Faculty of Engineering

- **An Undergraduate International Society 2014-15 Session**

  The establishment of the UG International Society in the Department of Civil and Environmental Engineering seeks to fulfil a mediator role, through the promotion of social and educational activities that will enable students to establish friendship and professional bonds that can be developed and maintained throughout their studies and upon graduation. The inaugural meeting was held on the 24th February 2014 (Robert Burns lunch taster) and invites were extended to all UG international students and class representatives for each year of study. The intention was for the class representatives to provide a “bridge” between the foreign students and the home students through the role of surrogate mentors/buddies. The event attracted 18 students.

  **Events list**-(feedback on webpage)

  25/05/15  Visit to The Kelpies, Queensferry Crossing Project and The Scottish Parliament

  26/01/15  Second Annual Burns taster + talks from students (Italy and Greece)

  03/12/14  International Students walk Below the River Clyde

  12/11/14  A Journey through Iran and the Netherlands

- **Feedback for Coursework in Digital Form** — Feedback is given to students directly in the submitted document in digital format (either Microsoft Word or pdf files). This way, students can relate the feedback to particular sections of their report, allowing them to act on it more effectively. It also enables a very high level of detail in the feedback, ranging from generic comments to even typing and syntax errors.

- **Reading for a Degree: Using the National Geographic Magazine to Introduce Humanities into Undergraduate Civil Engineering Studies** — This case study considers the use of the *National Geographic* magazine as a means to ignite the students' curiosity with the world around them. The results from a pilot study and a content analysis of a number of editions from over a decade shows that this periodical regularly has themes directly concerning the impact of civil engineering in society, be it political, financial, environmental, social or ecological.

- **Integrating the Appreciative Inquiry (AI) Paradigm into a Lecture-Based Class in Architecture** — This optional class AB 966 Cultural and Behavioural Factors in Architecture and Urbanism is offered to year 5 PgDipl in Advanced Architectural Design and Year 2 MSc in Advanced Architectural Studies. The class is premised on the view that the built environment is not simply a background against which human actions take place, but it regards it as it reflects and shapes human assumptions, beliefs, feelings, and behaviours.

  Coupled with typical format of delivery of a series of lectures, I provided a series of in-class and out of class exercises and assignments that employ active, experiential, and inquiry-based learning as forms of Appreciative Inquiry (AI) and learning from reality. The exercises involved group and individual work and varied in time from 10 minutes in-class exercises in teams of two students, to two-hours collaborative design game of teams of four students, to a structured learning experience out of classroom (contemplating settings exercise), and to finally a group research project.

- **Quizzing Students During the Class for Immediate Feedback**. — Multiple choice questions with timing in some cases and 3 most important things of the lecture were incorporated in each class.

- **Education or Edutainment? The use of television programmes for teaching and learning with undergraduate civil engineers** — This case study examines the results (N=189 returned questionnaires from 217) from an innovative 3rd year undergraduate coursework (15% weighting for a 10 credit module). The students were required to select one programme (television / radio) each from a portfolio of programmes related to civil engineering that have been selected by the tutor and recorded on the university Planet eStream facility.

  The students worked in groups (N=4-5) and were required to select a different programme from their peers. Each student was required to undertake a review (critique) of their chosen programme and to write a 3 page reflective account of what new knowledge they had gained from this exercise. The students were required to identify any ‘gaps’ in their knowledge and to take actions and show evidence (vis-a-vis references) of further learning.

  For each programme the tutor has provided a list of related reading / further programmes related to the theme / contents of the programme. To enable further learning to be gained from the assessment and to encourage cooperative peer group learning each student was required to read their peers’ reflective accounts and each group was required to prepare a cross-case analysis that identifies common themes across all of the programmes.

- **Engineer Successful College to University Transitions - The Engineering Academy** — The main aim of this project was to understand and co-develop successful support approaches and mechanisms for students making transition into their first year of study in Higher Education, by direct entry into second year from Further Education colleges. Specifically this project focussed on Engineering Academy students making their transition into year 2 of an engineering degree at the University of Strathclyde from a network of Further Education colleges.

  Two engineering student interns carried out the study in collaboration with key academic and engineering academy staff. The student interns, who had just completed second and third year respectively, had both taken non-traditional access routes to studying engineering at the University of Strathclyde. One through the engineering academy route whilst the other came to first year engineering through a further education college HNC route.
Initially, the study focussed on capturing the current experience of Engineering Academy students, specifically:

- Interaction with University during HNC study
- Social and academic integration
- CV and employer engagement
- Departmental practices
- Summer schools
- Student union groups and societies
- Library and on-line services
- Social media

Opportunities for improvement were then explored, specifically:

- Interaction with University during HNC study
- Induction to University
- Managing expectation and informing choices
- Social and academic integration
- Mentoring including peer mentoring
- Student event
- Summer schools

In order to fully understand the Engineering Academy student transition experience and develop appropriate support mechanisms the following methodology was adopted:

- A literature review
- Survey of Engineering Academy students
- Interviews with EA staff
- Case studies from other institutions
- Library and on-line services
- Social media

A full research report is available below.

This work was supported by Enhancement Theme funding from the QAA.

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**Peer Evaluation in Groupwork**

The fourth year CPE students spend the second semester on a project. Working in groups of 5 or 6 students, they have to design a chemical plant and produce a report. Each group is supervised by an academic, who meets the group every week and makes sure that the group is progressing. At the end of the project the students receive an individual mark assigned by their supervisor. To enhance the group work experience, peer evaluation was introduced. The peer evaluation had to be submitted half-way through the project. The results and the peers’ comments were reported to each student, in an anonymous way, so that each student could reflect on the peers’ comments and improve their own performance. As this was a trial run, the peer assessment had no weight on the final mark given to each student.

**Internships and placements in the faculty of engineering**

This is a two year project of which one year has been completed. The main aims of this project are:

1. To understand the Engineering Academy student placement/internship experience
2. Together with the EA students co-develop mechanisms for maximising the benefits of internships
3. Integrate key learning experiences in to the Engineering Academy student experience.
4. Investigate and identify key opportunities for transferability across the faculty of engineering and wider university

Objectives 1&2 will be addressed in 2016, with 3&4 taking place in 2017.

The Engineering Academy (EA) at the University of Strathclyde provides a widening access transition route for students from a partner Further Education college into second year of a BEng honours/MEng stream within a range of engineering disciplines across six faculty of engineering departments. The EA is currently unique within the Faculty of Engineering in that all Engineering Academy students are provided with the opportunity to undertake a placement or internship during the summer months. This proposal will focus, initially, on the Engineering Academy using it as a rich data source surrounding placements and internships as EA students make their transition through and beyond Higher Education. In 2014/15 the first cohort of over 40 EA students undertook a wide range of summer placements and internship opportunities from employers including Allied Vehicles, ABS, Babcock International, Aggreko, Alexander Dennis and Star Refrigeration. By 2017 approximately 70 EA students will be undertaking placements and internships. In 2015 (the first cohort of EA students undertaking placement opportunities) reporting and reflection on learning gained from EA placements was limited. There is a clear opportunity to maximise the learning and benefit from these placement experiences and integrate them as a core part of the student experience both within the Engineering Academy and in a wider university context.

This project was supported by Enhancement Theme funding from QAA Scotland.

**Internships and Placements in the Faculty of Engineering - Stage Two**

The Engineering Academy (EA) at the University of Strathclyde provides a widening access transition route for students from a partner Further Education college into second year of a BEng honours/MEng stream within a range of engineering disciplines across six faculty of engineering departments. The EA is currently unique within the Faculty of Engineering in that all
Engineering Academy students are provided with the opportunity to undertake a placement or internship during the summer months. There is a clear opportunity to maximise the learning and benefit from these placement experiences and integrate them as a core part of the student experience both within the Engineering Academy and in the wider faculty of engineering and university context. This project was completed in two phases which were undertaken in the summer of 2016 and 2017 respectively. The main and overall aims of this project were:

1. To understand the Engineering Academy student placement/internship experience
2. Together with the EA students co-develop mechanisms for maximising the benefits of internships
3. Integrate key learning experiences in to the Engineering Academy student experience.
4. Investigate and identify key opportunities for transferability across the faculty of engineering and wider university

This report focusses on the findings from the 2017 study covering objectives 3 & 4. Objectives 1&2 were addressed in the summer of 2016 with the findings being reported in a previous SPELT study (http://spelt.strath.ac.uk/display/SPELT /Internships+and+placements+in+the+faculty+of+engineering)

This study aims to embed findings from stage 1 of the study carried out in summer 2016 within the Engineering Academy and widen opportunities for the impact of these findings across the faculty of engineering and beyond. Findings from the initial project stage included identifying strengths, benefits, challenges, barriers and areas for improvement in the existing engineering student placement experience. An interactive tool which guides students through the placement experience from application to returning to university was developed. This tool highlights how students can harness benefits and opportunities in addition to strategies and tips for overcoming common challenges and barriers.

Key learning strategies from stage 1 that were identified for integration in to the Engineering Academy and transferability across the Faculty of Engineering were:

- Providing opportunities for reflection on placement experiences on return to university through provision of a feedback learning loop
- Implementation of a peer mentoring scheme to facilitate the reflection and feedback learning loop opportunities
- Investigate opportunities to collaborate with clubs and societies to help launch a peer mentoring scheme and facilitate the reflective learning loop.

The first stage of this work was reported in an earlier SPELT case study: http://spelt.strath.ac.uk/display/SPELT /Internships+and+placements+in+the+faculty+of+engineering

This work was supported by Enhancement Theme funding from the Quality Assurance Agency Scotland

- Uncovering the boundaries for learning through a Legitimate Peripheral Participation (LPP) and Communities of Practice (COP) lens: A case of civil engineering students in post-summer placement transition through university — Students returning to university from an industrial summer placement are in transition through two different learning environments. They leave behind a culture where their knowledge construction is undertaken in a collaborative space, guided through mentoring by a community of professional engineers. They are exposed to real-world problems, vocabulary and artefacts that assist them to learn on an identity as a civil engineer. On return to university they re-enter a learning space that is largely characterised by competitive learning whereby a different identity is shaped through learning codified knowledge and where academic staff can be ‘gatekeepers’ to a curriculum of knowledge that is often simulated rather than real-world. Negotiating the boundaries between these two environments (often on multiple occasions over a 5 year MEng degree) en-route to a graduate position is known to be troublesome for students. Employing a social learning systems approach, particularly the concepts of LPP and COP can provide a lens to understand and improve the transition process for students and faculty. This work was supported by Enhancement Theme funding from the Quality Assurance Agency Scotland

- Assessment for Learning (Book, Chapter, Jigsaw) —

A flipped classroom approach using a jigsaw book exercise with undergraduate civil engineering students (n=474) in years 1,3,4,5. - To focus the learning and assessment process on students being active in constructing their own and group knowledge (explicit and tacit) and to promote a ‘reflective practitioner’ behaviour akin to that of professional engineers. -To introduce students to the role of civil engineering knowledge and practice and to establish a foundation on which students will be self-motivated to ‘read’ widely as a commitment to becoming a professional engineer. - To introduce students to a collaborative learning space where peer knowledge is considered to be contributory (as opposed to ‘in competition’) to a holistic understanding of new knowledge whereby cooperation can be seen to lead to synergistic outcomes.

- Encouraging engineering students to develop a global and cultural awareness mind-set through collaborative coursework — A first-year UG coursework (15% weighting for CL120 Construction & the Environment) for civil engineers to help establish an organic growth for the department UG international society (see An Undergraduate International Society 2014-15 Session) and to provide links to other curricular and non-curricular activities (CL327 Engineering for International Development / ERASMUS) that have EU / International context.

Students were required to undertake collaborative learning (within existing groups) leading to the production of a group poster to showcase civil engineering technology in a foreign country. Each group (n=65) was aided by an International student mentor enrolled on a UG or PG course within the Department of CEE. The role of the mentor was to provide guidance on their home country (culture / customs / life) as well as some ideas about appropriate civil engineering buildings & structures.

Once completed, the posters were displayed for all students to view. Each student (n=260) then submitted a one-page reflective blog on their experience undertaking the coursework. Students who participated in the production of the poster and who submitted their blog received a 100% grade. Whilst this approach to grading may appear unorthodox, the overarching aim of the coursework was to expose the students to a multicultural learning experience.
The immediate gains can be gauged from the positive statements (verbatim) made by students in their blogs. In the longer term, it is envisaged that the students will develop a growing maturity in relation to cultural and global issues, particularly those issues that will have a bearing on their profession.

- **Co-Curricular Academic Studies: Civil Engineering 4 real (CE4R) as Problem Based Learning** — Workshops on real-world civil engineering problems, run by engineers from industry.

  302 students attended 1 or more of the 55 workshops

  (N=1183 returned questionnaires from 1302 attendances)
  - 55 x 2hr workshops (Monday 5-7PM)
  - 302 undergraduate students attended 1 or more workshops (years 1-5)
  - 1302 student attendances
  - 1302 X 2hrs = 2604 hours of CPD created
  - (n=1183) returned questionnaires from 1302 student attendances
  - 39 industrial partners (17 contractors / 17 consultants / 5 clients)
  - 85 industrial workshop presenters

Workshops on real-world civil engineering problems, run by engineers from industry. 357 students attended 1 or more of the 67 workshops (n=1477 returned questionnaires from 1571 attendances)

  - 67 x 2hr workshops (Monday 5-7PM)
  - 357 undergraduate students attended 1 or more workshops (years 1-5)
  - 1571 student attendances
  - 1571 X 2hrs = 3142 hours of CPD created
  - (n=1477) returned questionnaires from 1571 student attendances
  - 45 industrial partners (19 contractors / 21 consultants / 5 clients)
  - 132 industry workshop presenters

- **Using Graduate Engineers (Alumni) to Mentor Undergraduate Students** — This case study discusses the results from a graduate mentoring initiative (2010-2018 sessions) involving third year (n=621) civil & environmental engineering (CEE) student mentees, graduate mentors (n=139) and employers (n=34).

  In self-selected groups (n=3-5) the student mentees visited a graduate engineer (a mentor) either in a design office or in a construction project setting. The requirement was for the mentors to provide their mentee group with a minimum of two visits per semester with each visits being at least 2 hours in duration. The mentors and mentees were also encouraged to develop informal communications between the visits.

  The mentee role is akin to that of a non-participant observer, whereby the mentor dispenses knowledge, guidance and advice and the mentees listen, observe, reflect, question and respond. These activities could be considered a partial fulfilment of the experiential learning (Kolb, 1984) theory designed to help individuals identify the way they learn from experience.

- **Industrial Placement Big Buddies-Little Buddies Programme** — Twenty-three students (with relevant summer industry experience) from years 2-5 volunteered to take on the role of ‘Big Buddies’ (BB’s) to mentor groups of first year students, Little Buddies (LB’s). Each of the BB’s will meet their group in a formal setting on two occasions during both semesters (during a CL120 Construction & the Environment timetabled class) and facilitated rolling programme of informal meetings and communication through social media will be established.

- **Using Myplace templates for Student Assessment and Feedback in Engineering Management for UG and PG Subject Areas** — I have utilised the various Myplace tools and advanced features to create marking rubrics, quizzes and grading schemas, in order to provide online assessment and feedback. A structured format provides consistency and timeliness that supports lecturers and students as they progress through the courses and assessments.

- **Using Flipped Classes to Enhance Face to Face Discussion in Engineering Labs** — This case study describes the introduction of an online lesson in experimental engineering laboratory classes to facilitate the face-to-face discussion prior to the experimental activity.

- **Using Online Forums: A Tool to Enhance Experimental Engineering Laboratories** — This case study describes the introduction of online asynchronous forums in experimental engineering laboratory classes, to facilitate discussion and comparison of results from different experiments.

- **Use of MyPlace Rubrics for Assignment Marking in Large Engineering Classes** — MyPlace Rubrics were used to mark written technical report assignments in three separate large classes (4 separate assignments, over 120 students for each).

- **Introducing a Programme of Report Writing in Undergraduate Engineering Classes.** — It was identified that there was no formal approach used to instruct students in report writing within the undergraduate classes of Mechanical and Aerospace Engineering. Classes were identified where guidance could be included. Online lessons were developed to be presented on MyPlace alongside assignments requiring technical reports. The basis for the structure of any technical report was standardised to reflect the dissertation guidelines for the Departments 4th Year Individual Project.

Guidance was given in the following areas:

- Formatting
Classes in first, second and third year were identified and online activities concerning specific assignments were developed. An online lesson was also developed to take 4th Year individual project students through the guidance for dissertation and technical paper submission.

The Faculty librarian, Sally Bell, was involved in discussions.

### Use of Online Submissions and Feedback Tools —

The coursework submission method was changed from hard copy to electronic submission via online learning portal (MyPlace). Provision of both assessment and feedback was delivered via online tools (TURNITIN). This allowed students to see assessment against the rubric, relevant comments and content, issues of originality and to keep a long term record of feedback to refer to later. It also allows the academic to also keep a copy to refer to as required and use as examples of future work. This intervention was taken first in 2014-15 and each year I have built on the successes.

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**Introducing Fresher Civil Engineers to the Institution of Civil Engineers (ICE)** — This case study examines the data (coursework’s and questionnaires) collated from an innovative undergraduate (n=428) assessment (2010-2015). The first-year students were required to select and read six inaugural addresses by former ICE presidents (2 from the 19th century; 2 from the 20th century and 2 from the 21st century) and use these as a catalyst for writing their own ICE student president address (circa 2000 words) whilst keeping an eye towards 2050.

The coursework required the students to write in first person and to consider the relationship between civil engineering and society. Emphasis was put on looking backwards and forwards to enable the students to speculate on the role of civil engineering in the UK and abroad towards 2050.

The students who receive the top five grades for their coursework are invited to present (now 2nd year students) an abridged version (10mins each) of their address to the new first-year students during the following academic session. These new fresher students are asked to vote on their preferred candidate to become the Strathclyde ICE Student President. The voters are informed that their selection criteria should be based on (1) confidence in delivery / communication (2) visionary ideas towards 2050 (3) quality of information on the slides used.

The winner receives a trip to London (sponsored to £300 by an engineering company) to visit the ICE HQ and a prestigious civil engineering project and for the past three years we have also toured landmark Scottish bridges.

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**“Reading for a Degree”: A Compulsory Book Reading Coursework and Associated Book Club —**

A compulsory book reading coursework for all 1st year civil engineers. Each year, the freshers are required to read one book from four that have been selected by the tutor (see the attached document for the 24 books used since the 2009-10 session).

The books selected for reading are chosen on the basis that they provide knowledge about the history and heritage of civil engineering including biographical text and/or contemporary accounts of inspirational civil engineering projects.

A department book club was established to run in parallel with the coursework and throughout the academic session so as to encourage students to discuss their book reading with peers, and to provide a platform to invite book authors to the department.

Book Club meetings to date have been:

- **December 2014**- Dr Ian Stewart, Alumni, and co-author of *How to Read Bridges: A Crash Course Spanning the Centuries*, visited the department on the 18th December 2014. Ian is a Chartered Engineer and an Associate at Blyth & Blyth. He has a BEng (Hons) Civil Engineering (2000) and a PhD in Structural Dynamics (2003).
This project investigated the transition into year civil engineering students (n=162) to undertake regular reading of UK newspapers. Evidence of further research (i.e. consultation with text books/scholarly journals/manufacturer's websites etc.) shows that weekday newspapers should carry more stories about this industry sector. The results suggest that the initiative can be easily replicated and that it can act as a catalyst to encourage engineering students to become more regular and critical readers of news media throughout their studies.

Newspaper image by Silke Remmery, Flickr CC-BY-2.0

Using a Weekly Trade Magazine (New Civil Engineer) for Learning & Assessment. —

This case study presents evidence from an initiative employing a weekly industry magazine - New Civil Engineer (NCE) - as a vehicle for introducing construction technology to first year students (N=153).

Using one or more hard copy editions of the magazine (from inaugural edition in 1972 onward) available in the university library, and following guidance regarding the definition of construction technology, the students were required to select six technological themes from any section (news, projects, adverts, etc.) of the NCE magazine.

Students were required to produce six drawings/sketches on either A3 or A4 paper and annotate each sketch and provide further notes indicating evidence of further research (i.e. consultation with text books/scholarly journals/ manufacturer’s websites etc.)

Transition to employment: Alumni stories about dyslexia from the Civil Engineering and Law disciplines. — This project investigated the transition into employment of university graduates with dyslexia.

This work was supported by Enhancement Theme funding from the Quality Assurance Agency Scotland

Rich Pictures for Creative and Imaginative Learning —

1. A themed report (2000 words / 60% weighting) coursework required the students’ to select one topic from six different lecture (CL437 Project Analysis) topics and to critique the topic and where possible link their discussion to professional practice.

2. The rich picture assessment (20% weighting) required students to form self-selected pairs with a peer who had researched a different topic to their own. Each pair peer review the other’s ‘themed’ coursework report and the students’ were encouraged to engage in constructive dialogue that would ideally be the catalyst for reflective thinking, leading to synergy, unexpected learning, and providing links between what may have initially appeared to be disparate topics.

3. The rich picture task required the students to represent this new knowledge in a pictorial format. The students were sent links to guidance explaining the concept and purpose of rich pictures and were required to construct a rich picture during a 2 hour class session. The students were informed that coloured pens and flip chart paper would be made available and that they could bring along any other art materials that they may like to use. It was envisaged that this activity would offer a fun environment for practicing sketching / doodling and challenge students’ to be intuitive & creative in the representation of their combined knowledge.

4. The students’ were informed that they would have 90 minutes to complete their rich pictures and that on completion all of the posters would be displayed for viewing. As an incentive to encourage the students to view the posters in an active manner a competitive element was introduced whereby the students were asked to make one vote for their favourite rich picture poster. A small cash prize for the two authors of the most popular poster was offered. Given that the viewing window was time bound the students were not issued with objective guidance on how to assess the quality of the posters and were left to make their own personal value judgements.

5. The smaller part of the assessment (5% weighting) required the students’ to submit an anonymous one-page reflective report to MyPlace. The students’ were informed that this part of the assessment would not be graded and that they would receive 100% for recording their
honest opinions concerning their participation in the rich picture AfI. The purpose of this part of the AfI was twofold, (1) to encourage the students to develop metacognition skills through reflecting on their own practice of acquiring explicit and tacit knowledge, and (2) to assist my own understanding of employing rich pictures as a pedagogical intervention and to evaluate its effectiveness in conjunction with my assessment of their posters.


(2) What is Rich Picturing? 6 Tips to Get Started with Rich Picturing https://www.youtube.com/watch?v=39Wc5ACx5v4