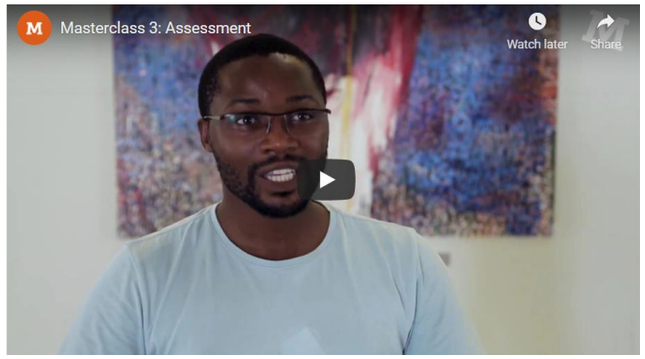
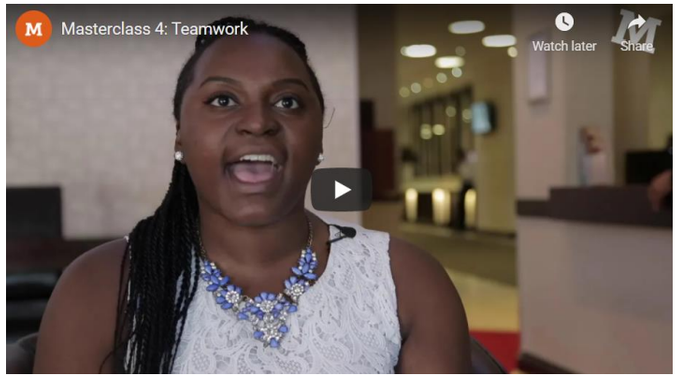
Innovative
ENGINEERING CURRICULUM

Bringing Life to Engineering Education: Work Session 1: Series 1 Ep 1 Integrated Curricula

Presented by Dr Lelanie Smith and Prof John Mitchell
27 January 2022

Master Classes for Engineering Educators 2017-2019





Bringing Life to our Engineering Curricula

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Higher Education and Training
REPUBLIC OF SOUTH AFRICA

ROYAL ACADEMY OF ENGINEERING

What is integrated curriculum?

Definition of integrated curriculum:

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

Shay, S., Wolff, K., & Clarence-Fincham, J. (2016). *New Generation Extended Curriculum Programmes: Report to the DHET. Cape Town:* University of Cape Town.

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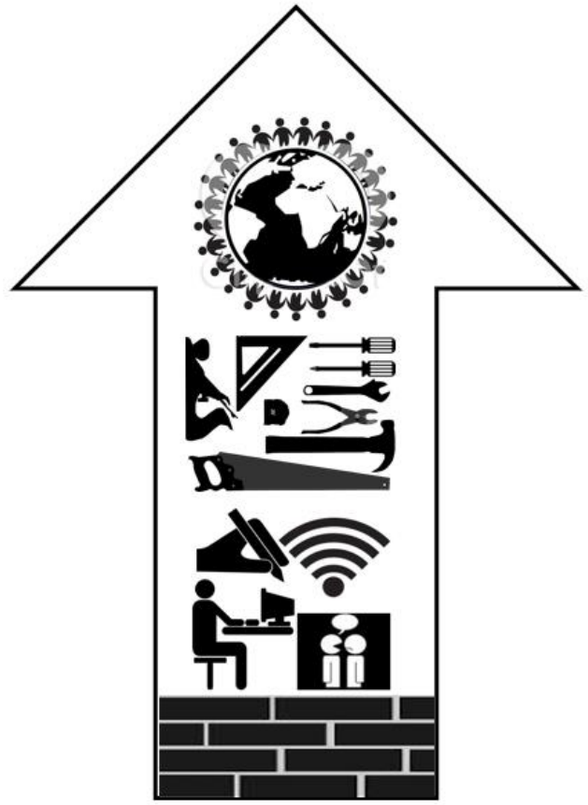

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Implementing an Integrated Curriculum?

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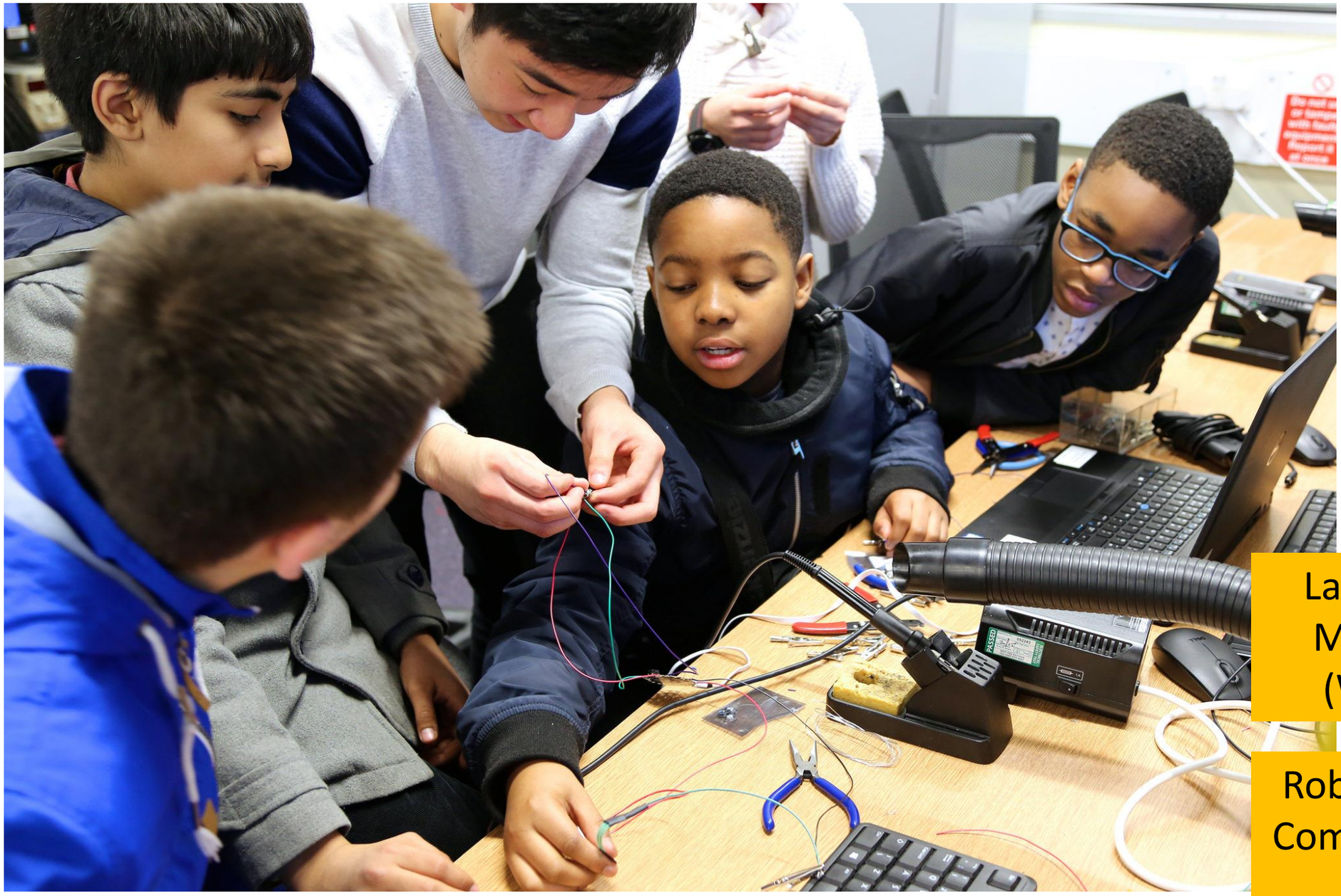
Research group

Information and Communication
Engineering

Integrate Disciplines

Integrate Theory and Practice



LabWork Module (WITS)

Robot Race Competition (UP)

Integrate Skills

Community Engagement (CUT)

ECSA Portfolio (UKZN)

Engineers in Society/ Business (UCT)

Integrate Workplace learning

EWB
(UJ)

Learning
Factory
(NMU)

Integrate Assessment

Fluid Mechanics Activities (SUN)

Why an Integrated curriculum?

Student Demands:

- *Students increasingly drawn to engineering because they want to design creative solutions to major global challenges.*
- *Want to see the connection between theory and practice.*
- *Increased consideration of employability.*
- *Require competencies in working across a multiplicity of boundaries and with people whose specialisation and/or cultural frameworks that differ from their own.*

Why an Integrated curriculum?

Industry Demands:

Engineering Education

What is it for?

- *It is education – it is not training*
- *Develop intrinsic-motivation and agency within students*
- *Develop professional attitudes and competencies*
- *Develop graduates that appreciate socio-economic and environmental contexts, sustainability, ethics, innovation and entrepreneurship*
- *Confident communicators and team-workers*
- *Deep specialist knowledge*

Integrated Curriculum

What might it look like?

Curriculum innovation includes cross-disciplinarity with increasing use of:

- *problem and project-based learning,*
- *group learning and assessment,*
- *authentic workplace learning, and*
- *research-based/enquiry learning,*

supported by:

- *engineering education research,*
- *industry engagement,*
- *connections with alumni,*
- *staff development and expansive teaching spaces.*

Project Objectives

- *Develop a framework for a contextual integrated curriculum in SA engineering programs;*
- *Implement pilot projects within faculties;*
- *Train staff to facilitate active integrated learning.*

Phase 1: Initial Activities

- *Initial Conversation with Deans*
- *Interview programme coordinators at different institutions*
- *Showcase existing initiatives (in progress)*
- *NOW: Workshops across SA institution*

Conclusion

This is exciting but it can't happen without you!!

Breakout Room Instructions

45 min Breakout Room Session Schedule:

***STEP1**: 1 minutes per participant*

- *Introduce yourself (Name, Affiliation, current role (Mech Eng or Professional Communications etc)*
- *Why are you attending?*

***STEP2**: Nominate people to take notes (Google Slide Page) and give feedback per Question in STEP 3-4 (2 core points).*

***STEP3**: 10min group discussion – What are the benefits of an integrated curriculum in your context?*

***STEP4**: 10min group discussion – How does integration bring life?*

***STEP5**: 10min group discussion – What are the biggest risks of an integrated curriculum?*

Feedback

What is IEC?

- *Integration does not exclusively mean Project-Based Learning (PBL)*
- *Horizontal and Vertical alignment can be low hanging fruit within existing curriculum*
- *Monolith modules were staff have their own kingdom is not ideal.*
- *Staff teams – weekly or every second week discuss with staff in your teaching semester and specialist stream; Important that this is effectively facilitated.*

Feedback

What are the benefits?

- *Emphasizes the importance of complementary modules and balance the relative importance of different modules for students*
- *Attracts a broader range of interdisciplinary researchers for PG*
- *Graduates can be better prepared if they are trained for the bigger picture - Improves relevance of what students are learning*
- *Create expectation, enthusiasm amongst students – mentoring potential between peers across year groups.*
- *Improved quality of research because UG are better prepared.*
- *Helps transition to industry, better prepared*

Feedback

What are the benefits?

- *Increasing motivation of students. Create expectation, enthusiasm amongst students – mentoring potential*
- *Diversity of skills developed in early years - Prepare students for projects in later years in their UG studies. Early integration can make students comfortable with complex ill-defined problems*
- *Foster innovation*
- *Real-world contextual problems that are multi-disciplinary create opportunity for learning to communicate outside of their discipline. Can enhance potential collaboration and integration between discipline*

Feedback

What are the benefits?

- *Reflection as a skill needs to be taught before it is required*
- *Connection between design, maintenance and operation*
- *Viability and relevance of curriculum to serve industry and society*

Feedback

How does integration bring life?

- *Enables better implementation of GA*
- *More industry ready graduates - Can simulate what it might be like to be an actual engineer early on*
- *Encourage students to be more creative, excited and promote autonomy and promote learning – exciting for students*
- *Integrated Curricula can help them focus more in the journey rather than an end goal.*
- *Enhances scale on intervention across multiple modules because of the connections between modules*

Feedback

How does integration bring life?

- *Engineers do not really have a clear role in society – impact and influence that an engineer can have can be brought into an integrated curricula*
- *Practical open ended problems – students have a more authentic learning experience, stimulate curiosity on the students side – life long learning*
- *Student engagement – improves self and active learning. Promote entrepreneurship*
- *Silos could destroy student passion which integration could bring life back to it*
- *Can bring connection between different knowledge basis - Better connection between students and lecturers*

Feedback

How does integration bring life?

- *Closer collaboration between Universities-Industry-Community - Improved stakeholders engagement (government, industries)*
- *Collaboration broadens staff horizons*

Feedback

Biggest risk of integration?

- *Rural resources*
- *Staff workload*
- *Assessment workload for large class projects*
- *Quality for large class project-based assessment*
- *Question of sustainability – resources, time and staffing cycle*
- *Gradual integration can be more sustainable*
- *Different learning style from high schools for students*
- *Potential loss of foundational technical knowledge/concept*

Feedback

Biggest risk of integration?

- *Buy in from stakeholders (students, industry, funders, ECSA)*
- *Champion and coordination – takes time and effort*
- *Resistance from colleagues – pressure for research. Buy in from our colleagues. Not open to change/adapt. Reluctance might be due to not being prepared.*
- *Cohesion but also independence – make sure students can still progress if they don't pass*
- *Lack of experience and exposure from staff to understand integration or different styles of teachings*

Feedback

Biggest risk of integration?

- *Practical integration challenge where curriculum does not encourage it*
- *Workload is a risk but also an opportunity for rethinking how we use our time*
- *Expectation of students must be clear – how do they pass a module*
- *Guide students out of their normal learning styles – staff would need experience on how to do this. Under-equipped and under-prepared staff*
- *Institutional support for time and training required for Integrated Curricula.*
- *Assumption that all students are starting from the same skill level – can make things worse in integration*

Feedback

Biggest risk of integration?

- *Lecturers think of teaching in terms of content and not the skills*
- *Assessments are often outdated, even more so if we start integration. WE would need to rethink assessment. Potential issues with institutional policy as well as staff experience. Quality of assessment.*
- *Outsourced modules must be connect to the main stream modules.*
- *PBL – issues on how to teach and assess. Staff are not prepared*
- *Not all staff has a link to industry – perhaps workshops with industry*
- *Usually design modules take all responsibility for integration without support*
- *Where does integration make sense?*

Feedback

Biggest risk of integration?

- *Assessing GA vs content – how do we know a student is really successful – how would we integrate these two?*
- *Background and diversity can be problematic in team work*

What is next?


• Session 1: 27 January 9h00-12h00
What is an Integrated Curriculum? And how does it bring life?
• Session 2: 10 February 14h30-16h30
Integrating ECSA
• Session 3: 24 February 14h30-16h30
Assessment Strategies for an Integrated Curriculum
• Session 4: 1 0 March 14h30-16h30
Sustainable Integration
• Session 5: TBD (end of March)
Three-hour Workshop
If you are interested, click here to complete the form.

Feedback from participants

We appreciate your participation and that you are committing time and energy to this initiative. Please give us some feedback:

https://forms.gle/qbn19Ji2FqckvrZ89