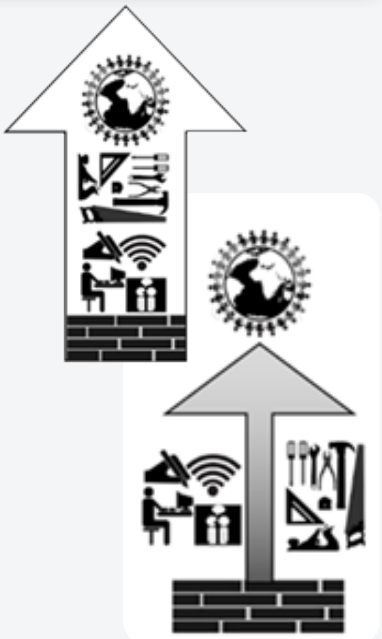
Integrated Curricula

Bringing Life to our Engineering Curricula:
Workshop 1

Facilitated by Prof John Mitchell (UCL) and Dr Lelanie Smith (UP) (27 January 2022)

1 What is an integrated curriculum?

An integrated curriculum facilitates a learning experience that connects professional development to technical knowledge and critical thinking.



2 Why integrate in a curriculum?

Facilitation of professional competencies are more complex than the technical competencies for a number of reasons; staff perception (engineering knowledge dominance and preference), staff preparedness (being trained as a technical expert not an educational facilitator), students' perception (engineering is science) and human resources these competencies require (time, staff members). A lack of connection of these competencies fosters a perception in students that they are not important. However, it has been shown that student success and the quality of professional competency facilitation are directly linked.

3 How/what can we integrate?

1. **Integrate disciplines:** Inter- or Multi-disciplinary activities (e.g. Projects) that enable students to put their expertise into practice in the context of working with other engineering disciplines or those outside of engineering.
2. **Integrate theory and practice:** Activities that bring together the theoretical learning from a number of modules through practical application.
3. **Integrate skills:** Activities that requires students to combine professional skills and technical competencies to demonstrate an output.
4. **Integrate workplace learning:** Workplace learning that forms a core and interconnected part of the curriculum, typically with specified core learning outcomes.
5. **Integrate assessment:** Assessment techniques that are authentic to the delivery of the material and the activities that students are tasked with - often mirroring outputs expected of professional engineers in industry.

Question 1:
What are the benefits of an integrated curriculum in your context?

- Real-world problems that are multi-disciplinary create opportunity for learning to communicate outside of their discipline
- Balance the relative importance of different modules for students (value of complementary modules)

Question 2:
How does integration bring life?

- Encourage students to be more creative, excited and promote autonomy and promote learning – exciting for students
- IC can help them focus more on the journey rather than an end goal
- Closer collaboration between Universities-Industry-Community

Question 3:
What are the biggest risks of an integrated curriculum?

- Resources (time and staffing cycle and experience)
- Expectations and understanding of a diverse student population
- Assessment workload for large class projects
- Potential loss of foundational technical knowledge
- Resistance from colleagues
- Pressure for engineering discipline/ technical focused research

Partnering with ECSA to facilitate Integrated Curricula (And bring life!)

Bringing Life to our Engineering Curricula:
Workshop 2

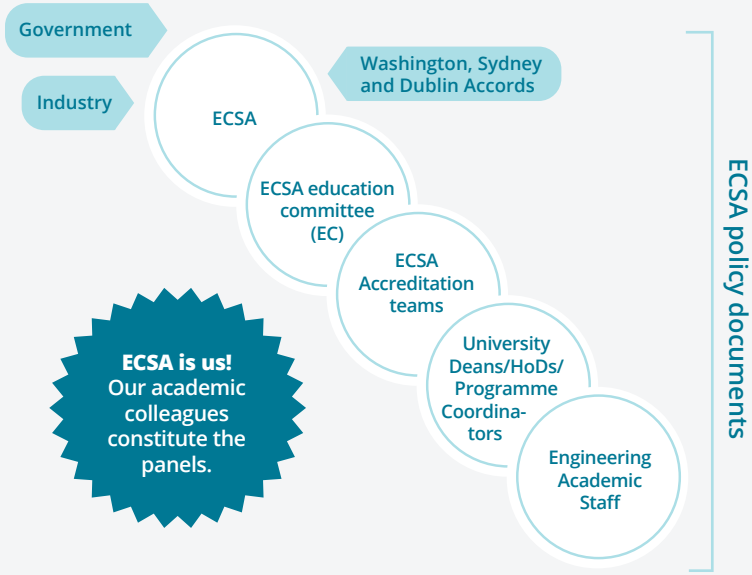
Facilitated by Dr Helen Inglis and Ass. Prof Chris von Klemperer (10 February 2022)

ECSA is not the big bad thing we normally think of at accreditation times, but the professional body we all make up!

ECSA is not just about accreditation. The GA requirements are the professional competencies that ensure connection in our curricula and its applicability to the real world. These GAs help us to see and understand the BIG picture of our curricula. ECSA / IEA (International Engineering Alliance) have paved the way for many curriculum updates and thus keep us (as HEIs) up to date with international industry demands.

NB:
Remember that ECSA and International Engineering Alliance (IEA) are not prescriptive about our curricula, they just want to see a coherent plan on the development of the GA's through the curriculum. **In many cases the challenge is not to just focus on their assessment.**

How do we as engineering Academics relate to ECSA?



Question:

"What are practical ways in which we can integrate professional and technical competencies across different courses in our curriculum in a way that (better) prepares our students for engineering practice?"

a. This is crucial for keeping our examples grounded and real life and provides an opportunity to break "silo" thinking. There is lots of small-scale integration happening at all our Universities, often just with 1st year and then again in capstone courses (usually in Design Modules).
b. Engineering academics have concerns on the challenges of not being trained to facilitate integration or professional competencies. Too often students are thrown into group work without any group work skills preparation.
c. Portfolios are an option to bring all of these GA competencies together for reflection and assessment. Combining these with report writing practice is common.
d. While some like the idea of competitions, others do not!
e. Some concerns on student workload with integrated projects.
f. Finding in service training and good vac work to give students a real understanding of Engineering life is an issue.

Open feedback:

a. One can use this community of practise as well as experienced academics who have been on ECSA accreditation visit for sounding boards when planning integrated or other curricula changes.
b. Academics feel that industry needs to be more involved in curricula development, both to provide examples and give feedback on real world engineering life. While they appear to be keen, finding the win-win scenarios seems to be elusive.
c. Entrepreneurship is a skill we need to nurture in our students.
d. Vacation work and WIL placements is a huge issue, ECSA, HEIs and Industry need to come together to make this happen better and to benefit the student and ultimately the future employers.

Assessment Strategies for an Integrated Curriculum

Bringing Life to our Engineering Curricula:
Workshop 3

Facilitated by Dr Zach Simpson (UJ) and Prof Teresa Hattingh (NWU) (24 February 2022)

Question:

How can an integrated curriculum lens address some of our assessment challenges?

Lecturers can adopt new approaches to assessment, keeping three guiding principles in mind:

1. **Assessment serves a variety of purposes and is a POWERFUL instrument of learning.**
2. **Assessment should empower learners to meet their FUTURE learning needs.**
3. **Assessment is INTEGRAL to a curriculum and should be seen as part of the teaching and learning process.**

IDEAS GENERATED BY WORKSHOP PARTICIPANTS

Who else can assess?
How can self-, peer- and other-assessment be incorporated into your module/programme, or not?

SELF ASSESSMENT:
- Develops reflective practitioners and encourages self-directed learning – **SUSTAINABLE ASSESSMENT**.
- Self-reflective portfolio of student experience both on classroom and assessment activities – students can reflect on progress made and can build confidence in their abilities.

AUTHENTIC ASSESSMENT:
- Creates collaboration in the broader context and creates opportunities for self-reflection.
- Involve industry in assessment - final year projects, work-integrated learning, poster presentations
- Needs to be a common understanding of what is valued.

PEER ASSESSMENT:
- Of fellow students in project work.
- Can be easier to do on multiple small assessments.
- Peer assessment develops self-evaluative skills and encourages self-reflection.

COLLABORATIVE ASSESSMENT:
- Self-identification of what is important in the assessment activity.
- Get students to help set up rubrics.

Who (else) can give feedback?
How can self-reflection, peer feedback, and other mechanisms be built into your module/programme?

DEVELOP FEEDBACK SKILLS:
- Feedback should be constructive and valuable
- Students can be confused by rubrics - are they valuable and do they support learning?
- Train lecturers / students to provide good feedback
- Qualitative feedback more valuable than marks.
- Give students multiple opportunities as this provides better preparation for industry.
- Consider using software for automated feedback to address efficiency challenges.

PEER FEEDBACK:
- Student A finds a reference on a topic, Student B decides if that reference is helpful.
- Assess the assessment - ask students to evaluate one another and assess the evaluation
- Students present and peers provide feedback.
- Using short in-class activities for peer assessment
- Better for low stakes assessments
- Develops students' understanding of expectations
- Detailed 360-degree feedback

SELF-FEEDBACK:
- Questionnaires pre-, post solution for assessments. Can develop self-directed and self-evaluation skills.

EXEMPLARS:
- Give examples of student variations in approach (so that they may learn from one anothers' approaches).

Who (else) can be responsible for designing assessment?
How can students or others be involved in the design of assessment?

INTEGRATED ASSESSMENT:
- To prevent working in silos: use a "case" over multiple years where students can build their knowledge
- Get students to work across disciplines.

INFORMED ASSESSMENT DESIGN:
- Use published EngEd research
- Get feedback from colleagues

COLLABORATIVE ASSESSMENT DESIGN:
- Matric exam assessors and first-year lecturers
- Lecturing teams (coordinator, lecturers, moderators)
- Collaboration between different subject lecturers to design an **INTEGRATED ASSESSMENT** to allow for more holistic experience.
- **INDUSTRY PARTNERS** involved in assessment process. Make it easier to make the link between GA's required by industry and makes assessment tasks more "real".

CO-DESIGN (WITH STUDENTS):
- Students design an assessment with a feedback strategy
- Design assessments for earlier years - what would I have needed to have a better grasp of XYZ.
- Involve students to provide their own context for an assessment incorporating their voice
- Can assist students to understand expectations and what is important and identify gaps.
- Ask students to reflect on their learning and provide feedback that can be used to improve assessments.

Sustainable Integration

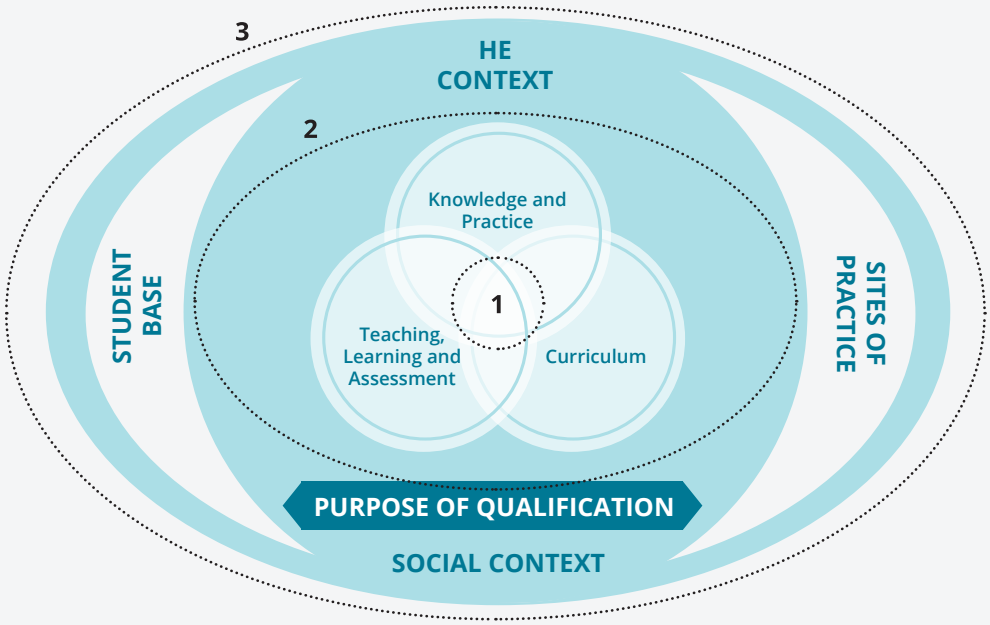
Bringing Life to our Engineering Curricula:
Workshop 4

Facilitated by Ass. Prof Karin Wolff (SUN) and Dr Lelanie Smith (UP) (10 March 2022)

How do we facilitate coherent & sustainable integration?

1. **Disciplinary Collaboration**
2. **Institutional Communities of Practice:**
3. **Professional collaboration (extra-institutional/ professional/ industry):**

Question:
What kind of collaboration would help you to introduce/increase a sustainable integrated curriculum in your context?



EXISTING COLLABORATIONS

MODULE	PROGRAMME	FACULTY AND BEYOND
• Collaboration with corporate coaches, industry and community partners • Peer Evaluations (Collaborating with students on assessment) • Collaboration between modules around central design concept/theme • Collaboration with Academic Development, Humanities and Faculty Student Advisors • Engineering management and labour relation – students engaging with external consultants • Make communication in multiple forms (writing, drawing, verbal) intrinsically part of the problem-solving process	• Portfolio of Evidence of Learning • Multidisciplinary projects • Contextualise value of writing / literacy skills within a technical profession • Give students feedback on how to take knowledge & skills from one module to follow up modules • Laboratory modules with vertical integration of qualitative and quantitative research methods	• External company provides Virtual Lab Software • Real-world case study videos (Industry Engagement) • Collaboration across catalysis colleagues (SASEE workshops and IEC) • Inter-institutional collaboration on systems thinking in curriculum and teaching and learning • Engineers Without Borders Design Challenge (National Grand Final competition with 8 Engineering Schools in SA) • Group Project, interviewing someone from industry

REQUIRED COLLABORATIONS

MODULE	PROGRAMME	FACULTY AND BEYOND
• Academic Development Support • Writing Center • More collaboration between colleagues and modules – overcoming silo's • Collaborative final year research projects - collaborate with other departments and other universities - seeding ongoing research collaboration • Having more than one lecturer involved (even if peripherally) at all stages (active co-teaching) • Internal moderation - feedback while course is running used to adjust course	• Student buy-in crucial to innovative curriculum design and to drive change and build a relationship of trust (students need to believe that you're invested in their success) • Collaboration across first year • Enabling students to see 'bigger picture' • Coordinated cross-cutting project that runs across years, assesses different GA's - need a team to develop the materials • Mechanisms for ensuring continuity • Mentorship of colleagues around education (mutual) - sharing ideas with each other	• Lab space and equipment (can we collaborate across institutions to use labs?) online virtual or remote lab simulations. • Industry mentorship • Allowing moderators / interested colleagues to have access with LMS / course site • Formally collaborate (e.g. on a project) that cut across disciplinary boundaries within a department (e.g. water/ transport/ structures) or even across departments • National Industrial; Competitions can be credit-bearing;