delivered use Webcourses (DIT) or Moodle (ITB) as a teaching support tool with staff investing a lot of time and effort. This project plans to investigate student engagement in these teaching resources through monitoring their attendance at lectures, practicals and tutorials and their use of Webcourses. It will also survey their self-directed learning activities. This engagement will be correlated to module performance. To complete this project we will develop an efficient and robust recording system of student attendance (easy to use, cost effective and rapid) based on their student cards. Develop a protocol to capture student interaction with Web based teaching and learning resources. These tracking tools will be piloted on lab based modules in DIT and ITB. Reliable data on correlation of engagement against student performance will be analysed and interrupted. This system would allow for reflection and review of course delivery and interaction. Students 'at risk' due to low or lack of engagement could be highlighted early in the Semester.

# **College of Applied Arts and Tourism**

# 1 Acting for Opera Singers

Jennifer Hamilton

Conservatory of Music and Drama

Contact: [jennifer.hamilton@dit.ie](mailto:jennifer.hamilton@dit.ie)

## Abstract

As the majority of professional classical singers earn a significant part of their living in opera, it is vital that conservatoires and studios are able to provide fit-for-purpose education for these trainee artists. As opera productions today are increasingly influenced by the trends in cinema and live-streamed media, this study sought to identify and clarify the range and detail of acting and performance skills required of opera singers in this evolving professional environment. A significant part of the data collected relates to the participants' perceptions about the relevance of technical stagecraft skills. These techniques mainly relate to how performers negotiate and occupy space when on stage, in terms of angle, direction and distance.

The main component of the investigation has been conducted through a series of online and live interviews with a wide profile of practitioners including stage directors, performers, conductors, designers, teachers and intendants (company managers - usually artistic directors). The questions have been devised in order to evaluate the skills, resources and attributes which singers need to acquire in order to be able to succeed in this competitive industry.

The data revealed the fact that opera singers today are required to possess a high standard of acting skills. The investigation also confirmed that there is an increasing demand for these performers to be instigative and creative in the rehearsal process while working collaboratively. The findings also revealed that all the performers in the study consciously employ technical performance skills.

The conclusions from the investigation proposed that conservatoire programming therefore needs to incorporate technical performance training along with classes which will engender and develop creative and imaginative resources. It is advisable that these skills are contextualised regularly through participation in performance projects.

**Keywords:** *opera, acting, singers, stagecraft, conservatoire, multidisciplinary*

## Introduction

A brief scan of the web-sites of major international conservatoires would reveal that vocal departments strongly promote their opera programmes, indicating that opera appears to be sustaining a position in the market place.

As opera singers also have to be convincing actors, the purpose of this study has been to obtain more detailed information about what those professional expectations are today. The findings were collated from online feedback from a broad profile of professional performers, directors, and teachers working in opera. The data also included feedback from 'live' interviews with a conductor, a drama teacher and a director who also works in theatre and film.

The online questionnaire was devised to elicit feedback on the following:

- Perceptions about influences and/or trends in productions today
- Professional expectations; skills, resources and attributes necessary for singers to engage successfully in the profession
- Perceptions about the utilisation of technical skills; with particular reference to stagecraft
- Recommendations for relevant programme implementation in conservatoires

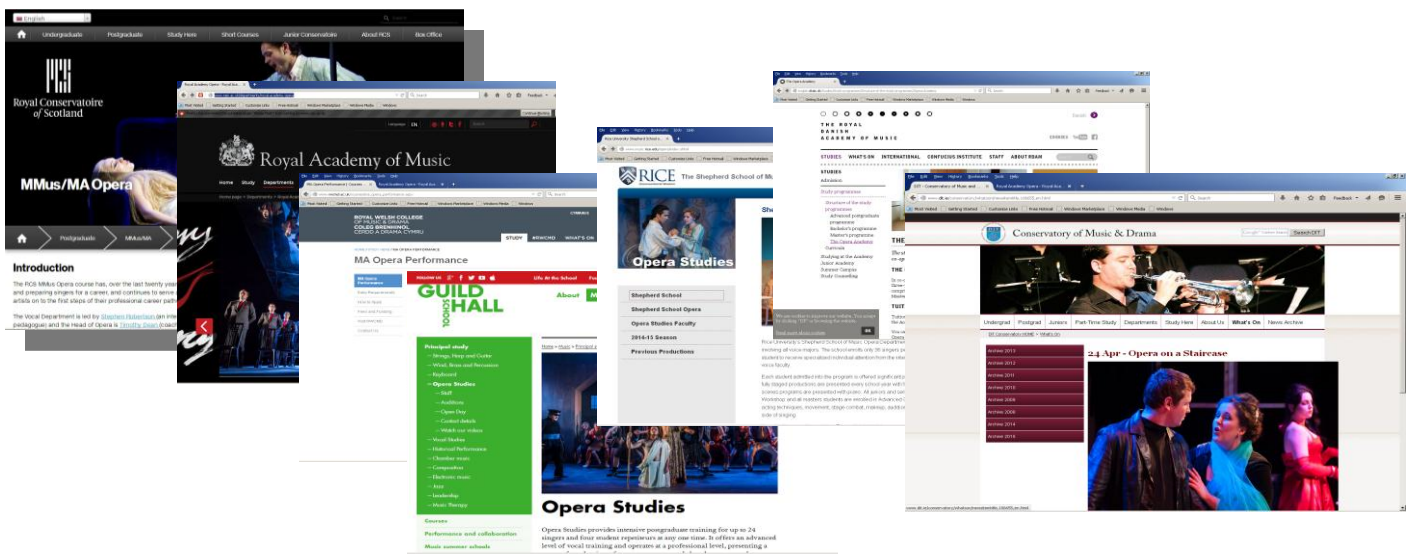


Figure 1.1: Conservatoire opera department web-pages

## Literature Review

*The Cambridge Companion to Opera* (Till 2012) provides informative articles about the evolution in production trends over the last ten years. These have been very useful in helping contextualise this study. In terms of forming recommendations for programme development, it was also useful to obtain an overview of the current attitudes towards multidisciplinary study in conservatoires.

Reformulating the idea of what a musician could be - what he or she has beyond a technical proficiency in one instrument - is highly relevant to the work-place, as musicians now need many strings to their bow. (Gregory 2005: 298)

As many of the findings reflected a current imperative for opera singers to portray realistic and believable characterisations, *Stanislavski on Opera* (Stanislavski and Rumyantsev 1975), a collection of writings about the Russian stage director Constantin Stanislavski's innovative direction of the Bolshoi Opera Studio in the 1920s, still provides an approach to dramatic characterisation which is equally pertinent today. With reference to current publications, David Ostwald's *Acting for Singers: Creating Believable Singing Characters* (Ostwald 2005) provides a commendable methodical approach towards dramatic interpretation.

While there is a reasonable body of such literature which focuses on the psychological approach to acting skills for singers, there appears to be less contemporary material which focuses on matters pertaining to stylistic awareness and technical performance technique (often known as stagecraft).<sup>1</sup> My own teaching experience at undergraduate and postgraduate level has for some time led me to conclude that many vocal students need to assimilate technical principals before they are able to channel their creativity and imagination in rehearsal and performance. It would therefore seem logical that this subject would be adequately reflected in publication. I have been curious to understand what the apparent literature gap might be indicating and how these techniques are currently perceived in the profession.

## Outline of Project Methods

This qualitative investigation was undertaken as a thematic analysis of data retrieved through a series of online questionnaires with a broad profile of 19 practitioners including directors, performers, teachers, conductors, designers and *intendants* (company managers – usually artistic directors) working in Ireland and abroad. These practitioners

<sup>1</sup> Stagecraft is also a term which can refer to scenery building skills.



ranged from major international *intendants* to fledgling performers who are just starting their careers. Live interviews were subsequently held with one director, one conductor and a drama teacher. In agreement with the participants, identities have been withheld in publication.

- Eleven Directors (including two director/*intendants*, one director/designer and two director/teachers)

The profile range of the directors included one practitioner at the beginning of their career, two international *intendants* and an Oscar-winning film director who also directs straight theatre and opera. One of the director/teachers is Head of Opera Department in a major European conservatoire.

- Eight Performers (including one performer/teacher/director)

The profile of the performers ranged from three principal soloists who have been performing for more than fifteen years in major international opera houses to three young singers who have recently graduated from post-graduate study.

- One Conductor (also artistic director of a European opera company)
- One Drama teacher (former course coordinator in a European Conservatoire opera department)

The findings were primarily collated in order to determine any prevalent viewpoints, whilst also comparing and contrasting divergent opinions. The process of analysis was mainly conducted through collating similar vocabulary and phraseology.

- Findings pertinent to a particular topic were drawn from a range of questions.
- The findings were further investigated in order to identify any patterns common to either the performer or non-performer cohorts.
- The collation of anomalous and contradictory opinions formed the final part of the investigation.

## Findings

### Influences and Trends

All the participants confirmed that acting skills are significantly important. There was a strongly held perception among the older performers that there has been an increase over the last ten years in these requirements.

#### Cinematic influence

Eight participants made specific reference to the cinematic/TV influences on opera production:

'The presentation and direction of opera has changed significantly since the 60/70/80s when young and successful stage directors and designers moved into the world of opera bringing the skills of theatre and film production into the genre – Visconti, Zeffirelli, Hall, Miller, Brook.'  
(Participant 7, 2014)

The consequence of this influence was generally felt to imply that singers are increasingly expected to produce characterisations which are '*realistic*', '*truthful*', *appropriate to 'intimate close-up work'* or '*naturality*' (Participants 1, 3, 5, 6, 2014).

Several directors stated that they wished that singers would aspire more towards a deeper commitment to acting, instead of being preoccupied with their voices. However, most of the performers spoke of the challenges implicit in the current demand for dramatic realism, particularly with reference to the need to maintain the necessary physical posture, flexibility and strength to be able to sing demanding vocal lines.



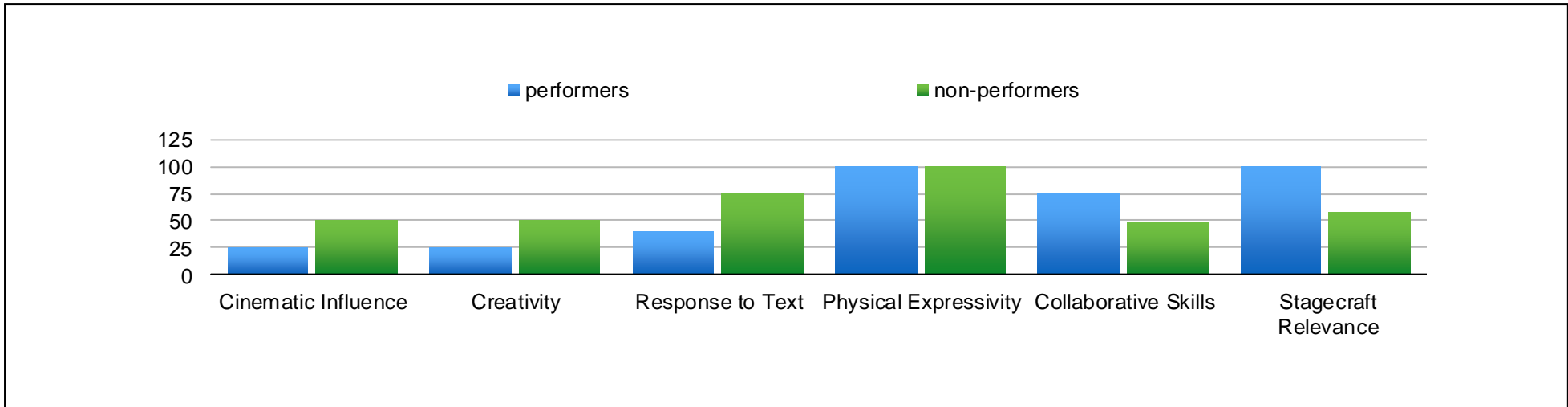


Figure 1.2: Major themes from the findings

## Physical Image

'The singer's body now is required to fit the description of the character, Lulu, Butterfly Mimi.'  
(Participant 7, 2014)

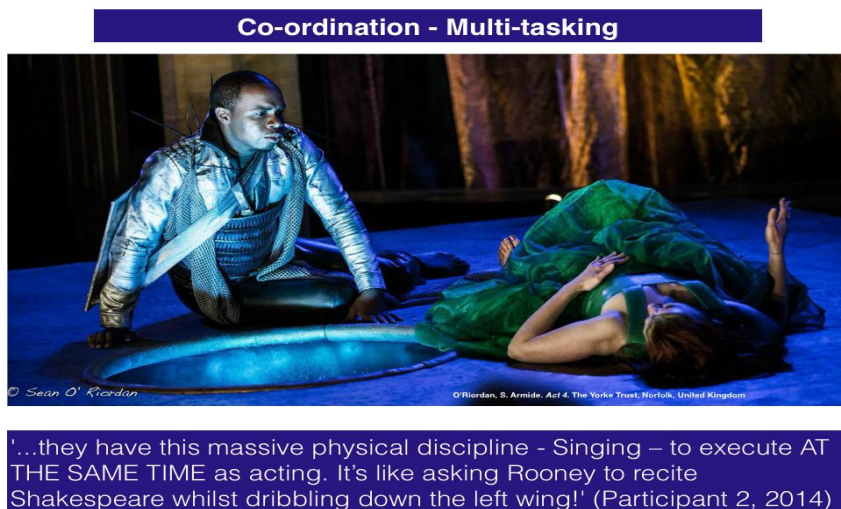
In relation to cinematic influences, three singers and four directors remarked on the current demand for singers to possess role-appropriate physical appearance.

## Professional Expectations: skills, resources, attributes

'Of course she can sing beautifully, of course she can act/dance ... now what else has she got?'  
(Participant 16, 2014)

The feedback from every single participant reflected the fact that opera singers today have to be multi-skilled. The need to be able to work in a team and to work creatively and imaginatively was a very strong priority reflected in the directors' findings. Many of the directors referenced imagination and creativity; equally, five out of eight of the performers' online interviews indicated that they are conscious of an expectation to be able to instigate and improvise in the rehearsal process.

## Physical Co-ordination and Expressivity



*Figure 1.3: Operatic multi-tasking*

All the participants commented that the ability to express emotional information through the body is a prime requirement. All the findings also reflected the fact that there is an expectation for singers to be sufficiently physically coordinated in order to be able to sing demanding vocal lines while acting with naturalness and credibility. This expectation is possibly informed by the HD cinematic influence in the industry. Some directors wished that singers were more adept in this field while some singers felt that certain directors had a lack of understanding of the physical demands required to sing. However the findings were unanimous in stating that a high level of coordination is a very necessary requirement to be involved in a production today. The following performer's account of his responsibilities onstage illustrates this:

'I had to steer a left handed car with my right hand (... with only inches of margin for error, or I would have fallen into the pit or got stuck on the stage) and operate a smoke machine with my left. That was complicated!' (Participant 15, 2014)

## Text

'The ability to act with the voice – and especially the declamation of words. That is the heart of a singing actor.' (Participant 2, 2014)

Eight directors and the conductor expressed an expectation and/or wish for singers to have a strong relationship with text. This was generally revealed as a bigger preoccupation with directors than performers. In live interview, the conductor spoke in detail about the fact that singers who audition with fluent and accurate linguistic delivery make a much more positive impression.

The directors' references to text all related to an imperative for performers to have a deep and detailed understanding of the characters and narrative of the piece in which they are participating. This expectation would link to the other assumption that performers may need be ready to instigate and improvise in rehearsal, and would consequently need to be well prepared in the research and understanding of the role they are portraying.



*Figure 1.4: Example of 'cheating'*

## Stagecraft

The questions about stagecraft elicited some of the most interesting findings in the study. Stagecraft skills are techniques which relate to how performers negotiate and occupy space when on stage, in terms of angle, direction and distance. One of the most important of these techniques is known as 'cheating'. The prime function of this skill is to facilitate projection out to the audience, and in opera, to maintain a line of visual contact with the conductor. This in turn enables the performers to negotiate the use of space with their fellows and play out when necessary while also maintaining spatial relationships with each other. Other stagecraft include finding light, coordinating footwork, handling props, stylistic use of period costume etc.

While the performers unanimously expressed their belief that stagecraft is a very relevant part of their skill-set, the non-performers were not unanimous in this. One highly experienced practitioner felt that the skills were 'old-fashioned' and another very experienced interviewee stated that he believed that these abilities were 'instinctive'. Of those directors who did vouch for the relevance of these techniques, two of the responses were relatively ambivalent.

## Conclusions

It is advisable to develop multidisciplinary training in opera skills at both undergraduate and postgraduate level. These modules could be greatly enhanced through interdisciplinary collaboration with other schools and it is possible that students in other disciplines could attend these classes as electives in other programmes.

There appeared to be a misalignment of perception between performers and non-performers in several findings. Similar disconnects between voice and drama practitioners were also reflected in the commentary. It would be advisable therefore to embed more congruencies and connections between these disciplines.

## Recommendations to DIT

Although some of the recommendations for conservatoire training are already in place at DIT, the study would indicate that further programmatic provision would be desirable. As this could quickly become unrealistically expensive, the following recommendations are based on ideas which could be incorporated into the existing structure or which could also be of use to other student cohorts. Implementation could additionally be made through forming professional links with existing companies.

### Professional Practice Class

Several participants strongly suggested that conservatories should provide practical professional advice and guidance delivered by members of the industry. This would seem to be a very sound recommendation and could include guidance about professional self-preservation and career sustainability. This could include advice about appropriate role choices, as there seems to be an implicit risk with ref to cinematic influence in productions, for young singers being asked to play image-appropriate roles which may yet be too vocally demanding for them.

The demand for appropriate physical image however is unlikely to disappear, yet the reality of this situation is at odds with increasing conditions in Higher Education for 'correctness' in tutor/student feedback. For example, in certain conservatoires, tutors are requested not to discuss weight issues with students.

Therefore, the implementation of Professional Practice Class may be a very valuable forum, where these professional realities could be discussed and shared in a group setting without the situation becoming over-personalised. These sessions would be in the form of 'from the coal-face' consultations, where visiting professionals would come to discuss relevant issues with the students. Such a class could incorporate discussion and information about such professional factors as agents, role types, time-management strategies, memorising strategies, audition techniques, rehearsal etiquette, personal presentation. Professional practitioners are usually only too willing to share their experience, and this therefore may not be a costly addition to a programme if it is planned to coincide when visiting personnel are working in Dublin.

### Movement classes

As 'physical coordination, flexibility and expressivity' appeared significantly in the findings, it would be advisable to provide *regular dance/movement classes*. These may well appeal to other cohorts of students (drama students for example) and the implementation of these sessions may also go some way to address issues relating to physical fitness and appearance.

Stylistic awareness with reference to movement and body language however could be greatly enhanced if students were able to attend classes in *art history* and *media studies* where they could assimilate a deeper understanding of the aesthetics relating to a particular era. Creativity, imagination and confidence in improvisation may well be enhanced through exposure to a broader spectrum of cultural awareness. Such cross disciplinary study could be facilitated at DIT and would merit further investigation.

## Textual and linguistic support

Text work can be incorporated further into Acting for Singers classes. However, as the recommendations also pertained to linguistic ability, this is another area which requires ongoing implementation. This year at DIT, we incorporated text work from the French and German song classes into projects in the Acting for Singers classes. Students were encouraged to explore the poetry of the songs in greater depth and detail by creating characterised dramatic monologues out of the texts. This is an approach which could be developed and evaluated further. From a linguistic point of view, there may be opportunities to forge further links with relevant schools.

## Stagecraft tuition

As stagecraft skills were strongly commended by all the performers, it would be advisable to continue to include these as part of the Acting for Singers class. The findings lead one to surmise that the reason there isn't more literature in this area is because the techniques are practical, pragmatic, and not considered to be particularly 'artistic'. While all the performers spoke of the practical relevance of the techniques in their professional careers, the non-performers appeared to be more ambivalent. This may suggest that this is a subject which is not particularly discussed in the professional rehearsal process, as it is assumed that all performers have already acquired these techniques by osmosis. Contextualising stagecraft skills would therefore be advisable. These can be explored in devised improvisations, but are perhaps easier to assimilate when taught in tandem with preparation for public performance.

## Proposed Future Work

A publication and DVD about Acting for Singers which address the issues which arose from the study could be a valuable learning tool. I would hope to start work on such a project with DIT colleagues and students in the future.

## References

- Gregory, S. (2005) *The creative music workshop: a contextual study of its origin and practice*. In G. Odam & N. Bannan, (eds). *The reflective conservatoire: Studies in music education*. London: Ashgate Publishing Ltd and GSMD.
- Ostwald, D (2005) *Acting for singers : creating believable singing characters*. New York: Oxford University Press
- Stanislavski, C. & Romyantsev, P. (1975). *Stanislavski On Opera*. Ed. and trans. E. Hapgood. New York: Routledge.
- Till, N. (ed) (2012) *The Cambridge Companion to Opera Studies*. New York: Cambridge University Press

## Further Reading

- Dublin Institute of Technology Conservatory of Music and Drama. (2015, March 20). *What's On*. Retrieved from DIT Conservatory of Music and Drama: [http://www.dit.ie/conservatory/whatson/newsitemtitle\\_106655\\_en.html](http://www.dit.ie/conservatory/whatson/newsitemtitle_106655_en.html)
- Guildhall School of Music and Drama. (2015, March 20). Opera Studies Cover Page. Retrieved from Guildhall School of Music and Drama: [http://www.gsmd.ac.uk/music/principal\\_study/opera\\_studies.html](http://www.gsmd.ac.uk/music/principal_study/opera_studies.html)
- Rice University Houston. (2015, March 20). Sheperd School Opera Studies Department. Retrieved from: <http://www.music.rice.edu/opera/index.shtml>
- Royal Academy of Music. (2015, March 20). Royal Academy Opera. Retrieved from Royal Academy of Music: <http://www.ram.ac.uk/departments/royal-academy-opera>
- Royal Conservatoire of Scotland. (2015, March 20). MMus Opera. Retrieved from Royal Conservatoire of Scotland: <http://www.rcs.ac.uk/postgraduate/masters-music-mmus/opera/>
- Royal Danish Academy of Music. (2015, March 20). Opera Academy. Retrieved from Royal Danish Academy of Music: <http://english.dkdm.dk/Studies/Study-programmes/Structure-of-the-study-programmes/Opera-Academy>
- Royal Welsh College of Music and Drama. (2015, March 20). MA Opera Performance. Retrieved from Royal Welsh College of Music and Drama: [http://www.rwcmd.ac.uk/courses/ma\\_opera\\_performance.aspx](http://www.rwcmd.ac.uk/courses/ma_opera_performance.aspx)



## 2 Students in Action Initiative

Theresa Ryan, Ziene Mottiar, Bernadette Quinn, Catherine Gorman,  
Kevin Griffin, Ruth Craggs, Deirdre Quinn

### School of Hospitality Management and Tourism

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### Abstract

The *Students in Action Project* in the School of Hospitality Management and Tourism was established in 2012 as a way of engaging students and working with stakeholders in a destination. The overall aim of the project was to immerse students in an active collaborative learning environment within the destination to identify ways in which tourism could be enhanced. In the 2014/2015 academic year the project involved over 300 students from a variety of programmes and modules working with local stakeholders in Wexford Town. To date the project has been successful in its aims to develop staff, student and community engagement and has generated positive impacts in terms of lecturer and student collaborations and has also provided substantial outcomes for the destination. Going forward, while posing challenges in terms of funding, timetabling and logistical issues, the project provides extensive opportunities for further enhancement of student engagement and collaborative learning.

**Keywords:** *Student engagement, collaboration, learning, tourism destinations*

### Introduction

The *Students in Action Project* was developed in the School of Hospitality Management and Tourism as a means of engaging students in an active collaborative learning environment. Underpinned by the knowledge that student engagement is 'a key factor for learning and personal development' (Salaber 2014: 115) the development and application of the *Students in Action Project* involved students from across a number of programmes and modules working with the local community and businesses in Wexford during the 2014-2015 academic year. Cognisant that a greater emphasis on engagement with wider society has for some years now been a key objective of many higher education institutes and authorities, the overall aim of the project was to involve students in a multi-faceted project to the benefit of the students, the destination and all members of the community. Underpinned by Hunt's (2011) recommendation for students' engagement with the wider society to become more firmly embedded in the mission of higher education institutions, the project held at its core a key objective of providing a better educational experience by involving students in a project that ultimately developed staff, student and community engagement. The project explored many aspects of student engagement and applied these through collaborative learning with the stakeholders within the destination.

### Outline of Project

The primary aim of the *Students in Action Project* was to counter what Eyler and Giles (1999) refer to as the isolation of learning from experience through providing students with a real world venue in which they could apply the skills they learned during their course (Owen and Hill 2011; Bandy, 2014). In doing so, the project aimed to develop both discipline specific and transferable skills. It was a means of building on the work being done individually by a number of lecturers who had through their modules been engaging in field trips on an annual basis, through focusing the attention of a number of modules and programmes on one destination during one academic year. This provided the students with an opportunity to address many issues that the destination was experiencing from a number of different perspectives, and to build on their overall knowledge and skill base. The project was a collaborative approach between lecturers, students and stakeholders and its key objectives are outlined in Table 2.1.

Students in Action Project 2014/2015	
<b>Objective One</b>	To offer support to a destination over the course of an academic year in the form of focused project work and research.
<b>Objective Two</b>	To provide students with 'real life' experience to enhance their educational experience and skills
<b>Objective Three</b>	To provide a more integrated approach to module assessment across programmes
<b>Objective Four</b>	To provide an opportunity for lecturing staff to enhance their knowledge and aid the development of new teaching materials and techniques

Table 2.1: Students in Action Project Objectives

## Project stages

The project involved two phases: Planning, and Implementation and Evaluation and each involved a number of key stages as follow.

### Phase One: Planning

- Stage 1: Selecting a destination, Wexford town (Figure 2.1) was chosen as an appropriate destination for the 2014/2015 academic year based on the key criteria for selection which included:
  - The existence of a strong tourism community
  - Within broad proximity of Dublin and the DIT
  - Evidence of wide ranging issues relating to tourism and hospitality, thus providing a rich foundation for student assignments and experiences.

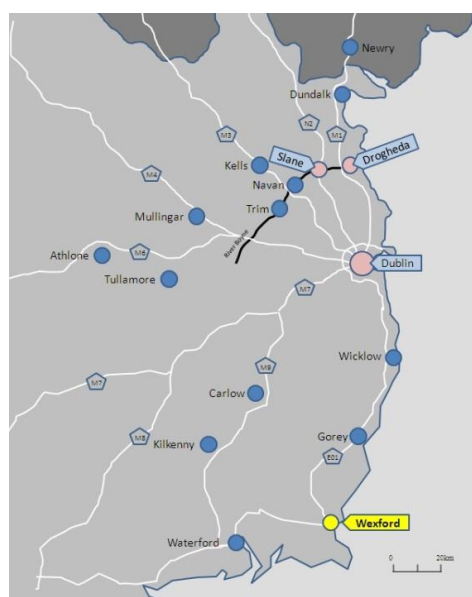
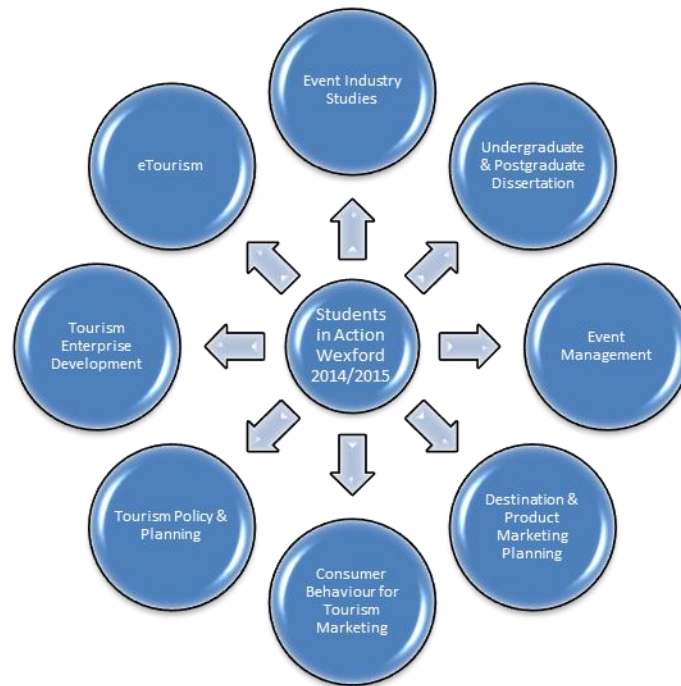


Figure 2.1: Wexford town, the destination chosen for the 2014/2015 project



- Stage 2: Initial contact was made to discuss the project and to get agreement for involvement from destination stakeholders. Subsequent to this initial consultation, meetings were undertaken with a variety of stakeholders in the destination; this established key points of contact and clear lines of communication.
- Stage 3: Core team members sought expressions of interest from fellow lecturers.
- Stage 4: Module content, expected learning outcomes and relevancy were explored with a view to complementing all stakeholder requirements. This process was negotiated firstly with the core team outlining the project at a school meeting and subsequently engaging with colleagues on an individual basis as appropriate. The modules that were included in the project were decided on by the core team and the destination stakeholders, and are presented in Figure 2.2.



*Figure 2.2: Modules involved in Wexford Students in Action Project 2014/2015*

- Stage 5: Project refinement leading to a final proposal that was agreed by all involved and was ready for action on commencement of Semester 1.
- Stage 6: Organisation of site visits for each semester with a focus, programme and content pertinent to the different programme groups, the academic timetable and module needs.

## **Phase Two: Project implementation and evaluation**

- Stage 1: Briefing students on the project and module requirements, and field trips. Emphasis was placed on explaining the opportunity for them to make a difference by applying their knowledge to a 'real life' situation. Useful theoretical and industry material links relevant to both the module content and destination were made available through various channels of communication both online and offline.
- Stage 2: Students undertook activities in the classroom to prepare them for site visits to Wexford.
- Stage 3: Site visits were planned and undertaken. Collaboration between the lecturers and the destination stakeholders was essential to their execution and success. Content varied according to requirements but generally involved the provision of short talks and presentations by tourism and hospitality stakeholders (Figure 2.3) followed by visits to relevant sites and/or meetings with appropriate individuals or businesses (Figure 2.4). Time was provided for specific module and assignment work to be undertaken and students were also provided with free time during which they were encouraged to wander and explore the destination, to get a 'feel' for the place and to engage with local people.



*Figure 2.3: Student briefings by key stakeholders in Wexford*



*Figure 2.4: Students on a site visit in Wexford*

- Stage 4: Reflection on and continued engagement with the destination through assignment and dissertation completion and submission.
- Stage 5: Co-ordination of students' assignments and key recommendations. Individual evaluation process with students on completion of each module.
- Stage 6: Dissemination of findings at a feedback event at the National Heritage Park, Wexford. Formal presentation of students' findings to Wexford stakeholders using a range of media; poster presentations, reports, oral presentation and videos (Figures 2.5 and 2.6 show photographs taken at the feedback session with examples of the posters and presentation). The posters generated through student work will be on display in the National Heritage Park, Wexford.



*Figure 2.5: Poster presentation*



*Figure 2.6: Students presenting their findings*

The event was attended by a number of members of the County Wexford Age Equality Network who took part in the *Students in Action Project* (Figure 2.7).



*Figure 2.7: Members of the County Wexford Age Equality Network attending the feedback event in Wexford*

- Stage 7: Student Awards event to congratulate students who achieved excellence in their contribution to the project. The lecturer of each participating module nominated a group or individual based on their assignment work and the students were presented with a certificate in recognition of their achievement (Figure 2.8).



*Figure 2.8: Students in Action Award Ceremony*

### **Community Participation**

Community participation embracing the DIT Students Learning with Communities initiative formed the basis of assessment for the Destination and Product Marketing Planning module. Two student cohorts followed this module which involved collaboration with the County Wexford Age Equality Network and Wexford Local Development (WLD). In order to undertake the assignment which specified engagement with senior members of the community, a series of focus groups between the students and the member of the network were undertaken during a site visit to Wexford in February 2015. Input from the senior group influenced the output of this module and contributed towards intergenerational engagement as well as fulfilling the learning outcomes. The Age Equality Network/ WLD and the selected students received a DIT Access and Civic Engagement, Students Learning with Communities Award for their work in April. This resulted in very positive feedback from both students, Wexford Local Development and the Age Equality Network. A conference paper is currently being prepared building on this collaboration.



Figure 2.9: (left to right) Dr Noel O Connor, Director, Student Services, DIT, Sarah Lawler, BSc in Tourism Marketing, Sean Kinsella, County Wexford Age Equality Network, Rachel Lennon, BSc in Tourism Marketing

## Evaluation and Conclusions

The feedback session was an opportunity to gather all stakeholders together in order to highlight the project outcomes, disseminate the findings, and bring the project to a conclusion. The event was held in the Heritage Park in Co. Wexford where refreshments were available to attendees who could examine the posters and attend a presentation of students' findings. This was followed by a question and answer session and members of the Wexford community also took the opportunity to thank the students for their work and to comment on the quality and extent of what had been achieved.

An individual evaluation process took place with the students on completion of each module through institutional quality assurance measures. In addition more extensive feedback has been sought from students in both verbal and written forms with a view to building on the experience and addressing challenges going forward. Findings from this research indicate that student engagement projects and research can help students to deepen their understanding of course content and enable them to integrate knowledge and theory with practice. Indeed, some DIT students reported that they 'felt more involved than [with] other assessments', and liked the fact that 'it was based on real life situations and could actually have an effect on people's lives' and that they 'got to interact with the community and get their views and opinions'.

Other benefits for students include the development of transferable skills and the application of various types of skills, for example, critical thinking, reflective practice and problem solving. This is particularly pertinent for final year undergraduate students and postgraduate students, where the project or research may require higher level thinking. Alternatively, for first year undergraduate students, community engagement projects and research can provide a good introduction to a topic or issue, motivate students and enhance their skills in working collaboratively. Finally, engagement projects provide enjoyable experiences for students beyond the classroom and an alternative assessment to a typical essay, report or group project.

Community benefits include collaborative learning with students, improved relationships with the college, the opportunity to educate future professionals about community needs, knowledge exchange and a useable end-product for the community, i.e. research reports, idea generation and problem solving. Community stakeholders have been found to value the enthusiasm, expertise and ideas of students and they explicitly identify the benefits they gain from the project outputs. Furthermore, community stakeholders can help throughout the project in a dynamic way, developing project and assessment ideas with academic staff to create a useable end-product for their community and gain increased access to college resources.



## Future of the Project

The *Students in Action Project* has succeeded in its objectives of engaging students in an active collaborative learning environment and has generated positive impacts in terms of lecturer and student collaborations and has also provided substantial outcomes for the destination. A key challenge going forward for the project is finding suitable partners for collaboration. In order to be successful the project requires all stakeholders to be totally committed and it is imperative that partners are found in destinations and communities that want to work with students, and where there is scope for collaboration and engagement. The project also has a number of challenges in relation to matching course content with the project and in relation to funding and timetabling issues. Despite these challenges, the *Students in Action* team have already begun plans for the 2015/2016 academic year and have made initial contact with key stakeholders at a destination, who are eager to be part of the project and discussions are currently taking place in relation to taking the project forward.

## Recommendations to the DIT

Key recommendations include:

- Greater support in terms of funding for projects such as *Students in Action* that encourage and develop greater student engagement.
- Increased support for developing opportunities for cross-collaboration both within and across colleges and schools.
- Greater recognition and support for colleagues involved in such projects, much of which encompasses a great deal of organisation and development beyond the scope of timetabled work.
- Embedding a particular emphasis on the building of relationships with stakeholders so that the achievements of the present can be maximised into the future and across projects.
- Employ a more structured approach to orienting students to the varied project locations.

## Dissemination activities

To-date the project has achieved the following:

- Dissemination of findings with key stakeholders at an event held in the Heritage Park in Co. Wexford.
- Dissemination of findings and award ceremony in DIT Cathal Brugha Street.
- Publications:
  - Craggs, R., Gorman, C. Griffin, K. Mottiar, Z. Quinn, B. & Ryan, T. (2015) '*Collaborative learning in a 'real-world' destination: Student perceptions of their learning outcomes*' Paper presented at the 2014 ATHE Conference: CO-CREATION IN TOURISM TEACHING & LEARNING. 4th-5th December 2014 at The Royal Society of Edinburgh .
  - Craggs, R., Gorman, C. Griffin, K. Mottiar, Z. Quinn, B. & Ryan, T. (2015 Forthcoming) 'Students in Action', a destination-based learning approach to student engagement in Benckendorff, P. & Zehrer, A. (Eds.) *International Handbook of Teaching & Learning in Tourism*, Edward Elgar.
- Further planned outputs
  - A conference paper on the collaboration with the County Wexford Age Equality Network and Wexford Local Development (WLD) is currently being developed.
  - Research is currently being undertaken with students who have been involved in the project. The findings of this research will be used as the basis of a paper for publication in an international peer reviewed journal in the area of Tourism Education.

## References

- Bandy, J. (2014) *What is Service Learning or Community Engagement?* Accessed on 17<sup>th</sup> September 2014 from <http://cft.vanderbilt.edu/guides-sub-pages/teaching-through-community-engagement/>
- Eyler, J. and Giles, D. (1999) *Where's the Learning in Service-Learning?* Jossey-Bass: San Francisco.
- Hunt, C. (2011) *National Strategy for Higher Education – Report of the Strategy Group*, Irish Department of Education and Skills, Dublin
- Owen, D. and Hill, S. (2011) *Embedding Public Engagement in the Curriculum: A Framework for the Assessment of Student Learning from Public Engagement*. NCCCPE, 201. Available at: [http://www.publicengagement.ac.uk/sites/default/files/publication/assessing\\_student\\_learning\\_from\\_pe.pdf](http://www.publicengagement.ac.uk/sites/default/files/publication/assessing_student_learning_from_pe.pdf) Accessed 12th September 2014.
- Salaber, J. (2014) Facilitating student engagement and collaboration in a large postgraduate course using wiki based activities. *The International Journal of Management Education* (12): 115- 126.

# College of Business

### 3 An Action Plan for Implementing the Principles for Responsible Management Education in College of Business Programme Learning Outcomes

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#### Report Part A: A Literature Review of the Teaching of Ethics in Higher Education

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##### Abstract

Recent corporate scandals have resulted in criticism of business schools for graduating students who put too much emphasis on shareholder value and profit maximisation but neglect the broader social and environmental context in which businesses operate. This research fellowship set out to review current literature of ethics education in third level universities and institutions to determine best practice in the area. It also set out to review the reports of the signatories of PRME (Principals for Responsible Management Education) to develop an understanding of the range of options available to the College of Business to embed principles for responsible management across all aspects of the College's education portfolio. This paper analyses a comprehensive literature review of the teaching of ethics in higher education. It reviews the importance of teaching ethics in higher education and reviews *what* should be taught and *how* best to teach this. Traditional teaching methods have been criticised for their over emphasis on theoretical and conceptual analysis and have given way to a more interactive, inclusive, problem based approach to business ethics education.

**Keywords:** *ethics, corporate social responsibility, higher education, active learning*

##### Introduction

Business schools have been criticised in recent years for graduating students who put too much emphasis on shareholder value and profit maximisation but neglect the broader social and environmental context in which businesses operate (Rasche, Gilbert and Schedel 2013). It has been argued that business schools need to put more emphasis on ethics within their programmes (Gu and Neesham 2014; Vendemia and Kos 2013). As part of its mission, the College of Business at DIT is committed to the education of outstanding responsible managers and corporate leaders. This project set out to review current literature of ethics education in third level universities and institutions to determine best practice in the area. It also set out to review the reports of the signatories of Principals for Responsible Management Education (PRME) to develop an understanding of the range of options available to the College of Business to embed principles for responsible management across all aspects of the College's education portfolio. This paper reviews current literature in the area of ethics in higher education.



## Outline of Project

### Literature Review

Corporate scandals that illustrate greed and rampant materialism have led to an increased distrust for business leaders (Crossan et al. 2011), whether fraud, embezzlement or insider trading, these scandals have led to a lack of faith in the manner in which business is conducted (Vendemia and Kos 2013). Such behaviours are not only harmful to the well-being, performance and reputation of organisations but they are detrimental to society (Birtch and Chiang 2014; Gu and Neesham 2014). One of the key factors that lead to such disasters is the unethical decisions of business leaders (Gu and Neesham 2014). Cavanagh (2009: 20) has noted that the leaders responsible for these scandals are graduates of our 'best business programs', he goes on to argue that business schools have 'failed to convey ethics, social responsibility and good moral habits to their graduates'. Business schools are often mentioned when people are asked what and who may be to blame for many of the corporate scandals economies have experienced in recent years (Sigurjonsson, Vaiman and Arnardottir 2014). They are considered responsible for not producing ethical managers and entrepreneurs (Gu and Neesham 2014). As the business news continues to be inundated with scandals 'business schools must find a better way of impacting the attitude of their graduates' (Vendemia and Kos 2013: 95).

The Association to Advance Collegiate Schools in Business (AACSB 2013) launched a task force in ethics education to prepare a report on the state of ethics education in business schools. The report requested business schools undergo a 'renaissance' in ethics education that would prepare tomorrow's leaders for ethical dilemmas in business (Waples et al. 2009). It recommended that member schools 'renew and revitalize their commitment to ethical responsibility', 'strengthen ethics components of our curricula in all disciplines' and 'offer courses that introduce frameworks that may help in resolving ethical business and managerial problems' (Dzurainin, Shortridge and Smith 2013).

### The Necessity for Teaching Ethics in Higher Education

Both graduate and undergraduate business programmes should include learning experiences that enhance the ethical understanding, reasoning skills and awareness of ethical responsibilities of their students (Dzurainin, Shortridge and Smith 2013). However, debate exists among educators as to the method of delivery, content and assessment criteria regarding business ethics education (Waples et al. 2009). Ethics is treated like any other learning outcome; their accomplishment is the responsibility of the business school (Vendemia and Kos 2013).

Business schools play an instrumental role in laying the foundations for ethical behaviour and socially responsible actions in the business community (Birtch and Chiang 2014). Undergraduate students need a foundation in ethics and ethical decision making as part of their education (Hurt 2006). The move to a global, service based economy, coupled with new technology has increased the pace of change and decision making within business. This has increased the importance of ethical in education (Waples et al. 2009). According to Dzurainin, Shortridge and Smith (2013) the need for ethics in education is as important now as it was after the wave of corporate scandals in the early 2000s. As the business news continues to be inundated with scandals, business schools 'must find a better way of impacting the attitudes of their graduates' (Vendemia and Kos 2013: 95). Crossman et al. (2013: 286) pose the question 'How are we changing the way we educate leaders today to ensure that they make a more positive difference in the world tomorrow?'

Evans and Weiss (2008) found that more than 80% of their respondents including CEOs, business college Deans and Faculty agreed that more emphasis should be placed on ethics in education. Less than 1% disagreed and 80% of respondents agreed that 'A concerted effort by business schools to improve the ethical awareness of students eventually will raise the ethical level of actual business practice' (Evans and Weiss, 2008: 51). A study of managers view of ethical teaching carried out by Sigurjonsson, Vaiman and Arnardottir (2014) that 60% of managers disagreed that ethics should be thought in the workplace. Some 90% agreed that students should have strong ethical standards before entering the workforce while 92% felt it is the responsibility of business schools to assist their students in becoming

more socially responsible and more ethically sensitive. According to Vendemia and Kos (2013) the question is not whether ethics in business warrants attention. Rather, by what means should this issue be addressed.

## What to Teach?

Waples et al. (2009) argue that the focus should be on developing an awareness of ethical issues, an understanding of the moral reasoning process specifically within the organisational context. Similarly, Dzurainin, Shortridge and Smith (2013) argue that there are two key learning outcomes. Firstly, *increased awareness of ethical issues*. This learning outcome aims to provide graduates with a greater perception and understanding of personal values, business ethics, corporate social responsibility and their ability to identify ethical issues (Vendemia and Kos 2013). It is also important that students develop an understanding of the consequences of unethical behaviour. This was noted as a critically important factor within a study of business school deans and business students (Floyd et al. 2013).

Secondly, *enhanced decision making skills*. The purpose of this learning outcome is to enhance decision making skills, to improve the graduate's ability to make thoughtful, deliberate decisions. This might involve exposing the student to a number of ethical theories and decision making frameworks. Vendemia and Kos (2013) similarly identify the ability to solve ethical problems in business as an important learning outcome. Floyd et al. (2013) argue that providing students with information about theories and concepts of ethical decision making is widely acknowledged to be a critical factor in teaching business students. According to Crossan et al. (2013) increased training in ethical decision making skills can positively impact a student's level of moral development and thus lead to more ethical behaviours associated with character strength. Indeed, Sigurjonsson, Vaiman and Arnardottir (2014) study found that managers argue for strengthening students' self-confidence in making ethical decisions, as they believe this to be missing.

## How Best to Teach Ethics in Higher Education

At the heart of the business ethics debate is the question 'What is the most effective way to teach business students about ethical behaviour and moral decision making?' (Floyd et al. 2013). According to Gu and Neesham (2014) formal ethics teaching programmes tend to be too abstract for students to be able to contextualize successfully. Rule prescription is often too general, inflexible and removed from the personal experiences of individuals to be able to motivate them into engagement (Edelstein and Krettenauer cited in Gu and Neesham 2014: 529). Traditional teaching methods which can be criticised for their over-emphasis on theoretical and conceptual analysis have given way to a more interactive, inclusive, problem based approach to business ethics education (Birtch and Chiang 2014).

Sigurjonsson, Vaiman and Arnardottir (2014), in their study of managers, found that when asked how ethics should be taught; the most common answer was to use the past to demonstrate the impact of unethical behaviour in business. It was commonly thought that this may be done through the use of case studies. The use of case studies helps the student think through the ethical decision making process. A well-taught case creates awareness of the ethical issue, allows for critical judgement of alternatives and encourages the formulation of an intention to act ethically (Crossan et al. 2013). Waples et al. (2009) advocate the use of case studies in ethical teaching as they provide the opportunity for the student to heavily engage in the learning process as well as facilitate transfer of learning to the world of work. These case studies should have a strong focus on implementation (Crossan et al. 2013). Students may be encouraged and supported in ethics case competitions (Dzurainin, Shortridge and Smith 2013).

Active learning is important in this area (Dzurainin, Shortridge and Smith 2013). Experiential methods may be incorporated to move students from knowing what is good to actually doing good. For example, role playing where students are put in character stretching situation can result in positive character development (Crossan et al. 2013). In addition, extra-curricular activities such as mentoring and volunteering aim to develop skills and capabilities in business ethics as an integral part of the whole person education agenda (Birtch and Chiang 2014). Inviting guest lecturers from industry that have dealt with ethical dilemmas in business to share their experience is a good method to teach ethics (Crossan et al. 2013; Dzurainin, Shortridge and Smith 2013; Sigurjonsson, Vaiman and Arnardottir 2014).

Swanson and Fisher (cited in Floyd et al. 2013: 754) have argued that it is 'common practice in business schools of marginalizing ethics by scattering ethics topics superficially and incoherently across the curriculum'. They note that less than one third of all accredited business schools offer a stand-alone course in business ethics to graduate or undergraduate students. There is on-going debate as to whether a business school should provide a single stand-alone course on business ethics or incorporate ethics into all subjects that it is considered important to be included in. Ketcham (2003) suggests that stand alone ethics courses may be rigorous but few colleges utilise this approach partly because it is difficult to identify qualified and willing staff.

Birtch and Chiang (2014) argue in favour of the integration of ethics into all relevant modules rather than providing a stand-alone module. Integration across modules contextualises ethical issues, signals to students that ethics is an important part of business functions and broadens the range of topics addressed (Dunfee and Robertson 1988). While Sigurjonsson, Vaiman and Arnardottir (2014) point out that ethics is found in every facet of business life – be it finance, accounting, marketing, strategy or human resource management – they argue that the goal should be to show students that they cannot really escape encountering ethical considerations.

However, such an approach may result in repetitious learning outcomes. An integrated approach is difficult to evaluate. The use of a stand-alone module allows for the analysis of the specific content and a direct measure of the course's impact (Vendemia and Kos 2013). According to Ritter (2006) the ideal situation occurs when student learn basic philosophical theories underlying ethical decision making in a stand-alone module and ethics is also further integrated throughout business modules which may allow the student apply the concepts to specific contexts. Dean Krehmeyer (cited in Floyd et al. 2013: 756), Executive Director of Business Roundtable, advocated that business schools provide 'both a stand-alone course and the integration of ethics into the other core disciplines'.

Ethics teaching should be part of the strategy of the business school. According to Sigurjonsson, Vaiman and Arnardottir (2014) it should not be the responsibility of an individual faculty member to decide whether and how business ethics are delivered in his/her course, but that this should be part of an overall strategy and embedded into the structure of the school. Rasche, Gilbert and Schedel (2013) similarly argue that effective ethics education requires structural changes to the curriculum, in particular more mandatory ethics courses and a stronger integration of ethics related debates into disciplines such as finance and accounting is required. This raises the question as to whether ethics modules should be optional or mandatory. Vendemia and Kos (2013) are in favour of mandatory modules. Sigurjonsson et al. (2014) survey of managers found 91% believe an ethics module should be mandatory at third level business education. The argument can be made that optional modules are 'preaching to the converted'.

According to social learning theory, individuals learn what acceptable behaviour is by observing cues and information from their environment or their ethical climate (Birtch and Chiang 2014). An ethical climate is defined as 'the prevailing perceptions of typical organisational practices and procedures that have ethical content' (Victor and Cullen 1988: 10); in other words, the elements of the environment that determine what constitutes acceptable ethical behaviour. Trevino Weaver and Reynolds (1998) argued that one can expect that the ethical climate of a business school can play a significant role in shaping its students' ethical values and behaviours. Individuals learn from their environment, not only from formal standards and policies but informal norms about what is acceptable and unacceptable. Business schools should explicitly recognize and reward the ethical values and behaviours of their students (Birtch and Chiang 2014; Crossan et al. 2013, Floyd et al. 2013).

## Conclusion

In summary, this paper has highlighted the need for ethics to be taught in business schools. Business schools have been criticised for graduating students with insufficient moral standards (Cavanagh 2009: 20) and have been encouraged to place more emphasis on 'impacting the attitude of their graduates' (Vendemia and Kos 2013: 95). Debate exists among educators as to the method of delivery, content and assessment criteria regarding business ethics education (Waples et al. 2009). Key learning outcomes include increased awareness of ethical issues (Dzurainin, Shortridge and Smith 2013;

Floyd et al. 2013; Vendemia and Kos 2013; Waples et al. 2009) and enhanced decision making skills (Floyd et al. 2013; Vendemia and Kos 2013).

In addition to considering *what* to teach, it is also important to determine *how* best to teach ethics. Literature has argued in favour of a more interactive, inclusive, problem based approach to business ethics education (Birtch and Chiang 2014; Gu and Neesham 2014). In particular, the use of case studies has been advocated (Crossan et al. 2013; Dzurainin, Shortridge and Smith 2013; Sigurjonsson, Vaiman and Arnardottir 2014; Waples et al. 2009) and the use of guest lecturers (Crossan et al. 2013; Dzurainin, Shortridge and Smith 2013; Sigurjonsson, Vaiman and Arnardottir 2014).

There is on-going debate as to whether a business school should provide a single stand-alone course on business ethics or incorporate ethics into all subjects that it is considered important to be included in. The ideal situation is one which uses both (Floyd et al. 2013; Ritter 2006). Another important consideration is whether the module should be mandatory or optional for students. Finally, the report also highlighted the importance of a culture of integrity within the business school which reinforces ethics teaching.

## Recommendations to the DIT

Based on the literature review the following recommendations are proposed for DIT:

### 1. Audit of current modules and programmes

This report recommends that the College of Business undertakes an audit of all modules and programmes within the college to identify the extent of responsible management teaching with the college. Following this, an audit of all module learning outcomes should be carried out to identify the extent to which responsible management is contained within all modules.

### 2. Audit of responsible management activities

An audit should be carried out of all the responsible management activities carried out within the college, for example research activity, community engagement and sustainability initiatives.

### 3. Discussion with staff

It is recommended that dialogue takes place with staff within the college of business to identify the level of interest in the area of responsible management within the college. This should aim to identify the extent to which staff feel that a responsible management module should be included within all programmes, what the key learning outcomes of this module should be, whether this module should be optional or core and how best this should be taught and assessed for example through case studies.

### 4. Steering Committee

It is envisaged that a strengthening of responsible management with the college and implementation of the PRME would involve a strong commitment from the college. It is recommended that a steering committee is established within the college. This should include members of management, academic staff and researchers. This group should meet regularly to review the progress of change of responsible management within the college and the progression toward signing up to PRME.

## Future Research

Ethics in higher education is an area requiring on-going rigorous research to allow researchers assess their activities and evaluate the success of their initiatives and benchmark the college against best practice. It is recommended that research continues and evaluates the implementation of the PRME within the College of Business, DIT.

## References

- AACSB (2013) Business Accreditation Standards. Available at: [www.aacsb.edu](http://www.aacsb.edu)
- Birtch, T. and Chiang, F. (2014) The influence of business school's ethical climate on student's unethical behaviour *Journal of Business Ethics* 123: 283-94.
- Cavanagh, G. (2009) What's good for business *America* 20(4): 20-22.
- Crossan M., Mazutis, D., Seijts G. and Gandz J. (2013) Developing leadership character in business programs. *Academy of Management Learning and Education* 12(2): 285-305.
- Dunfee, T. and Robertson, D. (1988) Integrating ethics into the business school curriculum. *Journal of Business Ethics* 7: 847-859.
- Dzurandin, A., Shortridge, R. and Smith, P. (2013) Building ethical leaders: A way to integrate and assess ethics education. *Journal of Business Ethics* 115: 101-114.
- Evans, F. and Weiss, E. (2008) Views on the importance of ethics in business education: survey results from AACSB Deans, CEOs and Faculty. In Swanson, D. and Fisher, D. (eds) *Advancing Business Ethics Education*. Information Age Publishing.
- Floyd, L., Xu, F., Atkins, R. and Caldwell, C. (2013) Ethical outcomes and business ethics: Toward business ethics education. *Journal of Business Ethics* 117: 753-776.
- Gu, J. and Neesham, C. (2014) Moral identity as leverage point in teaching business ethics. *Journal of Business Ethics* 124: 527-536.
- Hurt, R. (2006) We don't have ethics here... or do we? *Strategic Finance* (March): 16-18.
- Ketcham, A. (2003) Variations on the ethics component of the AACSB accreditation process. *Journal of the Academy of Business Education*. Available at: [www.abeweb.org/proceedings/proceedings03/proceed2003.html](http://www.abeweb.org/proceedings/proceedings03/proceed2003.html)
- Rasche, A., Gilbert, D. and Schedel, I. (2013) Cross-disciplinary ethics education in MBA programs: Rhetoric or reality? *Academy of Management Learning and Education* 12(1): 71-85.
- Ritter, B. (2006) Can business ethics be trained? A study of the ethical decision making process in business students. *Journal of Business Ethics* 68(2): 153-164.
- Sigurjonsson, T., Vaiman, V. and Arnardottir, A. (2014) The role of business schools in ethics education in Iceland: The managers' perspective. *Journal of Business Ethics* 122: 25-38.
- Trevino, L., Weaver, G. and Reynolds, S. (1998) The ethical context in organisations: Influences on employee attitudes and behaviours. *Business Ethics Quarterly* 8(3): 447-476.
- Vendemia, W. and Kos, A. (2013) impact of undergraduate business curriculum on ethical judgement. *Business Education Innovation Journal* 5(2): 95-101.
- Victor, B. and Cullen, J. (1988) The organisational bases of ethical climate. *Administrative Science Quarterly* 33: 101-125.
- Waples, E., Antes, A., Murphy, S., Connelly, S. and Mumford, M. (2009) A meta-analytic investigation of business ethics instruction. *Journal of Business Ethics* 87: 133-151.



# **College of Engineering and the Built Environment**

## 4 Introducing PBL into Civil and Structural Engineering

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### Abstract

The benefits of problem based learning for students are a deeper understanding of lecture material, and the development of problem solving and collaboration skills which will greatly enhance their educational experience. This approach has been successful in other programmes as it departs from the traditional '*what I am told I need to know*' to '*what I need to know to solve the problem*' promoting self-directed learning. Lecturers in turn transition from the giver of information to the facilitator of learning through support, guidance and monitoring. This project introduced an active learning element into two concrete technology modules by replacing traditional laboratory exercises with a project requiring students to design, test and report on a series of concrete mixes and aggregate samples in the context of a real life assignment. Previously, the details to conduct the laboratory were provided to the students. This project, carried out in groups, required students to apply the theoretical knowledge from lectures thereby increasing their understanding of the material, developing their learning and teamwork skills and appreciating the context in which engineers work.

**Keywords:** *Problem-based learning; research; activity; graduate attributes*

### Introduction

First introduced in the 1960s, Problem Based Learning (PBL) is an established pedagogy that involves learning through activity. Typically, a problem is introduced early in the semester which provides the context and motivation for the student's learning. PBL has been shown to provide a deeper understanding of lecture material by students while promoting problem solving and improving collaboration skills. Lecturers move from the giver of information to the facilitator of learning with a polar shift in students attitude where the traditional '*I am told what I have to do*' changes to '*what do I do to solve the problem*'. This in turn promotes self-directed learning, a lifelong skill in itself. Several studies have been carried out using PBL in a civil engineering context and results have indicated success in increasing the technical knowledge of lecture material. Results have also demonstrated increased engagement from students and evidence of critical thinking and deeper learning.

Here, a PBL project was carried out as part of two second year concrete technology modules in an ordinary (DT004/2) and Honours (DT024/2) degree programme. While the project concluded that PBL was effective in encouraging deep learning of the subject it also provided an insight into potential problems for the students in terms of adjusting to this new way of learning. It also notes the difficulty in scheduling sufficient time for students to prepare for and carry out the laboratory testing. The importance of smaller group sizes and using an appropriate marking scheme to assess the whole process are also highlighted.

A review of graduate attributes following the exercise was also undertaken. Graduate attributes include soft, key, employability, generic, non-technical and transferable skills. [2-3, 5-19] and are often interchanged. The Institute of Engineers of Ireland (IEI) regard graduate attributes to include the ability to



extract, through literature search or experiment, information pertinent to an unfamiliar problem that is within the current boundaries of the field; design and conduct experiments and, under guidance in a peer or team relationship, to analyse and interpret data; write technical papers and reports, and synthesise their own and their team's work in abstracts and executive summaries.

(Engineers Ireland 2015: 16)

These attributes have been developed in consultation with employers and should also form the backbone of engineering education. The results show, following surveys, that students felt these attributes did improve during this project.

## Project Outline

Current third year students from the DT004/3 and DT024/3 who had previously completed the laboratory element of the two modules in their 2<sup>nd</sup> year participated in a focus group where a questionnaire was presented and completed. Students were encouraged to reflect on what they enjoyed within the laboratory sessions and asked if they felt the proposal would be of interest and/or benefit. The main outcomes of the two focus group sessions showed that:

- students enjoyed the practical aspect of the laboratory;
- individual reports for each experiment were repetitive and unnecessary with group work preferred;
- the need for peer assessment was highlighted to ensure marks were attributed fairly amongst the group;
- an example of a professional report would be of benefit;
- there was disagreement on the attitude towards independent research with students still preferring detailed instructions;
- the introduction of a real life scenario would help bridge the gap between theory and practice;
- several students thought PBL would involve more work on their part.

The results from the focus group were used to design the intervention, particularly in relation to the extent of background information provided and the marking scheme.

## Design of the Intervention

The PBL approach was implemented into the two modules, one in each semester, over a 12 week period. The DT004 and DT024 class had 30 and 16 students respectively and split into groups. The DT024 class were split into four groups of four. However, due to timetabling issues, the DT004 class were split into three groups of ten. Each group was given their assignment in week 1 with different criteria for the concrete mix design.

Students were presented with two scenarios to mimic tasks comparable to those they may attempt in employment as a graduate engineer.

### Scenario One:

'A new quarry has just opened near to the location of a proposed motorway project. Your employer has been engaged to assess the quality of the aggregates contained within. You will be supplied with a sample of aggregate from the quarry and the following tests should be carried out in accordance with appropriate standards:

- Specific gravity;
- Particle size distribution of the quarries fine (<5mm) and coarse aggregate;
- Flakiness index;
- Elongation index.

Structural properties should also be assessed, namely the:

- Aggregate impact value;
- Aggregate crushing value;
- 10% fines'.

## Scenario Two:

Your employer has been engaged as the structural design engineer for a new concrete multi-storey car-park. Your concrete mix design (using justified assumptions) should satisfy the recommendations in EN206 and BS 8500 for concrete in a car-park environment. To provide confidence, the unreinforced compressive and tensile strengths should be determined using at least two methods and the results compared. The results from the compressive strength results should be assessed using an appropriate method to determine if the concrete is acceptable. All tests should be carried out in accordance with appropriate standards to satisfy the following criteria:

- Cube compressive strength;
- Flexural strength;
- Slump test;
- Compaction factor;
- Ultrasonic Pulse Velocity;
- Schmidt hammer strength;
- Indirect flexural strength'

Students were provided with material during lectures preceding the laboratory on the types of tests that can be carried out on aggregate samples and hardened concrete, but the specific details of each test were not covered. Students were also given an example of how a concrete mix design was carried out.

The work consisted of three laboratory sessions per group. Students in each group were expected to come to the laboratory session prepared with detailed information on how to carry out the tests in accordance with relevant national standards and present to the lecturer. The aggregate tests were completed first and the results were used as inputs for the concrete mix design. Students designed, cast and made samples for testing in the next session.

During this time, the tutors in the laboratory provided guidance but re-asserted that the research and preparation for the laboratory tests needed to be completed by the students themselves. Students were asked to keep a blog of their experiences of the laboratory session on Webcourses which provided good feedback for making changes to the second cycle of this project.

The culmination of the project was the production of a professional report and a presentation to the class and tutors on the methodology of the testing regime, but most importantly the reasoning behind the group's decision on whether to accept the aggregate supply or the concrete mix. This closely mirrors what a graduate engineer would be expected to do in a design office; research the task, make an assessment and decision and provide backup evidence on whether a supplier product is acceptable or not. Both scenarios were presented in one final report at the end of the semester.

## Data collection

Before the exercise started, students were surveyed to determine their perception of particular skills and abilities on a scale of 1-10 under the headings below. With the exception of technical knowledge, are desirable as graduates attributes identified in the literature:

- Technical knowledge of concrete
- Independent research
- Teamwork
- Time management
- Self-directed learning
- Team communication
- Problem solving
- Report writing
- Presentations
- Self-confidence
- Pro-activeness
- Innovation

- Articulation
- Personal effectiveness

The survey was re-taken by the students after the laboratories and the data used to assess the improvement in the range of skills outlined above.

## Findings

The findings from the two surveys before and after the project are reflected in two spider diagrams.

Figures 4.1 and 4.2 show the results from the Level 8 Honours degree class (DT024/2). As may be seen, all areas do show an improvement in ability but the extent of which are minor with the highest improvement in personal effectiveness. While these results are disappointing, this exercise was undertaken as a trial in Semester 1 so the findings could be reflected upon and fully implemented into DT004/2 in Semester 2. Feedback from the blogs confirmed that this was the first opportunity the students had had to carry out independent research. As second year students, this is perhaps a little unsurprising but highlights the importance of providing opportunities to develop these skills in the first year programme design. An increase in their ability to carry out independent research has also been identified as a benefit of PBL which noted an increase in both research and reading outside of the course.

Personal effectiveness and proactivity also shows an increase. This data is also backed up by one on one discussion's with the students and blog responses. The students felt that the group size of four was optimal as everyone was expected to contribute and they enjoyed the practical aspect of the laboratory sessions. Students were also asked to peer-review each other as part of the marking scheme and these results also show evidence that, in general, team members contributed equally. It is well known that students do not always engage in an honest appraisal of each other's work, but it was observed that peer assessment was closely aligned with the activity of particular group members. This is perhaps due to the overall mark for the laboratory part of the module worth only 20% and did not contribute towards a final year mark. The issue of grading is a recurring problem identified previously but has not been raised as an issue by students within this study.

The aim of the project was to identify areas where this approach did not enhance development of graduate attributes. The results show no particular areas where this is true. Students also noted in blogs that they felt they had run out of time as the reports and presentations were due on the last week of the semester, clashing with other deadlines. There was a very poor standard of presentations from all groups. They did not come well prepared and were significantly lacking in presentation skills.

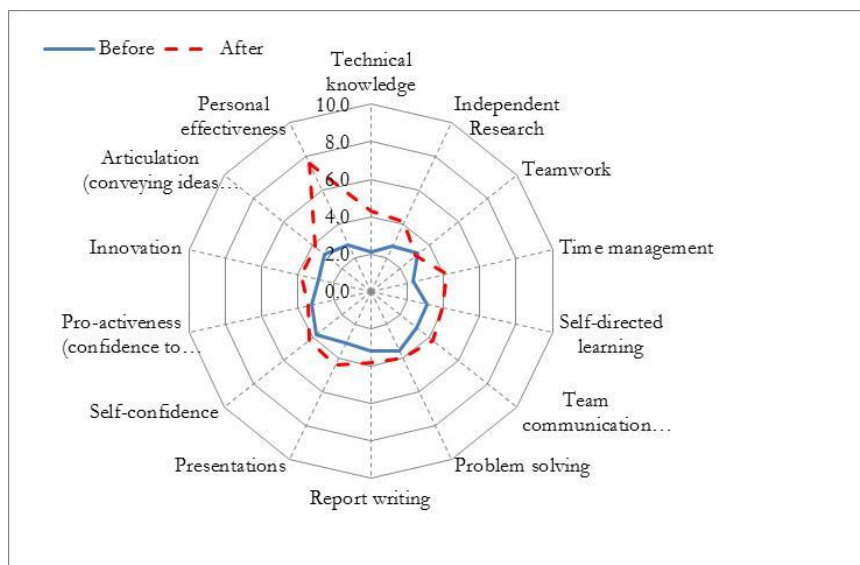


Figure 4.1: DT024/2 Spider diagram of graduate attributes before and after

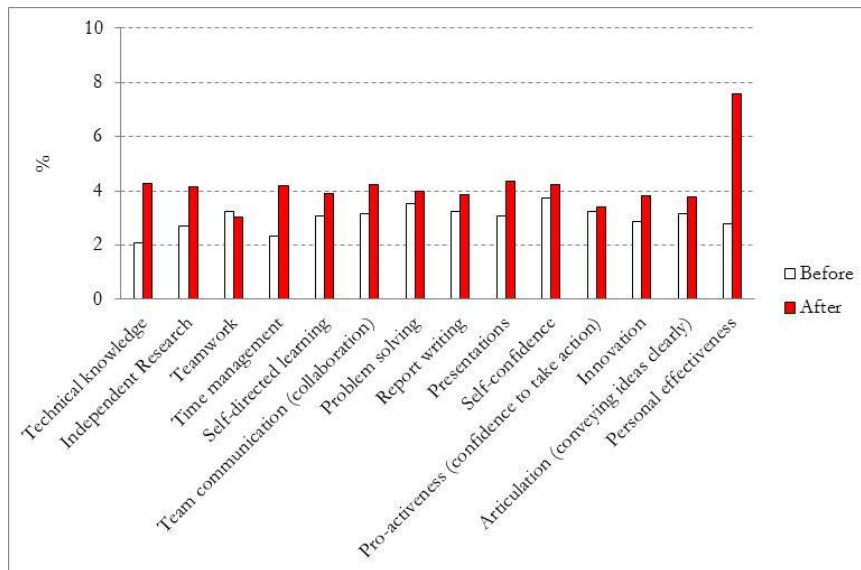


Figure 4.2: DT024/2 Improvements in graduate attributes before and after

Figures 4.3 and 4.4 show the improvements in graduate attributes before and after the exercise was introduced into the DT004/2 class. As shown, there is significant improvement in students’ perceptions of these abilities in all areas. The best improvement is in technical knowledge of concrete which is particularly pleasing and demonstrates that PBL was effective in improving concrete technology understanding from lectures.

From a purely academic point of view, it is pleasing to observe the largest increase in student abilities was in their technical knowledge of concrete technology. The results show an increase in students’ attributes in all areas and more so than for the DT024 class. This is due to the feedback received from DT024 following the trial implemented for DT004. Issues highlighted in terms of better referencing supplied to students, more in-depth presentations by the lecturer of what was required and strict adherence to having material ready before the laboratory began.

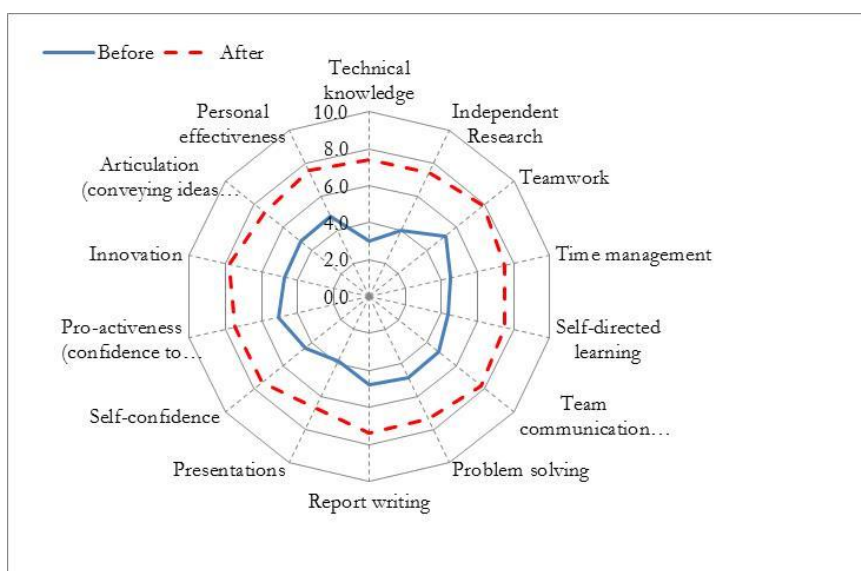


Figure 4.3: DT004/2 Spider diagram of graduate attributes before and after

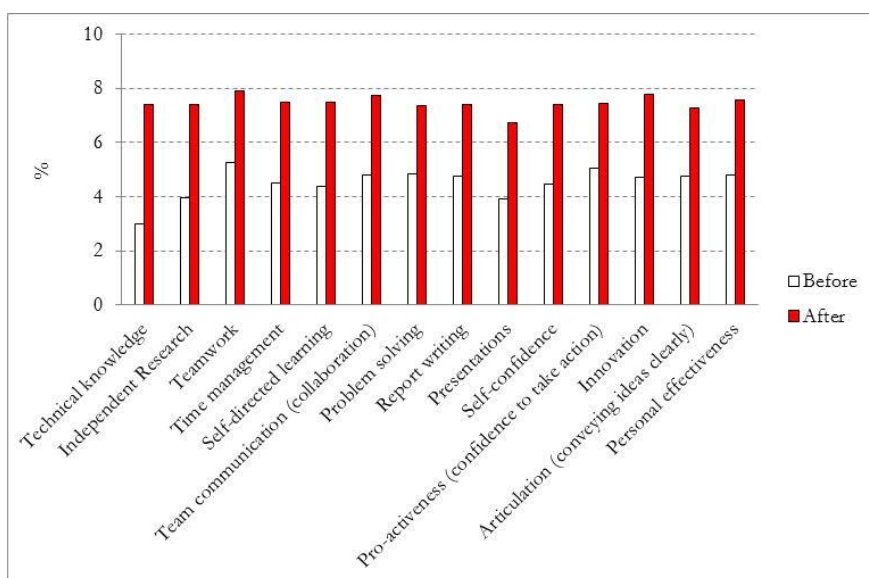


Figure 4.4: DT004/2 Improvements in graduate attributes before and after

## Evaluation and Conclusions

Overall, this first attempt to introduce PBL formally into two undergraduate programmes was well received by the students involved. They enjoyed the activity, the practical aspect of the tests and the fact that it was their designed concrete mix they were testing, not just some pre-determined recipe. Several students noted the obvious link between theory and practice.

It is clear that PBL is an effective teaching pedagogy to enhance deep learning of a subject, but unless the PBL project is designed with specific graduate attributes in mind, it can lack opportunities to develop deep learning including soft skills such as time management and report writing.

This was the first cycle of this project and changes will be made to further cycles in line with the recommendations. This is with a view to creating a PBL project which is focussed on providing opportunities for students to develop graduate attributes. It is intended that a longitudinal study is carried out to enhance this module over the course of several years.

## Recommendations to DIT

Below are the recommendations from this work.

- Groups should be asked to provide a five minute presentation at the beginning of each laboratory session identifying the research they have carried out beforehand. This will aid their presentation skills while enforcing the requirement to come prepared.
- A basic reading list should be provided to assist students in finding relevant information both for the testing regime but more importantly for the discussion of results.
- Students should be required to attend a library information session to assist in their independent learning.
- The project should be split into two, with each scenario requiring a separate report and presentation. Whilst this may result in more work for the students, feedback has suggested that this would help significantly with time management. It would also allow the tutors an opportunity to give feedback on report layout and presentation style half way through the semester.
- Groups should be required to produce a Gantt Chart at the start of the project, identifying each task and the deadline for each group member to have completed his/her task. This will expose students to aspects of forward planning, programming and project management.

## Future work

The authors are working within their School to formally implement PBL activities in undergraduate and postgraduate programmes. It is hoped, following consultation with colleagues that it be introduced into two modules per semester.

## Publications

Beagon, U & Holmes, N. (2014). The role of model making as a constructivist learning tool to enhance deep learning in a building technology module, *Irish Journal of Academic Practice*, Vol. 3 (1), 1-27

Beagon, U and Holmes, N (2015). Improving Graduate Attributes Using Problem Based Learning, *The 6th Research in Engineering Education Symposium – Translating Research into Practice*, Dublin Institute of Technology, 13-15th July.

## Bibliography

- Ahern, A.A. (2010) A case study: Problem –based learning for civil engineering students in transportation courses. *European Journal of Engineering Education*, 35(1): 109-116.
- Abdullah, S.R.S., Takriff, M.S., Ismail, M., Kalil, M.S., Daud, W.R.W., Mohammad, A.B., Rahman, R.A., Mohammad, A.W., Anuar, N., Abdullah, N., Harun, S., Kamarudin, S.K., Tasirin, S.M., Yaakob, Z., Jahim, J., Kofli, N.H.T., Markom, M., Rahman, N.A., Rahim R.R.R.A.A. and Rahaman, M.S.A. (2012) Analysis of Integrated Project Effectiveness in the Implementation of Generic Skills. *Procedia- Social and Behavioural Sciences*, 60: 512-521.
- ABET, *Accrediting Engineering Programs, Effective for Reviews During the 2015-2016 Accreditation Cycle*, Available from <http://www.abet.org>, (last accessed 4th January 2015).
- Baharom, S., Hamid, R., and Hamzah, N. (2012) Development of a problem based learning in concrete technology laboratory work. *Procedia- Social and Behavioural Sciences*, 60: 8-13.
- Crosthwaite, C., Cameron, L., Lant P. and Lister, J. (2006) Balancing curriculum processes and content in a project centered curriculum: In pursuit of graduate attributes. *Education for Chemical Engineers*, 1: 39-48.
- Dacre Pool, L. and Sewell, P. (2007) The key to employability: developing a practical model of graduate employability. *Education + Training Journal*, 49(4): 277 – 289.
- Engineers Ireland (2015) *Accreditation Criteria for Professional Titles*, Available from <http://www.engineersireland.ie/EngineersIreland/media/SiteMedia/email/jobs/EngineersIrelandAccreditationCriteria2014.pdf> (last accessed 4th January 2015).
- Fernandes, S. (2014) Preparing graduates for professional practice: Findings from a case study of project-based learning (PBL). *Procedia- Social and Behavioural Sciences*, 139: 219-226.
- Grant C.D. and Dickson, B.R. (2006) Personal skills in Chemical Engineering graduates: The development of skills within degree programmes to meet the needs of employers. *Education for Chemical Engineers*, 1: 23-29.
- Husain, M.Y., Mokhtar, S.B., Ahmad A.A., and Mustapha, R. (2010) Importance of employability skills from employers' perspective. *Procedia- Social and Behavioural Sciences*, 7(C): 430-438.
- Iborra, M., Ramirez, E., Tejero, J., Bringue, R., Fite, C. and Cunill, F. (2014) Re-vamping of teaching-learning methodologies in laboratory subjects of the Chemical Engineering undergraduate degree of the University of Barcelona for their adjustment to the Bologna process. *Education for Chemical Engineers*, 9: e43-e49.
- IOT Report (2011) *Engineering graduates: Preparation and Progression*. Institutes of Technology Honours Bachelor Degree Engineering Graduate Study. Dublin Institute of Technology.
- Iqbal Khan, M., Mourad S.M., and Zahid, W. M. (2014) Developing and qualifying Civil Engineering Programs for ABET accreditation. *Journal of King Saud University – Engineering Sciences*, 1-11.
- Jollands, M., Jolly L. and Molyneaux, T. (2012) Project-based learning as a contributing factor to graduates' work readiness. *European Journal of Engineering Education*, 37(2): 143-154.
- Kember, D. (2000) *Action Learning and Action Research. Improving the Quality of Teaching and Learning*, London: Kogan Page.
- Knobbs, C.G. and Grayson, D.J. (2012) An approach to developing independent learning and non-technical skills amongst final year mining engineering students. *European Journal of Engineering Education*, 37(3): 307-320.
- Le, K. N. and Tam, V. W.Y. (2008) On generic skill development: an engineering perspective. *Digital Signal Processing*, 18: 355-363.
- Markes, I. (2006) A review of literature on employability skill needs in engineering. *European Journal of Engineering Education*, 31(6), 637-650.
- Mutalib, A.A., Baharom, A., Razali, S.F.M., Hamid, R., Othman S.A., and Badaruzzaman, W.H.W. (2013) Development of professional competencies in the CSED curriculum at UKM, *Procedia- Social and Behavioural Sciences*, 102: 74-79.
- Veldman, F.J., De Wet, M.A., Ike Mokhele N.E., and Bouwer, W.A.J. (2008) Can engineering education in South Africa afford to avoid problem-based learning as a didactic approach? *European Journal of Engineering Education*, 33(5-6): 551-559.





## **College of Sciences and Health**

## 5 Exploring technology enhanced instruction and assessment in the advanced physics laboratory

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### Abstract

The development of a strategic, thoughtful and reflective approach to the undertaking of experimental work is key to the development of physicists and physical scientists. This project undertook to remodel senior physics laboratories to adapt to changing skillsets required in the workplace and to instil the graduate attributes necessary for flexible employment in physics and related disciplines. The objective of this project was to foster an enquiry-based model that has been shown both to help engage the students with their subject and develop habits of experimental approach appropriate to physical scientists. The project used e-assessment methods and electronic documentation of student experimental planning, reflection and data recording, while adjusting laboratory instructions and resources. These adjustments included minimising experimental procedures such that this created a less restrictive and more free-form experimental experience, challenging the students to plan prior to experimental work and reflect afterwards. A number of evaluation techniques were used to measure the impact of these changes, including an anonymised on-line survey using the University of Colorado E-CLASS (Colorado Learning Attitudes about Science Survey for Experimental Physics) survey and peer evaluation of experimental reports. The E-CLASS survey was also taken by School of Physics staff to provide a measure of the expert view. The success of this new approach to laboratory instruction is seen in the general alignment between student views of issues of importance in experimental approach. This innovative approach to laboratory instruction will continue to be evaluated and refined for future student cohorts.

**Keywords:** *technology, electronic instruction, physics laboratory*

### Introduction

Equipped with his five senses man explores the world around him and calls the adventure Science.

(Edwin Hubble, *Harper's Magazine* 1929)

Laboratory instruction and learning in the laboratory is a hugely important component of the development of professional scientists in the experimental sciences, particularly so in physics. This is often invisible outside of teaching institutes with the result that this type of instruction can be seen as unstructured and costly (Baruch 2014; Trumper 2003). Contrary to this view, students who learn to innovate and be creative within the laboratory can in the future apply these skills on a grander scale within a research environment or in the transfer of technological innovations to the market. Therefore engendering a degree of freedom to explore within the laboratory environment can be more fruitful from a learning perspective than in-class instruction alone (Baruch 2014). Where in-class instruction can actively engage students in solving conceptual problems using physical principles, in-laboratory instruction focuses on actively engaging students in solving problems of measurement or demonstration of physical effects. The learning outcomes and skills developed within each type of instruction are distinct, but of equal importance.

Laboratory instruction is often asked to reinforce the theoretical introduction of ideas that have been introduced within the lecture. Traditional laboratories typically demonstrate a well understood phenomenon or a well-defined quantity.

This can be illuminating but can also be limiting; students may not identify connections between concepts if they are not exposed to a wider view of examples from within their subject. This type of instruction can frequently be procedural, teaching students the technical aspects of performing experiments rather than the creative and inquisitive skills required for the design and refinement of experimental approaches, which is the essence of experimental physics (Zwickl, Finkelstein and Lewandowski 2013). It is the latter type of approach which is favoured within the senior laboratory as one which produces the skills of enquiry commonly viewed as being particular to a professional experimental physicist (Ibid.). In addition empowering students to be inquisitive in a logical and thorough manner allows them to explore beyond the boundaries of the experiment. This is closer to the authentic research experience of a graduate student where direction is limited and the student must strategise.

This approach to laboratory instruction can often be resource intensive, with staff to student ratios in the region of 1:10 often required (Beun 1971; Blue, Bayram and Marcum 2010; Zwickl, Finkelstein and Lewandowski 2013). It is also essential to give students adequate time for reflection coupled with appropriate intervention and feedback. Both of these requirements place stresses on the teaching resources within the laboratory. A further stress on this resource is generated by the need for oral assessment of progress within the laboratory; it is frequently difficult to ensure that timely feedback and/or appropriate oral assessment is given to the student.

## Recent Developments in Senior Physical Laboratory Instruction

Although the literature is replete with examples of the implementation and effectiveness of modern approaches to in-class instruction in physics (such as active learning) (Deslauriers, Schelew and Wieman 2011; Meltzer and Thornton 2012; Freeman et al. 2014), the same cannot be said of approaches to in-laboratory instruction. However, clear direction can be taken from the in-class active learning literature on the impact of active engagement and self-direction on comprehension and retention of knowledge, together with its engendering a sense of control and responsibility in students over their own learning (Deslauriers, Schelew and Wieman 2011; Freeman et al. 2014). Various examples of modernisation of laboratory programmes focussing on specific disciplines within physics have been described, including optical spectroscopy (Blue, Bayram and Marcum 2010), laser physics (Henningsen 2011), and quantum mechanics (Galvez et al. 2005; Pearson and Jackson 2010). At the University of Colorado, Boulder, a full renewal of a senior physics laboratory programme has recently been undertaken and is described by Zwickl, Finkelstein and Lewandowski (2013). Aside from modernising the experiments themselves, this work outlines a strategy for this process:

- (a) identifying a set of learning objectives is a key component of the overall process;
- (b) designing and optimising the experimental apparatus such that more than one experiment can be performed and more than one learning objective achieved using any given apparatus;
- (c) evaluation of learning outcomes using a combination of written and oral assessment;

Internationally there are a variety of learning goals in the senior laboratory experience, including the formation of their strategies around experimental design, the development of measurement technique, uncertainty analysis, computational modeling and inquiry oriented and research experiences. The learning objectives (LO) set out by Zwickl, Finkelstein and Lewandowski (2013) may be summarised as follows:

- 1 Modelling – this entails describing, or using a description of the physical system being investigated, together with modelling the measurement system being using during the investigation, and statistical analyses of data to compare with the mathematical description of the system.
- 2 Design – this entails designing the experimental apparatus together with appropriate trouble shooting.
- 3 Technical – this entails understanding the operation of test and measurement equipment, interfacing the experimental apparatus with computers and the associated data analysis software, and implementation of appropriate analytical techniques.
- 4 Communication – this entails producing cogent argumentation in favour of, or against, the hypothesis of the experiment on the basis of the experimental results, and communicating this through written reports and oral presentation.

Most senior laboratory programmes at university level have similar learning objectives, including those at the School of Physics in the Dublin Institute of Technology. While modernisation of equipment and design of modern experiments allowing deep enquiry into physical effects can be inspirational to students and can more readily engage them, supports must be put in place in the laboratory environment to allow students properly to achieve the learning objectives. In particular, tuition is often required to supply students with the fundamental knowledge of technical computing, interfacing and data analysis techniques as part of LO 3; a more efficient approach to this is to give students access to electronic video resources explaining the theoretical and practical aspects of these issues, with Q&A sessions given in the laboratory by a tutor (Zwickl, Finkelstein and Lewandowski 2013). LO 4 can be evaluated by oral examination of the student and evaluation of their written report, with almost immediate feedback. Difficulties arise in providing adequate feedback in a timely fashion to enable students achieve LO1 and LO2, mainly due to restrictions on teaching resources. Electronic asynchronous tutoring and peer-collaboration and tutoring may both be resources that might improve student achievement in this regard.

## Methods for Evaluation and Transformation of the Senior Physical Laboratory

Experimental science in the laboratory requires that students learn a range of skills and approaches to bring experimental investigation from the research question stage through experimental design, prototyping, result acquisition, analysis and interpretation, and evaluation of outcomes. This allows each individual student to become an independent, self-reliant investigator who can then use their inspiration and actively learn by examining their own ideas and attempt various avenues of investigation. This transformation agenda is intended to give students a passion for experimental science and a confidence in their habitual approaches and strategies. Capturing the evolution of the students' thoughts and actions within a laboratory setting has traditionally relied upon the written laboratory report. With the advent of electronic recording mechanisms and the increased use of these media by the students it is possible to use other forms of reporting to analyse the students' learning.

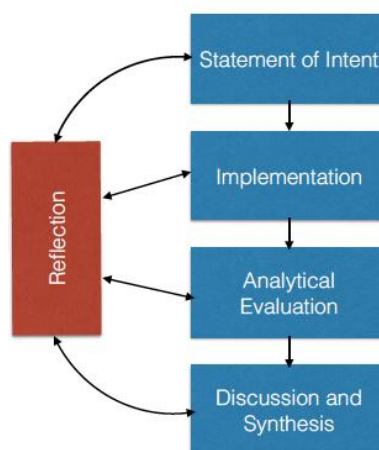


Figure 5.1: Schematic of the experimental process

The process of exploration within a given advanced physical experiment is often non-linear (see Figure 5.1). Despite the fact that there is a logical progression from one stage to the next, there tends to be a process of iteration within the experiment during which various approaches to the measurement or simulation are modified and honed to optimise the experiment. An important element of experimental laboratory instruction at the advanced level is also to provide minimal direction on the conduct of the experiment (Henningsen 2011; Masters & Grove 2010; Zwickl, Finkelstein and Lewandowski 2013). All of these approaches are designed to produce physical scientists who understand the

experimental process in the round and who are prepared for work in industry and further training as professional physical scientists (Zwickl, Finkelstein and Lewandowski 2013).

As part of the transformation of the senior physical laboratory at DIT the following series of measures have been implemented in the 2014-2015 laboratory session:

- 1 Students are required to produce a short 'Statement of Intent' (Sol) prior to beginning the experimental part of their laboratory. This statement comprises the students' vision, experimental strategy and planning around the conduct of the experiment before beginning, together with notes on expected results and contingencies where applicable. This is a key component of research planning that all professional scientists undertake at the experimental planning stage and is viewed as being a very important component of a student's understanding of the conduct of experiments. The students are required to supply this component of their work electronically in the form of a wiki, which is accessible to the instructor only, and through which the instructor can give feedback asynchronously and advise on modifications to the experimental approach or strategy; overall this facilitates the instructor giving feedback to students within large groups that are not seen face-to-face during the laboratory period.
- 2 The students are supplied with laboratory instructions that are optimised and minimized for each experiment. This allows the experimental approach and outcomes for each experiment and each student to be somewhat elastic and thus the outcomes of the experiment more accurately reflect the abilities of the students.
- 3 During the conduct of the laboratory, and in particular at the end of the allotted period for the experiment, the students are asked to reflect upon the outcomes of their experimental approach vis à vis the suitability of their initial strategy for satisfying the experimental objectives. They are required to record any changes they have implemented in light of this reflection and highlight whether these changes have had any effect. This reflection on the part of the student is intended to both inform them for their future conduct of the experiment and inform the instructor on their perceptions of the conduct of the experiment for both marking and feedback purposes. A component of the laboratory marks was awarded for the completion of the electronic records for each of their experiments.
- 4 As a means of informing the students regarding the quality of laboratory reports achieving the maximum marks the students were also supplied with redacted reports from their peers and asked to mark these reports. Again a component of the laboratory marks were awarded to each student for engaging with this activity.
- 5 Finally the students were asked to complete the E-CLASS survey questionnaire as a means of evaluating the effectiveness of the complete laboratory programme in terms of its impact on changing the students' approaches to the conduct of their experiments and their perceptions regarding the importance of the components of the classical experiment approach.

The E-CLASS Survey (Colorado Learning Attitudes about Science Survey for Experimental Physics) has been developed by the University of Colorado at Boulder and has to date been altered through several iterations to improve its effectiveness in terms of analysing students' perceptions and approaches to experimental physics (Adams et al. 2006; Gray et al. 2008; Adams and Wieman 2011; Zwickl, Finkelstein and Lewandowski 2013; Zwickl et al. 2014). It is an epistemology and expectations survey which analyses the students' beliefs regarding the conduct of experiments in physics and their theories on knowledge and learning.

The students are given a series of approximately 30 statements and asked to rate their agreement with each of the statements on a Likert scale. They are asked to provide ratings in terms of their own view and their perception of what the view would be of a qualified professional experimental physicist in research or industry. In addition faculty at the School of Physics in DIT were asked for their responses to the survey to provide a rating of expert-like responses.

The survey responses are evaluated both in terms of the distribution of responses and the adjustment in the distribution of responses pre and post the laboratory programme. This latter approach was not implemented in the

2014-2015 laboratory programme as the survey was given to the students after the laboratory programme. In addition the surveys are evaluated in terms of the fraction of students with expert-like responses to each question.

The statements are intended to evaluate the student's achievement and acceptance of widely accepted laboratory learning goals and are therefore intended to be applicable to any laboratory programme regardless of the particular nature of its focus. Typical issues the survey addresses are (Zwickl et al. 2014);

- (a) the time consuming nature of laboratories and their impact on student enthusiasm;
- (b) the fact that students replicate experiments with known results and the impact of this on their experimental design and reflection;
- (c) the fact that senior laboratories typically use advanced apparatus which students may treat as black boxes which they do not understand or investigate;
- (d) the fact that uncertainty analysis is typically seen as a procedural algorithmic activity by the students rather than a means to understand the significance of the results;
- (e) the fact that students often approach experiments as a means of aligning with the expectations of the instructor for grading purposes rather than a means of development of personal understanding, insights and the development of their communication.

The statements themselves (Appendix 5.1) may be grouped into eight categories relative to their addressing of the following issues:

- Personal interest;
- Real world connections;
- Conceptual connections;
- Sense making/efforts;
- Problem solving sophistication;
- Problem solving confidence;
- Problem solving general;
- Applied conceptual understanding.

These categories were not incorporated in the current work but can aid in understanding of the student responses in future analyses.

## Results

### E-CLASS survey

Institutional ethical approval was obtained for the conduct of the surveys detailed in this report. The E-CLASS survey was administered to the students and faculty as a Google form with responses anonymised. Student responses were collected for the senior lab cycle (N=37) which included third year students (N=27) and fourth year students (N=10). The expert opinions were recorded from the lecturing staff (N=6). In total 30 statements were presented to the students and staff. A full list of statements can be found in the appendix. All responses were recorded on a Likert scale. In this analysis the scale is considered as an interval scale and mean and standard error was calculated.

The most obvious result amongst the responses is that there is no significant difference between the expert's opinion and the students' perception of an expert's opinion in any of the statements presented. For further analysis the statements are sub-divided into two categories, responses to statements in which the average students and expert's opinion differ significantly and statements in which they do not. Diagrams showing the full results for the two categories are shown in the appendix, Figures 5.A1 and 5.A2. To illustrate the differences two such results are plotted in Figure 5.2.

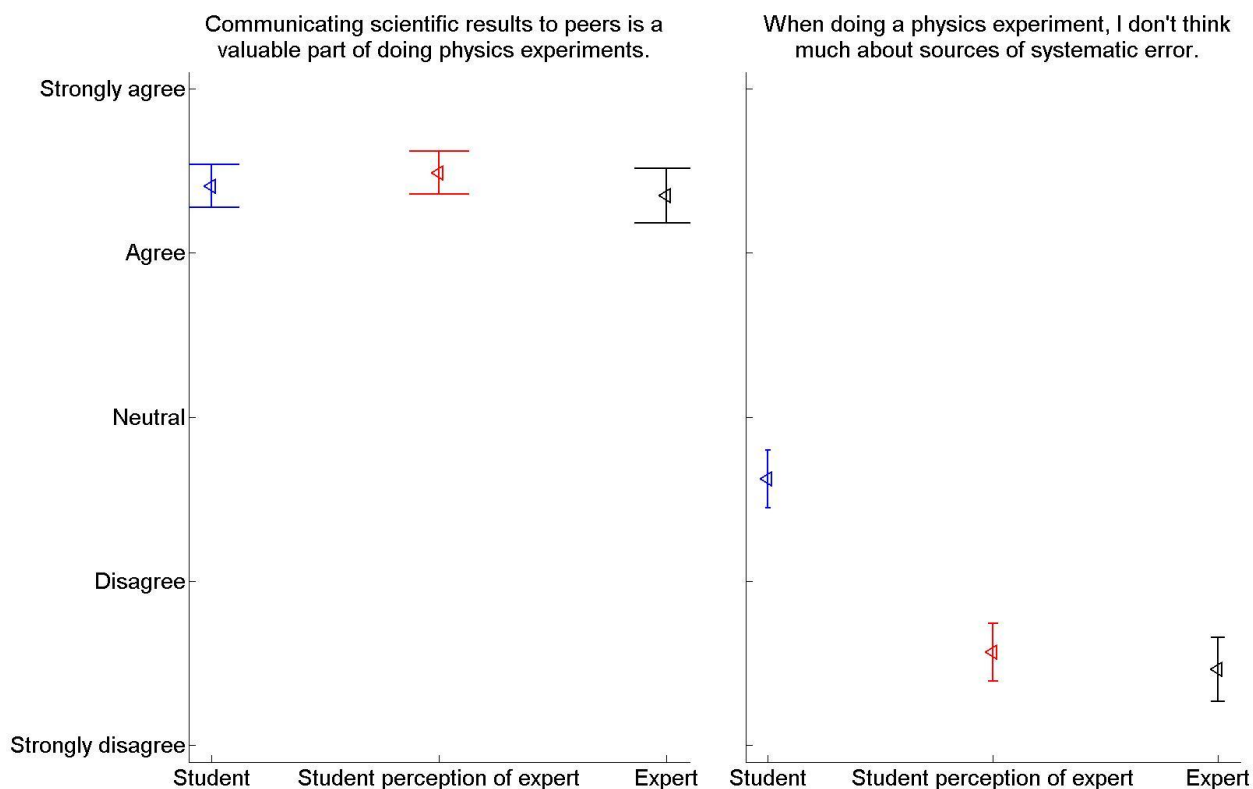


Figure 5.2: Average responses to two statements on the ECLASS survey. Error bars represent the standard error and it can be seen that the student and expert opinion differ significantly in the responses to one of the statements.

As we can see in Figure 5.2 the students and staff agree that communication is a valuable part of doing physics. In total the results indicate many aspects of experimental physics in which the students' and the staff (experts) agree. These can be considered areas of strength in which the students consider themselves as working to an expert level. Full results are shown in the appendix in Figure 5.A1 which clearly illustrates the many strengths of the DIT laboratory programme.

In addition, in Figure 5.2 we can see that the students believe that they should, but do not, consider systematic errors. This result is a clear indication that systematic errors must be stressed more in the development of the laboratory. In total many areas for development are indicated by the results of the survey. Full results for these areas can be seen in the appendix in Figure 5.A2. To probe whether these issues arise predominantly in the Year 3 as opposed to the Year 4 cohort, survey responses are separated by year. No statistically significant improvement is shown in the responses given by the fourth years although a higher proportion of expert-like responses to the survey questions was obtained from the fourth year cohort as compared to the third year cohort, reflecting an evolution in understanding between the last two stages of the programmes.

This project has as one of its aims to develop a more student-led inquiry-based laboratory experience and to move away from the 'cook-book' style experimental instructions. As is detailed earlier the students were supplied with laboratory instructions that are optimised and minimised for each experiment. In addition students were encouraged to make predictions and to run small datasets and check their proposed methods and results were reasonable. It is clear, however, from the responses to two survey questions shown in Figure 5.3 that more work is necessary in this area; some students feel that they can 'follow instructions without thinking about their purpose', others do not feel that they should 'make predictions to see if my results are reasonable'.

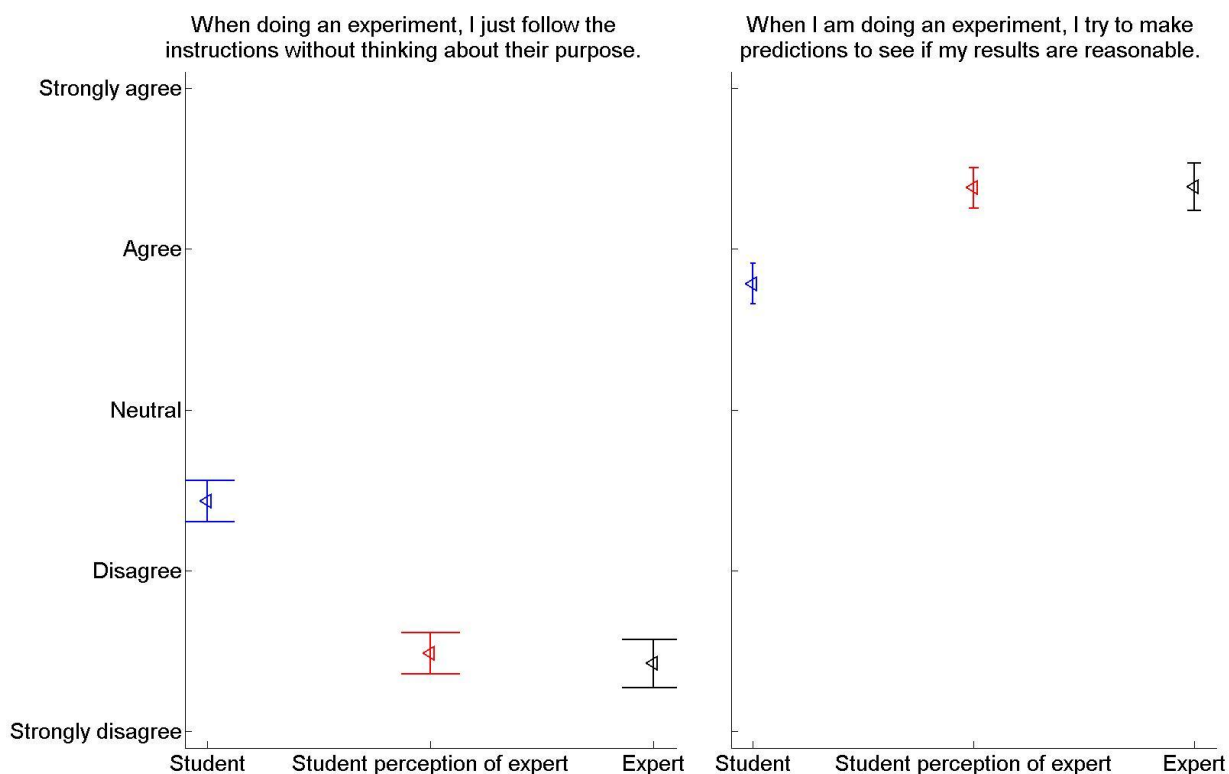


Figure 5.3: Average responses to two statements on the E-CLASS survey. Error bars represent the standard error.

The E-CLASS survey is designed as a pre- and post-instruction survey to examine the effect of lab instruction on the students. Due to time constraints the survey was presented to the students post-instruction. However, the study remains on-going and the third year students' post-test will become the fourth year students' pre-test in the coming academic year. This report is to become the beginning point for more detailed analysis of the collected data from this ECLASS survey including the organisation of statements by categories.

### Student and Staff Feedback

Feedback was collected from students in the form of short interviews with a number of students. Students were selected for interview to represent different types of students ranging from weak to strong academically and highly to weakly motivated. Third year students were interviewed by a member of staff involved in the project and the supervision of the lab and therefore bias may have influenced student responses.

Questions probed the new structure asking questions on the major changes, i.e. the pre-laboratory Sol, the less descriptive manuals and the requested reflections by the students. Many positive aspects were reported on by the students. For instance, the majority of students claimed to be more prepared coming into the due to the Sol: 'you know exactly what you are doing coming in, great advantage'.

It was noted by staff that the Sols gave an important chance to catch students' misconceptions before the lab class began. The Sol also gave a good starting point for discussion with the students about the experiment and it became very easy to see how much work the students had done before coming to class.



When discussing the reflection students reported that the exercise made them think about different aspects of the lab: *'Good idea, makes you think, easier to do if there were problems (sic with experiment)'*. It appeared that the students felt the major difference between the reflections and writing a conclusion or abstract was that they could discuss what went wrong in the reflection or as one student put it: *'great for complaining'*.

It was felt by the staff that the less descriptive manuals worked well. One student gave remarkable feedback: *'If you ask me something I can tell you, not just recite something, I felt if you asked me in six months I'd still remember'*. It is hoped that the student was not telling the instructor what they wanted to hear.

Not reported on by students but mentioned by staff was that the students seemed more engaged with the process, eager to see if their proposed experimental plan in their Sol was correct. Throughout the year it was found that students completed experiments using methods different to those removed from the manuals. Often it was difficult to get students to do short data runs to test their experimental set-up and reflect on the method they have chosen. This is noted also by the students in their responses to the E-CLASS survey.

Most of the negative feedback related to what we have named here *'teething issues'*. The most frequently mentioned were issues relating to wifi coverage in the lab and the wiki system chosen as the platform for the students' online electronic journals. If the internet connection was dropped all unsaved work would be lost, which was understandably frustrating to students. To address this in the coming academic year the system is to be changed from using the wikis tool to using the Google applications, Sheets and Docs. These provide the same advantages of online reporting but are more user friendly with increased functionality for data analysis and presenting of results. They also allow the user to work without an internet connection and save automatically when the connection is resumed.

The other main issue was the perceived increase in workload by the students. The students felt that the electronic reporting took much longer than the traditional reporting. Many efforts were made by the staff prior to the implementation of this method to balance the workload and the number of requested formal reports for assessment was dramatically reduced. However, many of the students still felt that it was very time consuming. [It is] *'like writing a full report, takes forever'*, [it is] *'More time consuming than lab book'*.

The reduction in the number of assessed formal reports did not seem to have a negative effect on the quality of submissions. A perceived higher quality of submitted formal reports was reported by one of the authors.

It was noted by staff that some highly-motivated students created electronic submissions which resembled more a formal report than an electronic replacement for the traditional log-book. It was confirmed in feedback to these students what was required for the electronic submissions. Unusually the students did not note the increased effort and time it took in the lab to complete experiments with the reduced instructions. Without step-by-step instructions the time it took students to complete experiments increased substantially. In some cases if students used an incorrect method and did not use a small data run to test their proposed method they did not have sufficient time to finish the experiment. However, it was felt that valuable lessons were learnt in the process.

## **Recommendations to DIT**

The feedback from staff and students are that the changes made have had a positive effect on the senior laboratories. Feedback from students is very positive with students reporting on the advantages of the developments to increase their learning potential in the laboratory. The students feel that the pre-laboratory statements of intent have better prepared them for the laboratory. The online submission of the pre-laboratory work has also provided instructors with opportunities to provide feedback to students before they enter the laboratory and also equip them with opportunities for quality targeted discussion with students in the laboratory. It was reported by staff and student feedback that the less descriptive manuals create deeper learning experiences with students designing their own experimental setups. Electronic log books have also increased the opportunities for timely feedback to the students who receive the feedback as soon as the lectures have submitted, rather than this occurring within the timetabled laboratory time.

E-CLASS survey, although only used as a post-test survey in this report provided many areas of strengths and development in the senior laboratory. Areas of strength are considered to be areas in which the students and the expert opinions were not significantly different. Conversely, areas for development highlighted here would be the students' consciousness of areas in which their opinion differed significantly from that of an expert, and to instil this consciousness progressively over the course of the senior laboratory programme.

## **Proposed Future Work**

The developments in the lab will continue with the only major change being the change in the platform used for electronic reporting. The system is changed from wiki reporting to reporting using Google applications, Sheets and Docs.

## References

- Adams, W. K. et al. (2006). New instrument for measuring student beliefs about physics and learning physics: The Colorado Learning Attitudes about Science Survey. *Physical Review Special Topics – Physics Education Research* 2, 010101.
- Adams, W. K. & Wieman, C. E. (2011). Development and Validation of Instruments to Measure Learning of Expert-Like Thinking. *International Journal of Science Education*. 33: 1289–1312.
- Baruch, J. (2014) Practical science has a global reach and appeal. *Nature* 507, 141.
- Beun, J. A. (1971) Experiences with a Free Undergraduate Laboratory. *American Journal of Physics*. 39: 1353.
- Blue, J., Bayram, S. B. & Marcum, S. D. (2010) Creating, implementing, and sustaining an advanced optical spectroscopy laboratory course. *American Journal of Physics*. 78: 503.
- Deslauriers, L., Schelew, E. & Wieman, C. (2011). Improved learning in a large-enrolment physics class. *Science* 332: 862–4.
- Freeman, S., Eddy, S.L., McDonough, M., Smith, M.K., Okoroafor, H.J. and Wenderoth, M.P. (2014) Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences, USA* 111: 8410–5.
- Galvez, E. J. et al. (2005). Interference with correlated photons: Five quantum mechanics experiments for undergraduates. *American Journal of Physics* 73: 127.
- Gray, K. E., Adams, W. K., Wieman, C. E. and Perkins, K. K. (2008). Students know what physicists believe, but they don't agree: A study using the CLASS survey. *Physical Review Special Topics – Physics Education Research* 4, 020106.
- Henningsen, J. (2011) Teaching laser physics by experiments. *American Journal of Physics* 79: 85.
- Masters, M. F. and Grove, T. T. (2010) Active learning in intermediate optics through concept building laboratories. *American Journal of Physics* 78: 485.
- Meltzer, D. E. and Thornton, R. K. (2012) Resource Letter ALIP–1: Active-Learning Instruction in Physics. *American Journal of Physics* 80: 478.
- Pearson, B. J. and Jackson, D. P. (2010) A hands-on introduction to single photons and quantum mechanics for undergraduates. *American Journal of Physics* 78: 471.
- Trumper, R. (2003) The Physics Laboratory – A Historical Overview and Future Perspectives. *Science Education* 12: 645–670
- Zwickl, B. M., Finkelstein, N. and Lewandowski, H. J. (2013) The process of transforming an advanced lab course: Goals, curriculum, and assessments. *American Journal of Physics* 81: 63.
- Zwickl, B. M., Hirokawa, T., Finkelstein, N. and Lewandowski, H. J. (2014) Epistemology and expectations survey about experimental physics: Development and initial results. *Physical Review Special Topics – Physics Education Research* 10, 010120.

## Appendix 5.1

Q30. Physics experiments contribute to the growth of scientific knowledge.

Q27. When I approach a new piece of lab equipment, I feel confident I can learn how to use it well enough for my purposes.

Q26. If I wanted to, I think I could be good at doing research.

Q25. If I try hard enough I can succeed at doing physics experiments.

Q23. I don't enjoy doing physics experiments.

Q16. A common approach for fixing a problem with an experiment is to randomly change things until the problem goes away.

Q15. When I encounter difficulties in the lab, my first step is to ask an expert, like the instructor.

Q14. Designing and building things is an important part of doing physics experiments.

Q13. When doing an experiment, I just follow the instructions without thinking about their purpose.

Q12. When doing an experiment I usually think up my own questions to investigate.

Q11. When I am doing an experiment, I try to make predictions to see if my results are reasonable.

Q9. When doing an experiment, I try to understand the relevant equations.

Q7. If I don't have clear directions for analyzing data, I am not sure how to choose an appropriate analysis method.

Q6. Calculating uncertainties usually helps me understand my results better.

Q5. Whenever I use a new measurement tool, I try to understand its performance limitations.

Q4. It is helpful to understand the assumptions that go into making predictions.

Q3. When doing a physics experiment, I don't think much about sources of systematic error.

Q1. When doing an experiment, I try to understand how the experimental setup works.

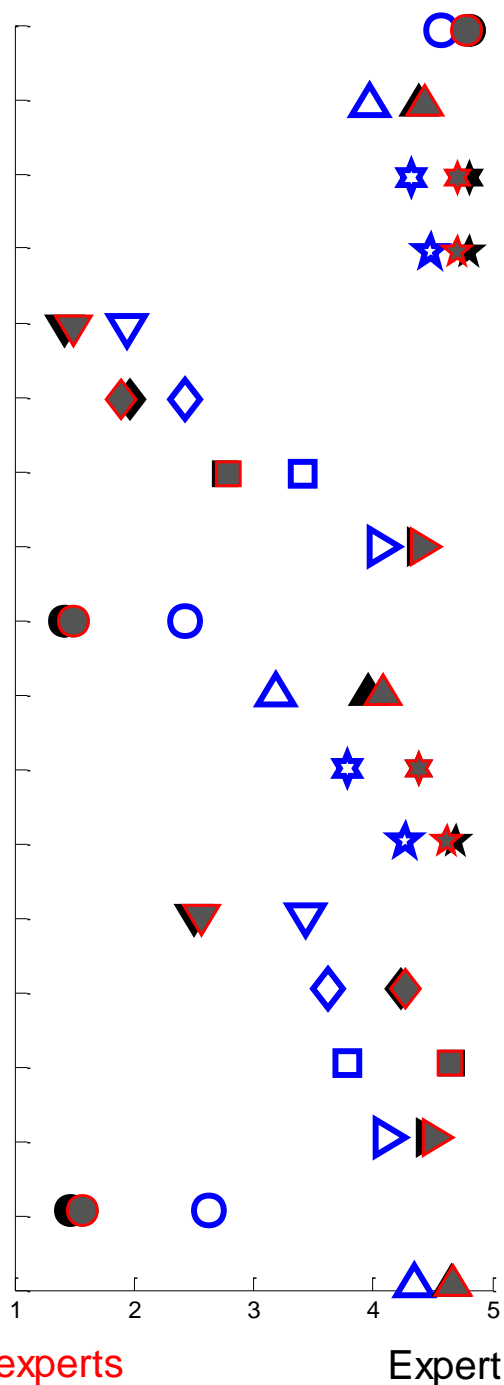


Figure 5A1: Statements in which there is no significant difference between students' opinion and that of the experts as measured by the average response and the standard error.

Q30. Physics experiments contribute to the growth of scientific knowledge.

Q27. When I approach a new piece of lab equipment, I feel confident I can learn how to use it well enough for my purposes.

Q26. If I wanted to, I think I could be good at doing research.

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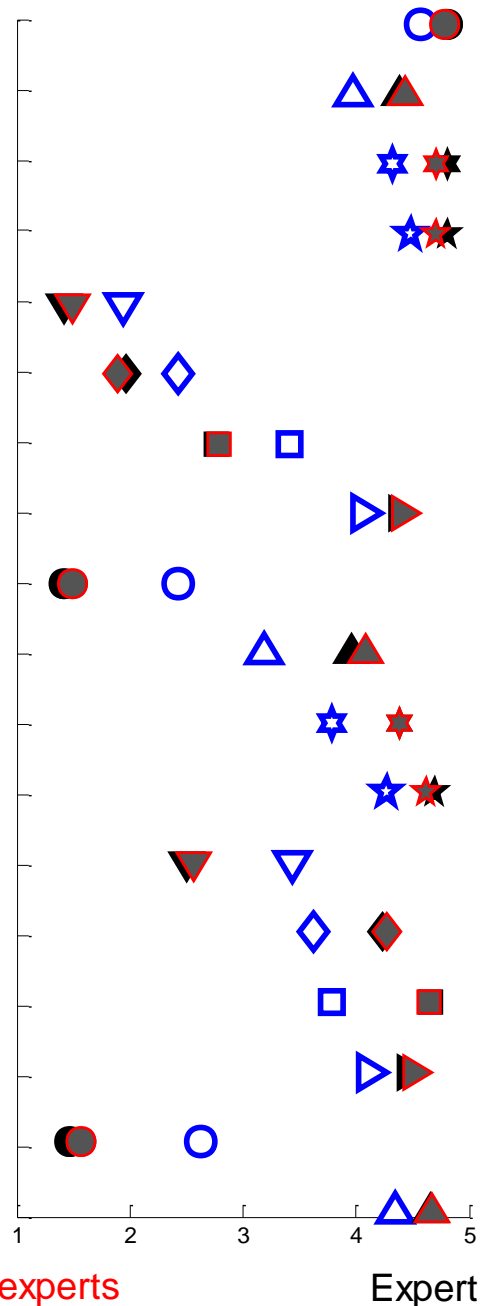


Figure 5A2: Statements in which there is a significant difference between students' opinion and that of the experts as measured by the average response and the standard error.

## 6 TrackEngage: Tracking student engagement in learning resources and its correlation to their performance

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### Abstract

An important factor in the academic performance of Laboratory based science students is attendance on the basis that practical experience and engagement in teaching activities are necessary to develop skills and competencies. Student attendance also has wider implications for science schools as they are increasingly challenged in providing laboratory based practical teaching in the face of increasing student numbers. The relationship between attendance and academic performance has been studied previously, but mainly limited to classroom-based lectures rather than laboratory activities and self-directed learning. The aim of this study was to evaluate the relationship between student attendance at laboratory practical sessions and class based activities and their engagement in learning resources with their overall academic performance. The hypothesis that students who engaged in more teaching and learning resources performed better in the overall module grade was proven, with the highest correlation found for lecture attendance to the end-of-semester examinations.

**Keywords:** *RFID attendance system, self-directed learning, Webcourses & Moodle*

### Introduction

Student attendance has a minimum requirement in a number of science based practical modules, both in the Dublin Institute of Technology (DIT) and the Institute of Technology Blanchardstown (ITB). This has led to staff developing their own laborious non-robust recording methods for student attendance such as sign in and roll calls. Student numbers have grown substantially, and a number of modules are co-taught with other courses (90+ in some modules). Also there has been a large evolution in teaching and learning methods employed in the classroom in recent years such as problem based learning and group work, which require student participation and therefore attendance. Most of the modules currently delivered use Webcourses (DIT) or Moodle (ITB) as a teaching support tool with staff investing a lot of time and effort.

This project investigated student engagement in these teaching resources through monitoring their attendance at lectures and laboratory practicals and their use of Webcourses. It also surveyed their self-directed learning (SDL) activities and the student engagement in these resources was correlated to module performance. To complete this project an efficient and robust recording system of student attendance (easy to use, cost effective and rapid) based on their student cards was developed. A protocol to capture student interaction with Web based teaching and learning resources was created. These tracking tools were difficult to procure due to Information Service restrictions and lengthy approval processes involved in student data capture. Therefore the project tools were only piloted on one lab based module in DIT. The strongest correlation was observed for lecture attendance with directly linked assessment and overall student performance in this module (final grades) followed a similar trend to the level of engagement. The robust attendance recording system and engagement tracking protocols were successfully developed and tested and this will allow for future complete trials in both Institutes.

## Outline of Project

The study was conducted within the School of Food Science & Environmental Health, Dublin Institute of Technology. The undergraduate module chosen was in Semester 2 (12 teaching weeks) in the penultimate year of a four-year degree course in science.

The study received institutional research ethics committee approval with the requirement for individual student consent for participation and this was freely given by the 29 participating students. The module comprises a combination of laboratory based activities and classroom-based learning activities with a range of learning resources including lecture and laboratory notes, reading material and recommended links available on-line through Webcourses.

The School regulations advise students that 'Permission to sit examinations is normally dependent on attendance of at least 80% in practical classes and 60% in Lectures'. There are no methods or specific criteria described for recording student attendance or an outline of the consequences of their poor attendance. Although students are strongly encouraged to attend laboratory sessions across the whole School, attendance is typically recorded ad hoc.

Student attendance was defined as attendance at a weekly three-hour laboratory session and a one-hour weekly lecture. The attendance for each student was calculated by comparing the number of activities the student attended with the number of activities delivered in the semester (Deane and Murphy 2013). The outcome of interest was the overall module grade (100%) and its components (exam 60% and portfolio 40%) obtained by each student. The assessment modalities used to determine the module grade were i) an end-of-semester written examination (one and a half hours in duration) consisting of two sections, Section A based on lecture material and Section B on laboratory relevant material (60% of the overall grade) and ii) a module portfolio and presentation (40% of the overall grade). The pass grade for this module was 40% and above.

Various options for recording student attendance exist (López Fernández et al. 2013) and these were investigated through consultation with Information Services, IT Suppliers and other institutes of education, and ranged in practical use, data capture abilities, price and compatibilities. Each student card has a Radio Frequency Identification (RFID) tag so it was decided to capture student attendance using a Springcard Prox & Roll RFID scanner (Figure 6.1). This relatively cheap (~€200), small device (8cm in diameter) is lightweight (116g) and connects via a USB port to any computer. Students tag on as they enter the classroom or Laboratory and successful tagging is instant and registered with a green light (Figure 6.1) and beep. This RFID data was then sorted and converted to Excel compatible files using purpose developed software *ANSEO*.

Maintaining paper records of student attendance is an onerous task that takes up class time and adds to the management burden. There are many other disadvantages to paper based recording systems including students not signing in, unreadable signatures, students signing in another student, and data management. Students who are inclined to skip classes know that manual attendance (i.e. calling roll, etc.) can be manipulated in their favour (Hingorani et al. 2013). This RFID reader and capture software is very easy to use and efficient as the student tags in as they are walking in to the room and it is visibly registered with a green light and an audible beep that makes the system difficult to manipulate.



Figure 6.1: Springcard RFID scanner connected via USB port which flashes green on successful student card tag on

A protocol based on work developed in DIT (<http://webcoursesanalytics.wordpress.com>) was used to harness student engagement data from Webcourses (DIT). An easy to use protocol was outlined based on Graphical Interactive Student Monitoring Tool for Moodle (<http://gismo.sourceforge.net/>) to harness student engagement data from Moodle (ITB). A wide range of information can be easily accessed and various reports compiled on engagement at individual student or group level. The interaction of individual students with Webcourses on a daily or component basis can be profiled. Data and reports can readily be exported to Excel. An example of such reports is presented in Figure 6.2 which shows that the highest Webcourses combined activity is on a Tuesday, the day before the lecture and laboratory sessions.

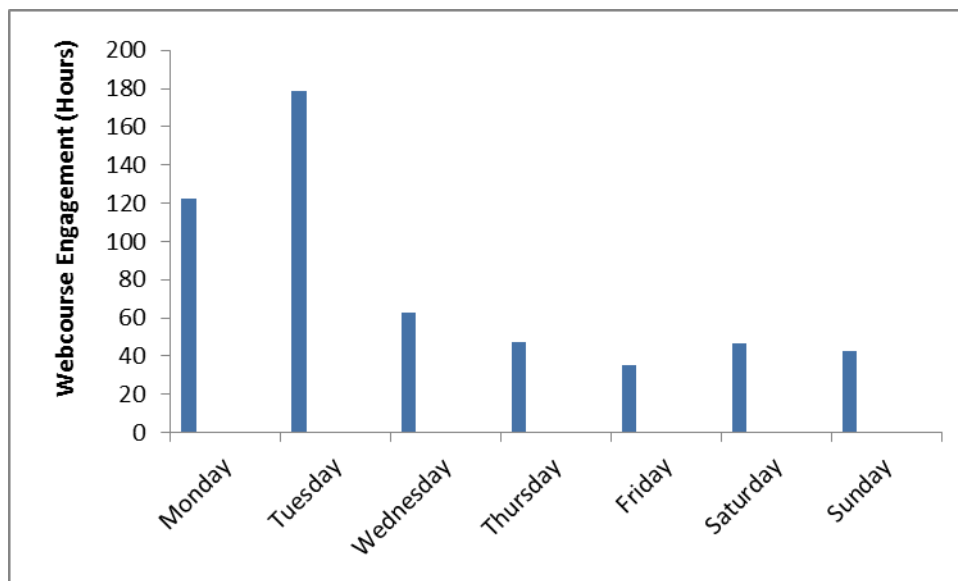


Figure 6.2: Student engagement with Webcourses on different days over the 12 teaching weeks of the semester

The 29 students in the DIT pilot module were surveyed to audit their module engagement and collection of data on self-directed learning. The data for the teaching and learning engagement was measured in hours and correlated against student performance. This data included a) lecture attendance, b) laboratory practical attendance, c) Webcourses engagement, d) self-directed learning and e) total student engagement in the module. The grades for the module (examination, continuous assessment and overall grades) were statistically correlated with teaching and learning engagement components (a-e) using Statgraphics Centurion XV.I and plotted in Microsoft Excel 2010 (Crede, Roch and Kieszynka 2010). The component and final grades were obtained from the School records following the end-of semester assessments.



Laboratory attendance remained  $\geq 80\%$  for the entire 12 teaching weeks (Figure 6.3). Students are aware of the 80% attendance requirement as this would have been reiterated over their five previous course semesters (September 2012-January 2015).

However, lecture attendance (Figure 6.3) rapidly declines over the semester. Many studies have investigated this absenteeism and the range of reasons include family, social and work commitments, illness, faking illness, family emergencies and faking family emergencies (Cleary-Holdforth 2007). However, the reasons suggested by students in this study were: the 9am start of this Lecture and also the fact that it was in another building than their 10am Laboratory session (~7 minute walk), the availability of lecture and support material online and the increasing workload as the semester progressed.

This cohort of 29 students had an overall high module performance (final grade) of between 56-82%. This grade was clearly linked to module engagement. As student engagement in module teaching and learning resources increased so did the students' overall grade, although statistically some correlations were low (Figure 6.4). This trend was evident for overall lecture and laboratory attendance, Webcourses interaction and self-directed learning activities (Figure 6.4).

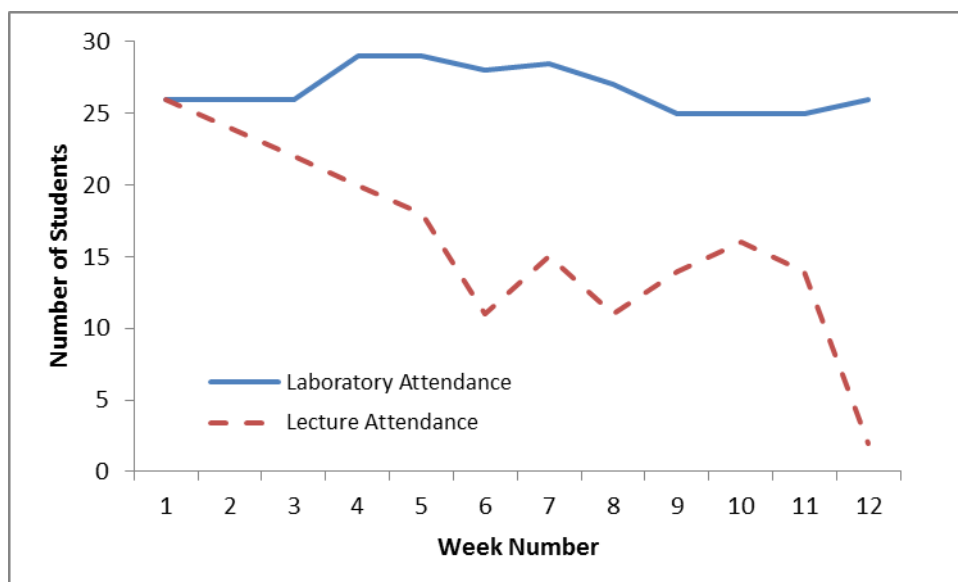


Figure 6.3: Laboratory and lecture attendance for 29 students in the pilot module over the 12 teaching weeks of the semester

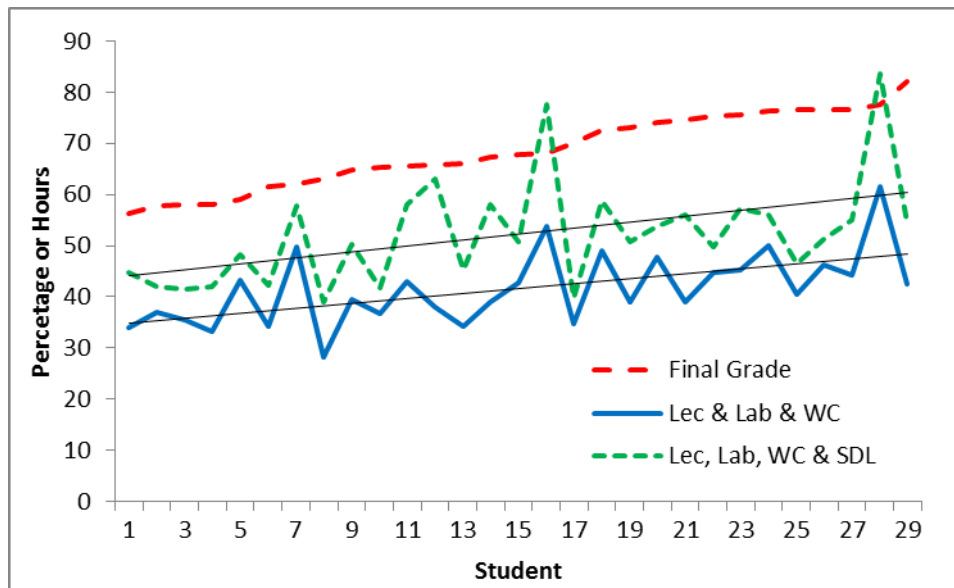


Figure 6.4: Overall student (n=29) performance (final module grade, %), laboratory (Lab) and lecture (Lec) attendance, Webcourses engagement (WC) and self-directed learning (SDL) for the pilot module (expressed in hours of engagement)

The final exam paper (worth 60%) is divided into two Sections (A and B). Section A examined material covered in the laboratory sessions and Section B examined material from lecture sessions. The final Section A grades of 32-82% (mean 53 with a standard deviation of 14) was attributed to normal distribution as the high attendance in the laboratory sessions and section grades had a low correlation (Figure 6.5A).

However, the correlation between Lecture attendance and grades in Section B (25-90%, mean 66% and standard deviation 15) were very highly correlated (0.891, Figure 6.5B). Traditionally attendance at classes has been thought to be a prerequisite to good academic performance and many studies have shown a similar positive correlation between them, regardless of the course subject or level of student (Cohall and Skeete 2012). This has significant implications for student and staff within the Institute and the development of this engagement tracking system can be used for reflection and review of course delivery and interaction (i.e. timetable of events, lecture delivery methods, availability of notes etc). Students 'at risk' due to low or lack of engagement could be easily highlighted early in the semester/module delivery and a trigger set in Webcourses or to staff for intervention.

## Evaluation

There were substantial delays to this project due to Ethics Committee and Information Services approval for both student data capture and novel technology. As a result, the full project plans could not be realised and therefore evaluation involved a reduced trial of the tracking system in Semester 2 with 29 students in only one pilot module.

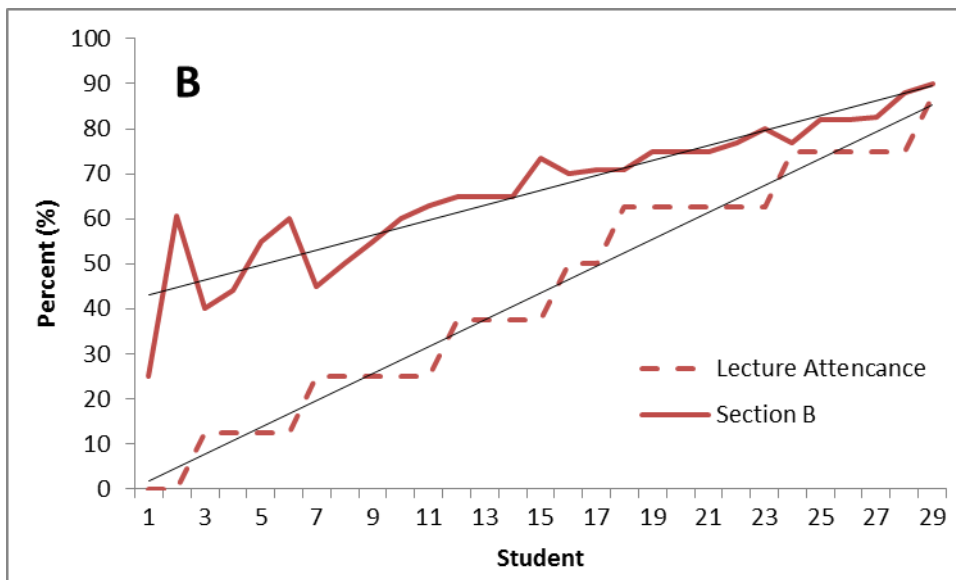
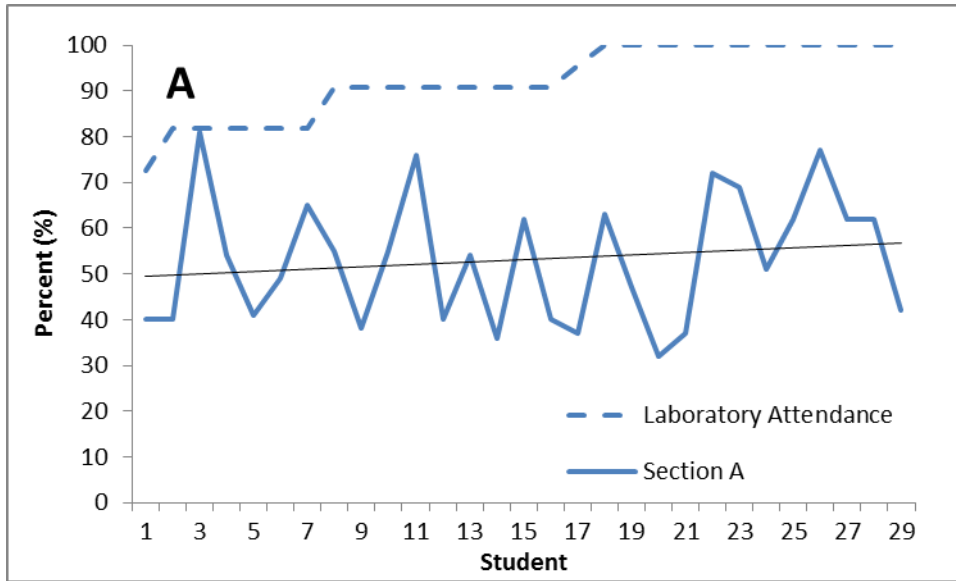


Figure 6.5: Student ( $n=29$ ) performance in:  
 A: Section A of exam linked to increasing laboratory attendance and  
 B: Section B of exam linked to increasing lecture attendance for the pilot module

## Conclusions

- The RFID attendance recording system developed is very cheap, easy to use, with a robust output and could very easily be scalable across courses and schools within each partner Institute.
- Laboratory attendance remained above the course required figure of 80%.
- Lecture attendance dropped significantly over the semester.
- There was a clear link between student engagement in learning resources (laboratory and lecture attendance, Webcourses and self-directed learning) and module grades.
- Lecture attendance was highly correlated to related examination assessment.

## Recommendations to the DIT

1. Recording Student attendance is a requirement for various reasons (practicals, PBL, etc.) and DIT must support staff in implementing an effective user friendly system (easy to use, cost effective and rapid). This however, will need full support of Campus Planning, the Information Services department and College finance departments.
2. Protocols to track student engagement have been developed and successfully trialled and their use by staff would allow for reflection and review of course delivery, management and interaction.
3. Reliable data on correlation of engagement with performance has implications for the General Assessment Regulations.
4. Students 'at risk' due to low or lack of engagement could be highlighted early in the Semester and intervention taken.

## Proposed future work

- Complete the planned trials of this project to a second practical module in DIT and two modules in ITB.
- Include a larger student cohort in the next trial and investigate two cohorts of students from different courses that are co-taught in the module.
- Gather more information on student demographics (gender, age, nationality, extracurricular activities, and student status, etc.) to create student profiles and assess for possible correlation to engagement (Cohall and Skeete 2012).
- Roll out the successful tracking system to other courses in the School of Food Science & Environmental Health (DIT) and School of Informatics & Engineering (ITB) and eventually Institute wide use.
- Disseminate the project findings.

## Future Dissemination plans

- Presentations at School meetings.
- Present findings to students.
- Organisation and running of workshops for interested staff.
- Teaching and Learning Conferences i.e. NAIRTL, HEA STEM or PeEcon.
- Two peer reviewed papers, i.e. the *International Journal of Technology Enhanced Learning* and *Journal of Educational Multimedia and Hypermedia*.

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## References

- Cleary-Holdforth, J. (2007). Student non-attendance in higher education: a phenomenon of student apathy or poor pedagogy. *Level 3*, June 2007: Issue 5.
- Cohall, D.H. and Skeete, D. (2012). The impact of an attendance policy on the academic performance of first year medical students taking the Fundamentals of Disease and Treatment course. *Caribbean Teaching Scholar*, :, 115–123.
- Credé, M., Roch, S.G. and Kieszczyńska, U.M. (2010). Class Attendance in College: A Meta-analytic review of the relationship of class attendance with grades and student characteristics. *Review of Educational Research*, 80: 272 -295.
- Deane, R.P and Murphy, D.J. (2013). Student Attendance and Academic Performance in Undergraduate Obstetrics/Gynecology Clinical Rotations, *JAMA*, 310: 2282-2288.
- Hingorani, K., McNeal, B., Carlton, D. and Askari-Danesh, N. (2013). Enhancing a learning management system to track attendance using RFID. *Issues in Information Systems*, 14: 13-318.
- López Fernández, M.J., Guzón Fernández, J., Ríos Aguilar, S., Salazar Selvi, B. and González Crespo, R. (2013). Control of attendance applied in higher education through mobile NFC technologies. *Expert Systems with Applications*, 40: 4478–4489.

## Web Links

<http://gismo.sourceforge.net/>

<http://webcoursesanalytics.wordpress.com>

## **7 DIT International: Development of an International Study Abroad Ireland Public Health Module**

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### **Abstract**

The overall aim of this project involves the research and development of an International Study Abroad Module in Public Health in the College of Sciences and Health. It is envisaged that this module will be validated as and be available on the international educational market. The first project objective includes the research and development of the module content. The module will be structured into three core areas. These include cultural, heritage and public health. It is hoped that this module template could be utilised and applied across DIT. The cultural and heritage aspects of the module would remain constant whilst the third area could be developed by each School or Department in accordance with the expertise in their chosen area. For the Teaching Fellowship the module will focus on International Public Health Issues. The second project objective includes the compilation of a business plan for the module to include the costing, delivery and promotion of the validated module. The development of such an International SA Module will further enhance the international identity of DIT and should appeal to a wider educational audience with regards to development of their understanding of Public Health issues along with the gaining a positive international experience in Ireland.

**A full report of this project will follow in 2016.**

## Teaching Fellowships 2014-2015 Dissemination Outputs

### **Jennifer Hamilton: Conservatory of Music and Drama**

As part of the DIT Fellowship programme, an overview of the project was provided at the Teaching Fellowships Launch on 21<sup>st</sup> October 2014 at DIT Aungier Street. Updates of work in progress were also given through the LTTC website, and at the DIT Annual Showcase of Teaching and Learning Innovations in DIT Aungier Street on 14<sup>th</sup> January 2015.

### **Theresa Ryan, Ziene Mottiar, Bernadette Quinn, Catherine Gorman, Kevin Griffin, Ruth Craggs, Deirdre Quinn: School of Hospitality Management and Tourism**

As part of the DIT Fellowship programme, an overview of the project was provided at the Teaching Fellowships Launch on 21<sup>st</sup> October 2014 at DIT Aungier Street. Updates of work in progress were also given through the LTTC website, and at the DIT Annual Showcase of Teaching and Learning Innovations in DIT Aungier Street on 14<sup>th</sup> January 2015. Key findings of the project were disseminated at an event held in the Heritage Park in Wexford with stakeholders and also at a Students Awards ceremony in DIT, Cathal Brugha Street. In addition the following two research outputs were produced: a book chapter and conference paper:

Craggs, R., Gorman, C., Griffin, K., Mottiar, Z., Quinn, D. and Ryan, T. (2015) 'Students in Action', a destination-based learning approach to student engagement. In Benckendorff, P. and Zehrer, A. (eds) *International Handbook of Teaching and Learning in Tourism*, Cheltenham: Edward Elgar

Craggs, R., Gorman, C., Griffin, K., Mottiar, Z., Quinn, D. and Ryan, T. (2015) Collaborative learning in a 'real-world' destination: Student perceptions of their learning outcomes. Conference paper presented at *Co-Creation in Tourism Teaching and Learning*, the 2014 ATHE Conference, 4<sup>th</sup>-5<sup>th</sup> December 2014, Royal Society of Edinburgh.

### **Maeve O'Connell, School of Accounting and Finance; Lorraine Sweeney, School of Retail and Services Management**

As part of the DIT Fellowship programme, an overview of the project was provided at the Teaching Fellowships Launch on 21<sup>st</sup> October 2014 at DIT Aungier Street. Updates of work in progress were also given through the LTTC website, and at the DIT Annual Showcase of Teaching and Learning Innovations in DIT Aungier Street on 14<sup>th</sup> January 2015.

### **Niall Holmes, Una Beagon: School of Civil and Structural Engineering**

As part of the DIT Fellowship programme, an overview of the project was provided at the Teaching Fellowships Launch on 21<sup>st</sup> October 2014 at DIT Aungier Street. Updates of work in progress were also given through the LTTC website, and at the DIT Annual Showcase of Teaching and Learning Innovations in DIT Aungier Street on 14<sup>th</sup> January 2015. A paper was also presented at the REES Conference in July 2015 entitled *An investigation into the use of problem-based learning to develop graduate attributes in Irish Engineering Undergraduate Education*.

### **Aidan Meade, School of Physics**

As part of the DIT Fellowship programme, an overview of the project was provided at the Teaching Fellowships Launch on 21<sup>st</sup> October 2014 at DIT Aungier Street. Updates of work in progress were also given through the LTTC website, and at the DIT Annual Showcase of Teaching and Learning Innovations in DIT Aungier Street on 14<sup>th</sup> January 2015. In addition, preliminary results were presented at the Variety in Chemistry Education/Physics Education Conference (VICE-PHEC) at the University of Nottingham from 20<sup>th</sup>-21<sup>st</sup> August 2015.

### **Catherine Barry-Ryan: School of Food Science and Environmental Health**

As part of the DIT Fellowship programme, an overview of the project was provided at the Teaching Fellowships Launch on 21<sup>st</sup> October 2014 at DIT Aungier Street. Updates of work in progress were also given through the LTTC website, and at the DIT Annual Showcase of Teaching and Learning Innovations in DIT Aungier Street on 14<sup>th</sup> January 2015.

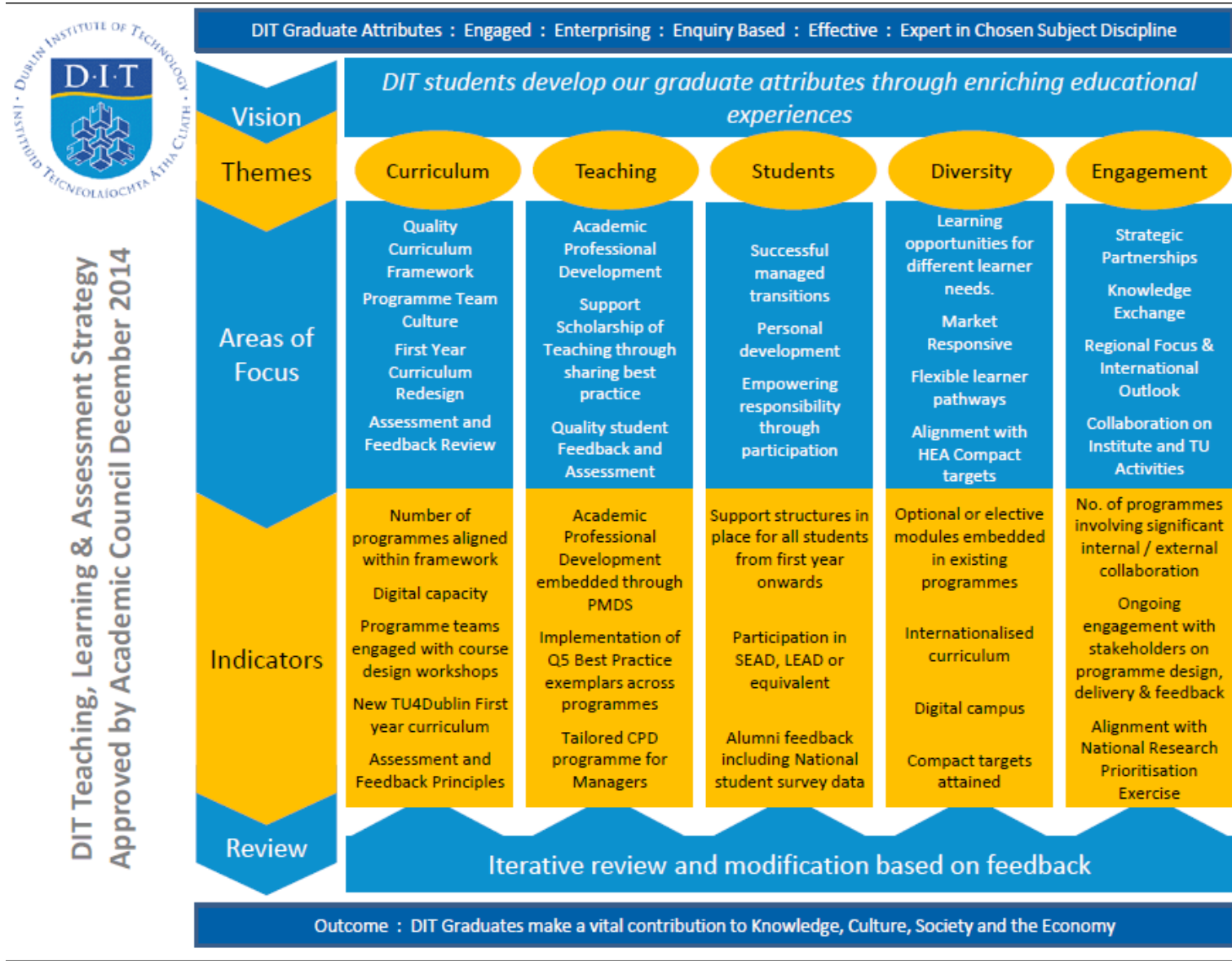
**Sara Boyd: School of Food Science and Environmental Health**

As part of the DIT Fellowship programme, an overview of the project was provided at the Teaching Fellowships Launch on 21<sup>st</sup> October 2014 at DIT Aungier Street. Updates of work in progress were also given through the LTTC website, and at the DIT Annual Showcase of Teaching and Learning Innovations in DIT Aungier Street on 14<sup>th</sup> January 2015.



# Appendices

# Appendix A



## Appendix B

### Teaching Fellowships Evaluation and Feedback

**1. How did you first become aware that DIT had established College Teaching Fellowships, e.g. did you see them advertised, heard by word of mouth etc.?**

- I saw adverts by email and also word of mouth.
- Heard about it and saw it on-line.
- Heard from College Head of Teaching.
- I saw them advertised on the DIT website. I also heard about them while I was undertaking the teaching and learning postgrad diploma.
- Colleagues, email.
- Word of mouth.

**2. How did you become a Teaching Fellow for your College, e.g. were you nominated to apply, did you submit the application form when you saw the call etc.? Please briefly outline the process below.**

- I was approached by a colleague to ask if I would jointly apply.
- Saw call and applied.
- I submitted the application after the call. However, ideas had been in gestation for some time.
- I decided to apply myself. My Head of School was very supportive.
- Submitted an application.
- Nominated.

**3. How did you feel this application process worked for you? How might it be improved if there is another call for College Teaching Fellowships next year?**

- It worked well. Perhaps a short interview would also help as it's difficult to get enthusiasm across in a Word document.
- It worked fine.
- Giving very advanced notice of the call and reminders months in advance would be useful to allow preparation and refining of ideas.
- It worked out very well. The process was very straightforward. This application process is fine as it is.
- Good.

**4. How important was the money in you being able to undertake your fellowship research?**

- 2 Very important
- 3 Quite important
- 1 Not important but it helped
- 0 Didn't make any difference
- 0 Don't know

**5. Which of the following best describes how you used your Fellowship money?**

- 2 Buy out of hours
- 3 Buy equipment/resources for the project etc.
- 4 Disseminate findings at a conference
- 0 Other (please specify):  
It gave us time and deadlines to produce research outputs from the project which otherwise is unlikely to have occurred.

**6. In addition to the Fellowships launch (October) and Showcase event (January), have any additional seminars, workshops, presentations been organised in your department as a way to also promote the work?**

- 1 Yes
- 5 No

**7. If yes please outline here:**

- Conference paper and book chapter.
- Roundtable meeting to present results.

**8. Support from the LTTC staff has been made available to help you plan/implement your Fellowship project. What kind of support have you found most useful so far and what kind of additional support would you like for the next stage of your work?**

- I attended an Academic Writing module which really helped but that was outside the Teaching Fellowship. The Showcase and launch were great ideas because we had to produce something for them.
- I did not receive support from the LTTC in planning or implementing the Fellowship. Head of Research was an excellent support.
- In fact I didn't really use the LTTC much as I and my colleague worked well as a team. For people working individually this would be more useful.
- I didn't use the support available but I am aware of it. I would like to know how my findings could be used in other suitable modules.
- Good support. Perhaps did not avail of it sufficiently.

**9. Has being a teaching fellow for your College been as you expected?**

4 Yes  
2 No

**10. If no, in what way has it been different?**

- Not sure what I expected but from the College there won't be an awful lot made of it. Through DIT there was more.
- It was a very independent piece of work.

**11. Do you feel that the DIT should continue to support Fellowships into the future?**

5 Yes  
0 No

**12. Any other comments you would like to make about the continuation of the Fellowships, or the Fellowships more generally?**

- Winners should be encouraged to add it to their email signature. I didn't but should have!
- This is an excellent scheme. Well done to all involved.
- Great idea. Good start/continuation of research journey. Can support staff starting research or new areas of research.





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