OLTF Powerful Assessment Exemplars 2016

Data Sorted by Type

Key tests for powerful assessment

Some key tests identified by the Fellowship participants for a 'powerful' assessment task

The assessment task or tool under consideration

- Attracts high levels of student satisfaction;
- Clearly addresses the key capabilities set down for the program/unit, especially those identified as characteristic of work ready *plus* graduates in the field of education concerned;
- Brings to bear different perspectives, taps into multiple domains of learning;
- Is integrated – that is, it concurrently seeks to assess key personal, interpersonal and cognitive capabilities in the profession/discipline concerned along with appropriate and effective use of relevant competencies;
- Is not just problem-based but solutions oriented; involves doing not just knowing;
- Has a whole-of-program focus;
- Directly relates to what has been learnt;
- Produces representations of what students can do rather than just a grade;
- Can be digitally enabled;
- Is, whenever possible, dilemma-based /'wicked' (Rittel &Webber, 1973)/ real-world focused/'authentic' (Wiggins, 1993), and demonstrably relevant to effective early career practice;
- Can be used for learning (formative) as well as for assessment (summative);
- Is scalable.

Types of 'powerful' assessment

The typology for powerful assessment below and the examples which follow were provided in workshops held from 2014-16 as part of an Office for Learning and Teaching National Senior Teaching Fellowship on assuring achievement standards and the quality of assessment. Our gratitude goes to all of the participants for their contributions. Many of these exemplars were kindly provided anonymously by participants in their feedback at the Fellowship workshops. Whenever a particular institution providing an exemplar was identified this has been noted. It is important to note also that some assessment tasks can involve more than one type of 'powerful' assessment.

Type	Code
o Capstones and other forms of program-level assessment – especially when these test the ability of students to address key technical and human challenges based on real-world cases in an integrated way. Assessment tools for capstones include reports, observation schedules and reflective journals, portfolios, products & videos (see Nicky Lee's OLT National Senior Teaching Fellowship website and report on Capstones at: http://www.capstonecurriculum.com.au/). Also see Beverley Oliver's Assuring Graduate Capabilities site, in particular the assessment section at: http://www.assuringgraduatecapabilities.com/assess.html	Cap
o Portfolios which provide evidence of effective performance against the highest ranking capabilities and competencies identified as most important in studies of successful early career graduates in the profession/discipline concerned.	Port
o Dilemma-based assessment. Here students are confronted with a real-world dilemma - an actual 'forked-road' situation - identified by an early career graduate and asked to say what they would do and why. These dilemmas can be presented as a case, in-tray exercise, a simulation or as a trigger video.	Dil
o Field research, action research, work-integrated assessment, clinical or practicum placements,	Field

	internships and real-world projects – local and international – always with a focus on the key capabilities identified as most important by successful graduates and employers in the field of practice concerned.	
o	Senior students and early career graduates as co-creators of assessment tasks with a rationale on why they are relevant. (see the clearing house of good practice examples in the 'Students as change agents' review by Mick Healy (2013)	Co-C
o	Role-play/simulation based on real-world cases.	RPS
o	Assessment tasks focused on social entrepreneurialism, creativity, invention, addressing key issues associated with social, cultural, economic and environmental sustainability, including Blue Economy projects (projects concerned with making money out of waste).	Inv
o	Performances in various mediums, including scripting and production of a film on a hot issue in the profession/discipline concerned which is loaded onto YouTube for formal review.	Perf
o	ICT-supported assessment – for example, wiki, interactive assessment including assessable gaming.	ICT
o	Disassembling a real world product and identifying all of the aspects of the course necessary to build it; then reassembling it and applying what has been learnt to the development of a new product.	Prod
o	Reflective learning journals using a validated set of high ranking capabilities for effective practice in the specific practice area as a benchmark for self-evaluation of performance.	Reflect
o	Problem-based or solutions-based assessment around a real world challenge.	PBL
o	Case study analysis and evaluation.	Case
o	Learning contracts.	LC
o	Interviews with successful early career graduates and critically discussing the relationship between what they say and what is being learnt in the degree.	Interv
o	Thesis (including undergraduate thesis)/Viva Voce.	T/V
o	Critical appraisal of data, articles, performances using agreed quality tests.	Crit
o	Other	Other

Examples of 'powerful assessment' sorted by type of assessment

Capstone

Business

- Capstone –briefing from a client on a real-world business challenge and the group provides the suggested solutions and ways to implement them, with attention to existing research, feasibility and relevance. Assessment is a report with the criteria including accuracy of diagnosis of client needs, feasibility and relevance of the solution, appropriate use of what has been learnt in the course and the quality of group work. (Cap)
- Portland State Senior Capstone 'Capstone courses are designed by Portland State University's faculty to build cooperative learning communities by taking students out of the classroom and into the field. In Capstone courses, students bring together the knowledge, skills, and interests developed to this point through all aspects of their education, to work on a community project. Students from a variety of majors and backgrounds work as a team, pooling resources, and collaborating with faculty and community leaders to understand and find solutions for issues that are important to them as literate and engaged citizens. Click here to see the wide range of capstones' (Cap).

- 'SBA 495 is Portland State University's largest Capstone and engages over 750 students in 35 sections of a business strategy course that partners with an organization in the community to address real world business challenges. In this Capstone students learn to systematically analyze a firm's internal and external environments and, through engagement with community partners, apply concepts and theories related to the formulation and implementation of business/organization strategies. Students join an interdisciplinary team; pool their knowledge, skills, and interests; use strategy to address a problem or concern of the community partner. Emphasis is on multiple functions and perspectives to understand diverse management and stakeholder interpretations, conceive integrative solutions, and address social and organizational outcomes (Portland State University)'(Cap/Inv/PBL).
- A business simulation game in which teams of 3 each play a real world (and carefully briefed) role that involves them in first developing a 'pitch' to a specific type of investor and then 'fronting' people from industry. Assessment is based on evaluation from industry, the extent to which what has been learnt is effectively applied to the pitch and a self-evaluation of the effectiveness of the group process against key checkpoints discussed in advance (Cap/RPS).
- Business capstone. Students have to 'manage' an international company with constant input of unexpected challenges (Cap/Dil).
- A finance portfolio. Students get a client statement and have to develop and monitor an appropriate share portfolio. The quality of the advice is tested using a 'real world' simulation over 5 weeks against what actually happened to the recommended portfolio of shares. The assessment task reflects what they would actually have to do as a stockbroker. As part of the assessment task students have to critically appraise how they developed, monitored and enhanced the portfolio over the 5 weeks and link their strategy and outcomes to all they have learnt (Cap/PBL).

Creative industries, Arts & Design

- Students are to scan ads using a range of media and contact networks for potentially relevant jobs in their professional area. They are to select one job and outline and justify how they would 'pitch' for it. They then have to locate a request for tender and have to write a bid for the tender with a business plan. Assessment includes a focus on the effectiveness of search, the quality and justification of the 'pitch' and the relevance of the tender (Inv/Cap/Field).

Education

- Capstones involving real world projects in particular schools (Cap/Field).
- Capstone course in a Graduate Certificate in Education (University Teaching) – a negotiated project– the participants choose a 'hot' T&L issue and develop it into a conference/journal paper. Staged assessment is used: the first submission is the project proposal. The second is an oral presentation to peers with a collective focus on the challenges, unexpected barriers, how things have had to be changed, how to deal with uncertainty in pursuit of completing the project and suggestions for improvement from the class. An evidence-based self-assessment is carried out using a rubric supplied to the student and then the instructor tests the veracity of the self-assessment (Cap/LC/PBL).
- Capstone in Education: final year students design, run and evaluate the effectiveness of a 'conference' in which they bring together all that they have learnt and how they are going to manage the transition into teaching with keynote speakers that include successful early career teachers and other leaders in education (Cap/Co-C/Field).

Engineering

- A fourth year engineering capstone involves the production of an integrating thesis. Students are given the opportunity to work with a faculty member to define and design an original research project, as well as to conduct and communicate engineering-related research. Every year, nearly 200 students in the Engineering Science program work with over 100 supervisors from 20-25 distinct academic departments, and across theoretical, clinical, design and laboratory settings. This gives the opportunity to assess a number of key attributes in engineering education, such as design, investigation and communication (University of Toronto) (Cap/T/V).
- Waterloo Engineering Ideas clinic
  The Engineering Ideas Clinic™ (https://uwaterloo.ca/engineering-ideas-clinic/) at the University of Waterloo supplements a traditional engineering curriculum with open-ended activities designed to spark student self-learning and exploration…
  We focus on design since this represents the pinnacle of engineering practice and integrates a full range of technical and non-technical knowledge, skills and abilities. Examples of

Engineering Ideas Clinic Activities: Teamwork Activities include a series of six scaffolded workshops (so far, two are active and four are being designed) provides engineering students with an introduction to team-forming and building, team communication, and conflict management through team-based challenges performed in the context of relevant engineering problems. The last three workshops are intended to provide reinforcement and opportunities for application in the same areas in multidisciplinary settings. Each workshop is approximately two hours and provides an opportunity for both the introduction of theory and practice. Student reaction and learning are assessed via pre- and post-workshop testing and we also intend to measure anticipated improvements in final-year capstone design projects. (Cap/PBL). Contacts: Jason Grove (jagrove@uwaterloo.ca) and Sanjeev Bedi (sanjeev.bedi@uwaterloo.ca)

Health

- Capstones are reported as being used in public health at universities like Johns Hopkins School of Public Health in the US and at the University of Guelph in Canada (Cap).

Hotel management

- Capstones involving real world projects undertaken in conjunction with a placement. Criteria include the ability to diagnose what lies behind the improvement area chosen and to develop a plan to address it which is demonstrably relevant, feasible and aligned with what has been taught in the course (Cap/Field).

ICT and software engineering

- Capstones involving real world projects undertaken with a university partner. Criteria for assessment include quality and relevance of what was delivered, relevant application of what has been learnt and partner evaluation on these indicators (Cap/Field).
- Year long capstone – a development reviewed formatively by peers and external entrepreneurs then summatively in a staged way against a rubric discussed and illustrated at the outset of the program (Cap/Inv).
- Portfolio-based Constructive Alignment: The portfolio-based approach to constructive alignment aims to motivate students to engage in learning by removing marks from coursework assignments, using frequent formative feedback to produce evidence, and performing final summative assessment using criterion referenced assessment. With this approach, educators define unit learning outcomes and assessment criteria to indicate how students can demonstrate they have achieved unit learning outcomes to different grade levels. To help guide students to this understanding, educators create tasks for students to engage with during the teaching period and work with students to help them demonstrate unit learning outcomes through completing these tasks. At the end of the teaching period, the resulting work is compiled into a portfolio for summative assessment, and assessed against the assessment criteria. Data can be collected from the formative feedback process to help educators perform the final summative assessment quickly and accurately. For further details see: http://crpit.com/confpapers/CRPITV136Cain.pdf and See: Cain, Andrew. 2013. “Constructive Alignment for Introductory Programming.” Ph.D. thesis. Swinburne University. Hawthorn, Australia (Cap/Port).

Medicine

- Capstone: Translational Research (TR) is defined by the National Centre for Advancing Translational Science as ”The process of turning observations in the laboratory, clinic and community into interventions that improve the health of individuals and the public". The Institute of Medical Science (IMS) recently launched a new professional Masters program focused on TR. Central to the program is a Capstone project where students integrate their knowledge to create solutions that address unmet health science needs. The capstone is both a vehicle for problem solving and an opportunity for our students to demonstrate critical skills and competencies that are core-learning outcomes. These skills include networking, collaboration, teamwork, implementation skills, communication, creativity, problem solving and risk management. Unique processes and rubrics are being formulated to capture the exercise of these skills throughout the capstone process. (University of Toronto) (Cap/PBL).

Nursing

- Bachelor of Nursing students are to review all of the clinical reports they have received so far in the course and produce a consolidated self-assessment on key areas of strength and areas for improvement. The areas for enhancement are then prepared for, implemented and tested for effectiveness and further improvement in the final placement (Cap).

Psychology

- A staged formative and summative assessment process is used in a fourth year class in this

program. Each team of four meets with a 'client' - a trained psychologist who is role playing - and has to come up with an appropriate counselling response – with a series of dilemmas thrown in by the 'client' as they proceed. This is videoed – there is staff, peer and self review of the video. Each student is to identify what everyone said went well, what did not work well and what they would do next time, relating their evaluation to the input of the course. It is this capstone that confirms students are capable of undertaking a foundational counselling session. The room in which the simulation takes place replicates the real life context (Cap/RPS).

Science

- A capstone subject in science on 'unravelling complexity' seeks to illuminate the tacit assumptions underpinning a selected, 'complex', tricky issue in science by bringing in keynotes from different disciplines to give their view on them. The assignment requires the students to state their considered position on each with reasons, referring to, drawing upon or critiquing the input from the keynote speakers and the key points made in the course (Cap/Reflect).

Sustainable social, cultural, economic and environmental development

- Arizona State University course MAE 446/598 at: http://semte.engineering.asu.edu/docs/solar/syllabi/MAE%20446-598%20Syllabus.doc Energy Systems design Capstone Design Course for Energy & Environment Students. The emphasis of the course is on learning and demonstrating the use of the Integrated Product Design (IPD) process. The outcome of the course is for students, through their team projects, to demonstrate their mastery of the ABET criteria for graduating mechanical engineering students. (Cap).

Transdisciplinary studies

- Social sciences/communications capstone involving a multidisciplinary team that has to develop an integrated, relevant action plan to address a real world issue identified by one of the university's partner NGOs (Cap/PBL).
- *Capstone – student-student collaboration projects in applied statistics across disciplines* In a capstone course for students in applied statistics, the statistics students collaborate with research students from other disciplines, bringing their quantitative expertise to the projects. The final product is a written report to the collaborator, intended to be of professional quality. Students also work through a sequence of learning activities, all assessed. These activities scaffold the students' skills needed to produce their report. Skills in statistical methodology, computation, and professional report writing are assessed along with the students' understanding of themselves as professionals and their abilities in the non-technical aspects of statistical consultation such as professional and ethical behaviour and written and oral communication, both formal and informal (University of Toronto) (Cap/Co-C).

Dilemma-based assessment

Business

- Video triggers on the key dilemmas faced by early career graduates gathered from the field – assessment involves saying how you would handle the dilemma presented and why your strategy is both feasible and is likely to be effective, given what has been learnt in the course (Dil).
- Business capstone. Students have to 'manage' an international company with constant input of unexpected challenges (Cap/Dil).
- Students have an assignment in which they have to state and justify a considered position on a real world ethical dilemma from a business case-study which is currently in the press (Dil).

Community & social work

- In a final year community-based service project students work for 2 semesters with a community group on one of its key development priorities and have to demonstrate their ability to work constructively with the client, respond to their needs, develop a relevant and workable plan of action on an improvement area and commence the process of implementation (Field/PBL/Dil).
- Assessment of discretionary decision-making in social work (Dil).
- Responding to scenarios of the most common challenges early career social workers experience. The assessment is based on what the student would do to manage the situation and how this is consistent with the good practice principles taught in the subject (Dil).

Dentistry

- Dentistry: a real world case of a client – involving diagnosis and patient relations then interviewing a successful dental practitioner on how they would handle the same case and reporting back both in an assessment submission and in a class presentation (Case/Dil/Int).

Education

- Reflective practice: students work in groups of 3-4 to respond to a critical incident drawn from real world practice (an unexpected dilemma/challenge actually experienced in the classroom, on a field trip, in a school lab, or in dealing with parents). The dilemma is provided in the form of a video clip or a case file. For assessment, each student then writes up their own diagnosis of what is going on and how best to handle the situation in the light of this diagnosis and what has been learnt in the degree (Dil/Reflect).
- Actual examples of a range of different student work in math are given to trainee teachers with notes on the backgrounds of students – each trainee is to analyse what the student work is saying about how they are thinking, what the gaps in their skills/understanding are/what is the best aspect of each case and what most needs improvement. They are then to identify a strategy for addressing this 'diagnosis'. Students come together in small groups to compare and contrast their diagnoses. They then implement their plan and evaluate the outcomes. Why is this powerful? It tests the ability to 'read' the student background and their performance and 'match' the most fitting response. It is authentic (the work is actually from real students). Students learn how to learn from each other, confirm their diagnosis and formulate a better response. It emphasises how the effective teacher needs to 'read' the unique situation and capabilities of each student and custom-tailor a response. Added to this are 'killer moment' scenarios – e.g. when a trainee says, "I'll get one of my best students to help a weaker one." To deepen the dialogue, she is asked, "What do you do if the parent of the bright student comes in and says, 'Why are you using my daughter as a tutor when you should be giving her more advanced work so her chances of getting into an Ivy League University are optimized?" (Dominican University of California) (Field/PBL/Dil).
- Trainee teachers have to select one special needs student and work with them on math or literacy.

  The assessment involves:
  - Developing a background profile of the student and identifying areas for development
  - Reading the formal assessment documentation for their selected student and then, from both (a) and (b) develop an individual management plan, with a justification
  - Implementing their plan and videoing themselves working with the student on it – noting the most 'wicked' moments and discussing what they did to handle the dilemma and to evaluate its effectiveness.
  - Working week-by-week with their chosen child and in University debrief class held each week discussing what went well and what didn't with peers and the instructor. Particular attention is given to the 'wicked moments' and the strategies used.

  The focus of assessment
  - to determine how effectively the trainee draws out the key lessons from the experience against the good practice guidelines discussed in class
  - to evaluate the personal, interpersonal and cognitive capabilities of the student along with their skills and knowledge in an integrated way.

  Why is this powerful?
  - It checks the ability to reflect in action; the ability to 'read and match'; and to change course if a planned strategy is not working.
  - It encourages 'reading the emotional state not just the cognitive state of students. It checks trainees' ability to manage themselves personally and their interpersonal capabilities when something doesn't go according to plan.

  (Dominican University of California) (Case/PBL/Dil).

Engineering

- Ethics embedded assessment – a real world case where the practitioner is faced with an ethical dilemma. The assessment is focused on what you would do, why and how this aligns with key ethical principles of professional practice as an Engineer discussed in class (Case/Reflect/Dil).

English

- The assignment requires students to identify a key dilemma currently experienced in their life circumstances and to:

- Describe the dilemma
- Look at the option first chosen to deal with it
- Identify an alternative way it could have been handled
- Trace out the different consequences that could have resulted depending on which option was selected
- From this come up with a more optimal approach that would have given the best outcome possible.

The assessment task is introduced by showing a clip from the movie "Sliding Doors" which traces out the different consequences that ensue based on whether the heroine did or did not get on a train as the doors were sliding close. The instructor also models how to do the project by presenting her own sample from a dilemma she is experiencing.

This assignment measures 'adaptability', the ability to trace out the consequences of and evaluate alternative, potentially relevant courses of action and 'responsiveness' (Maricopa college system Arizona) (Dil)

Entrepreneurship & invention courses

- Social entrepreneurship program – An organisation active in the area gives teams of students a real world dilemma/problem around a social challenge – this is an example of 'real-world' ethical entrepreneurialism and requires each student to demonstrate that they are able to accurately 'read and match' (Dil).

Health

- In the assessment of a community service unit in an allied health course students are presented with a critical incident. They have to describe clearly and accurately what is going on and from this derive an accurate diagnosis and plan of action justifying what they develop by using the capability framework and good practice principles discussed in class (Dil).

ICT and software engineering

- IT and chemistry: online interdisciplinary scenario-inquiry tasks for active learning in large, first year STEM chemistry courses with more than 1000 students enrolled – students from different disciplines are to work together to determine how best to handle a complex, real world issue with no 'right' answer – this was a UQ led initiative funded by ALTC/OLT in 2009 (Dil/PBL/Inv).

Medicine

- Trigger videos based on real-life dilemmas identified by experienced medical practitioners are discussed in class in groups. Each group is to say how they would handle each case and why. Then, they compare and contrast their strategy with what the practitioner did. At the end of the semester in a final examination, they are faced with a new, unseen dilemma and have to say what they would do to handle it and why, explaining how their strategy aligns with the effective approaches and key capabilities explored during the course. (Dil).
- 'Long cases' in medicine – high stakes and developed from real life dilemmas and cases faced by early career medical practitioners. (RPS/Dil).
- Scenario for intensive care medicine specialists: a tragedy has occurred and the patient is brain dead. Her spouse is in another city and is flying in and has only been told that there has been a bad accident. Students have to say how they will break the news and broach the issue of organ donation. Assessment is outcomes-based and criterion-referenced (RPS/Dil).
- Scenario assessment: how, as a male doctor, will you undertake a gender and culturally-sensitive physical examination of a female patient who is a refugee from the Middle East. Explain and justify your approach (RPS/Dil).
- The modified exam question or MEQ (Feletti, G.I. and Engel, C.E., 'The modified essay question for testing problem-solving skills'. *The Medical Journal of Australia*, volume 1, number 2, Jan 1980 pp79-80) is based on a scenario in which the individual student is to take on the role of a professional early in their career working in a specified context. A practical example provided by Professor J Knox is included in the University of Glasgow's Introduction to Assessment (McCulloch, M, L&T Centre 2007) pg 22 :

Prang

Page 1

Do NOT look through this booklet before you start. Answer briefly each of the four questions in turn completing each one before moving to the next. .Do not go back and add to or alter what you have written

Page 2

It is your night off, and you are relaxing at home. At 22.30 you are startled by the sound of breaking

glass and crumpling metal outside your house. You rush out and, in the dark, dimly discern a small shattered sports car on the pavement, wedged between the wall and a lamp post. List but do not elaborate on, the main points in your plan of action, putting what you consider to be the most important actions first.

Page 3

The car lights are still lit and in their glow you see a sole occupant trying in vain to get out through the off side door, which is jammed. Petrol is pouring out from the shattered tank. Already passing cars have stopped and people are running towards the scene of the accident. What immediate specific actions do you take, and why?

Page 4

As the driver stumbles out through the nearside door he says, "its all right, I'm a doctor". You recognise him as one of your partner's patients who is working as a pre-registration house physician in the local hospital, half a mile down the road. His breath smells strongly of alcohol and he says in an over deliberate way – "Course, I'm under the influence – had six pints – was going too fast – skidded, lost control – bang!" Miraculously, he appears to have escaped without any physical injury, though he is pale and shaken. What do you consider you should do next?

Page 5

In fact you run him up to the accident department of the hospital where he works and leave him with the duty surgical registrar. On your return home, half an hour later, you find the scene of the accident swarming with police, firemen and breakdown personnel. As you put your car away you wonder if you have discharged completely your responsibilities. List, but do not elaborate upon, the various factors which influence your decisions about your next actions. (RPS/Dil).

Nursing

- Simulations of the real world dilemmas that arise in practice identified by successful early nursing practitioners – tests the student's ability to apply skills and knowledge to a unique situation, diagnosis, client relations and capacity to deliver and evaluate the results (RPS/Dil).
- Managing, assessing and helping a deteriorating patient using a de-identified, real world case, with increasing challenges unfolding over time. Assessment is based on the quality of analysis, diagnosis, how well the management plan matches the condition of the patient, and the quality of interpersonal skills with not only the client but also with the family (Case/Dil).
- Evidence based practice focused on handling real-world dilemmas faced during the practicum. The practicum report takes one dilemma faced and the trainee writes up what happened, how it was handled, the outcomes and compares their perceptions with the feedback from the supervisor on the effectiveness of the approach using the top 12 key capabilities identified by successful early career nurses as an evaluation framework (Dil).

Occupational Therapy

- In a simulation-based assessment task students are given a specific role as part of an O.T. team and confronted with a case where there are number of possible ways to respond to the case as outlined. Students have to say what way of proceeding is likely to be most productive and why. This task gives focus to seeing how well the student would handle the most common real-world dilemmas that occur in early career practice (RPS/Dil).

Field-based assessment

Accounting

- A small group research exercise which involves identifying relevant newspaper articles and critiquing them against the management accounting principles taught in the course (Field/Crit).
- Students have to find a current newspaper article (this stops plagiarism) and apply the theory learnt in class to the claims made in the article– this shows the relevance of theory and practice and tests students can actually make the application link. Students hand in a draft for formative feedback in week nine – exemplars from work on earlier articles are shown. When this assessment was introduced student satisfaction scores went up significantly. (Field/Crit)

Business

- Overseas placement in a developing country. Each student works with a local team in-country on an actual strategic problem a firm is having and presents and discusses a relevant, feasible solution that has been undertaken in partnership with local students in-country. The assessment requires them to reflect on what they learnt about the country, the people, themselves, the problem addressed and effective change management and capacity-building in that cultural context. In this way the assessment task integrates technical skill with personal, interpersonal and cognitive capabilities with a particular focus on developing capability to

work productively with diversity (Field).

Community & social work

- Use of ePortfolios and reflective journals against a good practice framework when on placement in an NGO (Port/Ref/Field).
- Third year university students mentor school students to build interest in STEM (via a community service subject which assesses their ability to relate to the school students, the quality of their strategy, student response and a self-evaluation of this against a set of effective engagement and learning checkpoints discussed in class) (Field).
- A not-for-profit organisation provides a real world challenge and students work over a semester on a feasible, justified and practical solution. Each person is allocated to write up a section of the total report against a rubric focused on evidence that the solution is relevant and feasible which is discussed at the start of the subject to assure valid and reliable assessment (Field/PBL).
- In a final year community-based service project students work for 2 semesters with a community group on one of its key development priorities and have to demonstrate their ability to work constructively with the client, respond to their needs, develop a relevant and workable plan of action on an improvement area and commence the process of implementation (Field/PBL/Dil).

Creative Industries, Arts & Design

- Design students are taken to a Community Centre to intentionally meet professionals outside their own area – the focus is on an assignment that looks at the benefits of thinking in an interdisciplinary way. In one version of this task an exhibition and a book have been produced on the collective findings (Field/Reflect).
- Students are to scan ads using a range of media and contact networks for potentially relevant jobs in their professional area. They are to select one job and outline and justify how they would 'pitch' for it. They then have to locate a request for tender and have to write a bid for the tender with a business plan. Assessment includes a focus on the effectiveness of search, the quality and justification of the 'pitch' and the relevance of the tender (Inv/Cap/Field).

Dentistry

- Clinical performance assessment using a good practice rubric with a set of criteria and standards that are discussed in class in advance of the clinical placement – both student self-reflection and self assessment and the tutor's formative and then summative feedback are used for the written report. The focus is on patient-oriented care, effective patient management, accurate diagnosis, the appropriate and effective use of technical (psychomotor) skills and professionalism. In this program this approach takes place from year one (Field).

Education

- Capstones involving real world projects in particular schools (Cap/Field).
- Primary Education: 'learning stations' are created and implemented with students. For assessment students are to identify how successful the implementation was, using checkpoints discussed earlier in the course to guide their evaluation and then the extent to which the strategy improved student performance on their assessment. Key lessons for improving the approach are then to be identified (Field).
- Bed Primary: practicum – evidence is gathered in to demonstrate that the student is meeting the AISTL standards on inclusive assessment – the results are included in a hard copy of an ePortfolio. Students can choose how they would like to be assessed: 1:1 assessment by the lecturer or by a panel made up on a university staff member/the principal & an early career teacher. The practicum is supported by provision of video exemplars of students undertaking the task in earlier years with a commentary on how they handled any unexpected outcomes. Grading is pass/fail (Field).
- The development of a visual arts diary built into weekly activity and using unit input with the aim of producing a resource to take out onto the first practicum. Assessment includes a reflection on how the resource was developed, evidence that it engaged students (using the key student engagement tests identified in the course as a guide) and key lessons for next time (Field).
- *Education Social Studies* (first year): This assessment task involves students in addressing historical and geographically located themes with a view to producing a childrens' book on an interesting aspect of local (social) history. A key focus is on achieving the 'feeling of place'. Students can pursue a selection of themes including the lives of the original inhabitants, the

lives of migrants, what children did for entertainment in the area in earlier times etc. Students are required to locate and use primary resources and write the book at a language level suited to the child audience. They not only produce the book but submit notes on how they did it and a critical appraisal of the feedback received, relating this to the checkpoints on effective writing for the age group concerned discussed in class (Inv/PBL/Field).

- Capstone in Education: final year students design, run and evaluate the effectiveness of a 'conference' in which they bring together all that they have learnt and how they are going to manage the transition into teaching with keynote speakers that include successful early career teachers and other leaders in education (Cap/Co-C/Field).
- Actual examples of a range of different student work in math are given to trainee teachers with notes on the backgrounds of students – each trainee is to analyse what the student work is saying about how they are thinking, what the gaps in their skills/understanding are/what is the best aspect of each case and what most needs improvement. They are then to identify a strategy for addressing this 'diagnosis'. Students come together in small groups to compare and contrast their diagnoses. They then implement their plan and evaluate the outcomes. Why is this powerful? It tests the ability to 'read' the student background and their performance and 'match' the most fitting response. It is authentic (the work is actually from real students). Students learn how to learn from each other, confirm their diagnosis and formulate a better response. It emphasises how the effective teacher needs to 'read' the unique situation and capabilities of each student and custom-tailor a response. Added to this are 'killer moment' scenarios – e.g. when a trainee says, "I'll get one of my best students to help a weaker one." To deepen the dialogue, she is asked, "What do you do if the parent of the bright student comes in and says, 'Why are you using my daughter as a tutor when you should be giving her more advanced work so her chances of getting into an Ivy League University are optimized?" (Dominican University of California) (Field/PBL/Dil).
- Using the samples of five 3rd grade students' class work on addition and subtraction provided on the course moodle LMS site, in this assignment the trainee teachers have to:
  - Correct these math worksheets
  - Analyze the student work
    - What do the students know
    - With what concepts and procedures are they struggling
    - What does the class know about math collectively
    - What concepts and procedures are a struggle for many of these students
  - Create a responsive lesson plan for the next school day
    - Create learning outcomes based on their analysis.
    - Describe exactly what they would do the next day to teach and reach all of these students in a 90 minute math time. (Dominican University of California) (PBL/Field).

Engineering

- 'Engineers without borders' projects (Field/PBL).
- Engineering team project: embedded strategically in Engineering practice units across all levels. Teams are to design, build and demonstrate a product or process to meet a client need. This tests the ability to synthesise discipline knowledge and skills to meet a particular brief; self regulation; decisiveness; commitment; ability to positively influence others, project management capabilities and the ability to communicate in a clear and responsive way with both one's team and the client. This project demonstrates both relevance and the importance of 'reading' what is going to be most appropriate and feasible and being able to then 'matching' the right, fit-for-purpose response. To date the assessment focus has been more on the quality of the product but increased attention is now being given the above process factors as well (Field/PBL).
- Engineering students go to schools to talk to the students about the excitement of engineering, what their senior researchers are working on and are evaluated by their supervisor, teacher and students. This task is undertaken 6 times during the course (Field).
- Design-directed engineering education and technology entrepreneurship at Simon Fraser University. Here we study what it means to be an engineer using an open-ended design problem that covers all that we need to learn. The assignment (100 students) covers the following:
  - Customer needs and product specs
  - Refinement of these

- Translation to a relevant and feasible spec
- Success indicators
- Info gathering and use
- Building, testing refining the prototype

For assessment the team must hand in a report on each of above plus the different designs they came up with, along with evidence that they have benchmarked against what others done, and that their preferred design works (Field/PBL/Inv) (Simon Fraser University)

Entrepreneurship & invention courses

- Internships in successful enterprises – students observe and interview the entrepreneur and staff during a project and compare what they identify against the theory discussed in class on what makes for a successful enterprise (Field/Interv).

Health

- In a public health nutrition program students undertake a community-based research project from go to whoa. They have to work with their allocated provider on key areas for development and then develop a relevant and feasible solution with reference to key principles taught in the course (Field).

Hotel management

- Capstones involving real world projects undertaken in conjunction with a placement. Criteria include the ability to diagnose what lies behind the improvement area chosen and to develop plan to address it which is demonstrably relevant, feasible and aligned with what has been taught in the course (Cap/Field).
- Industry placements evaluated against a set of specified capabilities and competencies (Field).

ICT and software engineering

- Development of apps for use in developing countries to foster sustainable agriculture and subsistence farms. See, for example, the work of Professor Athula Ginige from Western Sydney University in Sri Lanka (Field/ICT/Inv).
- Capstones involving real world projects with a university partner (Cap/Field).
- Assessment of performance in sandwich programs/courses against a specific set of required graduate capabilities and skills (Field).

Law

- At the start of their law course students are to locate and attend a selection of local court sessions and spend four hours observing 3 cases and processes. They are to make notes on this, then write up an analysis and relate this to the key points made in the course. This tests personal capabilities – including the ability to find appropriate cases, get to court, be proactive; and interpersonal capabilities including the ability to relate to court staff, along with cognitive capabilities including the ability to diagnose and then make sense of what has been observed using key course content and theory (Field).

Marketing

- The development of business marketing plans commissioned by local tourism businesses. The criteria include how well the needs of the local business are identified and met, the relevance and feasibility of what is proposed, the clarity of its explanation to the client and the results when implemented (Field/PBL).

Media and Arts

- Successful programming in the university's radio/TV station (Field/Inv).

Medicine

- Third year medical students on placement discuss the typical issues to expect upfront. Then, when they are on site, they are to select a patient, develop a case, get peer review and write up the case for assessment against the input of the specialist who supervises them (Field).

Music

- Music – first year: students are to contact three well known industry professionals and undertake an interview focused on a set of key questions – including questions about the highlights and lowlights of the interviewee's career; what aspects of tertiary studies were most beneficial, how s/he managed financial survival, and the key advice they would give to a first year music student – this builds networks and helps show why the course is focusing on the program level outcomes it is emphasizing (Field/Reflect/Interv).

Nursing

- First year nursing: the nurse has to explain a diagnosis to a patient and translate complex jargon into plain English. The patient is then asked to explain what was said back to the supervisor for assessment of clarity, understanding and impact (Field/PBL).

- 2nd year nursing: develop an intervention with someone who has a developmental delay – a case history is provided and the student must diagnose, assess and establish a plan of support – another student then role plays the client – feedback is given by peers, the tutor, and an experienced fourth year student who is already working in the field with clients like this (Field/Case/PBL) .
- Read the latest literature on midwifery and develop a brief on it for a local maternity unit. Assessment includes a review of the data gathered in a short survey on the quality of the briefing by the maternity unit staff (Field/PBL).
- Students do a presentation for a group of early career nurses on a key issue with assessment focused on the outcomes sought and the process against a set of good practice checkpoints (Field).

Science

- Lab quality management – students check the lab for compliance against key quality assurance and safety checkpoints and then their work is evaluated by the external team of auditors they will actually have to satisfy when in the workforce (RPS/Field).
- General science: students link up with an early career researcher and are asked to describe in plain English to school students what the research is about, why it is relevant to them, what is being discovered and why it is so engaging to do this sort of experimental work – as a way to encourage more high school students to consider enrolling in STEM and as away to encourage UG students to consider this career path. Evaluated using a community service subject rubric (Inv/PBL/Field).

Sustainable social, cultural, economic & environmental development

- Development of apps for use in developing countries to foster sustainable agriculture and subsistence farms. See, for example, the work of Professor Athula Ginige from Western Sydney University in Sri Lanka (Inv/Field/PBL).
- Education for Sustainability at Western Sydney University: Developing 'sustainability literacy' requires the development and assessment of new ways of thinking and learning that enable us to recognise the connections between environmental concerns, social patterns and individual actions… and builds skills for inquiry, analysis and creative action. It promotes personal and social change, develops civic values and empowers learners to be leaders for a sustainable future (Inv/Field/PBL).
- A public health MSc at the University of Worcester which
    - Brings together Public Health, sustainability and climate change
    - Involves a case study – focused on the ecosystem of services in a particular community with a focus on improving public health
    - Students have to identify (diagnose) a hot issue in a particular site (e.g. air pollution in Beijing, floods and illness) and then determine (invent) how best to address it
    - In some cases virtual field work using 3D headsets is used.
    - Why 'powerful'?
        - Addresses ability to emphasise, diagnose and read and match
        - Aims to overcome professional silos.

      (PBL/Field/ICT).
- Developing and delivering 'Go green' week at the University of Worcester
  One week of sustainability awareness developed for and by students
  Five themes:
    - Nature – Nature on Campus, Sustainability Fair, community litter-pick
    - Health & food – Local food fair, cooking demo, food bank, Quz
    - Travel - pedi-cab rides, sus-trans, bike security
    - Re-use - repair cafe
    - Energy – home energy advice, cob oven demo, energy competition, pedicab challenge

  Students have to plan, take into account their audience, deliver the week's activities, handle unexpected implementation challenges, demonstrate clearly positive outcomes
  Why 'powerful'?
    - Real life
    - A bit 'scary'
    - Reflective
    - Requires reflectiveness and responsiveness, ability to 'read and match'
    - Adaptive

Students can cite what they did and achieved when applying for jobs.
(Field/Co-C).

- Semester in dialogue & the city studio - The city is the classroom This involves:
  - Dialogue about hot issues: e.g local food. The students host the dialogue and run the class – the guests have different positions – e.g. green food vs the local buyer for a large supermarket chain. Others are business people, community leaders
  - Major assignment – plan, host, deliver, evaluate a community dialogue – with a focus on its aim, outcomes, how it connects to what is being learnt in class, logistics, recruitment, delivery, problem solving. Capabilities tested: how to listen; how to both influence and respond emphatheticaly to others; ability to read what might work best and match then deliver the right strategy; ability to reflect in action and solve ongoing challenges; ability apply the key lessons on effective collaboration

    (Simon Fraser University) (Field/PBL).
- Interdisciplinary real-world sustainable development project in a developing country – Shelter in Bangladesh

  In order to create sustainable solutions to the world's most important challenges, global development professionals must reach beyond the traditional boundaries of their field of expertise combining scientific/technological, business, and social ideas in an approach known as integrated innovation. In this project-based course, students from multiple disciplines (engineering, management, health and social sciences) work together – using participatory methods with an international partner – to address a locally relevant challenge.
  The final team report for the course is a proposal that addresses the real-world global challenge and context issues. Elements must demonstrate the integration of various knowledge sets in the overall scope of the proposed solution.

  Proposed solutions (final presentation and report) are evaluated according to the following criteria: Interdisciplinary Cooperation, Innovation, Relevance and Significance, Execution and Evaluation, Sustainability and Ethics & Equity. Projects are also evaluated based on idea development/refinement from previous assignments. (e.g. how well was feedback acted upon and incorporated?)
  Several individual reflections and class participation evaluations are also incorporated in the assessment of the course.

  University of Toronto (Field/PBL).
- Solar energy engineering and commercialisation at Arizona State University
  At: https://engineering.asu.edu/semte/Solar_Courses.html (Inv/Field).
- Creating Sustainable Organisations. For assessment students are required to conduct independent research to develop a case study of a company that professes to be 'sustainable'. The focus of this investigation involves addressing the following question: "Can this company make a business case for sustainability? If yes, what are the grounds for this business case?" The research report should include the following sections: introduction; the company; findings; analysis; conclusion; references. Western Sydney University
  (At: http://handbook.westernsydney.edu.au/hbook/unit.aspx?unit=200853.1) (Field/PBL).

Theology

- Ecumenical dialogue: students are to engage in a 2 way dialogue with someone from a quite different ecumenical tradition – The focus is on the quality of listening and the ability to draw out commonalities and then discuss this in the light of the previous 13 weeks of studying theology (Field).

Tourism & Hospitality

- Field research on tourist behaviour with a report that makes sense of what is found against the research and theory taught in the subject with a set of suggested ways to take this into account provided and justified by the student (Field/PBL).
- Promotional videos and brochures custom-tailored to the particular needs and contexts of a range of island hotels and resorts (Inv/PBL/Field).
- Review of attractions and destinations tourism behavior through design of a tool or survey (group project), implementation with tourists and recommendations in the light of observation and interview – real project (tests key personal, interpersonal and cognitive capabilities in combination) (PBL/Field).

Transdisciplinary studies

- Engineering and Accounting: students in groups interview a successful early career performer at work on the capabilities that count and the key challenges they encounter and how they

handle them. Students report this to the class and their report is evaluated against an agreed rubric that covers a set of checkpoints on effective practice (Field/Reflect/Interv).

Co-creation with students

Arts & Social Sciences

- Student-run symposia on key course outcomes. Evaluated against a set of criteria jointly determined in advance by students and the lecturer. Criterion areas include: participant and lecturer feedback on the quality of design, relevance, engagement, evidence of positive impact along with a self-review on the quality of team-work using a set of good practice principles discussed in class at the commencement of the project. (Co-C)

Community & social work

- Student teams undertake a series of focus groups to identify instances of discrimination in the surrounding community. They are to write and produce a video script then load it up onto YouTube for use as a trigger for community feedback and class learning. The product is assessed on the quality of each component using class and teacher feedback along with clear evidence of effective performance of different team roles. This assessment task measures diagnosis, the ability to synthesise, the ability to work with diversity, creativity and invention, lateral thinking, and fosters the learning of generic skills – in this case use of video and YouTube as a form of public engagement and dissemination. (Inv/Co-C).

Education

- Capstone in Education: final year students design, run and evaluate the effectiveness of a 'conference' in which they bring together all that they have learnt and how they are going to manage the transition into teaching with keynote speakers that include successful early career teachers and other leaders in education (Cap/Co-C/Field).

Engineering

- A curriculum review simulation involves students in a co-creation project in chemical engineering and applied chemistry. For this summative assessment a project has been developed that encourages students to analyze the existing curriculum and then recommend and provide a rationale for changes. The project requires students to imagine that they represent the Chemical Engineering Department as they present a pitch to a group of interested donors. They must present a plan that earmarks the donor funds for a particular course-based or program level improvement. Students are directed to: "review the key learning outcomes of the 2nd year curriculum to consider how your courses work together to develop your skills and knowledge, and to identify gaps or areas for improvement in this curriculum." In their argument students can draw on a range of sources including research and popular papers, while also integrating their firsthand experience as students.

  The assessment criteria include clear and persuasive messages through effective argumentation; analyzing audience and purpose to select the most effective mode/genre of communication, and level of detail required; finding and properly integrating relevant information to support their purpose and argument; summarizing and synthesizing information from external sources; effectively organizing information and prioritizing it in each mode of communication (written, visual, oral) to convey a core message; applying effective strategies to the design of text, visuals and oral presentations; developing self-confidence in your process of communication (University of Toronto) (RPS/Co-C).

Flipped Assessment

- In *Flipping Assessment: making assessment a learning experience* Susan Spangler from the State University of New York notes that "What's been left out of the conversation about flipped classrooms, is why and how we might also need to flip our assessment practices". She reports how involving students in grading conferences, sitting with them and explaining what is being done as grading is undertaken and inviting them to identify evidence against key course outcomes leads them to be clearer on what is expected, more confident in revising their work and better able to self-assess in the future (Co-C).

Higher Education

- Production of a 'lonely planet' guide by experienced third year students on 'how things work around here' for incoming first years from the same background – assessed as part of a community service subject. The assessment includes an analysis of the feedback from the students it is intended to help. (Co-C).

Sustainable social, cultural, economic and environmental development

- Student-run conferences and campaigns on sustainability issues (Co-C).
- Developing and delivering 'Go green' week at the University of Worcester
  One week of sustainability awareness developed for and by students
  Five themes:
    - Nature – Nature on Campus, Sustainability Fair, community litter-pick
    - Health & food – Local food fair, cooking demo, food bank, Quz
    - Travel - pedi-cab rides, sus-trans, bike security
    - Re-use - repair cafe
    - Energy – home energy advice, cob oven demo, energy competition, pedicab challenge

  Students have to plan, take into account their audience, deliver the week's activities, handle unexpected implementation challenges, demonstrate clearly positive outcomes
  Why 'powerful'?
    - Real life
    - A bit 'scary'
    - Reflective
    - Requires reflectiveness and responsiveness, ability to 'read and match'
    - Adaptive

  Students can cite what they did and achieved when applying for jobs.
- Co-creation projects by students and staff of education for sustainable development programs at University of Uppsala's Centre for Sustainable Development & Environment and Development Studies. See the CEMUS (Centre for Environment and Development Studies)which is a student-initiated and primarily student-run university centre at Uppsala: http://www.web.cemus.se/. More info about the centre, how it got set up and how it works is available at: http://www.web.cemus.se/about/. Contact: Isak Stoddard Acting Program Director of CEMUS: isak.stoddard@csduppsala.uu.se (Co-C).

Transdisciplinary studies

- *Capstone – student-student collaboration projects in applied statistics across disciplines*
  In a capstone course for students in applied statistics, the statistics students collaborate with research students from other disciplines, bringing their quantitative expertise to the projects. The final product is a written report to the collaborator, intended to be of professional quality. Students also work through a sequence of learning activities, all assessed. These activities scaffold the students' skills needed to produce their report. Skills in statistical methodology, computation, and professional report writing are assessed along with the students' understanding of themselves as professionals and their abilities in the non-technical aspects of statistical consultation such as professional and ethical behaviour and written and oral communication, both formal and informal (University of Toronto) (Cap/Co-C).

Role-play/simulation

Archaelogy

- Using Minecraft 'world building' simulation game to successfully 'excavate' a medieval village by applying all that is being learnt in the course. For details see: https://theconversation.com/recreating-medieval-towns-an-example-of-why-minecraft-is-a-great-learning-tool-53926 (RPS)

Arts & Social Sciences

- Participate in a simulated interview with peer and lecturer review against the effective interview checkpoints discussed in class with illustrative videos. Then use the feedback to write an evaluative essay on the outcomes, drawing appropriately on the key content covered in the course (RPS)
- Students have to develop a proposal to improve an existing policy addressing a key social issue including strategies and the indicators they would use to measure its effectiveness (issues can include treatment of asylum seekers, aboriginal incarceration, disability rights, domestic violence; bullying in schools; the Ice epidemic) and justify the changes advocated. They have to come up with a catchy policy name, present their proposal in a simulation where they are applying for seed funding to test the proposal in practice. They have to include a justification of their approach by drawing upon all that has been learnt in the course. (PBL/RPS)

Business

- Production for a simulated company of budgets with a clear rationale and justification (RPS)
- A business simulation game in which teams of 3 each play a real world (and carefully briefed) role that involves them in first developing a 'pitch' to a specific type of investor and then 'fronting' people from industry. Assessment is based on evaluation from industry, the extent to which what has been learnt is effectively applied to the pitch and a self-evaluation of the effectiveness of the group process against key checkpoints discussed in advance (Cap/RPS).
- Each student undertakes a speed interview for a job – the equivalent of speed dating with assessment based on a comparison of how well the student thought they went with how well the 'interviewer' thought they performed against a set of 'effective' interview principles discussed in class (RPS).
- *Real-world project using a Wiki tool and a simulation*
  An online collaborative writing activity using a Wiki tool on the course Blackboard site is a part of the course project that expands over a period of 10 weeks with diverse types of activities. Students in groups create an imaginary company, collaboratively write their company profile and a job offer, build a company website (Blog tool on Blackboard site) and prepare a group presentation. Playing the role of a hiring committee, groups present their company profile and a job offer to invite candidates-classmates to apply to their company. Students-candidates prepare their resume and cover letter according to the company's information. The company evaluates applications, selects a candidate, and produces a report justifying their selection in terms of specified criteria. The project aims to assess, in a progressive manner, students' written productions and analytical reading in business French, oral communication skills, ability to evaluate their own learning (through reflection writings), as well as their peers' production (University of Toronto) (RPS/ICT).

Creative industries, Arts & Design

- In a digital media course students undertake warcraft online and produce a video on the experience with a critical commentary on its design and impact (*World of Warcraft* is a multiplayer online role-playing game created in 2004 by Blizzard Entertainment. It is the fourth released game set in the fantasy Warcraft universe, which was first introduced by Warcraft: Orcs & Humans in 1994) (RPS/ICT).

Dentistry

- Dentistry – working with virtual patients – using inquiry based learning and assessment. The University is working in partnership with dental schools at other universities within and beyond the nation on this (RPS).
- A communication skills training program was developed for 2nd year dental students at the Faculty of Dentistry. It includes didactic content, modeling behaviour, and practical sessions with students working in small groups using Standardized Patients and role-playing in eight different communication scenarios commonly found in clinical practice. Communication is assessed using the Kalamazoo Essential Elements Communication Checklist, which is a validated scale that measures 7 elements of communication on a scale of 1 (poor) to 5 (excellent). Four assessment strategies are used: (1) Each student/dentist's communication is video-taped for subsequent review. (2) The student/dentist self-evaluates his or her communication skills, in addition to receiving written KEECC assessment provided by the group facilitator, patient, and observing fellow students. (3) Verbal feedback is provided by the group to the student/dentist, and (4) each student/dentist writes a reflection of their experience as the dentist. Criteria - The overall intent is for students to reflect on their own communication skills, to try and put themselves in the shoes of the patient to understand their patient's perspective, and to provide constructive comments on observed communication skills of their peers (University of Toronto) (RPS).

Education

- Micro teaching with peer and supervisor assessment against an effective teaching scale discussed in class prior to the assessment activity (RPS).

Engineering

- In the concrete structures unit of an Engineering program students design an RC concrete beam against a given brief/set of conditions. They physically prepare the beam in a team & test it to breaking point and then analyse the data, including making direct links to the relevant theory and research. Students again in a team run tests on a beam that is a critical construction element. This assessment task requires students to bring together technical skills, diagnosis and the ability to work reciprocally and constructively as part of a design and construction

team (PBL/RPS).

- An engineering simulation – you have to apply for a specific job so, given the criteria in the advertisement provided to you, what is your pitch and why? (RPS).
- Engineering is being integrated with the liberal arts in a range of US universities. This enables students to learn not only about engineering-design principles and their technical application but also about the social context in which these designs must be put into action. This article argues that engineering education (and its assessment) today needs to help students devise innovative solutions for a complex world while also anticipating their potential unintended consequences. In other words, engineering education needs to prepare students to design expansively and imaginatively. One example cited in the article concerns the civil-engineering course at Worcester Polytechnic Institute. This course transports students to the late 19th century and challenges them to decide how best to clean up Worcester's heavily polluted Blackstone River using the technologies available at the time. Students are confronted with a range of possible approaches — "the cheapest approach, the approach that will last the longest, the approach most likely to make Worcester an exemplar of advanced engineering design, the approach that will be least disruptive to businesses, or the approach most likely to ensure the just treatment of all residents of Worcester and along the Blackstone River" — against a historical backdrop of African-American migration from the rural South to the industrial North and concerns about threats to public health from the growth in manufacturing (RPS). At: http://chronicle.com/article/Bringing-the-Liberal-Arts to/229671/?cid=wb&utm_source=wb&utm_medium=en
- A curriculum review simulation involves students in a co-creation project in chemical engineering and applied chemistry. For this summative assessment a project has been developed that encourages students to analyze the existing curriculum and then recommend and provide a rationale for changes. The project requires students to imagine that they represent the Chemical Engineering Department as they present a pitch to a group of interested donors. They must present a plan that earmarks the donor funds for a particular course-based or program level improvement. Students are directed to: "review the key learning outcomes of the 2nd year curriculum to consider how your courses work together to develop your skills and knowledge, and to identify gaps or areas for improvement in this curriculum." In their argument students can draw on a range of sources including research and popular papers, while also integrating their firsthand experience as students.

  The assessment criteria include clear and persuasive messages through effective argumentation; analyzing audience and purpose to select the most effective mode/genre of communication, and level of detail required; finding and properly integrating relevant information to support their purpose and argument; summarizing and synthesizing information from external sources; effectively organizing information and prioritizing it in each mode of communication (written, visual, oral) to convey a core message; applying effective strategies to the design of text, visuals and oral presentations; developing self-confidence in your process of communication (University of Toronto) (RPS/Co-C).

Entrepreneurship & invention programs

Technology and entrepreneurship @ SFU. Over 2 years engineering and business students work together. Funded by BC Innovation Council and Simon Fraser University. Business students undertake a beginners engineering course and the engineers do a beginning business course. Assessment involves developing a 'pitch' for a $25K prototype grant in a dragons den like competition. Assessment criteria focus on the quality of each individual's contribution to the team, the quality of their 'elevator pitch', video and their final presentation along with the quality of individual reflection

(Simon Fraser University) (Inv/RPS).

Global Affairs

Simulation in Global Affairs (transdisciplinary)

An interdisciplinary course for First-Year undergraduates called "Order and Disorder: Global Affairs and Emerging Technologies" (WDW 152) draws upon Political Science, Sociology, History, Economics, and Philosophy.

Students are randomly divided into two groups – Soviet leaders and American leaders. The groups move to separate rooms and each receives initial instructions informing them that the year is 1983 and describing the tense state of superpower relations. Each group then receives a series of "intelligence reports" suggesting that the adversary has launched a nuclear attack. The groups must then reason through their response, discussing what they already know, what they

would like to know, and what their range of options might be. Throughout the discussion a stopwatch ticks down the time until the nuclear missiles reach their target. When the stopwatch rings the groups reconvene and each side announces its response. The exercise ends either in a nuclear war or peace.

The decision making processes on both sides are then compared with a short video about a real-life nuclear crisis that resembles the simulation. This is followed by students writing up, comparing and contrasting their decision making processes and outcomes with those of the real-world political leaders. For more information: http://wdw.utoronto.ca/wdwone/ (University of Toronto) (RPS).

Health

- In a Public Health program students have to write a ministerial briefing on an issue that is based on a real world case – this requires a clear understanding of evidence-based practice; what motivates a minister and how the political process works and how lobbying groups operate (RPS/Case).
- In a communication skills subject in Health Science students watch a video of an interaction with a client and have to take notes exactly just as they will have to do in a clinic after they graduate. They then have to write up a progress note which fits the legal requirements and conventions and which is relevant to what is seen and is coherent (RPS/PBL).

ICT and software engineering

- Identify a project from a given menu or one of your own choosing, form your own group of fellow students with the complementary skills necessary to deliver the develop, jointly formulate a project proposal and present this to a panel – assessment is based on both the quality of the outcome and the group process (RPS/PBL).

Languages

- In an English as a second language transition programs students from non-English speaking backgrounds practice scenarios of how they will participate constructively in seminars when and if they get a place at university. They are coached by successful senior university students from their background who receive a community service subject credit for their work with the student (RPS).

Law

- Assessment of a Middle East and International Law simulation and role play at the University of NSW that gives focus to international relations. For a detailed video on how this is done see: https://teaching.unsw.edu.au/role-plays-case-studies-unsw (RPS).
- International law: students role-play a country in an international dispute. The assessment is against a set of clearly identified capability tests and the extent to which students can successfully take into account cultural differences (RPS).
- Students are to write a letter of advice to a client using a range of data provided in the course with a commentary explaining the strategy adopted in the letter and its focus. This tests diagnosis; the ability to link the facts and identify what might be the best way to respond (RPS).

Marketing:

- One of our partner businesses presents students with a real problem. Students have to identify a relevant and feasible solution that will be cost-beneficial and, at the same time, figure out how best to 'sell' it to the client. This requires lateral thinking, understanding what motivates the client, ability to influence, clear, sharp and engaging presentation skills, an ability to think on your feet when the client asks a curly question during the presentation etc. Student teams present to the clients in a format similar to Dragons' Den (PBL/RPS).
- Marketing: a simulation – you are person 'X' in a marketing firm (full profile details for the person are given) and you have to pitch a given real world marketing idea to industry – with a review from a 'panel' of classmates led by the lecturer. The student then writes up a reflective report based on the feedback, the presentation principles discussed in class and identifies what they would do again or differently (RPS).

Medical Imaging

- In a role play the student is given a patient request including a clinical history and has to diagnose what needs to be done and why. The assessor asks the student to interpret the form and nominate projections to be taken, given that specific history. The 'patient' (a volunteer) is waiting outside the room and the student has to discuss and justify the selected treatment with the 'patient'. This tests the ability to 'read and match', clinical and technical knowledge and personal/interpersonal capabilities. The role play is evaluated by the supervisor using an

agreed rubric and takes into account the feedback from 'the patient' (RPS).

Medicine

- 'The stations' approach in Medicine including assessment of 'emotional intelligence' on entry
  - First done as a formative task – assessment for learning
  - Then at the end of the year it is done as a summative task – assessment of learning (RPS).
- 'Long cases' in medicine – high stakes and developed from real life dilemmas and cases faced by early career medical practitioners (RPS/Dil).
- Scenario for intensive care medicine specialists: a tragedy has occurred and the patient is brain dead. Her spouse is in another city and is flying in and has only been told that there has been a bad accident. Students have to say how they will break the news and broach the issue of organ donation. Assessment is outcomes-based and criterion-referenced (RPS/Dil).
- Scenario assessment: how, as a male doctor, will you undertake a gender and culturally-sensitive physical examination of a female patient who is a refugee from the Middle East. Explain and justify your approach (RPS/Dil).
- The modified exam question or MEQ (Feletti, G.I. and Engel, C.E., 'The modified essay question for testing problem-solving skills'. *The Medical Journal of Australia*, volume 1, number 2, Jan 1980 pp79-80) is based on a scenario in which the individual student is to take on the role of a professional early in their career working in a specified context. A practical example provided by Professor J Knox is included in the University of Glasgow's Introduction to Assessment (McCulloch, M, L&T Centre 2007) pg 22 :

Prang

Page 1

Do NOT look through this booklet before you start. Answer briefly each of the four questions in turn completing each one before moving to the next. .Do not go back and add to or alter what you have written

Page 2

It is your night off, and you are relaxing at home. At 22.30 you are startled by the sound of breaking glass and crumpling metal outside your house. You rush out and, in the dark, dimly discern a small shattered sports car on the pavement, wedged between the wall and a lamp post. List but do not elaborate on, the main points in your plan of action, putting what you consider to be the most important actions first.

Page 3

The car lights are still lit and in their glow you see a sole occupant trying in vain to get out through the off side door, which is jammed. Petrol is pouring out from the shattered tank. Already passing cars have stopped and people are running towards the scene of the accident. What immediate specific actions do you take, and why?

Page 4

As the driver stumbles out through the nearside door he says, "its all right, I'm a doctor". You recognise him as one of your partner's patients who is working as a pre-registration house physician in the local hospital, half a mile down the road. His breath smells strongly of alcohol and he says in an over deliberate way – "Course, I'm under the influence – had six pints – was going too fast – skidded, lost control – bang!" Miraculously, he appears to have escaped without any physical injury, though he is pale and shaken. What do you consider you should do next?

Page 5

In fact you run him up to the accident department of the hospital where he works and leave him with the duty surgical registrar. On your return home, half an hour later, you find the scene of the accident swarming with police, firemen and breakdown personnel. As you put your car away you wonder if you have discharged completely your responsibilities. List, but do not elaborate upon, the various factors which influence your decisions about your next actions. (RPS/Dil).

- The use of simulation-based assessment by the Royal College of General Practitioners in its Clinical Skills Assessment test. The aim of the CSA is to test a doctor's ability to gather information and apply learned understanding of disease processes and person-centred care appropriately in a standardised context, make evidence-based decisions, and communicate effectively with patients and colleagues. Being able to integrate these skills effectively is a key element of this assessment. The validity of the CSA resides in its realistic simulation of real-life consultations. Patients are played by trained and calibrated role players, and cases are written and assessed by working GPs. The format of the assessment also allows for systematic sampling from the curriculum, using a selection blueprint. Each candidate is allocated a consulting room and has 13 ten minute consultations. (for details see: http://www.rcgp.org.uk/training-exams/mrcgp-exams-overview/mrcgp-clinical-skills-

assessment-csa.aspx) (RPS).

Nursing

- Simulations of the real world dilemmas that arise in practice identified by successful early nursing practitioners – tests the student's ability to apply skills and knowledge to a unique situation, diagnosis, client relations and capacity to deliver and evaluate the results (RPS/Dil).
- Use of simulated patients to confirm ability to apply skills and knowledge effectively (RPS).
- Use of a video trigger in exam conditions to which the examinee must respond in terms of identifying what is happening, why, how the patient is behaving and what, in the light of this they would do to manage the situation, with a justification (RPS).
- Integrated assessment using video feedback. Entry-level nursing students in an accelerated nursing program complete a video project entitled "putting it all together", in which they film themselves performing a sterile, dry dressing change on a volunteer patient. The videos are uploaded and shared on a secure server. This assignment allows students to demonstrate their ability to perform a sterile, dry dressing change integrating three distinct components of the course: health assessment, relational skills and psychomotor skills. In addition, students view a classmate's performance and provide a constructive online peer review. After receiving the peer review, students summarize the learning by completing a short, online self-assessment, in which they reflect on their performance in the various components, how well they were able to combine the skills, and what their key learning was. (University of Toronto). (RPS/Reflect).

Occupational Health and Safety

- In a unit on critical thinking and decision-making students are given a scenario where they are supervising employees who are clearly doing something unsafe and illegal (e.g. entering a confined space tank). Students are asked to draw a flow chart of what is actually being done and a flow chart of what the law requires; then to compare the two. They are asked to draw a causal loop diagram of the non-technical issues going on (e.g. workers and/or employer are complacent). Students then must make a decision about what to do, referencing professional ethics and legal compliance, and draw up a communication plan for how they will communicate this decision to the people involved. The final report is a letter to the boss explaining what and why they are doing what they are doing (Case/RPS).

Occupational Therapy

- Students are presented with an online video of a scenario played by actors involving client family with a child who has cerebral palsy. Students have to identify what questions they will ask, what the optimum plan of action might be and give reasons to justify their approach based on what been learnt in the course. (RPS/Case/PBL).
- In a simulation-based assessment task students are given a specific role as part of an O.T. team and confronted with a case where there are number of possible ways to respond to the case as outlined. Students have to say what way of proceeding is likely to be most productive and why. This task gives focus to seeing how well the student would handle the most common real-world dilemmas that occur in early career practice (RPS/Dil).

Policing

- Police college simulations including the use of a scenario village. See, for example: http://www.police.nsw.gov.au/recruitment/the_training/associate_degree_in_policing_practice/simulated_policing (RPS).
- Virtual firearms training. See, for example: https://www.youtube.com/watch?v=-PuHzxB5cdw (RPS/ICT).
- Simulated forensic science scenes. A range of clues are built into the scene and the student has to locate them and explain what they imply, referring to the key principles discussed in class (RPS).

Psychology

- A staged formative and summative assessment process is used in a fourth year class in this program. Each team of four meets with a 'client' - a trained psychologist who is role playing - and has to come up with an appropriate counselling response – with a series of dilemmas thrown in by the 'client' as they proceed. This is videoed – there is staff, peer and self review of the video. Each student is to identify what everyone said went well, what did not work well and what they would do next time, relating their evaluation to the input of the course. It is this capstone that confirms students are capable of undertaking a foundational counselling session. The room in which the simulation takes place replicates the real life context (Cap/RPS).

Science

- Lab quality management – students check the lab for compliance against key quality

assurance and safety checkpoints and then their work is evaluated by the external team of auditors they will actually have to satisfy when in the workforce (RPS/Field).

- Use of triggers – science students are instructed on good practice in doing a presentation then they have to develop a presentation to the Board of a fictional company which is planning to close down its R&D department – this gets them to think through why they are doing science (RPS/PBL).

Sustainable social, cultural, economic and environmental development

- In a university-wide elective on Interdisciplinary Sustainable Development at the University of Manchester students are placed in teams and assigned a trained teamwork facilitator. Students are presented with a series of written project briefs and are given the role of sustainability consultants who must advice a series of clients on live, current problems, empowering them to make creative suggestions and think pragmatically how to devise an implementation plan that might work in practice… This requires them to balance economic, social and environmental consequences and take into account the ethics of the situation… Students are immersed in 'wicked' open-ended problems as discussed by Rittel and Webber in their 1973 book *Dilemmas in a general theory of planning*. Formative and summative team project reports are marked on the appropriateness of their response to the brief; the use of credible and relevant information; their development of a creative and well-justified proposal and their application of sustainability principles.
  (For full details see Helen Dobson and Bland Tomkinson 'Practical education for sustainable development through interdisciplinary problem-based learning', University of Manchester Ch 3 in Richard Atfield and Patsy Kemp (Eds) (2013); *Enhancing education for sustainable development in Business and Management, Hospitality, Leisure, Marketing, Tourism*, HEA, York at: https://www.heacademy.ac.uk/sites/default/files/esd_dobson_final_0.pdf). (RPS/PBL).

Theology

Business ethics and theology – different groups are given a position and they have to argue whether they support it or not. Each group has to discuss their conclusions with the other groups and identify the key points of difference and similarity, along with how convincing others found their argument to be. We reflect on what they have learnt and on the most effective learning approaches, on how to construct an argument, how to manage a project, the progression of argumentation, how to become self-reflective, self-evaluative learners. They then write a reflective report on the whole process (Reflect/RPS).

Portfolio-based assessment

Community & social work

- Use of ePortfolios and reflective journals against a good practice framework when on placement in an NGO (Port).

Engineering & Technology

- Purdue Polytechnic Institute's UG Transdisciplinary studies in Technology Program. 'The program emphasizes creation, application and transfer of knowledge through hands-on learning…. (it).. combines individualized plans of study, close faculty mentoring of students and a competency-based approach for traditional learners at a public research university"… (This approach)… shifts the focus away from traditional credit hours and instead measures student progress on demonstrated (capabilities and) competencies. The learning is organized around themes and driven by problems rather than seat time in a classroom…. A student must demonstrate expertise in eight broadly defined primary competencies in order to graduate. The primary competencies include design thinking, effective communication, social interaction on a team, ethical reasoning, and innovation and creativity. Each of the competencies is split into five sub-competencies…. Through the program, achieved competencies will be accounted for while an e-portfolio will showcase them and be added to the students' academic records…. Dean Bertoline said competency-based education answers the call from industry leaders looking for a different type of higher education graduate… "They are looking for well-rounded graduates that not only have deep technical knowledge and skills but very broad capabilities for open-ended problem solving, greater creativity, ability to work in diverse teams and better communications skills," he said. A video on the program is available at: https://drive.google.com/folderview?id=0BxdPFMVWz-l2ZVhIdVNqdXNUZjQ&usp=drive_web (Port/Inv/PBL/LC).

ICT

- Portfolio-based Constructive Alignment: The portfolio-based approach to constructive alignment aims to motivate students to engage in learning by removing marks from coursework assignments, using frequent formative feedback to produce evidence, and performing final summative assessment using criterion referenced assessment. With this approach, educators define unit learning outcomes and assessment criteria to indicate how students can demonstrate they have achieved unit learning outcomes to different grade levels. To help guide students to this understanding, educators create tasks for students to engage with during the teaching period and work with students to help them demonstrate unit learning outcomes through completing these tasks. At the end of the teaching period, the resulting work is compiled into a portfolio for summative assessment, and assessed against the assessment criteria. Data can be collected from the formative feedback process to help educators perform the final summative assessment quickly and accurately. For further details see: http://crpit.com/confpapers/CRPITV136Cain.pdf and See: Cain, Andrew. 2013. "Constructive Alignment for Introductory Programming." Ph.D. thesis. Swinburne University. Hawthorn, Australia (Cap/Port).

Medicine

- Development of an ePortfolio which gives evidence of the effective development and application of the key overall capabilities and competencies necessary for accreditation (Port).

Nursing

- A first year unit that asks students to research and reflect on nursing as a profession – assessment focuses on the quality of critical reflection and how effectively the student has been able to start the development of an evidence-based professional ePortfolio against the capabilities set down for development in the program (Reflect/Port).
- Nursing: a video of a trainee undertaking a procedure under supervision with a critical self review against an agreed rubric and compared with the supervisor's analysis and suggestions. The video and reflection goes into the student's portfolio on clinical performance and appraisal (Reflect/Port).

The UK Higher Education Achievement Report (HEAR)

> The way we currently communicate student achievement is in urgent need of modernisation…. The Higher Education Achievement Report (HEAR) provides a more sophisticated alternative for recording student achievement. A student's HEAR will include information describing their qualification: its subject, level of study and a brief description of the modules or units they have studied, with the individual grades they achieved. It will also cover extra-curricular achievements, which can be clearly evidenced through prizes and awards, representative roles and official posts, for example in a students' union. The report will supplement the traditional degree classification and will include the European Diploma Supplement.
> HEA (2012): A marked improvement: transforming assessment in higher education, HEA, York, pg 12 at: At: https://www.heacademy.ac.uk/sites/default/files/a_marked_improvement.pdf pg 12. (Port)

The Cal State System use of the Portfolium tool

- This tool is free for students and operates like 'Linked in" – in that it is intended to link students directly with employers looking for capable graduates
- Students can list all the curricular and co-curricular activities they have been involved in with evidence of the quality of their delivery and that they have met the capability requirements and indicators established as central to early career employment
- Employers can search the database in a Boolean fashion for potentially relevant graduates to consider for employment.
- Students can load up co-curricular activities and evidence; along with results on class assessment; placement evidence etc
- The system is being set up for the entire Cal State System (500,000 students).

For details of Portfolium overall see: https://portfolium.com/
For its use at California State University Northridge see: http://www.csun.edu/it/portfolium (Port)

EPortfolio Assessment of Clinical Skills in Nursing at UBC

UBC School of Nursing uses technology and innovation to assess student skills
At: http://apsc.ubc.ca/spotlight/ubc-school-nursing-uses-technology-and-innovation-assess-student-

skills

Author: Bernie Garrett, PhD, RN

Bernie Garrett is part of an innovative change taking place within the UBC Bachelor of Science Nursing program and the evaluation process of clinical competence of nursing students. One of the challenges facing nursing education is finding a method that effectively measures students' advancing clinical skills throughout the entirety of their degree. By developing the eportfolio system, educators have found an engaging way to assess students' clinical abilities and build confidence based on their development.

What is the big picture problem that your research tries to address?
Well, it's a professional problem for us in terms of nursing education, but it's a problem that is relevant for really any clinically-based education program where students have to be confident and have faith in their abilities. Assessing students in practice is a tricky thing to do; it involves quite a lot of one-to-one experience with their instructors and measuring a variety of clinical skills. The best way that we have been able to do this up until now is with individual assessment tools that only target particular courses. Gathering that information solely by talking to people creates challenges and the problem is that that it doesn't show a great deal of continuity from the student, as a novice, as they proceed forward to becoming an expert.
So what we have done is developed an approach for testing and evaluating assessment approaches using an electronic portfolio, so that from day one when students enter the program their clinical practices are assessed within the portfolio right through until they graduate.

What is innovative about the eportfolio system?
We contracted a developer and asked them to create a tool for us. We had done some research and couldn't find anything that resembled our vision. So the electronic portfolio or eportfolio has been developed in-house at the School of Nursing at UBC. It is a web-based system that operates and incorporates all the clinical assessment competencies that are required. We can link back to the registered professional standards that the College of Registered Nurses of BC requires.
We have incorporated learning tools such as reflective journals and logging of clinical skills within the eportfolio and give students the opportunity to add their own documents or digital artifacts to their portfolio. By allowing students a space to self-reflect on their entire learning experience, the eportfolio promotes an approach to learning where students provide the evidence for their knowledge, through their actions and reflections.
As well, no one else was using a system like this. We were the first in North America to be using this system of assessment of clinical practice of students. UBC School of Nursing has been using it since 2009 and it has proved very effective for us. Quite a few other schools and colleges throughout North America have started to switch over to electronic evaluations systems as well.

How will your research and the eportfolio make a difference?
In terms of teaching, an electronic evaluation system makes for a higher quality of assessment and therefore gives a higher quality of education. In terms of students it means that they now have evidence of their practice and performance throughout the whole of their training. They can then show evidence to employers when they are looking for jobs after graduation. It is a more transparent, convenient and effective method of assessment of student clinical competence.

Bernie Garrett, Associate Professor in UBC School of Nursing (Port)

Online learning portfolios at Portland State University
See: https://www.pdx.edu/unst/eportfolio-frinq-eportfolio-guide and https://www.pdx.edu/oai/pebblepad. In the ePortfolio system with freshmen in the University Studies program at PSU:

- The ePortfolio is developed against the four core capabilities to be developed in the Freshman university studies program: communication; working with diversity; inquiry and critical thinking; ethics and social responsibility. PSU is using a new enterprise tool: Pebble Pad (one of the first of 3 US clients of this UK group). Students can add evidence from all their activities with a justification of how it meets one or more of the key capability areas.
- Criteria for assessment: Portfolios are judged on their soundness of construction; the evidence provided; the focused expression; relevance; use of the IT-enabled tools (e.g. use of images/videos etc); and the veracity of the evidence claims made.

See also details of the PSU Capstone Course ePortfolio at: http://alt.wiche.edu/node/358 and the ePortfolio: Fundamentals unit at: https://www.pdx.edu/unst/eportfolio-fundamentals-start

(Port)

E Portfolios at Arizona State University

The tool used
ASU uses the tool: Digication. Currently 32,000 students have portfolios developed. See exemplary portfolios developed in English major.

Powerful uses of ePortfolio – key tests
1. Focuses on evidence that PLOs have been achieved
2. Taught in a 1st and 3rd year class - with exemplars, explicit, illustrated criteria, self review, peer review of classmates before submission
3. Includes both curricular and co-curricular activities – this is one significant way to recognize co-curricular activities
4. Includes a reflective self-assessment against specified criteria as part of the assessment
5. Assessment is against the criteria set down in the formal ePortfolio subject.

Examples (kindly provided by the Vice-Provost):

- The Department of English is taking a leading role with the ePortfolios. Here is an example of what they are doing: https://english.clas.asu.edu/admission/undergraduate-admission/undergraduate-scholarships-awards/exemplary-eportfolio-awards
- Exemplary ePortfolio Awards are given to students and faculty for portfolios that both include exceptional writing and make good use of the affordances of the ePortfolio technology. Winners are celebrated in a showcase and awards ceremony. (Port)

ASU School of Sustainability – Portfolios against program level outcomes in Sustainability
Students develop their portfolio of evidence against performance and a self assessment (curricular and co-curricular) on the following student sustainability outcomes:

- Systems thinking
- Future thinking
- Normative thinking (e.g. what we should do; values)
- Strategic thinking
- Interpersonal competence

(Port)

Communications & Information Technology
A first year subject involving 500 students in ICT is assessed via a constructively aligned portfolio. The student portfolios are to contain a combination of the student's test work, work they have prepared in response to the weekly assignments, a Learning Summary Report, and other pieces. The portfolio requirements and assessment criteria are included in the Unit Outline, and these are discussed with students in multiple lectures. To be eligible for a Pass grade the portfolio has to include a range of pieces from the weekly exercises. The Credit grade requires completion of extension exercises, including additional programs or reports on related concepts. Distinction and High Distinction grades require students to go beyond the set work: Distinction is awarded for portfolios that included a custom program of the student's design and creation, and High Distinction requires a research report that analyses some aspect related to programming. The overview of the assessment criteria from the unit outline is provided to the students in the first week. Each of the individual learning outcomes (ILOs) are then included in a separate set of criteria showing the different levels to which these outcomes could be demonstrated. Students are asked to reflect on their learning in the Learning Summary Report, and a template document is provided to assist students in preparing their comments. The template prompts students to describe the pieces they have included, how they are related to the ILOs, and then to reflect on what they have learnt from the unit. Further details are available at: http://crpit.com/confpapers/CRPITV136Cain.pdf

(Port)

Food systems & nutrition – tracking competency development & creativity
At the foundational level, students are asked to take responsibility for identifying and demonstrating how relevant competencies are acquired during the field visits, through discussion of course readings and through a “real world” group project report and presentation. Students use a competency record document that they maintain throughout the MPH program. At the same time, they are encouraged to keep a journal of their experiences and reactions to: readings; field visits to several community, corporate and government agencies; and guest speakers, in order to enable reflection in and on practice, a valuable means of enhancing professional learning (Schön 1983).

At the meso level, over a six week period, groups of five students work through actual challenges

facing agencies within the food system to meet deliverables and think through options that the agency could implement.

At the meta level, students are asked, at the beginning of the course, to create a framework/diagram that represents their current understanding of Canada's food system. They are given free reign as to how to represent it and their frameworks vary considerably in form and content. At the end of the course, students reflect on their original frameworks, and revise and resubmit them. Students are evaluated on the degree to which they are able to incorporate new insights about the food system into a revised or in some cases, substantially recreated framework.

By linking learning activities to both the competency requirements and the more creative framework development, opportunities for assessing different kinds of learning are woven together through the course. This "layering" encourages students to demonstrate foundational competencies while implementing higher order critical thinking and creatively generating new representations
(University of Toronto) (Portf)

Assessment of creativity, entrepreneurialism, invention

Business

- Assessment focused on social enterprise
  Students work in teams on a social enterprise project in a not-for-profit organisation and write up an evaluation/enhancement plan (this is done offshore in a range of developing countries as well as onshore). There is particular focus on demonstrating that the suggested strategy is feasible and that is being implemented with positive impact. In some cases this may require one group of students to 'hand over' the action plan to a subsequent team in which case assessment is based on the extent to which their briefing is clear, evidence-based and helpful to the group carrying on with the implementation of the action plan. (Inv/PBL)
- 'SBA 495 is Portland State University's largest Capstone and engages over 750 students in 35 sections of a business strategy course that partners with an organization in the community to address real world business challenges. In this Capstone students learn to systematically analyze a firm's internal and external environments and, through engagement with community partners, apply concepts and theories related to the formulation and implementation of business/organization strategies. Students join an interdisciplinary team; pool their knowledge, skills, and interests; use strategy to address a problem or concern of the community partner. Emphasis is on multiple functions and perspectives to understand diverse management and stakeholder interpretations, conceive integrative solutions, and address social and organizational outcomes (Portland State University)'(Cap/Inv/PBL).

Community & social work

- Student teams undertake a series of focus groups to identify instances of discrimination in the surrounding community. They are to write and produce a video script then load it up onto YouTube for use as a trigger for community feedback and class learning. The product is assessed on the quality of each component using class and teacher feedback along with clear evidence of effective performance of different team roles. This assessment task measures diagnosis, the ability to synthesise, the ability to work with diversity, creativity and invention, lateral thinking, and fosters the learning of generic skills – in this case use of video and YouTube as a form of public engagement and dissemination. (Inv/Co-C).

Creative industries, Arts & Design

- Production of a business case against a set of good practice guidelines for an invention produced in a cross disciplinary team (Creative industry course) (Inv/PBL).
- Audience and peer feedback using a set of agreed quality tests on the staging of a drama production (Inv).
- Compositions, performance and the quality of reviews in a Music Program (Inv/Perf) .
- Use of Sibelius to create a musical composition – multiple reviews and assessment via the web against a set rubric and indicators (Inv).
- Creative industries course: students blog a creative project – they keep a visual diary, have to produce a creative statement on 'me', demonstrate a clear understanding of skills and design philosophy (metacognition), set a project, deliver it, self evaluate, get and use peer review effectively; provide evidence of digital literacy and clear communications. The final product

is peer-reviewed by successful practitioners in the field and supported by students who form communication teams around common project areas in their blogs (Inv).

- UTS Bachelor of Creative Intelligence and Innovation – In this program students 'take ideas for a walk' and trial speculative scenarios – they undertake thought experiments and engage in carefully-designed sandpit environments with creative methods and practices from across the disciplines. Students explore what innovation looks like from multiple perspectives and are empowered to think big and 'think different' about future possibilities and their role as change-makers. In their final years they realise projects, initiate start-ups, run symposiums on creativity and innovation, and work with a broad range of academics and real world clients. (Inv).
- Students are to scan ads using a range of media and contact networks for potentially relevant jobs in their professional area. They are to select one job and outline and justify how they would 'pitch' for it. They then have to locate a request for tender and have to write a bid for the tender with a business plan. Assessment includes a focus on the effectiveness of search, the quality and justification of the 'pitch' and the relevance of the tender (Inv/Cap/Field).

Education

- *Education Social Studies* (first year): This assessment task involves students in addressing historical and geographically located themes with a view to producing a childrens' book on an interesting aspect of local (social) history. A key focus is on achieving the 'feeling of place'. Students can pursue a selection of themes including the lives of the original inhabitants, the lives of migrants, what children did for entertainment in the area in earlier times etc. Students are required to locate and use primary resources and write the book at a language level suited to the child audience. They not only produce the book but submit notes on how they did it and a critical appraisal of the feedback received, relating this to the checkpoints on effective writing for the age group concerned discussed in class (Inv/PBL/Field).
- Media/Arts is a new subject area in ACARA. In this task students are to identify apps that would help school students to engage productively and creatively with the arts. Each student is to locate an app, evaluate it and then demonstrate it briefly in class with a short evaluation review and suggestions on where it might best be used. Assessment would be in the form of a report based on class feedback, lecturer feedback and self review against the following evaluation criteria: links to the requirements of ACARA, relevance, feasibility, scalability and cost. (ICT/Inv)

Engineering

- Purdue Polytechnic Institute's UG Transdisciplinary studies in Technology Program. 'The program emphasizes creation, application and transfer of knowledge through hands-on learning…. (it).. combines individualized plans of study, close faculty mentoring of students and a competency-based approach for traditional learners at a public research university"… (This approach)… shifts the focus away from traditional credit hours and instead measures student progress on demonstrated (capabilities and) competencies. The learning is organized around themes and driven by problems rather than seat time in a classroom…. A student must demonstrate expertise in eight broadly defined primary competencies in order to graduate. The primary competencies include design thinking, effective communication, social interaction on a team, ethical reasoning, and innovation and creativity. Each of the competencies is split into five sub-competencies…. Through the program, achieved competencies will be accounted for while an e-portfolio will showcase them and be added to the students' academic records…. Dean Bertoline said competency-based education answers the call from industry leaders looking for a different type of higher education graduate… "They are looking for well-rounded graduates that not only have deep technical knowledge and skills but very broad capabilities for open-ended problem solving, greater creativity, ability to work in diverse teams and better communications skills," he said. A video on the program is available at: https://drive.google.com/folderview?id=0BxdPFMVWz-l2ZVhIdVNqdXNUZjQ&usp=drive_web (Port/Inv/PBL/LC).
- Engineering design – the creation of a real-world engineering device – e.g. a blood pressure device. The capabilities being assessed are imagination, innovation, feasibility, marketability with a business plan – students invent and then have to mount a case to convincingly sell it to a 'client' (Inv).
- Engineering – a group project to design a small robot with peer feedback and ongoing formative feedback from the instructor. The final formal submission measures not only inventiveness, feasibility and useability but also a wide range of interpersonal collaborative and self-management abilities. A clear grading rubric on each element is used and this is

discussed and made clear from the outset. This task allows students to deal with design issues at a much deeper and more collaborative level than the more traditional, isolated lab exercise. But it might be hard to resource if you had really large classes (Inv).

- Engineering in a range of US universities is being directly integrated with the liberal arts
  This enables students to learn not only about engineering-design principles and their technical application but also about the social context in which these designs must be put into action. This article argues that engineering education (and its assessment) today needs to help students devise innovative solutions for a complex world while also anticipating their potential unintended consequences. In other words, engineering education needs to prepare students to design expansively and imaginatively. One example cited in the article concerns an engineering design course at the Rochester Institute of Technology provides students with the opportunity to explore "effective access technologies" — that is, technologies aimed at providing services to people with disabilities. To create such technologies, engineering students need to do more than just consider the mechanics or electronics of a prosthetic limb, or a lifting device, or a mechanism to enhance vision for the partially blind. Engineers need to think about how these technologies will be used in different social and cultural settings and refine them accordingly to enhance their use (Inv).

  For more details see: Chronicle of HE April 27, 2015 Loni Bordooi and James WinebrakAt: http://chronicle.com/article/Bringing-the-Liberal-Arts to/229671/?cid=wb&utm_source=wb&utm_medium=en

- Waterloo Engineering Ideas clinic
  The Engineering Ideas Clinic™ (https://uwaterloo.ca/engineering-ideas-clinic/) at the University of Waterloo supplements a traditional engineering curriculum with open-ended activities designed to spark student self-learning and exploration…
  We focus on design since this represents the pinnacle of engineering practice and integrates a full range of technical and non-technical knowledge, skills and abilities. Examples of Engineering Ideas Clinic Activities include:

  Analysis and Redesign Activities. Students are challenged to explore in detail how real-word engineering artefacts operate, to develop and validate appropriate engineering models, and to apply these models to the re-design of the artefact for improvement, to suit a new application, etc. For example, students may be challenged to develop a model of a water filter for a hypothetical competitor company, or to take a model fuel cell car and integrate new control to facilitate bump detection, etc. Major longitudinal activities are under development in this thread, for example, in mechanical engineering, the dissection of an engine in first-year, followed by analysis of various components in subsequent courses, and culminating in a re-design in the final year. (Prod/Inv)

  Contacts: Jason Grove (jagrove@uwaterloo.ca) and Sanjeev Bedi (sanjeev.bedi@uwaterloo.ca)

- Design-directed engineering education and technology entrepreneurship at Simon Fraser University. Here we study what it means to be an engineer using an open-ended design problem that covers all that we need to learn. The assignment (100 students) covers the following:
  - Customer needs and product specs
  - Refinement of these
  - Translation to a relevant and feasible spec
  - Success indicators
  - Info gathering and use
  - Building, testing refining the prototype

  For assessment the team must hand in a report on each of above plus the different designs they came up with, along with evidence that they have benchmarked against what others done, and that their preferred design works (Field/PBL/Inv) (Simon Fraser University)

Entrepreneurship & invention programs

- The combined business –law experiential strategy seminar at the University of Windsor, Ontario taught by business professor Francine Schlosser and Faculty of Law professor Myra Tawfik, brings together students from each faculty and requires them to help businesses solve problems ranging from improving efficiency and market share to intellectual property protection. Fostering that creative problem solving in its students caught the attention of the Canadian Council of Small Business and Entrepreneurship, which awarded it for being the most innovative entrepreneurial education course in the country at its annual 2015 meeting

last month in Calgary (PBL/Inv).
See also the strategy and entrepreneurship concentration at the University of Windsor's Odette School of Business.

- UTS Degree in Creative Intelligence and Innovation. The Bachelor of Creative Intelligence and Innovation (BCII) is a unique, combined degree that encompasses high-level critical and creative thinking, invention, complexity, innovation, future scenario building and entrepreneurship; building leading-edge capabilities that are highly valued in the globalised world. BCII students are selected from 17 disciplines, from all faculties, to participate in a future-facing, world-first, transdisciplinary degree that takes multiple perspectives from diverse fields, integrating a range of industry experiences, real-world projects and self-initiated proposals – equipping students to address the complex challenges and untapped opportunities of our times (Inv).
- Harvard Innovation Lab
  At: https://i-lab.harvard.edu/explore/about/
  Launched in November 2011, the Harvard Innovation Lab (i-lab) is a resource for any student at Harvard interested in entrepreneurship and innovation. Programming is designed to help students grow their ventures at any stage of development and covers a wide range of disciplines. The i-lab offers a five-stage engagement model focused on foundational and experiential learning that enables students to explore entrepreneurship, meet and engage with a growing community of first-time founders and experienced entrepreneurs, ideate in human-centric ways, prototype and build to test the practicality of their visions, and launch and grow their ventures.

  Some 31 cross university courses are offered ranging from design, venture founders' dilemmas, commercialising science, eco-entrepreneurship, social entrepreneurship, entrepreneurial science and leadership, entrepreneurship in Africa, creative thinking and organisational success to entrepreneurial finance, entrepreneurship in the online economy, trade, development and entrepreneurship and an E-Lab.Assessment is predominantly project/thesis/group based (Inv/PBL).

Event management

- Event plan creation in partnership with a business/organization – this is a real project (it tests in combination students' personal, interpersonal and cognitive capabilities plus their ability to draw upon relevant generic and profession-specific skills and knowledge). The effectiveness of the plan in practice is then evaluated by the client against their original brief and success indicators (PBL/Field).

Health

- In a communication skills subject in Health Science students watch a video of an interaction with a client and have to take notes exactly just as they will have to do in a clinic after they graduate. They then have to write up a progress note which fits the legal requirements and conventions and which is relevant to what is seen and is coherent (RPS/PBL).

Higher Education

- Grad Cert in HE: participants have to rewrite a subject outline they are teaching applying the learning and assessment principles taught. They then have to justify their rewrite (PBL/Inv).

ICT and software engineering

- Development of apps for use in developing countries to foster sustainable agriculture and subsistence farms. See, for example, the work of Professor Athula Ginige from Western Sydney University in Sri Lanka (Field/ICT/Inv).
- Year long capstone – a development reviewed formatively by peers and external entrepreneurs then summatively in a staged way (Cap/Inv).
- IT and chemistry: online interdisciplinary scenario-inquiry tasks for active learning in large, first year STEM chemistry courses with more than 1000 students enrolled – students from different disciplines are to work together to determine how best to handle a complex, real world issue with no 'right' answer – this was a UQ led initiative funded by ALTC/OLT in 2009 (Dil/PBL/Inv).
- Computer programming: work integrated learning project based on a real world business need – the lecturer acts as a coach but doesn't write any of the code, only responds to what the student is doing with formative input (PBL/Inv).
- Identify a project from a given menu or one of your own choosing, form your own group of fellow students with the complementary skills necessary to deliver the develop, jointly formulate a project proposal and present this to a panel – assessment is based on both the

quality of the outcome and the group process (RPS/PBL).

Languages

- Using new online creation tools students create and produce stories and videos in Spanish which are evaluated for quality and production against a rubric discussed in class (Inv).

Media & Arts

- Video production and presentations with review by a panel against standard industry criteria (Inv/Perf).
- Successful programming in the university's radio/TV station (Field/Inv).

Music:

- In a music degree students each year create and record a series of individual pieces. Then they first self assess and then are evaluated by peers and finally are assessed by the lecturer using the popular music assessment tool - BoPMAT. Students are marked on how valid and justified their self-assessment is along with the peer feedback using 4 clear criteria. This is done online using BoPMAT – Students provide a paragraph of feedback on each track they record. They are admitted to the program by interview. For further details see: http://assessmentinmusic.com.au/wp-content/uploads/2013/07/The-BoPMAT-1.pdf (Inv/Reflect).
- Performing arts – music – the student has to compose a piece, orchestrate it, do all the sound checks, do a promotional poster, prepare a media release, get the college orchestra working then present it for review in a live venue. Assessment is based on the external review and the student's self-assessment against the key outcomes and criteria set down for the course (Inv/Perf).

Psychology

- A doctoral class in Psychology learns how to edit Wikipedia entries in their area of speciality The assessment looks at the response from the Wikipedia editors and if the students' evidence-based edits remain on the site (ICT/Inv).

Research methods

- In a qualitative methods class students are to teach their peers about a methodology so that they understand it well enough to evaluate research using that method. The assessment covers feedback on the effectiveness of the student teacher and the quality of application of the methodology to the piece of research evaluated by those taught (Inv).

Science

- Evaluation of a cross-disciplinary approach to animation of biological processes in which graphic artists, IT designers and scientists work together to show how biology works with a view to attracting more young people to a career in the area. Assessment can include evaluation of the design, creativity, technical robustness along with the number of downloads and audience feedback. For an example of what the results can look like see the Walter + Eliza Hall Institute for Medical Research's WEHI.TV site and WEHI.TV animations like insulin production and type 1 diabetes. (Inv).
- General science: students link up with an early career researcher and are asked to describe in plain English to school students what the research is about, why it is relevant to them, what is being discovered and why it is so engaging to do this sort of experimental work – as a way to encourage more high school students to consider enrolling in STEM and as away to encourage UG students to consider this career path. Evaluated using a community service subject rubric (Inv/PBL/Field).
- Students have to produce a YouTube video which makes clear to a lay person what a particular piece of science involves and how it is useful. Assessment is determined by (a) audience rating (b) number of hits on YouTube. Some of these YouTube student videos have gone viral and many have thousands of followers all around the world. For one example see: http://news.mit.edu/2012/k-12-education-video-initiative-0425 Inv/ICT).

Sustainable social, cultural, economic & environmental development

- Development of apps for use in developing countries to foster sustainable agriculture and subsistence farms. See, for example, the work of Professor Athula Ginige from Western Sydney University in Sri Lanka (Inv/Field/PBL)
- Education for Sustainability at Western Sydney University: Developing 'sustainability literacy' requires the development and assessment of new ways of thinking and learning that enable us to recognise the connections between environmental concerns, social patterns and individual actions… and builds skills for inquiry, analysis and creative action. It promotes personal and social change, develops civic values and empowers learners to be leaders for a

sustainable future (Inv/Field/PBL).

- The Aalto University (Finland) Masters in Creative Sustainability is a joint programme of the three Aalto University schools: School of Business, School of Arts, Design and Architecture and School of Engineering. The learning outcomes and assessment give focus to: *Systems approach***:** The ability to implement systemic thinking into critical problem solving that creates new holistic understanding about complex situations in society. The emphasis is on global awareness within the context of local communities and simultaneous modification of different aspects of sustainability. *Design thinking:* The ability to apply creative problem solving methods and tools in facilitating dialogs, defining problems, generating ideas and obtaining solutions. *Project management:* The ability to manage multidisciplinary teamwork and promote and discuss sustainability in culturally versatile industrial, urban and business environments. *Sustainability management:* The ability to develop new approaches for creating sustainable business models and to advance business ethics and corporate responsibility. Students are also to develop an understanding of the way that different organizational forms support the pursuits in sustainability (Inv/PBL).
- First year students from areas like Product Design, Fashion Design, Interior Design, Engineering, Landscape Architecture and Agriculture courses work in work in cross disciplinary groups to produce tender documents for the restoration of specified local sites of historical/cultural significance or the establishment of sustainability oriented local initiatives like Blue Economy Projects which aim to make money out of waste (Inv/PBL).
- Solar energy engineering and commercialisation at Arizona State University At: https://engineering.asu.edu/semte/Solar_Courses.html (Inv/Field).
- Students in a Blue Economy course (focused on how to make money out of waste) identify how to save ink in printing by using Gararmon type face (Using this was reported on ABC 702 3rd March 2016 at 4.15 as saving the US government up to $320m per annum). In another student developed sustainability and innovation project moths are attracted to lights on a low barge in a lake and become food for fish. (Inv/ICT).
- Leadership & entrepreneurship program: An assessment task which integrates learning into real world issues – 'Develop an Ecopreneurship Business Plan'. Students are required to produce a Business Plan focusing on an entrepreneurial idea for an environmentally friendly product or serve. The operational concept for this assessment is 'ecopreneurship' (Isaak 2005) which refers to a type of entrepreneurship that focuses specifically on environmental sustainability. Environmental responsibility is defined for the purpose of the unit as a set of organisational initiatives designed to mitigate environmental degradation.
  Instructions:
  As a team of savvy ecopreneurs, you have been hired by a large company to present a business plan for an environmentally friendly product or service. The presentation and the summary must encapsulate the strategic development of this product or service. Below are some suggestions of areas that could form the basis for your business plan:
    - Office recycling system
    - Solving the problem of E-Waste
    - Eco-efficiency project
    - Eco-efficiency Consulting
    - Green retrofitting
    - A sustainability joint venture
    - A renewable energy system (wind, solar, ocean, etc.)

  For further details see: http://handbook.westernsydney.edu.au/hbook/unit.aspx?unit=200863.1 & http://handbook.westernsydney.edu.au/hbook/course.aspx?course=3725.1 (Inv/PBL)

Technology & Entrepreneurship

- *Technology and entrepreneurship @ SFU*. Over 2 years engineering and business students work together. Funded by BC Innovation Council and Simon Fraser University, business students undertake a beginners engineering course and the engineers do a beginning business course. Assessment involves developing a 'pitch' for a $25K prototype grant in a dragons den like competition. Assessment criteria focus on the quality of each individual's contribution to the team, the quality of their 'elevator pitch', video and their final presentation along with the quality of individual reflection

  (Simon Fraser University) (Inv/RPS)

Theology

- In a fourth year seminar course on “Advanced Topics in Christianity” the class is divided into four groups, and each group is assigned a specific literary text (e.g., Thomas King’s ‘Green Grass’, ‘Running Water’). The problem they are then given is to design an undergraduate course on Christianity and modern literature featuring the text they had been assigned. Students are also required to submit reflective learning journals throughout the course.

  To help students with their group task they are provided with resources from the University’s Centre for Teaching Support and Innovation (e.g., on course design, and methods of assessment). The final project comprises two key pieces:

  - An annotated syllabus that would be given to the instructor hired to teach the hypothetical course, including a list of resources the instructor would need to be sufficiently prepared;
  - A lecture on the assigned text that would be given to the imagined students who had enrolled in the hypothetical course.

  (University of Toronto) (Inv/PBL)

Tourism & Hospitality

Promotional videos and brochures custom-tailored to the particular needs and contexts of a range of island hotels and resorts (Inv/PBL/Field).

Transdisciplinary studies

- *Technology and entrepreneurship @ SFU*. Over 2 years engineering and business students work together. Funded by BC Innovation Council and Simon Fraser University, business students undertake a beginners engineering course and the engineers do a beginning business course. Assessment involves developing a ‘pitch’ for a $25K prototype grant in a dragons den like competition. Assessment criteria focus on the quality of each individual’s contribution to the team, the quality of their ‘elevator pitch’, video and their final presentation along with the quality of individual reflection

  (Simon Fraser University) (Inv/RPS).
- Cross disciplinary assessment – Marketing students work with Engineering students on a project to invent and sell a workable, scalable and marketable robot – the prototypes are then publicly pitched and some have received funding. Assessment is based on a critical evaluation of the process of invention and cross-disciplinary collaboration, the success of the pitch and the outcomes achieved, along with the key lessons students will be taking with them for improved approaches in the next project (Inv/PBL).
- Quest University

  Quest university is designed with one goal: to provide the most effective and engaging undergraduate education in the liberal arts and sciences in order to produce … broadly educated individuals with an informed perspective on the problems of the 21st century and the integrative abilities to solve them. (see: http://squamish.ca/discover-squamish/education-and-learning/quest-university-canada/)

  The ‘Question’
  Toward the end of their "Foundation Program," Quest students take a course called "Question." While working with a course instructor and a faculty mentor of their choosing they develop a statement of their Question: a proposal for how they will study a topic of special interest to them.[4] This "Question" acts as the students major for their Bachelor of Arts or Bachelor of Science degrees and is much more similar to a master's thesis when compared to a standard undergraduate major.
  Questions often range from being very broad to being very focused. For example; What is honour? What is beauty? What are the elements of successful habitat restoration? How can we manage infectious disease outbreaks? [4]
  Questions are often framed in terms of several disciplinary approaches, key works and thinkers, or the sub-questions that will be addressed. This is largely based around the Foundation program's multidisciplinary approach.[4] This unique approach allows students to cater their academic research more closely with their academic interests. Each question is relatively unique to each Quest student thus providing a full range of academic pursuits and interests at the University.

  Concentration program
  The second half of the program is devoted to a "Concentration program". With the help of a faculty advisor, all students design their own program of concentration studies according to an interdisciplinary question or topic of research. Each student's Individual Concentration Program consists of four principal elements:

- a statement of the Question;
- a course plan;
- a list of related readings; and
- a Keystone project.

The Concentration Program may also include experiential learning components such as a semester abroad, leadership training, service learning, or an internship.
(Further details see: http://everything.explained.today/Quest_University/) (PBL/Inv)

Performance-based assessment

Media & Arts

- Video production and presentations with review by a panel against standard industry criteria (Inv/Perf).

Music

- Performing arts – music – the student has to compose a piece, orchestrate it, do all the sound checks, do a promotional poster, prepare a media release, get the college orchestra working then present it for review in a live venue. Assessment is based on the external review and the student's self-assessment against the key outcomes and criteria set down for the course (Inv/Perf).
- Evaluation of composition and performances using a set of agreed criteria in Music (Inv/Perf).

ICT-supported assessment

Archaelogy

- Using Minecraft 'world building' simulation game to successfully 'excavate' a medieval village by applying all that is being learnt in the course. For details see: https://theconversation.com/recreating-medieval-towns-an-example-of-why-minecraft-is-a-great-learning-tool-53926 (RPS)

Arts & social Sciences

- English literature: development and moderation of blogs on a poem with a critical justification for what was said and done and an analysis of the feedback given online to the blog. (ICT)

Business

- Use of Poplets for mind-mapping the connections between key factors, strategies and influences in tackling real-world problems (ICT).
- *Real-world project using a Wiki tool and a simulation*
  An online collaborative writing activity using a Wiki tool on the course Blackboard site is a part of the course project that expands over a period of 10 weeks with diverse types of activities. Students in groups create an imaginary company, collaboratively write their company profile and a job offer, build a company website (Blog tool on Blackboard site) and prepare a group presentation. Playing the role of a hiring committee, groups present their company profile and a job offer to invite candidates-classmates to apply to their company. Students-candidates prepare their resume and cover letter according to the company's information. The company evaluates applications, selects a candidate, and produces a report justifying their selection in terms of specified criteria. The project aims to assess, in a progressive manner, students' written productions and analytical reading in business French, oral communication skills, ability to evaluate their own learning (through reflection writings), as well as their peers' production (University of Toronto) (RPS/ICT).

Creative industries, Arts & Design

- In a digital media course students undertake warcraft online and produce a video on the experience with a critical commentary on its design and impact (*World of Warcraft* is a multiplayer online role-playing game created in 2004 by Blizzard Entertainment. It is the fourth released game set in the fantasy Warcraft universe, which was first introduced by Warcraft: Orcs & Humans in 1994) (RPS/ICT).

Economics

- Assessment of ability to apply game theory, gaming and assessment in economics (ICT)

Education

- Media/Arts is a new subject area in ACARA. In this task students are to identify apps that would help school students to engage productively and creatively with the arts. Each student is to locate an app, evaluate it and then demonstrate it briefly in class with a short evaluation review and suggestions on where it might best be used. Assessment would be in the form of a report based on class feedback, lecturer feedback and self review against the following evaluation criteria: links to the requirements of ACARA, relevance, feasibility, scalability and cost. (ICT/Inv)

ICT and software engineering

- Development of apps for use in developing countries to foster sustainable agriculture and subsistence farms. See, for example, the work of Professor Athula Ginige from Western Sydney University in Sri Lanka (Field/ICT/Inv).
- Use of interactive MOOCs to develop, check and self-test basic skills and knowledge (ICT).

Nursing

- Online learning as part of a blended learning nursing program: students go to the National Prescribing Service site and undertake the self-managed learning and testing modules there. The results are then verified by us. This saves time and uses a MOOC-like approach in an area of fixed, set, correct knowledge and saves class time for more interactive exercises and learning (ICT).

Policing

- Virtual firearms training. See, for example: https://www.youtube.com/watch?v=-PuHzxB5cdw (RPS/ICT).

Psychology

- A doctoral class in Psychology learns how to edit Wikipedia entries in their area of speciality The assessment looks at the response from the Wikipedia editors and if the students' evidence-based edits remain on the site (ICT/Inv).

Science

- Interactive, ICT-enabled simulations of experiments in physics and chemistry. See, for example, the MIT virtual lab initiative at: http://icampus.mit.edu/projects/ilabs/ (RPS/ICT).
- Students have to produce a YouTube video which makes clear to a lay person what a particular piece of science involves and how it is useful. Assessment is determined by (a) audience rating (b) number of hits on YouTube. Some of these YouTube student videos have gone viral and many have thousands of followers all around the world. For one example see: http://news.mit.edu/2012/k-12-education-video-initiative-0425 Inv/ICT).

Sustainable social, cultural, economic and environmental development

- A public health MSc at the University of Worcester which
    - Brings together Public Health, sustainability and climate change
    - Involves a case study – focused on the ecosystem of services in a particular community with a focus on improving public health
    - Students have to identify (diagnose) a hot issue in a particular site (e.g. air pollution in Beijing, floods and illness) and then determine (invent) how best to address it
    - In some cases virtual field work using 3D headsets is used.
    - Why 'powerful'?
        - Addresses ability to emphasise, diagnose and read and match
        - Aims to overcome professional silos.

      (PBL/Field/ICT).
- Sustainable cities certificate
  Students are to complete a concept map for each topic to identify the obvious and 'not so obvious' connections that have emerged from all that they have learnt/discussed in class or in their learning team. Criteria: must give specific focus to the three key domains of Education for sustainability: social (equal opportunity, social justice, human health, quality of living, education, sense of community, justice), economic (employment, city policies and regulations, taxes, economic incentives, sustainable economic development, business ethics, workers' rights, fair trade, externalized costs, sustainable planning, RYD, use of renewable and non-renewable resources) and environmental (environmental management, energy efficiency, use of natural resources, pollution - air, water, land waste-, climate change – green house gas emissions and biodiversity in relation to this course)
  Maricopa College System, Arizona (ICT).
- Students in a Blue Economy course (focused on how to make money out of waste) identify how to save ink in printing by using Gararmon type face (Using this was reported on ABC

702 3rd March 2016 at 4.15 as saving the US government up to $320m per annum). In another student developed sustainability and innovation project moths are attracted to lights on a low barge in a lake and become food for fish. (Inv/ICT).

Product analysis

Engineering

The Engineering Ideas Clinic™ (https://uwaterloo.ca/engineering-ideas-clinic/) at the University of Waterloo supplements a traditional engineering curriculum with open-ended activities designed to spark student self-learning and exploration…
We focus on design since this represents the pinnacle of engineering practice and integrates a full range of technical and non-technical knowledge, skills and abilities. Examples of Engineering Ideas Clinic Activities include:

- Dissection Activities. Successful product design requires input from a wide variety of engineering, scientific and other technical and non-technical professionals. Through the dissection of real-world artefacts, students are introduced to the design process through genuine design solutions. They are challenged to understand the analysis and trade-offs involved in design, the concepts of constraints and criteria, and to link the design to their theoretical knowledge base. For example, most of our engineering students dissect a coffee maker in the first week of their program. Assessment is based on their approach to the activity and their ability to reflect on and articulate their discoveries. (PBL/Prod)
- Analysis and Redesign Activities. Students are challenged to explore in detail how real-word engineering artefacts operate, to develop and validate appropriate engineering models, and to apply these models to the re-design of the artefact for improvement, to suit a new application, etc. For example, students may be challenged to develop a model of a water filter for a hypothetical competitor company, or to take a model fuel cell car and integrate new control to facilitate bump detection, etc. Major longitudinal activities are under development in this thread, for example, in mechanical engineering, the dissection of an engine in first-year, followed by analysis of various components in subsequent courses, and culminating in a re-design in the final year. (Prod/Inv)

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Reflective learning and assessment

Architecture

- A self-reflective exercise in which students have to outline their design philosophy as they would explain it to a client (done in first year and then again at the end of the degree). (Reflect)

Community & social work

- Use of ePortfolios and reflective journals against a good practice framework when on placement in an NGO (Port/Ref/Field).

Counselling in a Christian context

- Counselling – students are asked to articulate their own world view in first year – how do they know they are an authentic Christian and what has formed them – do they understand where their world view came from – and then how will this influence their practice as a counsellor. This is used for diagnostic assessment as well as summative assessment –the summative assessment is undertaken by a panel (It is noted that this approach may not be scalable to large groups) (Reflect)

Creative industries, Arts & Design

- Design students are taken to a Community Centre to intentionally meet professionals outside their own area – the focus is on an assignment that looks at the benefits of thinking in an interdisciplinary way. In one version of this task an exhibition and a book have been produced on the collective findings (Field/Reflect).

Education

- Reflective practice: students work in groups of 3-4 to respond to a critical incident drawn from real world practice (an unexpected dilemma/challenge actually experienced in the classroom, on a field trip, in a school lab, or in dealing with parents). The dilemma is provided in the form of a video clip or a case file. For assessment, each student then writes up their own diagnosis of what is going on and how best to handle the situation in the light of this diagnosis and what has been learnt in the degree (Dil/Reflect).

Engineering

- Ethics embedded assessment – a real world case where the practitioner is faced with an ethical dilemma. The assessment is focused on what you would do, why and how this aligns with key ethical principles of professional practice as an Engineer discussed in class (Case/Reflect/Dil).

Health

- Reflective journal in an Indigenous health unit of study – two stages – first formative and then summative. The journal is assessed against a clear rubric. The assessment is undertaken with a large group of students with grading carried out by sessional teams coordinated by a sessional team leader who assures calibration and quality (Reflect).

Marketing

- Taking different perspectives when pitching an idea – the aim is show you can read the different motivators of various players and match the right response (PBL/Reflect).

Music

- Music – first year: students are to contact three well known industry professionals and undertake an interview focused on a set of key questions – including questions about the highlights and lowlights of the interviewee's career; what aspects of tertiary studies were most beneficial, how s/he managed financial survival, and the key advice they would give to a first year music student – this builds networks and helps show why the course is focusing on the program level outcomes it is emphasizing (Field/Reflect/Interv).
- In a music degree students each year create and record a series of individual pieces. Then they first self assess and then are evaluated by peers and finally are assessed by the lecturer using the popular music assessment tool - BoPMAT. Students are marked on how valid and justified their self-assessment is along with the peer feedback using 4 clear criteria. This is done online using BoPMAT – Students provide a paragraph of feedback on each track they record. They are admitted to the program by interview. For further details see: http://assessmentinmusic.com.au/wp-content/uploads/2013/07/The-BoPMAT-1.pdf (Inv/Reflect).

Nursing

- A first year unit that asks students to research and reflect on nursing as a profession – assessment focuses on the quality of critical reflection and how effectively the student has been able to start the development of an evidence-based professional ePortfolio against the capabilities set down for development in the program (Reflect/Port).
- Nursing: a video of a trainee undertaking a procedure under supervision with a critical self review against an agreed rubric and compared with the supervisor's analysis and suggestions. The video and reflection goes into the student's portfolio on clinical performance and appraisal (Reflect/Port).
- Integrated assessment using video feedback. Entry-level nursing students in an accelerated nursing program complete a video project entitled "putting it all together", in which they film themselves performing a sterile, dry dressing change on a volunteer patient. The videos are uploaded and shared on a secure server. This assignment allows students to demonstrate their ability to perform a sterile, dry dressing change integrating three distinct components of the course: health assessment, relational skills and psychomotor skills. In addition, students view a classmate's performance and provide a constructive online peer review. After receiving the peer review, students summarize the learning by completing a short, online self-assessment, in which they reflect on their performance in the various components, how well they were able to combine the skills, and what their key learning was. (University of Toronto). (RPS/Reflect).

Occupational Health and Safety

- Reflection task using the course content as a framework. At the start of the subject students identify the best aspect of their current practice and an area most needing improvement. They again reflect on this at the end of the program using the key points in the subject as a framework to identify how well they went in addressing their improvement priorities along with emerging areas of good practice and further areas for improvement with a plan on how they will address them (Reflect).

Science

- A capstone subject in science on 'unravelling complexity' seeks to illuminate the tacit assumptions underpinning a selected, 'complex', tricky issue in science by bringing in keynotes from different disciplines to give their view on them. The assignment requires the students to state their considered position on each with reasons, referring to, drawing upon or critiquing the input from the keynote speakers and the key points made in the course (Cap/Reflect).

Sustainable social, cultural, economic and environmental development

- Students from all disciplines at the University of Kansas, regardless of their subject of study, can pursue a UG sustainability certificate. Completion is acknowledged on a student's official transcript and allows students in any field to bring a lens of sustainability to their future career.... Requirements of the Sustainability Certificate include completing a selection of interdisciplinary coursework subjects, an experiential learning component and a final reflection. The experiential learning requirement involves participation in 60 hours of service, research or fieldwork with a campus department, community organization or business on a project or effort related to sustainability. The certificate joins six other experiential learning certificates at KU. Further details: http://news.ku.edu/ku-introduces-undergraduate-sustainability-certificate Cited AASHE news 15th jan 2016 (PBL/Reflect).

Theology

- Theology – a reflective learning research project – what others say of their experience of God, what the bible and my church says, what my own experience says, what really excites me and then linking of all these sources into an enhanced, clearly articulated and justified personal philosophy (Reflect).
- Business ethics and theology – different groups are given a position and they have to argue whether they support it or not. Each group has to discuss their conclusions with the other groups and identify the key points of difference and similarity, along with how convincing others found their argument to be. We reflect on what they have learnt and on the most effective learning approaches, on how to construct an argument, how to manage a project, the progression of argumentation, how to become self-reflective, self-evaluative learners. They then write a reflective report on the whole process (Reflect/RPS).

Transdisciplinary studies

- Engineering and Accounting: students in groups interview a successful early career performer at work on the capabilities that count and the key challenges they encounter and how they handle them. Students report this to the class and their report is evaluated against an agreed rubric that covers a set of checkpoints on effective practice (Field/Reflect/Interv).

Problem based assessment

Arts & social sciences

- Students have to develop a proposal to improve an existing policy addressing a key social issue including strategies and the indicators they would use to measure its effectiveness (issues can include treatment of asylum seekers, aboriginal incarceration, disability rights, domestic violence; bullying in schools; the Ice epidemic) and justify the changes advocated. They have to come up with a catchy policy name, present their proposal in a simulation where they are applying for seed funding to test the proposal in practice. They have to include a justification of their approach by drawing upon all that has been learnt in the course. (PBL/RPS)
- Edit an actual (but de-identified) manuscript with justification for the key editorial recommendations made (PBL)

Business

- Students have to write an advice email against a specific in-tray briefing to a carefully created 'client' and justify their advice. The assessment criteria address the relevance and feasibility of the advice against the key material learnt in the course. Assessment also evaluates the quality of application of strategies discussed in the course on how to write powerful and courteous emails (PBL).
- Students are given an in-tray of data from a client and a list of people they can contact for advice. They have to diagnose what is the problem and identify a feasible and relevant way to address it. They then have to give this to the actual client who plays a role in evaluating the relevance, quality and feasibility of the advice (PBL).

- A finance portfolio. Students get a client statement and have to develop and monitor an appropriate share portfolio. The quality of the advice is tested using a 'real world' simulation over 5 weeks against what actually happened to the recommended portfolio of shares. The assessment task reflects what they would actually have to do as a stockbroker. As part of the assessment task students have to critically appraise how they developed, monitored and enhanced the portfolio over the 5 weeks and link their strategy and outcomes to all they have learnt (Cap/PBL).
- Assessment focused on social enterprise
  Students work in teams on a social enterprise project in a not-for-profit organisation and write up an evaluation/enhancement plan (this is done offshore in a range of developing countries as well as onshore). There is particular focus on demonstrating that the suggested strategy is feasible and that is being implemented with positive impact. In some cases this may require one group of students to 'hand over' the action plan to a subsequent team in which case assessment is based on the extent to which their briefing is clear, evidence-based and helpful to the group carrying on with the implementation of the action plan. (Inv/PBL)
- Students in an international business course produce a press release. They are to research the perspectives on a set E.U. policy from a consumer group; business; media and develop a press release presenting a responsive and balanced view. This is seen to be a 'powerful' assessment task because it is relatively 'plagiarism-proof' and requires students to demonstrate their ability to:
  - Appreciate and take into account different perspectives
  - address the dilemma of how to produce a balanced press release
  - integrates all of the key capability areas identified in the fellowship's professional capability framework. (PBL).
- 'SBA 495 is Portland State University's largest Capstone and engages over 750 students in 35 sections of a business strategy course that partners with an organization in the community to address real world business challenges. In this Capstone students learn to systematically analyze a firm's internal and external environments and, through engagement with community partners, apply concepts and theories related to the formulation and implementation of business/organization strategies. Students join an interdisciplinary team; pool their knowledge, skills, and interests; use strategy to address a problem or concern of the community partner. Emphasis is on multiple functions and perspectives to understand diverse management and stakeholder interpretations, conceive integrative solutions, and address social and organizational outcomes (Portland State University)'(Cap/Inv/PBL).

Community & social work

- A not-for-profit organisation provides a real world challenge and students work over a semester on a feasible, justified and practical solution. Each person is allocated to write up a section of the total report against a rubric focused on evidence that the solution is relevant and feasible which is discussed at the start of the subject to assure valid and reliable assessment (Field/PBL).
- In a final year community-based service project students work for 2 semesters with a community group on one of its key development priorities and have to demonstrate their ability to work constructively with the client, respond to their needs, develop a relevant and workable plan of action on an improvement area and commence the process of implementation (Field/PBL/Dil).

Creative industries, Arts & Design

- Production of a business case against a set of good practice guidelines for an invention produced in a cross disciplinary team (Creative industry course) (Inv/PBL).

Education

- Capstone course in a Graduate Certificate in Education (University Teaching) – a negotiated project– the participants choose a 'hot' T&L issue and develop it into a conference/journal paper. Staged assessment is used: the first submission is the project proposal. The second is an oral presentation to peers with a collective focus on the challenges, unexpected barriers, how things have had to be changed, how to deal with uncertainty in pursuit of completing the project and suggestions for improvement from the class. An evidence-based self-assessment is carried out using a rubric supplied to the student and then the instructor tests the veracity of the self-assessment (Cap/LC/PBL).
- *Education Social Studies* (first year): This assessment task involves students in addressing historical and geographically located themes with a view to producing a childrens' book on an

interesting aspect of local (social) history. A key focus is on achieving the 'feeling of place'. Students can pursue a selection of themes including the lives of the original inhabitants, the lives of migrants, what children did for entertainment in the area in earlier times etc. Students are required to locate and use primary resources and write the book at a language level suited to the child audience. They not only produce the book but submit notes on how they did it and a critical appraisal of the feedback received, relating this to the checkpoints on effective writing for the age group concerned discussed in class (Inv/PBL/Field).

- Actual examples of a range of different student work in math are given to trainee teachers with notes on the backgrounds of students – each trainee is to analyse what the student work is saying about how they are thinking, what the gaps in their skills/understanding are/what is the best aspect of each case and what most needs improvement. They are then to identify a strategy for addressing this 'diagnosis'. Students come together in small groups to compare and contrast their diagnoses. They then implement their plan and evaluate the outcomes. Why is this powerful? It tests the ability to 'read' the student background and their performance and 'match' the most fitting response. It is authentic (the work is actually from real students). Students learn how to learn from each other, confirm their diagnosis and formulate a better response. It emphasises how the effective teacher needs to 'read' the unique situation and capabilities of each student and custom-tailor a response. Added to this are 'killer moment' scenarios – e.g. when a trainee says, "I'll get one of my best students to help a weaker one." To deepen the dialogue, she is asked, "What do you do if the parent of the bright student comes in and says, 'Why are you using my daughter as a tutor when you should be giving her more advanced work so her chances of getting into an Ivy League University are optimized?" (Dominican University of California) (Field/PBL/Dil).
- Using the samples of five 3rd grade students' class work on addition and subtraction provided on the course moodle LMS site, in this assignment the trainee teachers have to:
  - Correct these math worksheets
  - Analyze the student work
    - What do the students know
    - With what concepts and procedures are they struggling
    - What does the class know about math collectively
    - What concepts and procedures are a struggle for many of these students
  - Create a responsive lesson plan for the next school day
    - Create learning outcomes based on their analysis.
    - Describe exactly what they would do the next day to teach and reach all of these students in a 90 minute math time. (Dominican University of California) (PBL/Field).
- Trainee teachers have to select one special needs student and work with them on maths or literacy.

  The assessment involves:
  - Developing a background profile of the student and identifying areas for development
  - Reading the formal assessment documentation for their selected student and then, from both (a) and (b) develop an individual management plan, with a justification
  - Implementing their plan and videoing themselves working with the student on it – noting the most 'wicked' moments and discussing what they did to handle the dilemma and to evaluate its effectiveness.
  - Working week-by-week with their chosen child and in University debrief class held each week discussing what went well and what didn't with peers and the instructor. Particular attention is given to the 'wicked moments' and the strategies used.

  The focus of assessment
  - to determine how effectively the trainee draws out the key lessons from the experience against the good practice guidelines discussed in class
  - to evaluate the personal, interpersonal and cognitive capabilities of the student along with their skills and knowledge in an integrated way.

  Why is this powerful?
  - It checks the ability to reflect in action; the ability to 'read and match'; and to change course if a planned strategy is not working.
  - It encourages 'reading the emotional state not just the cognitive state of students. It checks trainees' ability to manage themselves personally and their interpersonal capabilities when something doesn't go according to plan.

(Dominican University of California) (Case/PBL/Dil).

Engineering

- Purdue Polytechnic Institute's UG Transdisciplinary studies in Technology Program. 'The program emphasizes creation, application and transfer of knowledge through hands-on learning…. (it).. combines individualized plans of study, close faculty mentoring of students and a competency-based approach for traditional learners at a public research university"… (This approach)… shifts the focus away from traditional credit hours and instead measures student progress on demonstrated (capabilities and) competencies. The learning is organized around themes and driven by problems rather than seat time in a classroom…. A student must demonstrate expertise in eight broadly defined primary competencies in order to graduate. The primary competencies include design thinking, effective communication, social interaction on a team, ethical reasoning, and innovation and creativity. Each of the competencies is split into five sub-competencies…. Through the program, achieved competencies will be accounted for while an e-portfolio will showcase them and be added to the students' academic records…. Dean Bertoline said competency-based education answers the call from industry leaders looking for a different type of higher education graduate… "They are looking for well-rounded graduates that not only have deep technical knowledge and skills but very broad capabilities for open-ended problem solving, greater creativity, ability to work in diverse teams and better communications skills," he said. A video on the program is available at: https://drive.google.com/folderview?id=0BxdPFMVWz-l2ZVhIdVNqdXNUZjQ&usp=drive_web (Port/Inv/PBL/LC).
- 'Engineers without borders' projects (Field/PBL).
- In the concrete structures unit of an Engineering program students design an RC concrete beam against a given brief/set of conditions. They physically prepare the beam in a team & test it to breaking point and then analyse the data, including making direct links to the relevant theory and research. Students again in a team run tests on a beam that is a critical construction element. This assessment task requires students to bring together technical skills, diagnosis and the ability to work reciprocally and constructively as part of a design and construction team (PBL/RPS).
- Engineering team project: embedded strategically in Engineering practice units across all levels. Teams are to design, build and demonstrate a product or process to meet a client need. This tests the ability to synthesise discipline knowledge and skills to meet a particular brief; self regulation; decisiveness; commitment; ability to positively influence others, project management capabilities and the ability to communicate in a clear and responsive way with both one's team and the client. This project demonstrates both relevance and the importance of 'reading' what is going to be most appropriate and feasible and being able to then 'matching' the right, fit-for-purpose response. To date the assessment focus has been more on the quality of the product but increased attention is now being given the above process factors as well (Field/PBL).
- Ideas clinic
  The Engineering Ideas Clinic™ (https://uwaterloo.ca/engineering-ideas-clinic/) at the University of Waterloo supplements a traditional engineering curriculum with open-ended activities designed to spark student self-learning and exploration…
  We focus on design since this represents the pinnacle of engineering practice and integrates a full range of technical and non-technical knowledge, skills and abilities. Examples of Engineering Ideas Clinic Activities include:

  Teamwork Activities. A series of six scaffolded workshops (so far, two are active and four are being designed) provides engineering students with an introduction to team-forming and building, team communication, and conflict management through team-based challenges performed in the context of relevant engineering problems. The last three workshops are intended to provide reinforcement and opportunities for application in the same areas in multidisciplinary settings. Each workshop is approximately two hours and provides an opportunity for both the introduction of theory and practice. Student reaction and learning are assessed via pre- and post-workshop testing and we also intend to measure anticipated improvements in final-year capstone design projects. (Cap/PBL)

  Dissection Activities. Successful product design requires input from a wide variety of engineering, scientific and other technical and non-technical professionals. Through the dissection of real-world artefacts, students are introduced to the design process through genuine design solutions. They are challenged to understand the analysis and trade-offs

involved in design, the concepts of constraints and criteria, and to link the design to their theoretical knowledge base. For example, most of our engineering students dissect a coffee maker in the first week of their program. Assessment is based on their approach to the activity and their ability to reflect on and articulate their discoveries. (PBL/Prod)

Analysis and Redesign Activities. Students are challenged to explore in detail how real-word engineering artefacts operate, to develop and validate appropriate engineering models, and to apply these models to the re-design of the artefact for improvement, to suit a new application, etc. For example, students may be challenged to develop a model of a water filter for a hypothetical competitor company, or to take a model fuel cell car and integrate new control to facilitate bump detection, etc. Major longitudinal activities are under development in this thread, for example, in mechanical engineering, the dissection of an engine in first-year, followed by analysis of various components in subsequent courses, and culminating in a re-design in the final year. (Prod/Inv)

Contacts: Jason Grove (jagrove@uwaterloo.ca) Sanjeev Bedi (sanjeev.bedi@uwaterloo.ca)

- Design-directed engineering education and technology entrepreneurship at Simon Fraser University. Here we study what it means to be an engineer using an open-ended design problem that covers all that we need to learn. The assignment (100 students) covers the following:
    - Customer needs and product specs
    - Refinement of these
    - Translation to a relevant and feasible spec
    - Success indicators
    - Info gathering and use
    - Building, testing refining the prototype

  For assessment the team must hand in a report on each of above plus the different designs they came up with, along with evidence that they have benchmarked against what others done, and that their preferred design works (Field/PBL/Inv) (Simon Fraser University)

Entrepreneurship & invention programs

- The combined business –law experiential strategy seminar at the University of Windsor, Ontario taught by business professor Francine Schlosser and Faculty of Law professor Myra Tawfik, brings together students from each faculty and requires them to help businesses solve problems ranging from improving efficiency and market share to intellectual property protection. Fostering that creative problem solving in its students caught the attention of the Canadian Council of Small Business and Entrepreneurship, which awarded it for being the most innovative entrepreneurial education course in the country at its annual 2015 meeting in Calgary. See also the strategy and entrepreneurship concentration at the University of Windsor's Odette School of Business. (PBL/Inv).
- Harvard Innovation Lab
  At: https://i-lab.harvard.edu/explore/about/
  Launched in November 2011, the Harvard Innovation Lab (i-lab) is a resource for any student at Harvard interested in entrepreneurship and innovation. Programming is designed to help students grow their ventures at any stage of development and covers a wide range of disciplines. The i-lab offers a five-stage engagement model focused on foundational and experiential learning that enables students to explore entrepreneurship, meet and engage with a growing community of first-time founders and experienced entrepreneurs, ideate in human-centric ways, prototype and build to test the practicality of their visions, and launch and grow their ventures.

  Some 31 cross university courses are offered ranging from design, venture founders' dilemmas, commercialising science, eco-entrepreneurship, social entrepreneurship, entrepreneurial science and leadership, entrepreneurship in Africa, creative thinking and organisational success to entrepreneurial finance, entrepreneurship in the online economy, trade, development and entrepreneurship and an E-Lab.

  Assessment is predominantly project/thesis/group based (Inv/PBL).

Event management

- Event plan creation in partnership with a business/organization – this is a real project (it tests in combination students' personal, interpersonal and cognitive capabilities plus their ability to draw upon relevant generic and profession-specific skills and knowledge). The effectiveness of the plan in practice is then evaluated by the client against their original brief and success

indicators (PBL/Field).

Higher Education

- Grad Cert in HE: participants have to rewrite a subject outline they are teaching applying the learning and assessment principles taught. They then have to justify their rewrite (PBL/Inv).

ICT and software engineering

- IT and chemistry: online interdisciplinary scenario-inquiry tasks for active learning in a large, first year STEM chemistry courses with more than 1000 students enrolled – students from different disciplines are to work together to determine how best to handle a complex, real world issue with no 'right' answer – this was a UQ led initiative funded by ALTC/OLT in 2009 (Dil/PBL/Inv).
- Computer programming: work integrated learning project based on a real world business need – the lecturer acts as a coach but doesn't write any of the code, only responds to what the student is doing with formative input (PBL/Inv).
- IT: group assessment – select a project from a given menu or one of your own choosing, form your own group of people with complementary skills, develop a project proposal and present this to a panel – assessment is on both the quality of the outcome and the group process (RPS/PBL).

Law

- The student gets a client file and has to come to the lecturer who plays the role of a senior partner. The case has both legal and non legal issues embedded in it and students are marked on how effectively they engage with lecturer as a senior partner, handle the tricky questions put to them by the 'senior partner', how professional, focused and accurate the diagnosis is and how well they actually handle the documents (e.g. some documents must not be touched with a pen) (PBL).

Marketing

- The development of business marketing plans commissioned by local tourism businesses. The criteria include how well the needs of the local business are identified and met, the relevance and feasibility of what is proposed, the clarity of its explanation to the client and the results when implemented (Field/PBL).
- Marketing: one of our partner businesses presents students with a real problem. Students have to identify a relevant and feasible solution that will be cost-beneficial and, at the same time, figure out how best to sell it to the client. This requires lateral thinking, understanding what motivates the client, ability to influence, clear, sharp and engaging presentation skills, an ability to think on your feet what the client asks a curly question during the presentation etc. Student teams present to the clients in a format similar to Dragons' Den (PBL/RPS).
- Taking different perspectives when pitching an idea – the aim is show you can read the different motivators of various players and match the right response (PBL/Reflect).

Medicine

- Capstone: Translational Research (TR) is defined by the National Centre for Advancing Translational Science as "The process of turning observations in the laboratory, clinic and community into interventions that improve the health of individuals and the public". The Institute of Medical Science (IMS) recently launched a new professional Masters program focused on TR. Central to the program is a Capstone project where students integrate their knowledge to create solutions that address unmet health science needs. The capstone is both a vehicle for problem solving and an opportunity for our students to demonstrate critical skills and competencies that are core-learning outcomes. These skills include networking, collaboration, teamwork, implementation skills, communication, creativity, problem solving and risk management. Unique processes and rubrics are being formulated to capture the exercise of these skills throughout the capstone process. (University of Toronto) (Cap/PBL).

Nursing

- First year nursing: the nurse has to explain a diagnosis to a patient and translate complex jargon into plain English. The patient is then asked to explain what was said back to the supervisor for assessment of clarity, understanding and impact (Field/PBL).
- 2nd year nursing: develop an intervention with someone who has a developmental delay – a case history is provided and the student must diagnose, assess and establish a plan of support – another student then role plays the client – feedback is given by peers, the tutor, and an experienced fourth year student who is already working in the field with clients like this (Field/Case/PBL).
- Read the latest literature on midwifery and develop a brief on it for a local maternity unit.

Assessment includes a review of the data gathered in a short survey on the quality of the briefing by the maternity unit staff (Field/PBL).

Occupational Therapy

- Students are presented with an online video of a scenario played by actors involving a client family with a child who has cerebral palsy. Students have to identify what questions they will ask, what the optimum plan of action might be and give reasons to justify their approach based on what been learnt in the course. (RPS/Case/PBL).

Psychology

- Critical thinking task (developed with Learning and Teaching staff)– the student is given an in-tray of materials – eg. A newspaper article entitled 'Essay Factories', blogs on this, research on cheating and plagiarism, and other inputs – the student has to evaluate the quality of each source of information and come up with a diagnosis of what is causing this problem and, with evidence, what can be done to address it (Case/PBL).

Science

- Scientific research: production of research proposals on the influence of a given drug on driving ability – with group feedback followed by a final formal submission. Outcomes addressed – protocols applied; operationalization uses informed choice; partisan studies' risks; sorting out one's position on the dilemma of balancing 'road safety' with 'medication'; every decision needs to be accounted for with evidence (PBL).
- General science: students link up with an early career researcher and are asked to describe in plain English to school students what the research is about, why it is relevant to them, what is being discovered and why it is so engaging to do this sort of experimental work – as a way to encourage more high school students to consider enrolling in STEM and as a way to encourage UG students to consider this career path. Evaluated using a community service subject rubric (Inv/PBL/Field).
- Science students are instructed on good practice in doing a presentation then they have to develop a presentation to the Board of a fictional company which is planning to close down its R&D department on why this is not a sound decision. Assessment is based on an evaluation of the quality of the presentation, the soundness of the content, the way the case was argued and the effective application of the principles taught in class. This assessment task is 'powerful' because it gets students to think through why they are doing science and to identify what is most and least likely to engage people who are on Boards (RPS/PBL).
- Interactive, ICT-enabled simulations of experiments in physics and chemistry. See, for example, the MIT virtual lab initiative at: http://icampus.mit.edu/projects/ilabs/ (RPS/ICT).

Social sciences

- Social sciences/communications capstone involving a multidisciplinary team that has to develop an integrated, relevant action plan to address a real world issue identified by one of the university's partner NGOs (Cap/PBL).

Sustainable social, cultural, economic & environmental development

- Development of apps for use in developing countries to foster sustainable agriculture and subsistence farms. See, for example, the work of Professor Athula Ginige from Western Sydney University in Sri Lanka (Inv/Field/PBL).
- Education for Sustainability at Western Sydney University: Developing 'sustainability literacy' requires the development and assessment of new ways of thinking and learning that enable us to recognise the connections between environmental concerns, social patterns and individual actions… and builds skills for inquiry, analysis and creative action. It promotes personal and social change, develops civic values and empowers learners to be leaders for a sustainable future (Inv/Field/PBL).
- Climate change readiness tool design and implementation – a real project which tests students' personal, interpersonal and cognitive capabilities in combination (PBL).
- In an Art Conservation Science program students work on a 'real-world' conservation case. Students are taught and then tested on: how effectively they can diagnose what needs to be done; how well they can match all of the skills, knowledge and capabilities identified by a successful art conservator as being necessary to handle their diagnosis. This includes appropriate use of glues/adhesives, solvents, detergents, safe cleaning techniques, identifying and managing 'hot risk; areas, knowing environmental effects of the chemicals they are using risk assessment, effectively using electronic diagnosis instruments, bearing in mind intercultural issues. MOOCs are used to learn and self test the set knowledge and correct techniques off line. The approach uses a series of actual conservation cases (with what the

actual conservator did for use as a comparator to the diagnosis of each group) for learning and then a new case is used for the exam. Students need to demonstrate they can successfully apply the above approaches to the conservation of paintings, paper artifacts , and other conservation objects (PBL/Case).

- The Aalto University (Finland) Masters in Creative Sustainability is a joint programme of the three Aalto University schools: School of Business, School of Arts, Design and Architecture and School of Engineering. The learning outcomes and assessment give focus to: *Systems approach***:** The ability to implement systemic thinking into critical problem solving that creates new holistic understanding about complex situations in society. The emphasis is on global awareness within the context of local communities and simultaneous modification of different aspects of sustainability. *Design thinking:* The ability to apply creative problem solving methods and tools in facilitating dialogs, defining problems, generating ideas and obtaining solutions. *Project management:* The ability to manage multidisciplinary teamwork and promote and discuss sustainability in culturally versatile industrial, urban and business environments. *Sustainability management:* The ability to develop new approaches for creating sustainable business models and to advance business ethics and corporate responsibility. Students are also to develop an understanding of the way that different organizational forms support the pursuits in sustainability (Inv/PBL)
- Interdisciplinary design and assessment collaboration for sustainability education in Art & Design. First year students work in cross disciplinary groups from the Product Design, Fashion Design, Interior Design and Landscape Architecture courses. They have to produce an integrated proposal for a request for tender in real world project areas like local projects dedicated to recycling, conservation, energy efficient building and campus sustainability projects. (Inv/PBL).
- Social & environmental accounting at the University of Gloucestershire
  Students in groups of 3-4 develop and present a proposal for a new sustainability reporting framework to a given organization. This is seen to be a powerful form of assessment because: It encourages creative thinking around a key aspect of ESD; it throws students in 'at the deep end' and they have to diagnose what might work, research parallel initiatives and match a workable, engaging response; and it has helped students at interview when applying for a job in this area (PBL).
- A public health MSc at the University of Worcester which
  - Brings together Public Health, sustainability and climate change
  - Involves a case study – focused on the ecosystem of services in a particular community with a focus on improving public health
  - Students have to identify (diagnose) a hot issue in a particular site (e.g. air pollution in Beijing, floods and illness) and then determine (invent) how best to address it
  - In some cases virtual field work using 3D headsets is used.
  - Why 'powerful'?
    - Addresses ability to emphasise, diagnose and read and match
    - Aims to overcome professional silos.

  (PBL/Field/ICT).
- In a university-wide elective on Interdisciplinary Sustainable Development at the University of Manchester students are placed in teams and assigned a trained teamwork facilitator. Students are presented with a series of written project briefs and are given the role of sustainability consultants who must advice a series of clients on live, current problems, empowering them to make creative suggestions and think pragmatically how to devise an implementation plan that might work in practice… This requires them to balance economic, social and environmental consequences and take into account the ethics of the situation… Students are immersed in 'wicked' open-ended problems as discussed by Rittel and Webber in their 1973 book *Dilemmas in a general theory of planning*. Formative and summative team project reports are marked on the appropriateness of their response to the brief; the use of credible and relevant information; their development of a creative and well-justified proposal and their application of sustainability principles.
  (For full details see Helen Dobson and Bland Tomkinson 'Practical education for sustainable development through interdisciplinary problem-based learning', University of Manchester Ch 3 in Richard Atfield and Patsy Kemp (Eds) (2013); *Enhancing education for sustainable development in Business and Management, Hospitality, Leisure, Marketing, Tourism*, HEA, York at: https://www.heacademy.ac.uk/sites/default/files/esd_dobson_final_0.pdf).
  (RPS/PBL).

- Semester in dialogue & the city studio - The city is the classroom This involves:
  - Dialogue about hot issues: e.g local food. The students host the dialogue and run the class – the guests have different positions – e.g. green food vs the local buyer for a large supermarket chain. Others are business people, community leaders
  - Major assignment – plan, host, deliver, evaluate a community dialogue – with a focus on its aim, outcomes, how it connects to what is being learnt in class, logistics, recruitment, delivery, problem solving. Capabilities tested: how to listen; how to both influence and respond emphatheticaly to others; ability to read what might work best and match then deliver the right strategy; ability to reflect in action and solve ongoing challenges; ability apply the key lessons on effective collaboration

    (Simon Fraser University) (Field/PBL).
- Students from all disciplines at the University of Kansas, regardless of their subject of study, can pursue a UG sustainability certificate. Completion is acknowledged on a student's official transcript and allows students in any field to bring a lens of sustainability to their future career.... Requirements of the Sustainability Certificate include completing a selection of interdisciplinary coursework subjects, an experiential learning component and a final reflection. The experiential learning requirement involves participation in 60 hours of service, research or fieldwork with a campus department, community organization or business on a project or effort related to sustainability. The certificate joins six other experiential learning certificates at KU. Further details: http://news.ku.edu/ku-introduces-undergraduate-sustainability-certificate Cited AASHE news 15th jan 2016 (PBL/Reflect).
- Enabling leadership for transformational teaching and learning (ELTT) in Sustainable Development. ELTT is a professional training program provided by the Sustainability Team of the University of Zurich targeting university educators. The curriculum concentrates on real world projects in each university and sharing strategies that are working effectively across the universities represented. Assessment is focused on the capabilities and competences for embedding sustainable development into tertiary courses or programs, the participants' ability to reflect on sustainability in their working environments and to develop initiat systemic improvement, receive peer support for implementing ideas for sustainable development in courses, programs, and institutions, become part of an international network of ELTT peers and to foster (PBL) continuous exchange
- Interdisciplinary real-world sustainable development project in a developing country – Shelter in Bangladesh

  In order to create sustainable solutions to the world's most important challenges, global development professionals must reach beyond the traditional boundaries of their field of expertise combining scientific/technological, business, and social ideas in an approach known as integrated innovation. In this project-based course, students from multiple disciplines (engineering, management, health and social sciences) work together – using participatory methods with an international partner – to address a locally relevant challenge.
  The final team report for the course is a proposal that addresses the real-world global challenge and context issues. Elements must demonstrate the integration of various knowledge sets in the overall scope of the proposed solution.

  Proposed solutions (final presentation and report) are evaluated according to the following criteria: Interdisciplinary Cooperation, Innovation, Relevance and Significance, Execution and Evaluation, Sustainability and Ethics & Equity. Projects are also evaluated based on idea development/refinement from previous assignments. (e.g. how well was feedback acted upon and incorporated?). Several individual reflections and class participation evaluations are also incorporated in the assessment of the course.

  University of Toronto (Field/PBL).
- Creating Sustainable Organisations. For assessment students are required to conduct independent research to develop a case study of a company that professes to be 'sustainable'. The focus of this investigation involves addressing the following question: "Can this company make a business case for sustainability? If yes, what are the grounds for this business case?" The research report should include the following sections: introduction; the company; findings; analysis; conclusion; references. Western Sydney University (At: http://handbook.westernsydney.edu.au/hbook/unit.aspx?unit=200853.1) (Field/PBL).
- Leadership & entrepreneurship program: An assessment task which integrates learning into real world issues – 'Develop an Ecopreneurship Business Plan'. Students are required to produce a Business Plan focusing on an entrepreneurial idea for an environmentally friendly

product or serve. The operational concept for this assessment is 'ecopreneurship' (Isaak 2005) which refers to a type of entrepreneurship that focuses specifically on environmental sustainability. Environmental responsibility is defined for the purpose of the unit as a set of organisational initiatives designed to mitigate environmental degradation.

Instructions:

As a team of savvy ecopreneurs, you have been hired by a large company to present a business plan for an environmentally friendly product or service. The presentation and the summary must encapsulate the strategic development of this product or service. Below are some suggestions of areas that could form the basis for your business plan:

- Office recycling system
- Solving the problem of E-Waste
- Eco-efficiency project
- Eco-efficiency Consulting
- Green retrofitting
- A sustainability joint venture
- A renewable energy system (wind, solar, ocean, etc.)

For further details see: http://handbook.westernsydney.edu.au/hbook/unit.aspx?unit=200863.1 & http://handbook.westernsydney.edu.au/hbook/course.aspx?course=3725.1 (Inv/PBL)

Theology

- In a fourth year seminar course on "Advanced Topics in Christianity" the class is divided into four groups, and each group is assigned a specific literary text (e.g., Thomas King's 'Green Grass', 'Running Water'). The problem they are then given is to design an undergraduate course on Christianity and modern literature featuring the text they had been assigned. Students are also required to submit reflective learning journals throughout the course.

  To help students with their group task they are provided with resources from the University's Centre for Teaching Support and Innovation (e.g., on course design, and methods of assessment). The final project comprises two key pieces:

  - An annotated syllabus that would be given to the instructor hired to teach the hypothetical course, including a list of resources the instructor would need to be sufficiently prepared;
  - A lecture on the assigned text that would be given to the imagined students who had enrolled in the hypothetical course.

  (University of Toronto) (Inv/PBL)

Tourism & Hospitality

- Field research on tourist behaviour with a report that makes sense of what is found against the research and theory taught in the subject with a set of suggested ways to take this into account provided and justified by the student (Field/PBL).
- Promotional videos and brochures custom-tailored to the particular needs and contexts of a range of island hotels and resorts (Inv/PBL/Field).
- Review of attractions and destinations tourism behavior through design of a tool or survey (group project), implementation with tourists and recommendations in the light of observation and interview – real project (tests key personal, interpersonal and cognitive capabilities in combination) (PBL/Field).

Transdisciplinary studies

- Cross disciplinary assessment – Marketing students work with Engineering students on a project to invent and sell a workable, scalable and marketable robot – the prototypes are then publicly pitched and some have received funding. Assessment is based on a critical evaluation of the process of invention and cross-disciplinary collaboration, the success of the pitch and the outcomes achieved, along with the key lessons students will be taking with them for improved approaches in the next project (Inv/PBL).
- Quest University

  Quest university is designed with one goal: to provide the most effective and engaging undergraduate education in the liberal arts and sciences in order to produce graduates who are skilled in communication, imbued with quantitative reasoning skills, instinctively collaborative, inherently trans-disciplinary in their approach to problems and engaged in their local and global communities -- broadly educated individuals with an informed perspective on the problems of the 21st century and the integrative abilities to solve them. (see: http://squamish.ca/discover-squamish/education-and-learning/quest-university-canada/)

  The 'Question'

  Toward the end of their "Foundation Program," Quest students take a course called

"Question." While working with a course instructor and a faculty mentor of their choosing they develop a statement of their Question: a proposal for how they will study a topic of special interest to them.[4] This "Question" acts as the students major for their Bachelor of Arts or Bachelor of Science degrees and is much more similar to a master's thesis when compared to a standard undergraduate major.
Questions often range from being very broad to being very focused. For example; What is honour? What is beauty? What are the elements of successful habitat restoration? How can we manage infectious disease outbreaks? [4]
Questions are often framed in terms of several disciplinary approaches, key works and thinkers, or the sub-questions that will be addressed. This is largely based around the Foundation program's multidisciplinary approach.[4] This unique approach allows students to cater their academic research more closely with their academic interests. Each question is relatively unique to each Quest student thus providing a full range of academic pursuits and interests at the University.

Concentration program
The second half of the program is devoted to a "Concentration program". With the help of a faculty advisor, all students design their own program of concentration studies according to an interdisciplinary question or topic of research. Each student's Individual Concentration Program consists of four principal elements:
- a statement of the Question;
- a course plan;
- a list of related readings; and

- a Keystone project.
The Concentration Program may also include experiential learning components such as a semester abroad, leadership training, service learning, or an internship.
(Further details see: http://everything.explained.today/Quest_University/)
(PBL/Inv)

Case based assessment

Business

- Indigenous graduate attribute – assessment of a cross-cultural management case study (Case).
- A carefully coached traditional, initial assessment task to show how assessment grading works (Case).
- Living cases in Business at Queens University, Canada
'The Living Case initiative was developed in response to a growing student demand for technology-based learning and classroom discussions that focus on current, real-time events, driven by easy and immediate access to information. Living cases build on the latest market developments, drawing on SEC filings, analyst and news reports, social media and company information, to foster an enhanced understanding of strategic and operational decision-making and integration of activities across entire business systems.' David M. Saunders, PhD Dean, in his Deans message in Queens School of Business Year in Review 2013-14 (Case).

Dentistry

- Dentistry: a real world case of a client – involving diagnosis and patient relations then interviewing a successful dental practitioner on how they would handle the same case and reporting back both in an assessment submission and in a class presentation (Case/Dil/Interv).

Education

- Trainee teachers have to select one special needs student and work with them on math or literacy.
The assessment involves:
    - Developing a background profile of the student and identifying areas for development
    - Reading the formal assessment documentation for their selected student and then, from both (a) and (b) develop an individual management plan, with a justification
    - Implementing their plan and videoing themselves working with the student on it – noting the most 'wicked' moments and discussing what they did to handle the dilemma and to evaluate its effectiveness.
    - Working week-by-week with their chosen child and in University debrief class held

each week discussing what went well and what didn't with peers and the instructor. Particular attention is given to the 'wicked moments' and the strategies used.

The focus of assessment

- to determine how effectively the trainee draws out the key lessons from the experience against the good practice guidelines discussed in class
- to evaluate the personal, interpersonal and cognitive capabilities of the student along with their skills and knowledge in an integrated way.

Why is this powerful?

- It checks the ability to reflect in action; the ability to 'read and match'; and to change course if a planned strategy is not working.
- It encourages 'reading the emotional state not just the cognitive state of students. It checks trainees' ability to manage themselves personally and their interpersonal capabilities when something doesn't go according to plan.

(Dominican University of California) (Case/PBL/Dil).

Engineering

- Ethics embedded assessment – a real world case where the practitioner is faced with an ethical dilemma. The assessment is focused on what you would do, why and how this aligns with key ethical principles of professional practice as an Engineer discussed in class (Case/Reflect/Dil).
- Electrical Engineering – a focus on problem diagnosis using actual cases drawn from real-world, challenging Engineering projects (Case/PBL).

Health

- In a Public Health program students have to write a ministerial briefing on an issue that is based on a real world case – this requires a clear understanding of evidence-based practice; what motivates a minister and how the political process works and how lobbying groups operate (RPS/Case).

Industrial relations

- Industrial relations third year subject – a real-world in-tray case – the student has to produce a client advice on how best to apply the unfair dismissal legislation with a clear, justified rationale. The difficulty of these cases is built up over the duration of the degree (Case).

Nursing

- Assessing the mental health of a client with justification (via a video case or during the practicum) (Case).
- 2nd year nursing: develop an intervention with someone who has a developmental delay – a case history is provided and the student must diagnose, assess and establish a plan of support – another student then role plays the client – feedback is given by peers, the tutor, and an experienced fourth year student who is already working in the field with clients like this (Field/Case/PBL) .
- Managing, assessing and helping a deteriorating patient using a de-identified, real world case, with increasing challenges unfolding over time. Assessment is on quality of analysis, diagnosis, how well the management plan matches the condition of the patient, interpersonal skills with not only the client but also the family (Case/Dil).

Occupational Health and Safety

- In a unit on critical thinking and decision-making students are given a scenario where they are supervising employees who are clearly doing something unsafe and illegal (e.g. entering a confined space tank). Students are asked to draw a flow chart of what is actually being done and a flow chart of what the law requires; then to compare the two. They are asked to draw a causal loop diagram of the non-technical issues going on (e.g. workers and/or employer are complacent). Students then must make a decision about what to do, referencing professional ethics and legal compliance, and draw up a communication plan for how they will communicate this decision to the people involved. The final report is a letter to the boss explaining what and why they are doing what they are doing (Case/RPS).

Occupational Therapy

- Students view an online video of a scenario played by actors involving a client family with a child who has cerebral palsy. Students have to identify what questions they will ask, what the optimum plan of action might be and give reasons to justify their approach based on what been learnt in the course. (RPS/Case/PBL).

Psychology

- Critical thinking task (developed with Learning and Teaching staff)– the student is given an in-tray of materials – eg. A newspaper article entitled 'Essay Factories', blogs on this, research on cheating and plagiarism, and other inputs – the student has to evaluate the quality of each source of information and come up with a diagnosis of what is causing this problem and, with evidence, what can be done to address it (Case/PBL).

Sustainable social, cultural, economic & environmental development

- In an Art Conservation Science program students work on a 'real-world' conservation case. Students are taught and then tested on: how effectively they can diagnose what needs to be done; how well they can match all of the skills, knowledge and capabilities identified by a successful art conservator as being necessary to handle their diagnosis. This includes appropriate use of glues/adhesives, solvents, detergents, safe cleaning techniques, identifying and managing 'hot risk; areas, knowing environmental effects of the chemicals they are using risk assessment, effectively using electronic diagnosis instruments, bearing in mind intercultural issues. MOOCs are used to learn and self test the set knowledge and correct techniques off line. The approach uses a series of actual conservation cases (with what the actual conservator did for use as a comparator to the diagnosis of each group) for learning and then a new case is used for the exam. Students need to demonstrate they can successfully apply the above approaches to the conservation of paintings, paper artifacts , and other conservation objects (PBL/Case).
- Masters in Green design (from 2005). Assessment involved students addressing a live case and set of challenges involving a jointly owned campus area on Northern Way in Vancouver. owned by UBC, SFU, BCIT, Emily Carr. The task was how best to build an inter-institutional program and the greenest building in the world. The activity and assessment was organized as a design studio. Students were to come up with an eco-campus design, give effective attention to key challenges like mobility, and a BCIT technology plan. (Simon Fraser University) (Case).

Learning contract

Business

- Leadership Program: Small groups build a learning contract on what aspect of change leadership they will be investigating, why it is significant, what will be produced, by when, and what resources will be used. Then they apply a negotiated assessment rubric developed by them with the instructor to evaluate the outcomes. This gives focus to action learning, learning how to self-assess, and constructive team work. It is a pass-fail subject and might be difficult to use in a mass education UG program. (LC)

Creative industries, Arts & Design

- Use of learning contracts in an undergraduate play-writing unit at the Academy of Arts at QUT. For an article on the initiative see: http://www.textjournal.com.au/april98/copeland.htm (LC)

Education

- Learning contract based on a key area for improvement to be developed during the practicum. The contract includes what is to be learnt, why this is relevant, how this addresses one of the key capability/competency areas for the program, what will be produced as evidence of successful performance and what criteria will be used to judge its success (LC).
- Capstone course in a Graduate Certificate in Education (University Teaching) – a negotiated project– the participants choose a 'hot' T&L issue and develop it into a conference/journal paper. Staged assessment is used: the first submission is the project proposal. The second is an oral presentation to peers with a collective focus on the challenges, unexpected barriers, how things have had to be changed, how to deal with uncertainty in pursuit of completing the project and suggestions for improvement from the class. An evidence-based self-assessment is carried out via a rubric supplied to the student and then the instructor tests the veracity of the self-assessment (Cap/LC/PBL).

Engineering and Technology

- Purdue Polytechnic Institute's UG Transdisciplinary studies in Technology Program. 'The program emphasizes creation, application and transfer of knowledge through hands-on learning…. (it).. combines individualized plans of study, close faculty mentoring of students and a competency-based approach for traditional learners at a public research university"… (This approach)… shifts the focus away from traditional credit hours and instead measures student progress on demonstrated (capabilities and) competencies. The learning is organized

around themes and driven by problems rather than seat time in a classroom…. A student must demonstrate expertise in eight broadly defined primary competencies in order to graduate. The primary competencies include design thinking, effective communication, social interaction on a team, ethical reasoning, and innovation and creativity. Each of the competencies is split into five sub-competencies…. Through the program, achieved competencies will be accounted for while an e-portfolio will showcase them and be added to the students' academic records…. Dean Bertoline said competency-based education answers the call from industry leaders looking for a different type of higher education graduate… "They are looking for well-rounded graduates that not only have deep technical knowledge and skills but very broad capabilities for open-ended problem solving, greater creativity, ability to work in diverse teams and better communications skills," he said. A video on the program is available at: https://drive.google.com/folderview?id=0BxdPFMVWz-l2ZVhIdVNqdXNUZjQ&usp=drive_web (Port/Inv/PBL/LC).

Higher Education

- Graduate Certificate in HE: Learning contract on a key, current teaching challenge the participants are facing at their university (this method is based on the ITATE/UTS learning contract approach of the 1980s) (LC).

Interviews with successful practitioners

Dentistry

- A real world case of a client – involving diagnosis and patient relations then interviewing a successful dental practitioner on how they would handle the same case and reporting back both in an assessment submission and in a class presentation (Case/Dil/Int).

Entrepreneurship & invention courses

- Internships in successful enterprises – students observe and interview the entrepreneur and staff during a project and compare what they identify against the theory discussed in class on what makes for a successful enterprise (Field/Interv).

Music

- Music – first year: students are to contact three well known industry professionals and undertake an interview focused on a set of key questions – including questions about the highlights and lowlights of the interviewee's career; what aspects of tertiary studies were most beneficial, how s/he managed financial survival, and the key advice they would give to a first year music student – this builds networks and helps show why the course is focusing on the program level outcomes it is emphasizing (Field/Reflect/Interv).

Transdiciplinary studies

- Engineering and Accounting: students in groups interview a successful early career performer at work on the capabilities that count and the key challenges they encounter and how they handle them. Students report this to the class and their report is evaluated against an agreed rubric that covers a set of checkpoints on effective practice (Field/Reflect/Interv).

Thesis/Viva-voce

Engineering

- A fourth year engineering capstone involves the production of an integrating thesis. Students are given the opportunity to work with a faculty member to define and design an original research project, as well as to conduct and communicate engineering-related research. Every year, nearly 200 students in the Engineering Science program work with over 100 supervisors from 20-25 distinct academic departments, and across theoretical, clinical, design and laboratory settings. This gives the opportunity to assess a number of key attributes in engineering education, such as design, investigation and communication (University of Toronto) (Cap/T/V).

Law

- Rather than using the traditional examination clever multiple choice tools combined with an oral are used. Ensuring the feasibility and scalability of this approach, whilst ensuring that what is examined is directly relevant to what law partners want, is always a challenge. (T/V).

Critical evaluation of data/articles/articles/performances

Accounting

- A small group research exercise which involves identifying relevant newspaper articles and critiquing them against the management accounting principles taught in the course (Field/Crit).
- Students have to find a current newspaper article (this stops plagiarism) and apply the theory learnt in class to the claims made in the article– this shows the relevance of theory and practice and tests students can actually make the application link. Students hand in a draft for formative feedback in week nine – exemplars from work on earlier articles are shown. When this assessment was introduced student satisfaction scores went up significantly. (Field/Crit)

Business

- Business ethics course: It this assessment task students produce an annotated bibliography which ensures they can not only identify relevant material but evaluate its quality and veracity (Crit).

Engineering

- Engineering in a range of US universities is being directly integrated with the liberal arts
  This enables students to learn not only about engineering-design principles and their technical application but also about the social context in which these designs must be put into action. This article argues that engineering education (and its assessment) today needs to help students devise innovative solutions for a complex world while also anticipating their potential unintended consequences. In other words, engineering education needs to prepare students to design expansively and imaginatively. One example cited in the article concerns the World Masterpieces sequence of courses at Lawrence Technological University, in which great works of literature that feature technological artifacts and the mastery of nature as central themes (think *The Odyssey*, *Frankenstein*, *Don Quixote*, or *Brave New World*) are explored through both a literary and technological lens (Perf).
  For more details see: Chronicle of HE April 27, 2015 Loni Bordooi and James Winebrak At: http://chronicle.com/article/Bringing-the-Liberal-Arts to/229671/?cid=wb&utm_source=wb&utm_medium=en

Other

- Programmatic assessment (PA) in medicine: Traditional assessments focus on performance at infrequent single time points (i.e. examinations or tests) and encourages 'binging and purging' of knowledge. Students pass or fail on a limited number of high stakes assessments. The results of this approach are: learning that focuses on memorization of knowledge but not on transfer of knowledge and a culture that values marks over feedback. PA uses multiple assessment modalities: online quizzes as part of each week's case-based learning, written and/or online tests every few weeks to address the content covered in each subsection of the program, cumulative progress tests, direct observations of students performing history-taking and physical examination, simulation, peer feedback, supervisor feedback, students' written reflections on areas of their own strength and weakness and other assessment exercises as deemed appropriate.

  Performance on these assessments is aggregated on the basis of the competencies needed by practicing physicians instead of by course or method and students review their aggregated assessment data with a faculty mentor. PA is being implemented as part of the new MD curriculum in the 2016-2017 school year at the University (University of Toronto). (Other).
- *Associated co-curricular activities*
  The results of these and evidence of their success can be included in an ePortfolio.
  - **Maker works at MIT**
    At: http://makerworks.mit.edu/
    The mission of MakerWorks is to foster a student community in a hands-on learning environment where modeling, prototyping, and validation resources coexist. MakerWorks provides space and equipment for a community of innovators that focus on deterministic designing and problem solving. MakerWorks is a student run makerspace where students, faculty, and staff are allowed to work freely on any project they choose. MakerWorks consists of prediction, prototyping, and validation tools to support a wide variety of projects. More at our Member Wiki. Accepted projects: class, research or

personal. Free to use, charges for some machines and materials.

- **MIT Hackers**
  At: http://hacks.mit.edu/
  The IHTFP Gallery is dedicated to documenting the history of hacking at MIT.
  The word **hack** at MIT usually refers to a clever, benign, and "ethical" prank or practical joke, which is both challenging for the perpetrators and amusing to the MIT community (and sometimes even the rest of the world!). **Note that this has nothing to do with computer (or phone) hacking (which we call "cracking").**
  See also:https://en.wikipedia.org/wiki/Hacks_at_the_Massachusetts_Institute_of_Technology)
  Over time, the term has been generalized to describe anybody who possesses great technical proficiency in any particular skill, usually combined with an offbeat sense of humor. Like most art exhibitions, the great majority of hacks are temporary installations; most are removed within a day or so by MIT Physical Plant, the MIT Confined Space Rescue Team (CSRT),[54] or occasionally by the hackers themselves. It is a traditional courtesy to leave a note or even engineering drawings behind, as an aid to safe de-installation of a hack.[54] MIT hacks can push the limits of technical skill, and sometimes fail in spite of meticulous planning. Even these engineering failures have been acknowledged to have educational value, and sometimes a follow-up attempt succeeds. One hack on the Great Dome is documented as having finally succeeded on the fourth try, after a complete re-engineering of both the installed artifact and the installation method

  (More About the IHTFP Gallery and FAQ.)