

Reinventing Undergraduate Engineering Curricula

Collaborating Beyond the Single Classroom

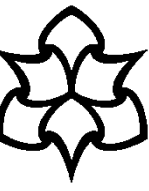


Fiona Saunders

Faculty Head of Education | Faculty of Science and Engineering

Margaret Fowler

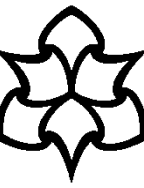
Education Lead | School of Engineering



Our Challenges & Opportunities

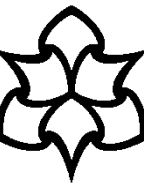
Reinventing Curriculum Chains of Success

Progress to date



Our Challenges & Opportunities

- To understand and celebrate our **identity** as a “Post-92” Engineering department
- To take full ownership of our **metrics** by problematising our curriculum, not our students
- To reinvent our curricula and team working structures to add value to our **partnerships** in academia, industry and our professional bodies



Identity: Our next door neighbour and us

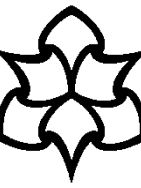
Manchester is home to two of the UK's largest universities @ c. 38,000 students

- The University of Manchester is part of the “Russell Group”
- Manchester Metropolitan is a “Post-92” University

Manchester Met students are more likely to:

- Come from Manchester and the North West of England
- Be in the first generation of their family to go to University
- Have studied for vocational qualifications at 16+

They are still top of their class and entry qualified for our courses



Metrics: Defining a Sustainable Position

The Teaching Excellence Framework (TEF) ranks Universities and subjects* on:

- continuation rates
- student satisfaction
- employment outcomes

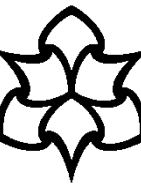
Manchester Met is currently ranked “Silver” and aspires to “Gold”

Engineering at Manchester Met is currently “Bronze”*

**Subject rankings are not published, yet*

In broad terms:

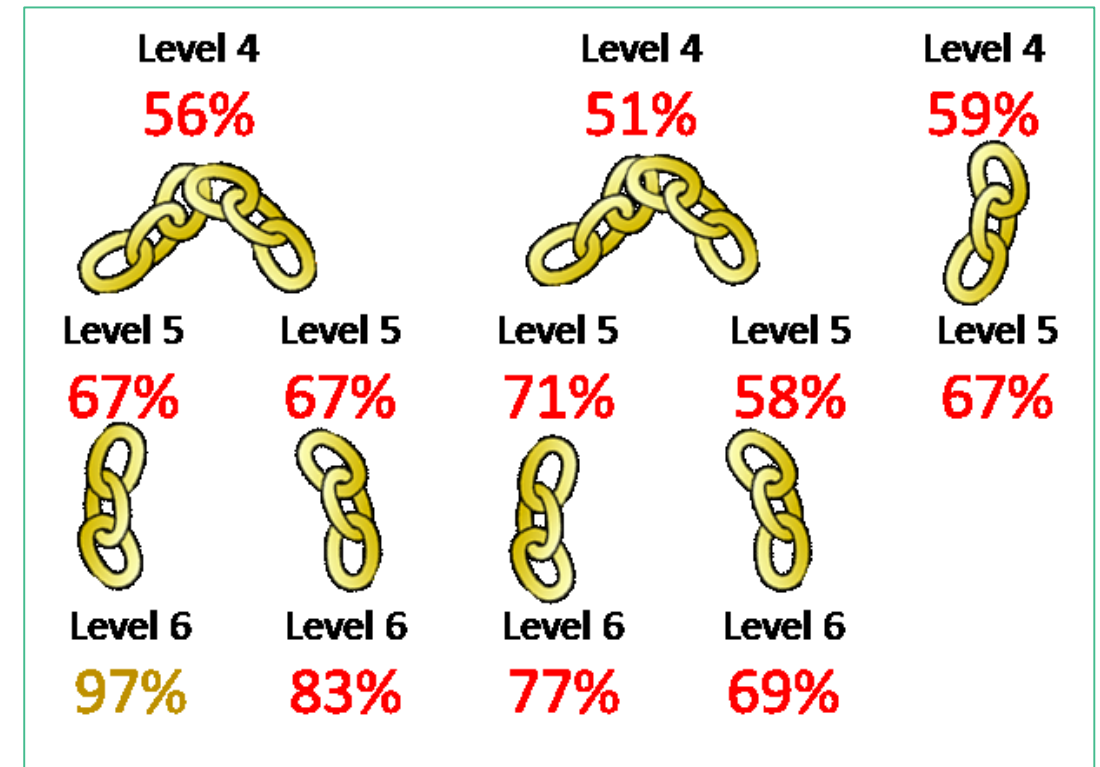
- Manchester Met Engineering TEF metrics at are around 70%
- The UK Engineering Post-92 sector TEF metrics are around 80%
- Manchester Met’s expectation is 90%+ by 2021



Barriers: Established Culture and Practice

- Separate module teams, each working through a “fixed set” of topics
- Employability, soft skills and **fun** seen as extras
- Troublesome Threshold Concepts underpin sets of modules, but are often left unresolved and passed along chains of related modules

2016-17 First Sit Module Pass Rates

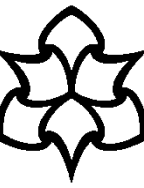




**Problematising
the
Curriculum,
not the
Students**

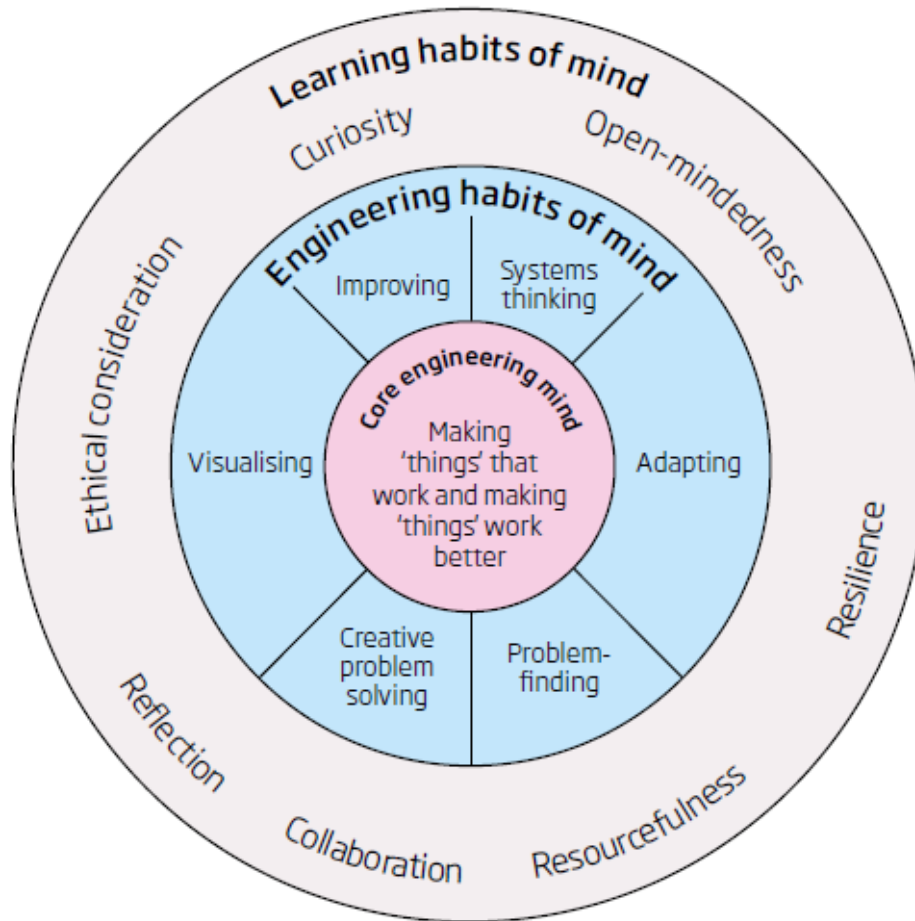
**Make Engineering
Great Again**

Take Back Control



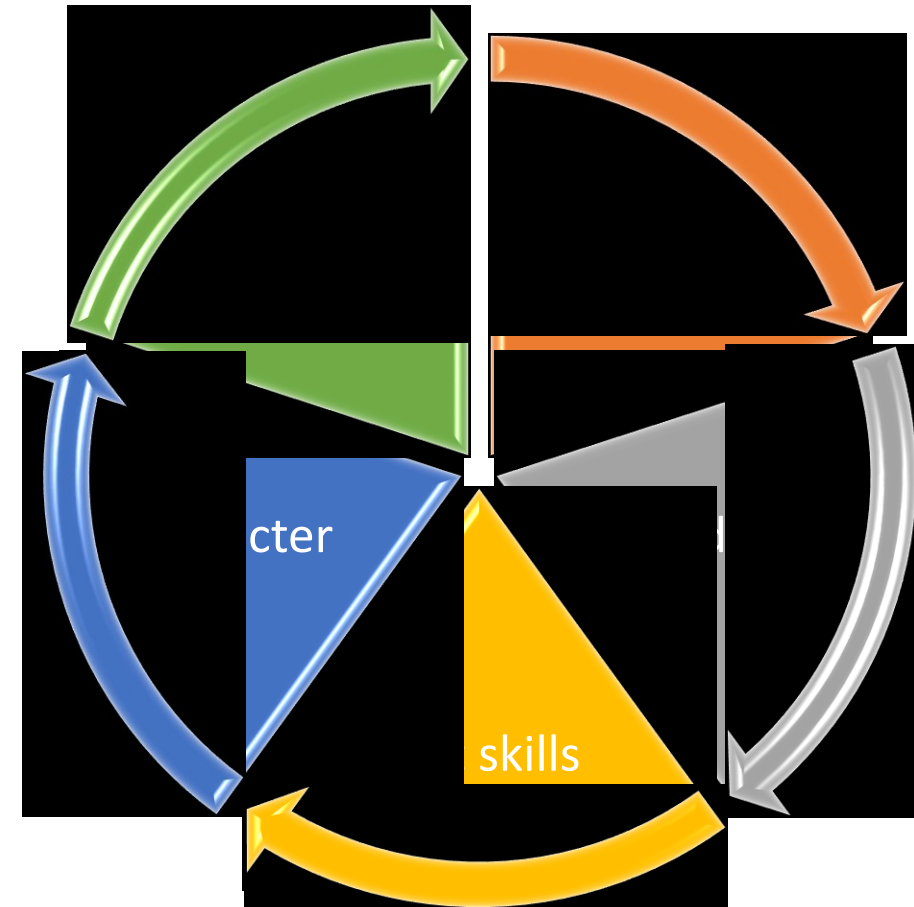
Models of an Employable Engineering Graduate

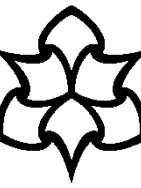
Royal Academy of Engineering



5 Components of Employability

Engineering UK 2018





Industry & Professional Bodies

- Industry frustrations about **numbers** and **work-readiness** of graduates, especially from Small to Medium Enterprise (SME) companies who struggle to offer training to match the graduate training schemes of the larger corporations

“The challenge for higher education is to support students to develop soft skills and character components of employability, in a more deliberate way.”

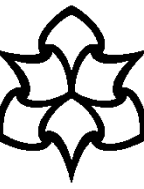
Engineering UK Report 2018

Significant recent growth in work with SMEs in Manchester Met Engineering

- one of the largest portfolios of Knowledge Transfer Partnerships (KTPs) for a single department
- increasing use of “live” projects for summative assessment

But:

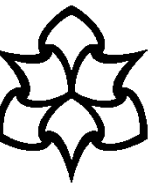
- Little room to reflect this fully in the curriculum, which is still heavily focussed on knowledge and hard skills



Our Challenges & Opportunities

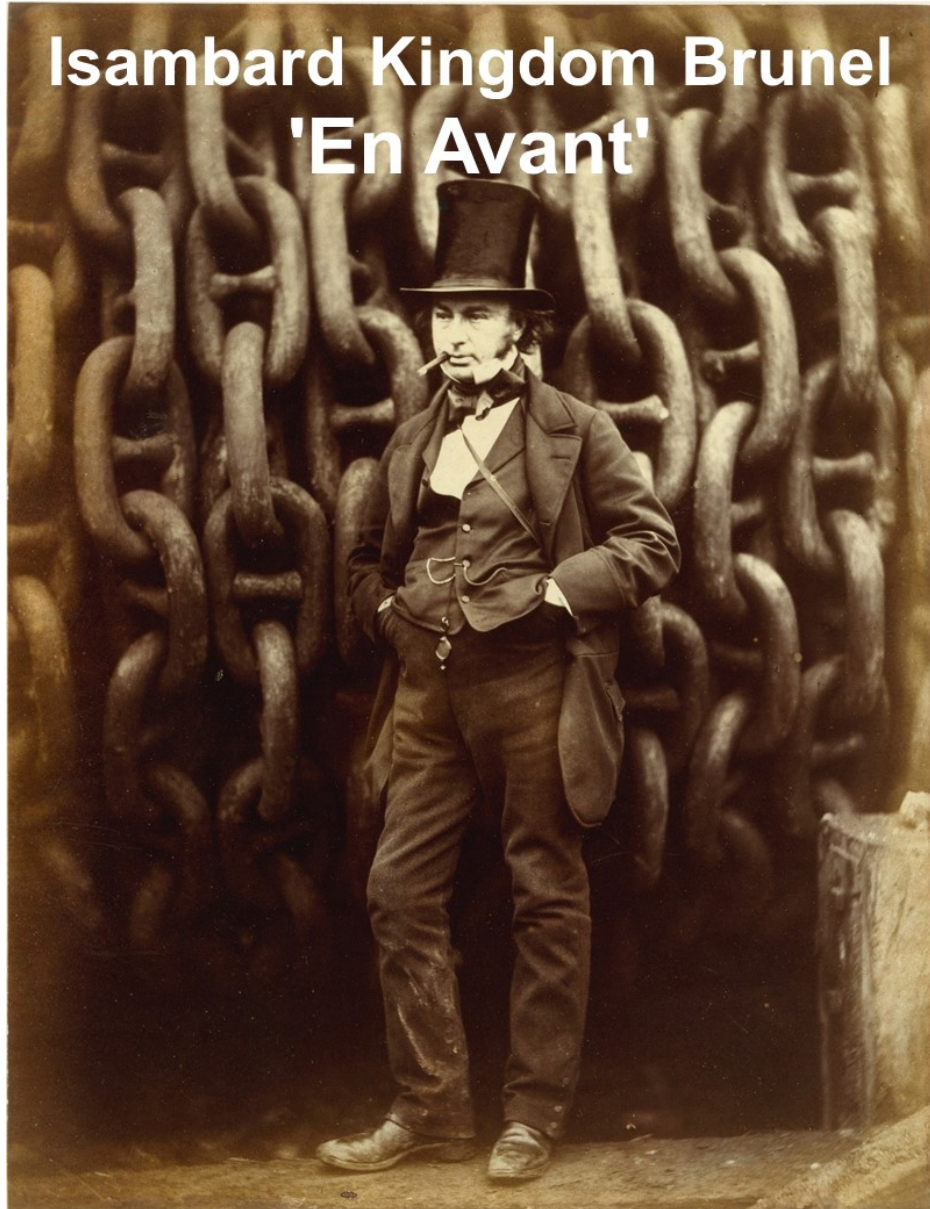
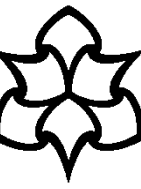
Reinventing Curriculum Chains of Success

Progress to date and Next Steps



Reinventing Curriculum Chains of Success

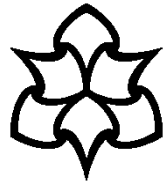
- Securing management support and setting the benchmarks
- Building teams and leading the narrative
- Reinventing the curriculum core and criteria



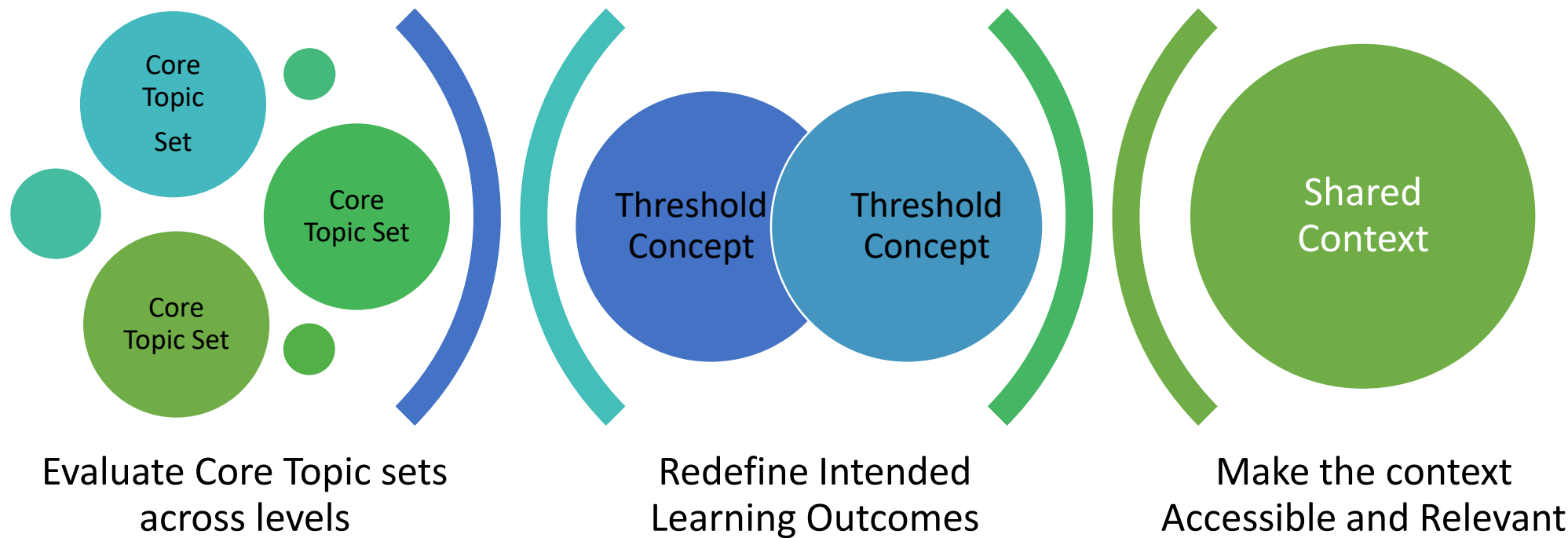
Isambard Kingdom Brunel
'En Avant'

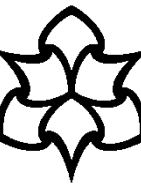
"Of all the wonderful feats I have performed, since I have been in this part of the world, I think yesterday I performed the most wonderful. I produced unanimity among 15 men who were all quarrelling about that most ticklish subject—~~taste~~".

standards



Model for Change





Step 1 – Block the Exits

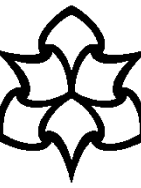
Vital to get full management backing
Enter:

- New Faculty Pro-Vice Chancellor (Dean) – Andy Gibson, taking no prisoners, but championing our cause with senior management
- New Faculty Head of Education – Fiona Saunders – calm, straightforward leadership
- Re-boot to my role
- Strengthening partnerships with professional bodies

There is a plus side to declaring a low point:

- We are all in it together – no more heroes and villains
- The opportunity to turn management attention into resource and support
- A chance to be bold
- A chance to shine a light into the darkest, hardest to reach corners

Hard work, but exhilarating



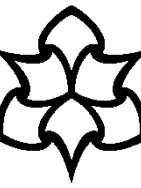
Step 2 - Some Easy First Steps for All

Two rapid action interventions sold as quick wins with students

- Faculty-wide introduction of key concept videos
 - Get your tutors' best explanations 24/7
- Introduction of early “Essentials” assessment point
 - Summative to drive engagement
 - Low weight/risk – a chance to recover

Biggest benefits were for staff:

- Videos: (Re-)Discovering:
 - What are the key concepts?
 - Are they the right ones?
 - Are they explicit and visible enough in the assessments?
 - A chance to tune out background noise
- Essentials: democratic snapshot
 - Early warning of inconsistency/risk of failure
 - Opportunity for cross module conversations/support

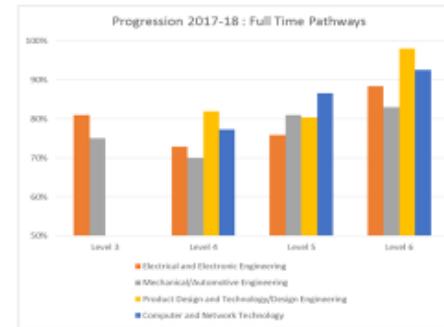


Step 3 – Accept that the Metrics are the Metrics

Outside the School, our outputs travel as numbers on spreadsheets

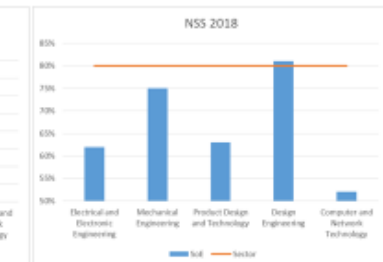
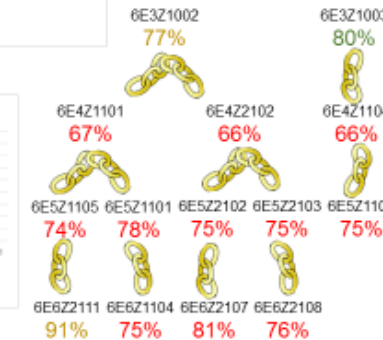
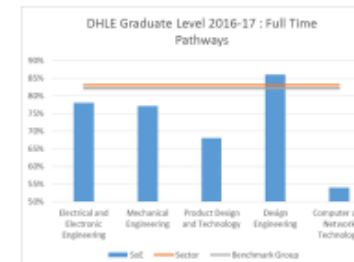
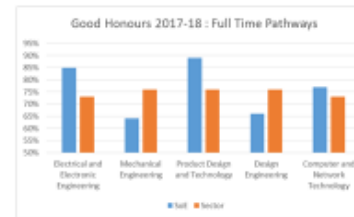
- No accompanying narrative
- Some sector and context adjustments made for TEF
- The University favours an absolute view

The challenge is to get the right balance inside the School between causes and fixes



School of
Engineering
Undergraduate
Programmes
2017-18 Outputs

Target Progression Chains
(First Sit Pass Rates)

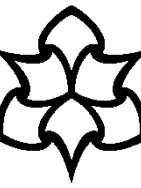


Unit Code	Unit Title	ISS	1st Sit	2nd Sit
6E4Z1102	Mechanical Engineering Design	81%	87%	90%
6E4Z1107	Stress, Structures and Engineering Dynamics	57%	81%	82%
6E4Z1108	Heat Transfer and Fluid Mechanics	95%	76%	85%
6E4Z1109	Automotive Engineering	100%	100%	100%
6E4Z1111	Control and Automation	81%	91%	93%
6E4Z1101	Electronic Engineering Design	73%	96%	98%
6E4Z1104	Electronic Systems Design	80%	75%	83%
6E4Z1106	Power Generation and Distribution	100%	100%	100%
6E4Z1110	Engineering Management	50%	90%	90%
6E4Z1100	Individual Engineering Project	69%	90%	92%
6E4Z1113	Product Design	93%	100%	100%
6E4Z1114	Design Engineering	80%	97%	100%
6E4Z1115	Advanced Design Communication	97%	96%	98%
6E4Z1004	Advanced Computer and Network Technology	73%	96%	96%
6E4Z1015	Advanced Computer Engineering	78%	92%	92%
6E4Z1016	Advanced Communication and Networks	60%	100%	100%

Unit Code	Unit Title	ISS	1st Sit	2nd Sit
6E5Z1102	Solid Mechanics and Dynamics	72%	75%	85%
6E5Z1103	Thermodynamics and Fluid Mechanics	88%	75%	83%
6E5Z1104	Mathematical Methods 2	58%	75%	82%
6E5Z1101	Electronic Systems	83%	78%	86%
6E5Z1105	Electrical Systems	81%	74%	84%
6E5Z1100	Professional Design and Practice	66%	87%	90%
6E5Z1108	Design Communication	95%	78%	87%
6E5Z1109	Environmental Design	84%	91%	91%
6E5Z1110	Applied Engineering Principles	84%	83%	87%
6E5Z1006	Computer Systems 2	85%	67%	83%
6E5Z1007	Networks 2	85%	88%	92%
6E5Z1008	Computer and Network Technology 2	77%	86%	92%

Unit Code	Unit Title	ISS	1st Sit	2nd Sit
6E4Z1101	Electrical and Electronic Science	84%	66%	77%
6E4Z1104	Mathematical Methods 1	71%	66%	76%
6E4Z1102	Engineering Mechanics	88%	67%	72%
6E4Z1100	Engineering Design and Practice	80%	75%	82%
6E4Z1105	Design Skills	92%	71%	82%
6E4Z1106	Engineering, Materials and Manufacture	69%	80%	84%
6E4Z1107	User Centred Design	85%	75%	84%
6E4Z1003	Computer Systems 1	89%	70%	81%
6E4Z1009	Networks 1	78%	74%	81%
6E4Z1004	Computer and Network Technology 1	78%	57%	80%

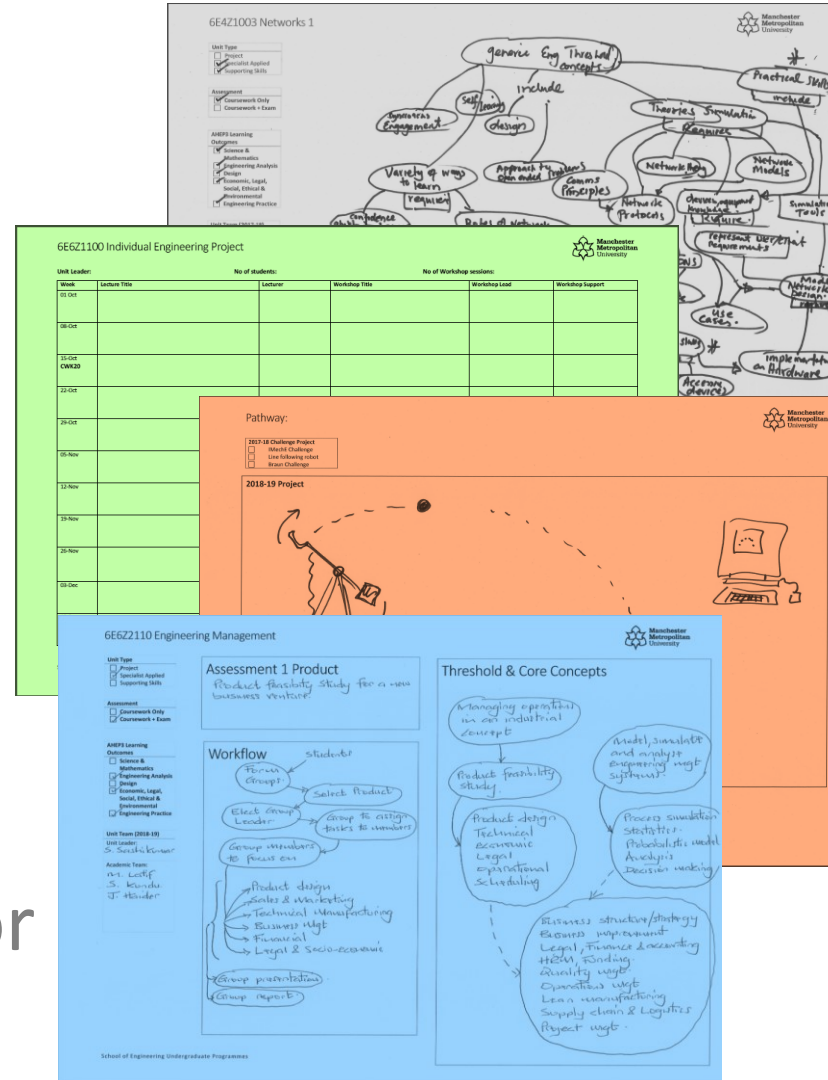
Unit Code	Unit Title	ISS	1st Sit	2nd Sit
6E3Z1002	Foundation Physics	95%	77%	78%
6E3Z1003	Foundation Mathematics for Engineering	84%	80%	82%
6E3Z1001	Foundation Computing	74%	83%	83%
6E3Z0001	Academic Skills for Higher Education	81%	86%	87%



Step 4 : Reflect and Plan Together

An intensive series of twice weekly workshops in the summer term

- High priority
 - attended by senior management
 - workload allowances
- No off-limits or opt-outs
- Outputs uploaded online for maximum sharing

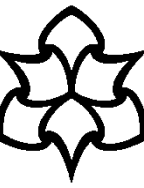


Concept maps of
2017-18 delivery

Schemes of work
for 2018-19

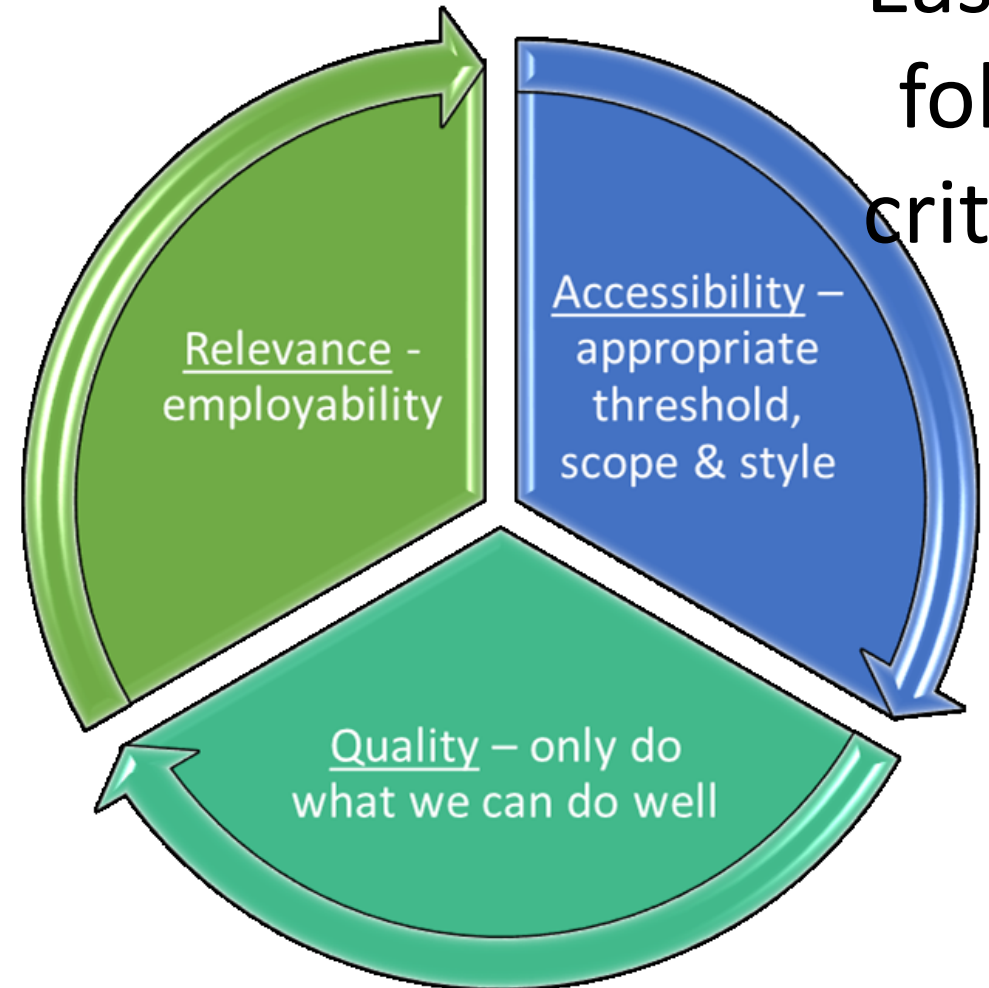
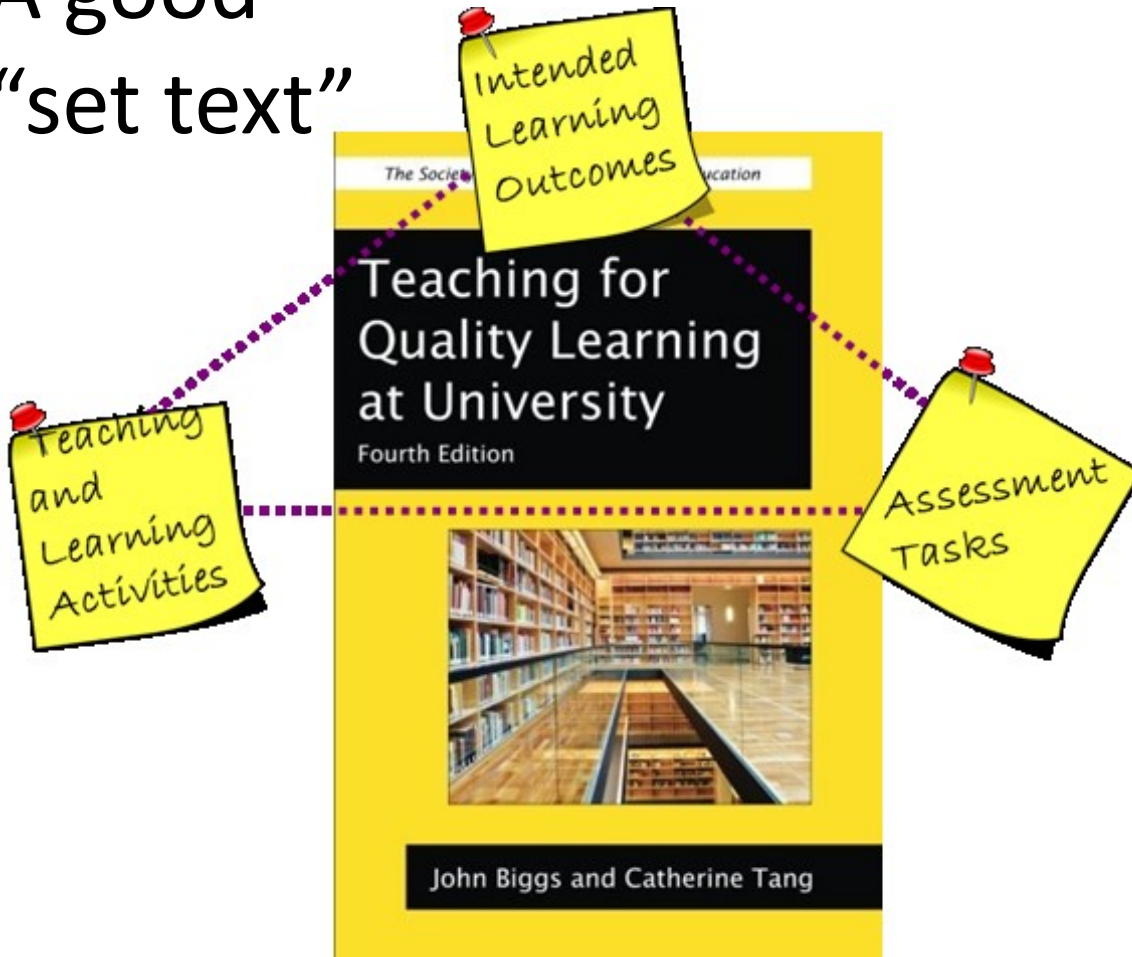
Level 4 induction
projects linked to
first assessments

Workflow and
Concept Maps
for coursework

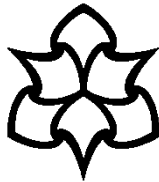


Step 5 : Establish Clear Core Criteria

A good
“set text”

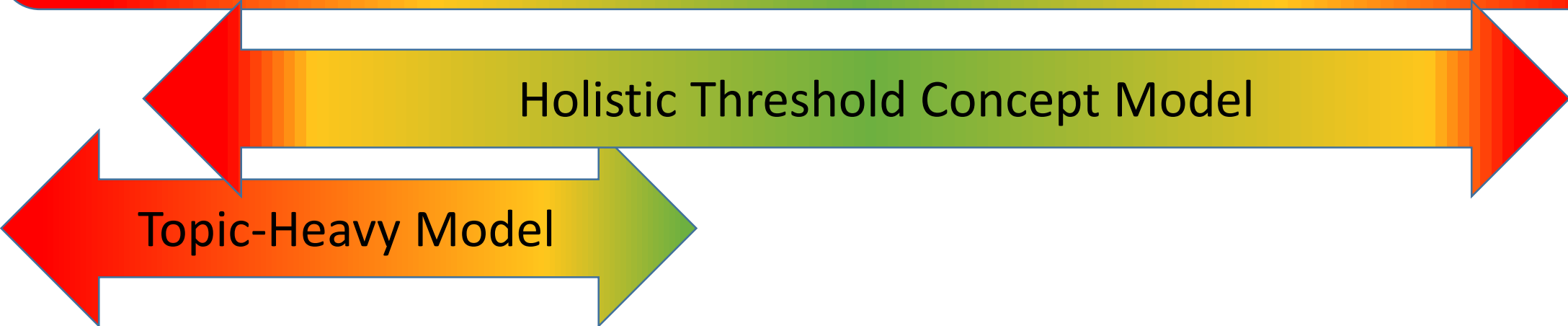
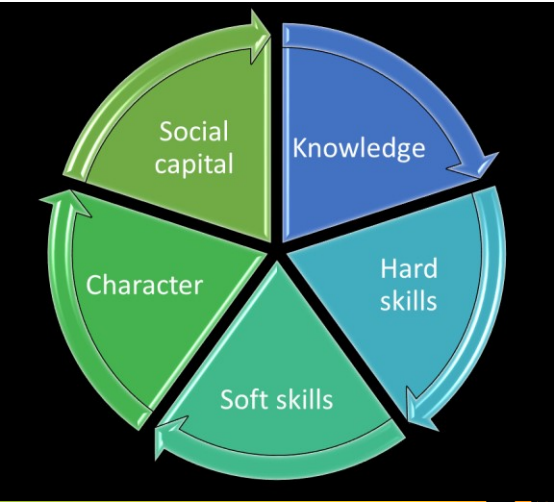
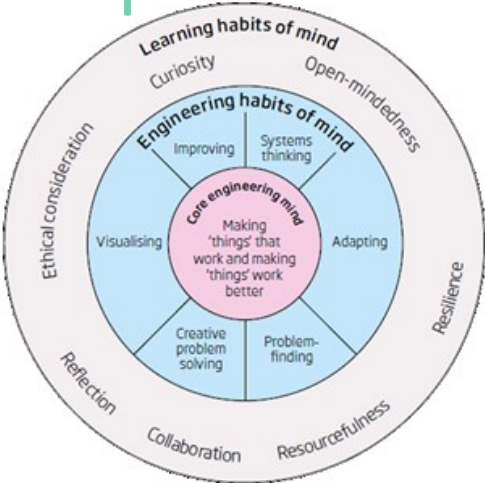


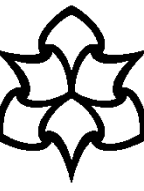
Easy to
follow
criteria



Progress to Date & Next Steps

Step 6 : Re-position Curriculum Core

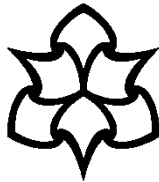




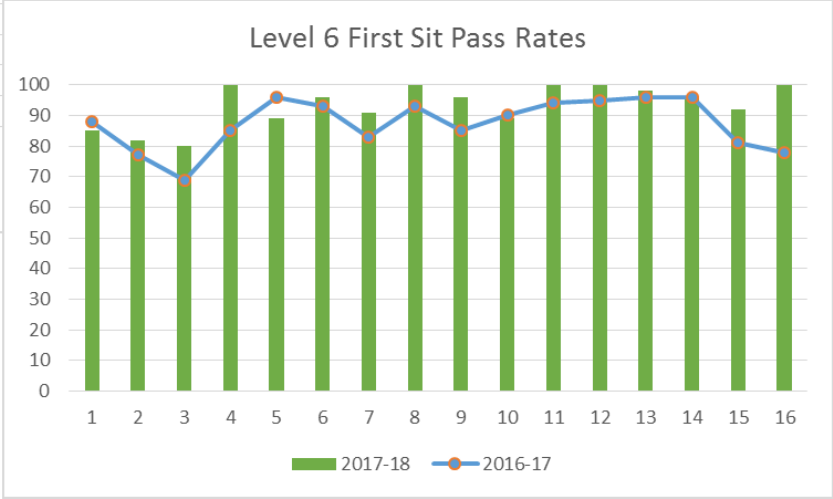
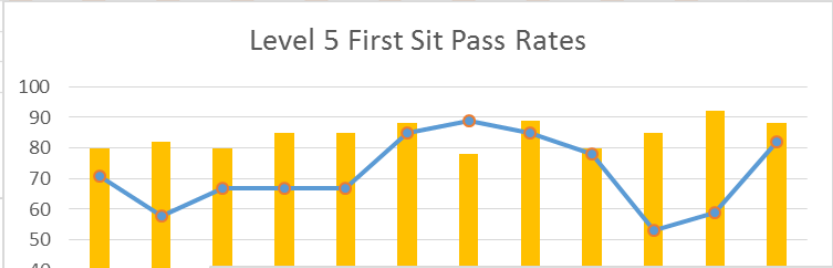
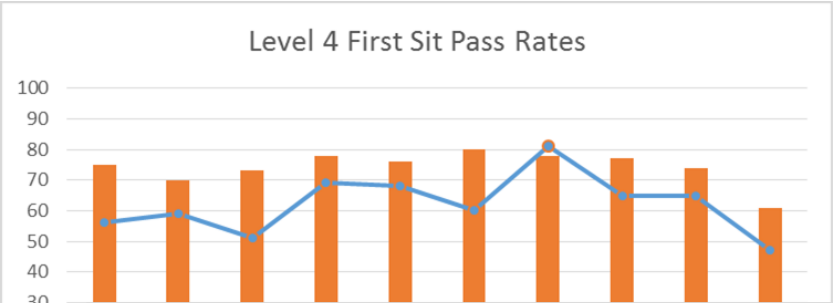
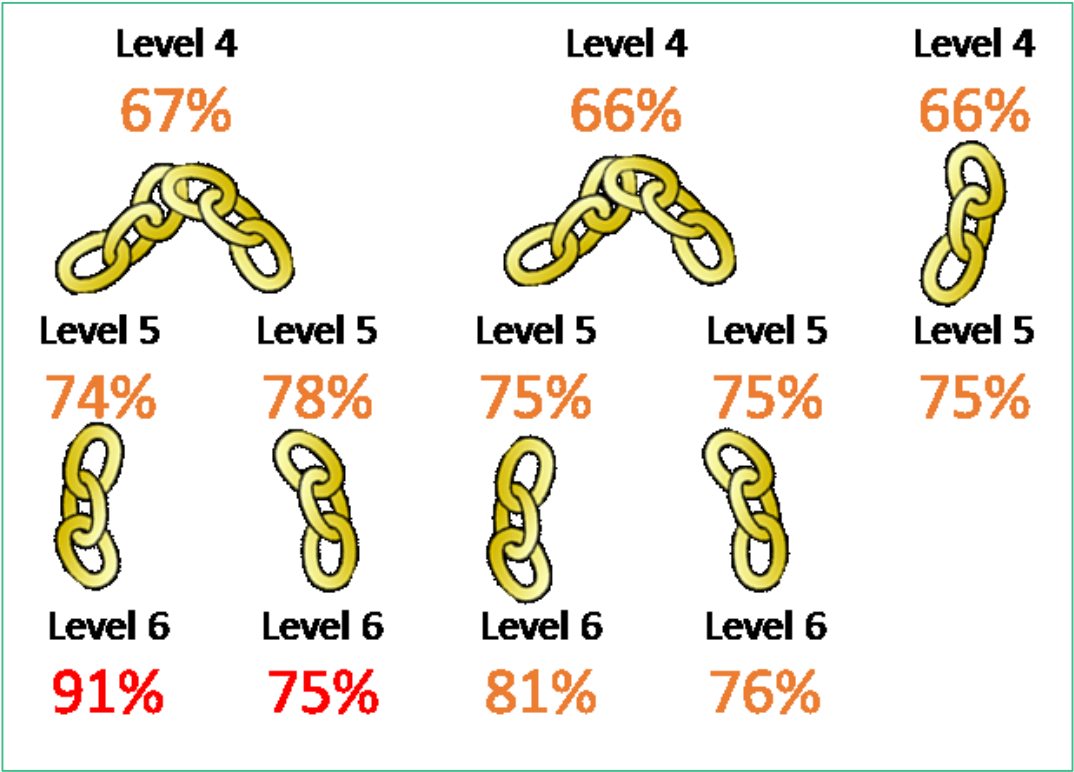
Our Challenges & Opportunities

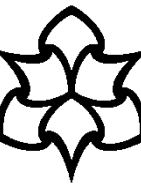
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2017-18 First Sit Module Pass Rates





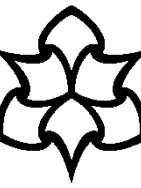
Results and Progress

Metrics

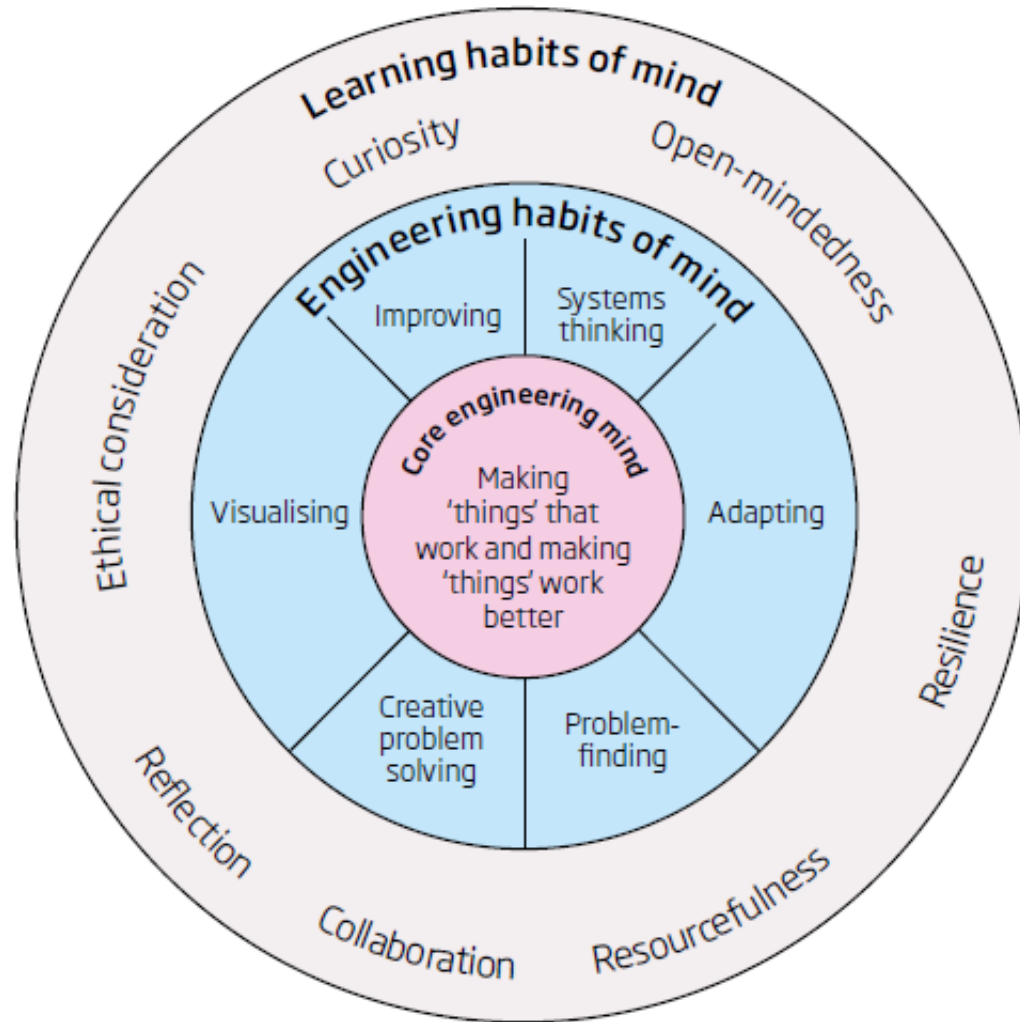
- Marked lift in output metrics in 17-18
 - Higher in our School than elsewhere in the Faculty
- Continued expansion of research and enterprise activity
 - Academics are still delivering across the range of their roles
- Successful recruitment of high quality staff

Culture

- Congratulations and encouragement from senior management and other schools/faculties
- Increased, shared ownership of outputs and the initiatives to improve them
- New learning and teaching leaders emerging



Academic, Industry and Research Partnerships



Developing partnerships with:

- Other departments within the University
- 2 other UK Engineering departments
- SME companies and professional body on an “Employability Milestones” project
- Anyone who is interested ...