Large Class Teaching in a Multi-Cultural, Multi-Ability & Multi-Disciplinary Setting

This two-day workshop will focus on the challenges and benefits of large-class teaching within a multi-cultural, ability and discipline setting. The two Workshop Facilitators have several years' experience teaching within an Engineering Setting in Birmingham, in the UK (One of the most diverse cities in the UK, Birmingham is a 'minority-majority' city).

Dr Gareth Thomson is a Reader in Mechanical Engineering at Aston University. With 28 years' experience researching at teaching Engineering in Higher Education, Gareth is the UK and Ireland Regional Co-Director of the Global CDIO initiative. An active Engineering Education Researcher, Gareth is also co-chair of the SEFI (European Society for Engineering Education) working group on Curriculum Development.

Having worked at Aston University since 2006, Dr Jane Andrews is now a Senior Teaching Fellow at WMG, University of Warwick. A Social Scientist whose area of expertise is Engineering Education Research, Jane has taught in Engineering for 10 years. She is a Governing Board Member of the UK & Ireland Engineering Education Research Network where holds the position of Membership Secretary and Publications Officer.

Together Gareth & Jane are able to provide a unique mixture of Engineering and Sociological ontologies and epistemologies. Bringing Engineering Education to life, five distinctive Workshop Activities will challenges and engage colleagues who will find themselves considering in some depth the issues and challenges of large class teaching within what is increasingly a 'global village' setting.

Day 1

9-10:	Welcome: The morning will kick off with an informal introductory session in which colleagues will be asked to identify their expectations in terms of the workshop. Exactly what is meant by the term "Large Class Teaching" will be discussed and the programme schedule for the next two days introduced. [Gareth & Jane]
10-11:	The second hour will comprise a facilitated group discussion which will be lead by Gareth & Jane who will start off the discussion by reflecting on the challenges of large class teaching within a multi-cultural / multi-ability setting and multi-discipline setting [Gareth & Jane]
11-11.30:	Break
11:30-1.00:	Interactive Workshop Activity (1): Pedagogy, People & Practice [Jane]

The first workshop activity will focus on the pedagogic benefits of large class teaching, looking particularly at managing assessment through development of purposefully constructed case-studies. Based upon the concept of 'sustainability' and ISO 26000 colleagues will work in small groups to identify and critique "Efficiency – v – Effectiveness is Large Group Teaching & Assessment". Issues around group dynamics, individual engagement and peer review of work will be form the basis of a lively discussion.

1-2: Lunch

2:00-3:30 Workshop Activity (2): The Student Perspective: [Jane]
Using role-play colleagues will look at groupwork from the student perspective. Critically considering how and why working in groups and teams can often be problematic. Based upon real-life examples, and taking account of engineering education research, colleagues will have the opportunity to consider the following issues from an individual and group perspective: Group Dynamics: Roles & Responsibilites: Identity: Belonging: Care: Wellbeing: Support

4:00-5:00 Summary and discussion

Day 2

9.00-9.30: Recap and Schedule for day – Gareth & Jane

9.30-11.00: Workshop Activity (3): Assessment in Large Class Settings: [Gareth]
This highly interactive session will provide colleagues with the opportunity to reflect upon the issues associated with assessment and feedback in large-class settings. Activities will include a Trivia Quiz and a Marking Exercise. The workshop will equip colleagues with the tools and knowledge to address and resolve assessment associated issues and problems

11.00-11.30: Break

11:30-1:00: Workshop Activity (4): The Logistics & Management of Large Class Teaching in Engineering [Gareth]
This part of the workshop will provide colleagues with resources for practical work, tools & training, rationalisation. A practical activity will be introduced based upon an activity in which students are asked to design a glider that is able to hit a target when thrown from a window. Colleagues will be given the opportunity to actively consider and experience the

pedagogic challenges and benefits of active learning approaches within a large class setting

1.00-2.00: Lunch

2.00-3.30: Summary Workshop Activity: Expert Panel [Gareth & Jane]
The afternoon will finish with a plenary in which all workshop Participants', including the facilitators will work together to form a series of small 'Expert Panels' in which the key challenges and benefits of large class teaching in a multi-cultural, multi-ability and multi-disciplinary environment will be debated.. Working in small groups a number of key challenges will be debated with each group leading part of the discussion. Colleagues will be asked to identify which questions they would like to discuss, with the following options be offered (this list is not fixed, colleagues may select to focus on different challenges)

1. How to manage a multi-ability classroom of 200+ students
2. Planning and managing multi-disciplinary groups
3. When small groups 'break down'
4. Peer marking, free-riding and student engagement: A recipe for success or failure?
5. A collision of cultures: Topics we don't talk about…

3.30-4.00: Wrap-up - Round-up, discussion, conclusion.

Large Class Teaching

in a Multi-Cultural, Multi-Ability & Multi-Disciplinary Setting

Jane Andrews
University of Warwick

Gareth Thomson
Aston University

9th & 10th May - Birchwood Hotel and Conference Centre – Boksburg, Johannesburg

Having worked at Aston University since 2006, **Dr Jane Andrews** is now a Senior Teaching Fellow at WMG, University of Warwick.

A Social Scientist whose area of expertise is Engineering Education Research, Jane has taught in Engineering for 10 years. She is a Governing Board Member of the UK & Ireland Engineering Education Research Network where holds the position of Membership Secretary and Publications Officer.

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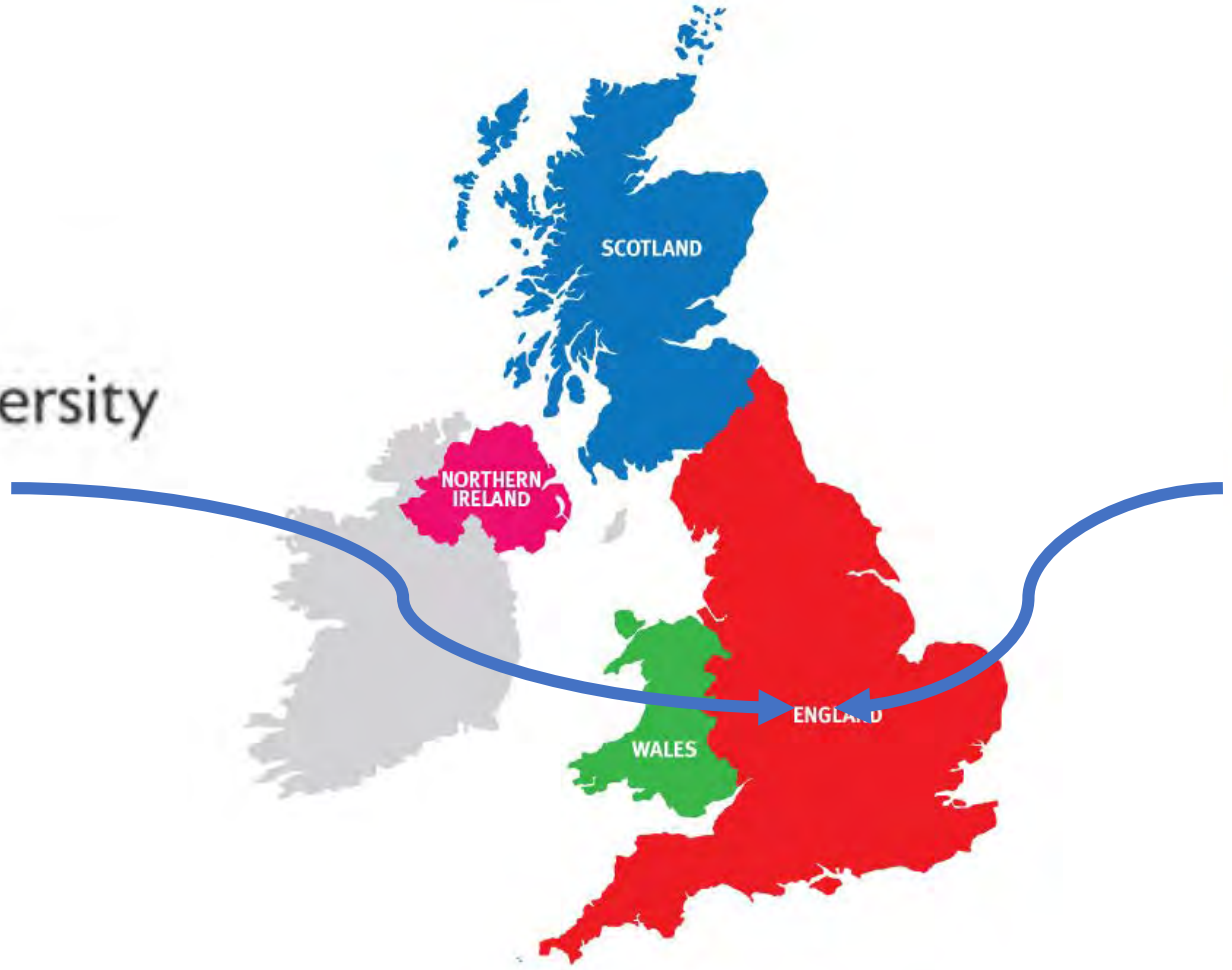
Jane Andrews
University of Warwick

Gareth Thomson
Aston University

Aston University
Birmingham



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Gareth Thomson
Aston University

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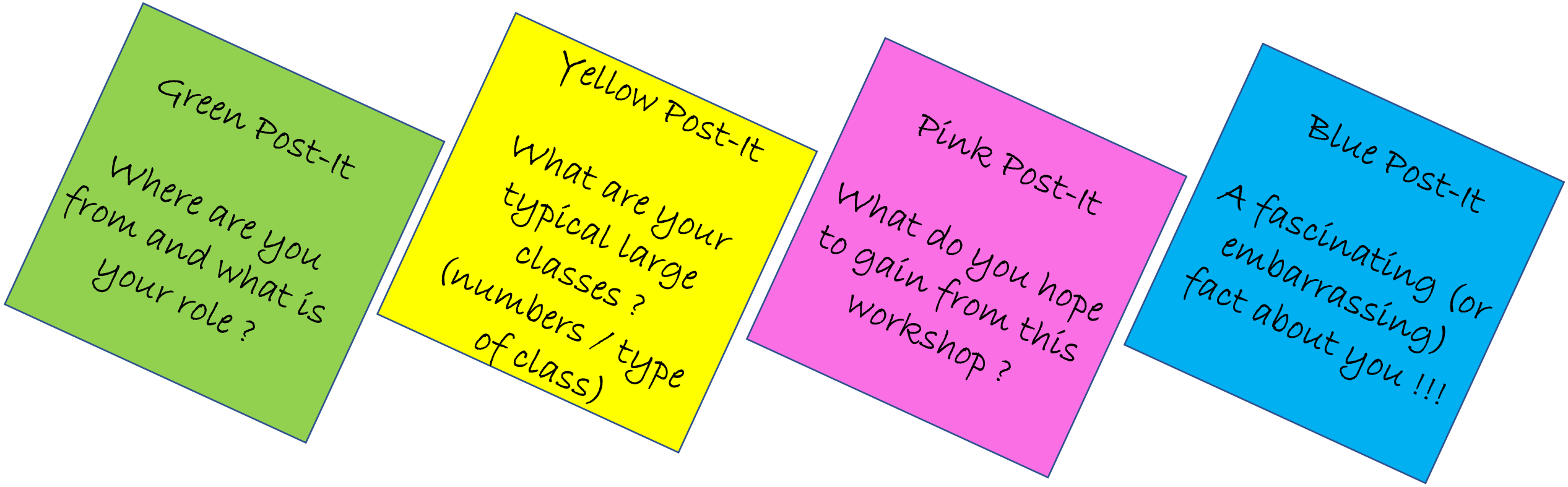
….but tell us about you ????



Jane Andrews
University of Warwick

Gareth Thomson
Aston University

Schedule (very loosely !)

Thursday 9th May

09:30-10:00	Welcome
10:00-11:00	Challenges of large class teaching
11:00-11:30	Break
11:30-13:00	Interactive Workshop : Pedagogy, People & Practice
13:00-14:00	Lunch
14:00-15:30	Interactive Workshop : The Student Perspective
16:00-17:00	Summary & Discussion

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REPUBLIC OF SOUTH AFRICA

Gareth Thomson
Aston University

Aston University Birmingham

Schedule (very loosely !)

Friday 10th May

09:00-09:30	Recap and Schedule for Day
09:30-11:00	Interactive Workshop : Assessment in Large Class Settings
11:00-11:30	Break
11:30-13:00	Interactive Workshop : Logistics & Management in Large Class Project Based Learning
13:00-14:00	Lunch
14:00-15:30	Summary Workshop : Expert Panel
15:30-16:00	Wrap-up and Conclusion

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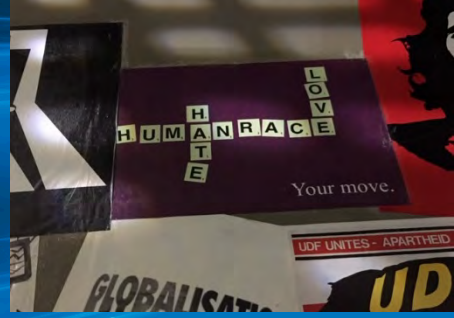

Workshop 1: Pedagogy, People & Practice: Embedding Scholarship in Large Group Teaching

Dr Jane Andrews
jane.andrews@warwick.ac.uk

Education Innovation Group

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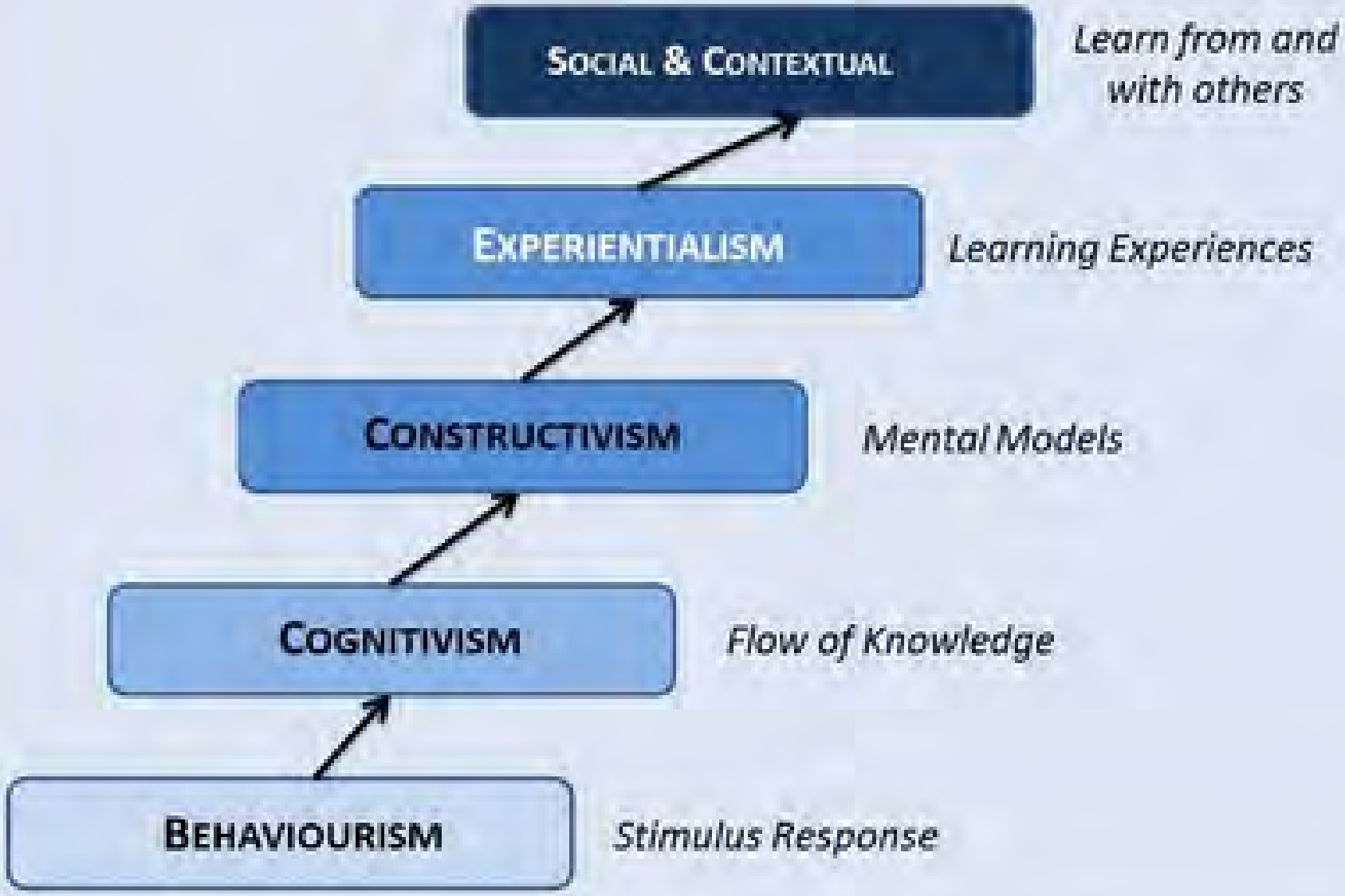
Workshop Aims (Intended Learning Outcomes)

Upon completion of this workshop colleagues will:

1. Have developed an understanding of what is meant by the concept of 'Scholarship' and how it applies to Engineering Education
2. Considered in some detail how to embed Scholarship into Large Group Teaching
3. Begun to develop a Model of Scholarship for use in their own Teaching

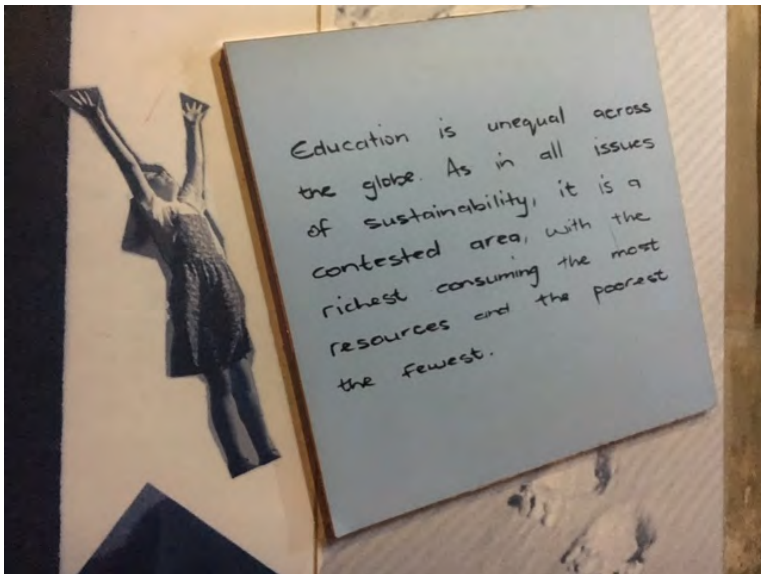
So before we start… what is learning?

5 Main Theories of Learning

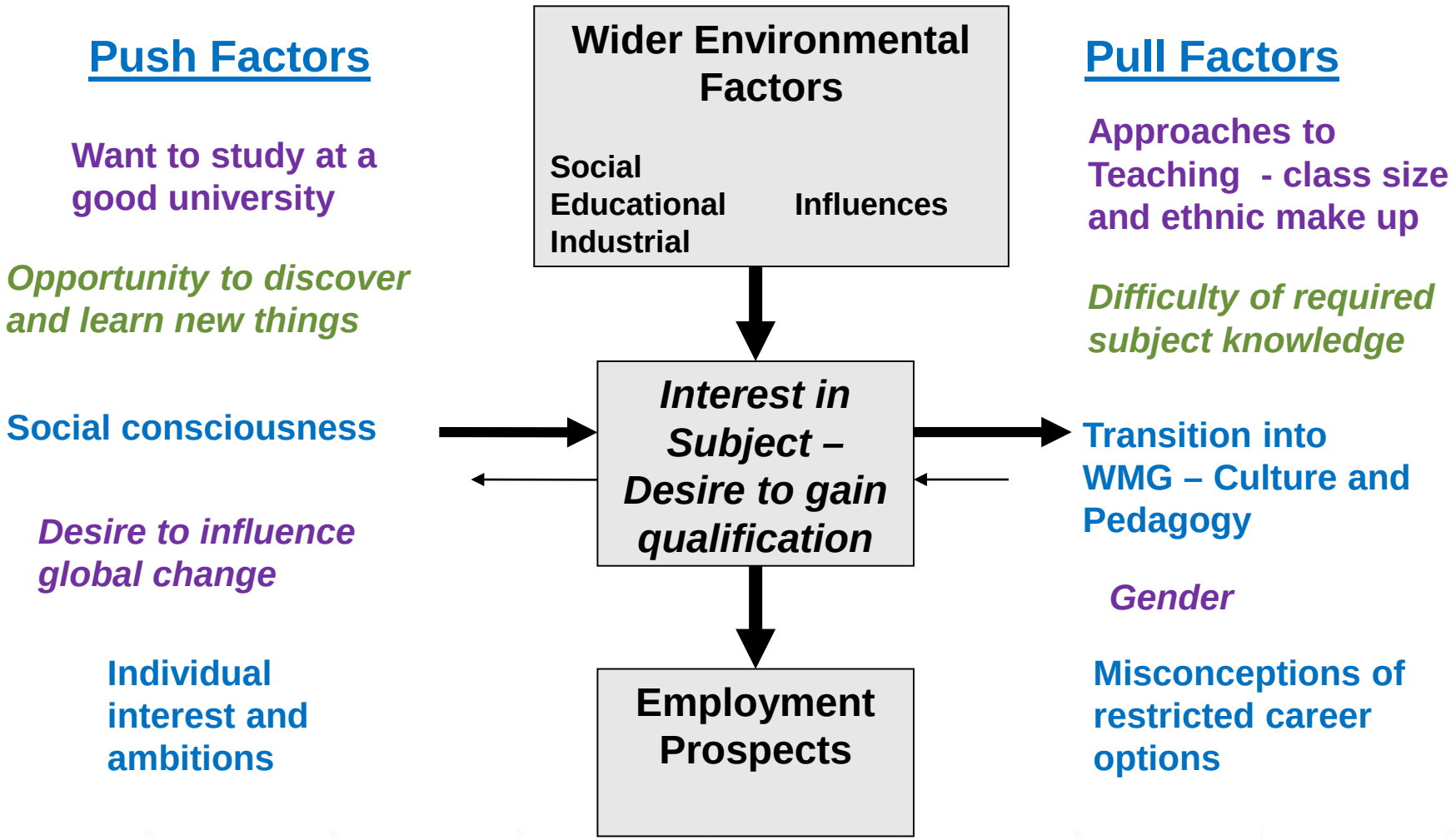


Activity 1: Let's get thinking…

- Why do young people come to university?
- What factors put them off?
- Why does this matter?

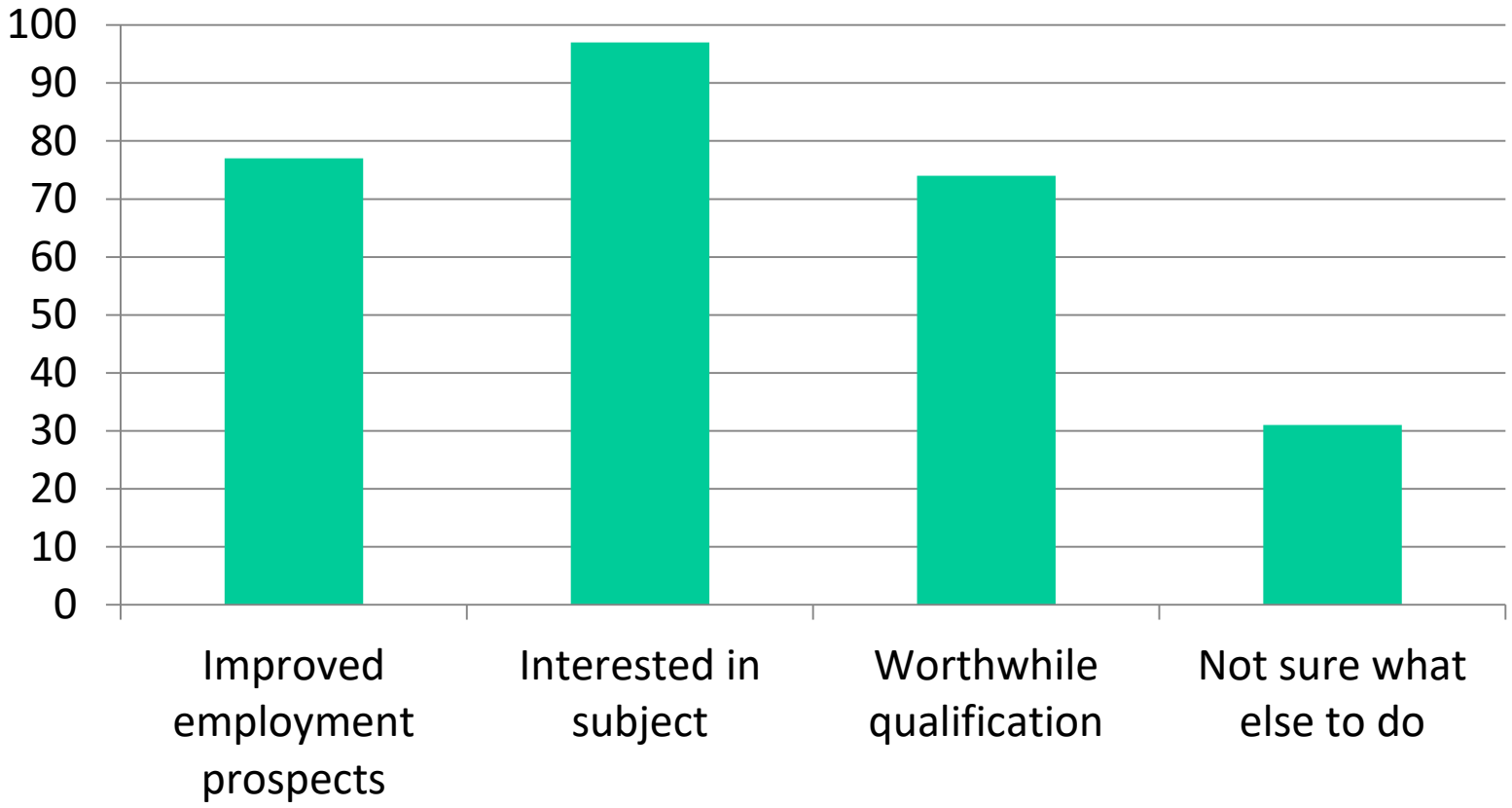


Attracting young people to study ENGINEERING – AND – Keeping them ENGAGED in Large Groups!



(Adapted from Andrews & Clark, 2011)

Why Study Engineering ? (Clark & Andrews, 2016)



So, what is large group teaching?

What do **you** perceive large group teaching to be in terms of class size??

I asked 5 colleagues "What's Large Group Teaching?"

- *Any group so large that it's impossible to learn everyone's name…..*
- *Having a big group in lectures, so big that you have to break the tutorial groups down into smaller groups and keep repeating the content around 6 times. I do one tutorial 12 times over 2 weeks with 20-30 students.*
- *Over 20 students*
- *50 to 100 students, anymore it's crowd control*
- *I teach over 300 students, now that's a large group*

Activity 2: What are the top five challenges YOU and YOUR colleagues face in Large Group Teaching environment?

Challenges Discussed in Workshop

1.

2.

3.

4.

5.

21st Century Challenges facing Higher Education

- How to engender a sense of belonging in our students?
- How to provide a high quality student experience with increasing demands from:

- Students (more savvy, in the UK fees have seen a 'customer culture emerge'
- University management: Budgets decreasing year by year whilst student numbers increase

- High numbers of students from diverse backgrounds can cause numerous challenges
- Industry – Ever changing requirements
- Professional Bodies - demands

Issues with large groups include

- Understanding – Threshold concepts
- Notation – limited visual screens
- Lateness – behavioural problems
- Educational divergence
- Anonymity – how many students do we know by name?
- Realism - v - Theory
- Institutional setting – Seating / Lighting / Sounds
- Noise – Talking
- Group working

So the questions then become…

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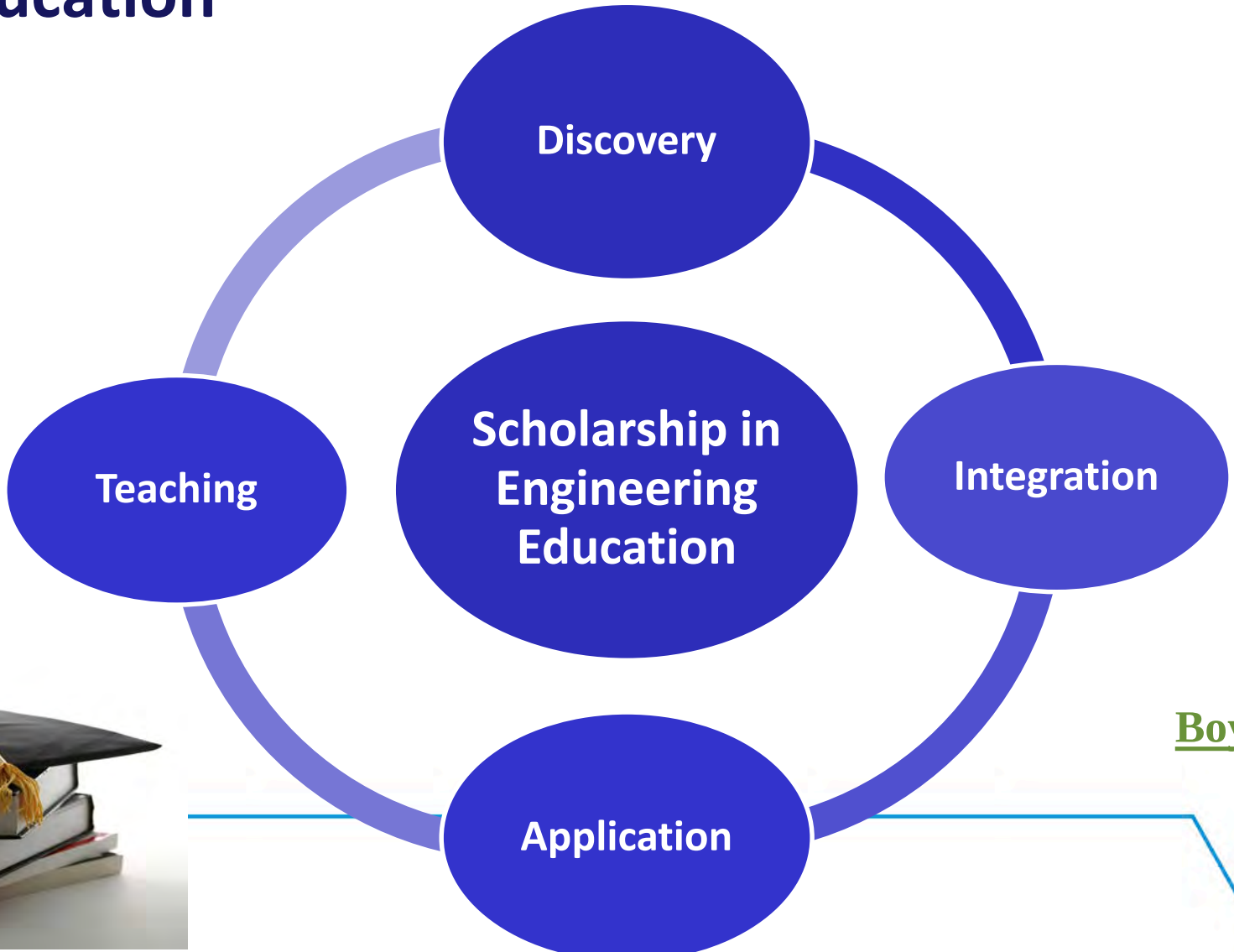
How to move from a cultural and educational mismatch with regards to an increasingly large student body to cultural and constructive alignment in engineering education?

Managing Large Groups through the Application of Scholarship in Engineering Education



Boyer, 1990

Teaching Engineers in Large Groups: The Scholarship of Discovery

The 'WOW' factor associated with Engineering

- Focused on *Process* not simply on *Outcomes*
- Involves Disciplined Investigation
- The pursuit of knowledge central to finding innovative and workable solutions

The Scholarship of Integration

Industry, Education:

Society and Science?

- Conceptual linkages across disciplines
- Involves thinking ‘out of the box’
- The 3i Approach to teaching engineering: Interdisciplinary, integrated, interpretative.

The Scholarship of Application

Applied knowledge that equips students with the means to make a difference …

- Applying discipline specific skills to improve lives
- Application of 'softer' skills, knowledge & insights
- Understanding and explaining *key models and theories to real-life problems and challenges.*

Scholarship of Learning & Teaching

Teacher's Knowledge & Experience → **Student**

(The transmission and development of knowledge)

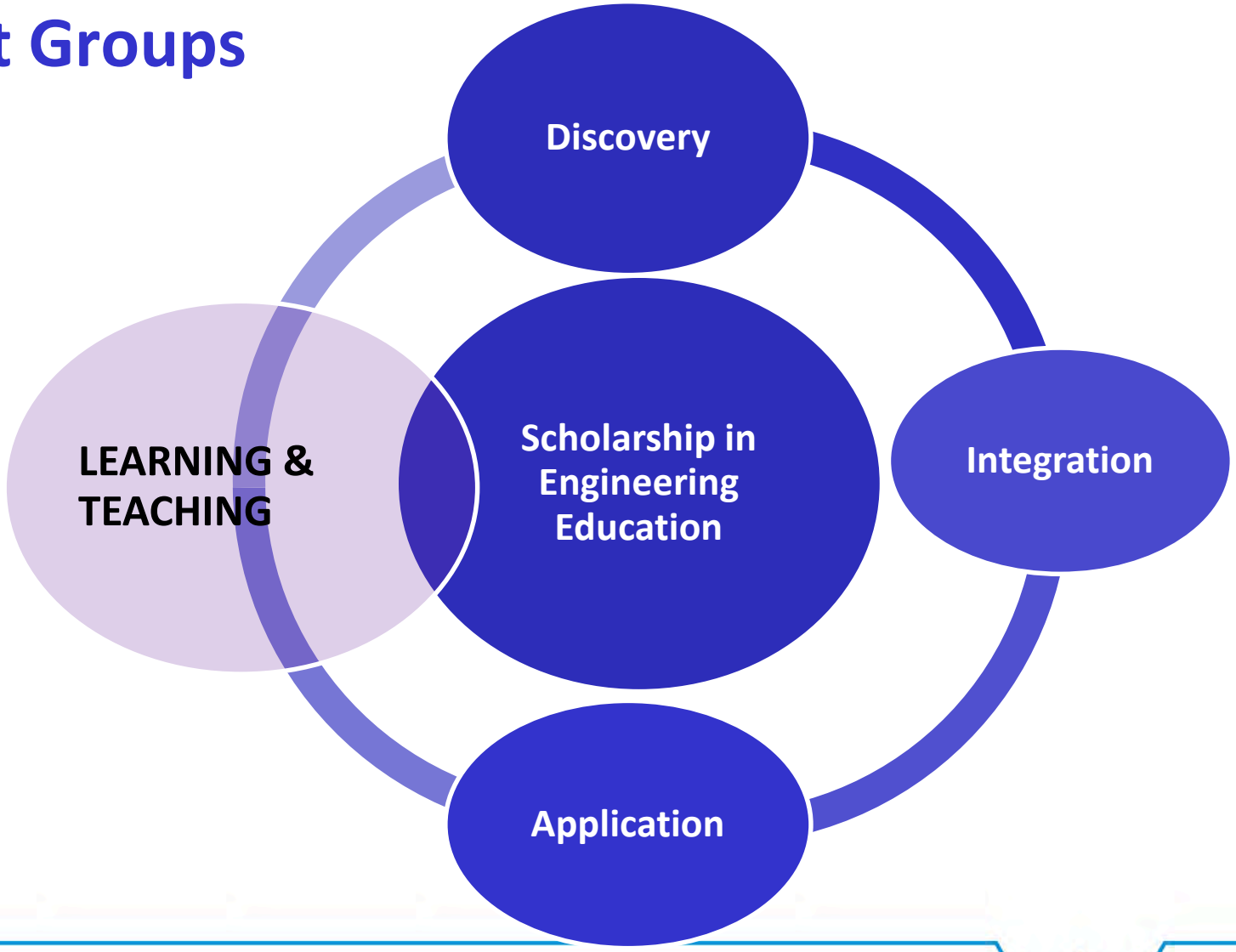
Practical Expertise & Experience

+ Theoretical Understanding

+ Out of the Box Thinking

= Scholarship in Education

Scholarship in Large Group Teaching: Breakout Groups



ISO 26000 [https://www.iso.org/iso-26000-social-responsibility.html]

- **The Seven Key Principles, advocated as the roots of Socially Responsible Behaviour, are:**

1. Accountability
2. Transparency
3. Ethical behaviour
4. Respect for stakeholder interests (stakeholders are individuals or groups who are affected by, or have the ability to impact, the organization's actions)
5. Respect for the rule of law
6. Respect for international norms of behaviour
7. Respect for human rights

- **The Seven Core Subjects, which every user of ISO 26000 should consider, are:**

1. Organizational governance
2. Human rights
3. Labour practices
4. Environment
5. Fair operating practices
6. Consumer issues
7. Community involvement and development

Learning Outcomes

If you don't know where you're going,

You'll probably end up somewhere else.

(Campbell 1984)

What are learning outcomes?

- An outcome is a result or consequence of an action or process
- A Learning Outcome results from a learning process (some of which will not be intended!!)
- Intended Learning Outcomes are statements which predict what learners will have gained as a result of learning on a particular module, course or programme (different level ILOs)

Group 1: Assessment: The Scholarship of Discovery

- **Taking the subject of 'CSR' and / or 'Sustainability' in Engineering: Develop an Assessment Framework / Rubric that encapsulates the Scholarship of Discovery by…**

1. **Identifying the main barriers and challenges associated with embedding the concept of 'Scholarship of Discovery' in large group teaching and assessment**
2. **Considering what 'the Scholarship of Discovery' might incorporate in terms of teaching CSR / Sustainability in an Engineering Education setting**
3. **Discussing what EDUCATIONAL, ENVIRONMENTAL, and ENGINEERING factors you need to take account so as to include the Scholarship of Discovery when developing a suitable Assessment Framework / Rubric when an 'Active Learning' approach is being used with a group of 80 or more students.**

Group 2: Assessment: The Scholarship of Integration

Taking the subject of 'CSR' and / or 'Sustainability' in Engineering: Develop an Assessment Framework / Rubric that encapsulates the Scholarship of Discovery by…

1. Identifying the main barriers and challenges associated with embedding the concept of 'Scholarship of Integration' in large group teaching and assessment
2. Considering what 'the Scholarship of Integration' might incorporate in terms of teaching CSR / Sustainability in an Engineering Education setting
3. Discussing what EDUCATIONAL, ENVIRONMENTAL, and ENGINEERING factors you need to take account so as to include the Scholarship of Integration when developing a suitable Assessment Framework / Rubric when an 'Active Learning' approach is being used with a group of 80 or more students.

Group 3: Assessment: The Scholarship of Application

Taking the subject of 'CSR' and / or 'Sustainability' in Engineering: Develop an Assessment Framework / Rubric that encapsulates the Scholarship of Application by…

1. **Identifying the main barriers and challenges associated with embedding the concept of 'Scholarship of Application' in large group teaching and assessment**
2. **Considering what 'the Scholarship of Application' might incorporate in terms of teaching CSR / Sustainability in an Engineering Education setting**
3. **Discussing what EDUCATIONAL, ENVIRONMENTAL, and ENGINEERING factors you need to take account so as to include the Scholarship of Application when developing a suitable Assessment Framework / Rubric when an 'Active Learning' approach is being used with a group of 80 or more students.**

Questions to think about…

What is an Assessment Framework?

- Revolves around Intended Learning Outcomes (will be covering these in more detail this afternoon)
- Assesses understanding:
  - Threshold Concepts
  - Discipline specific knowledge
  - Context and Content
  - Meanings & Mission
  - Uses and Utilisation

What do we need to think about when dealing with large groups?

- What to prioritise?
- Student Learning – v – Academic Workload
- Ability – v – Inability
- Know-how – v – Knowledge
- Student support needs – v- promotion of independent learning
- Group & team work – v – Individualised study
- Practicalities – v – Presentation
- Student workload – v- assessment rating

We will feedback in a single group, identifying the main facets of a model ‘Assessment Rubric’ for use in large group settings

Large Group Assessment & the Scholarship of Education… some thoughts

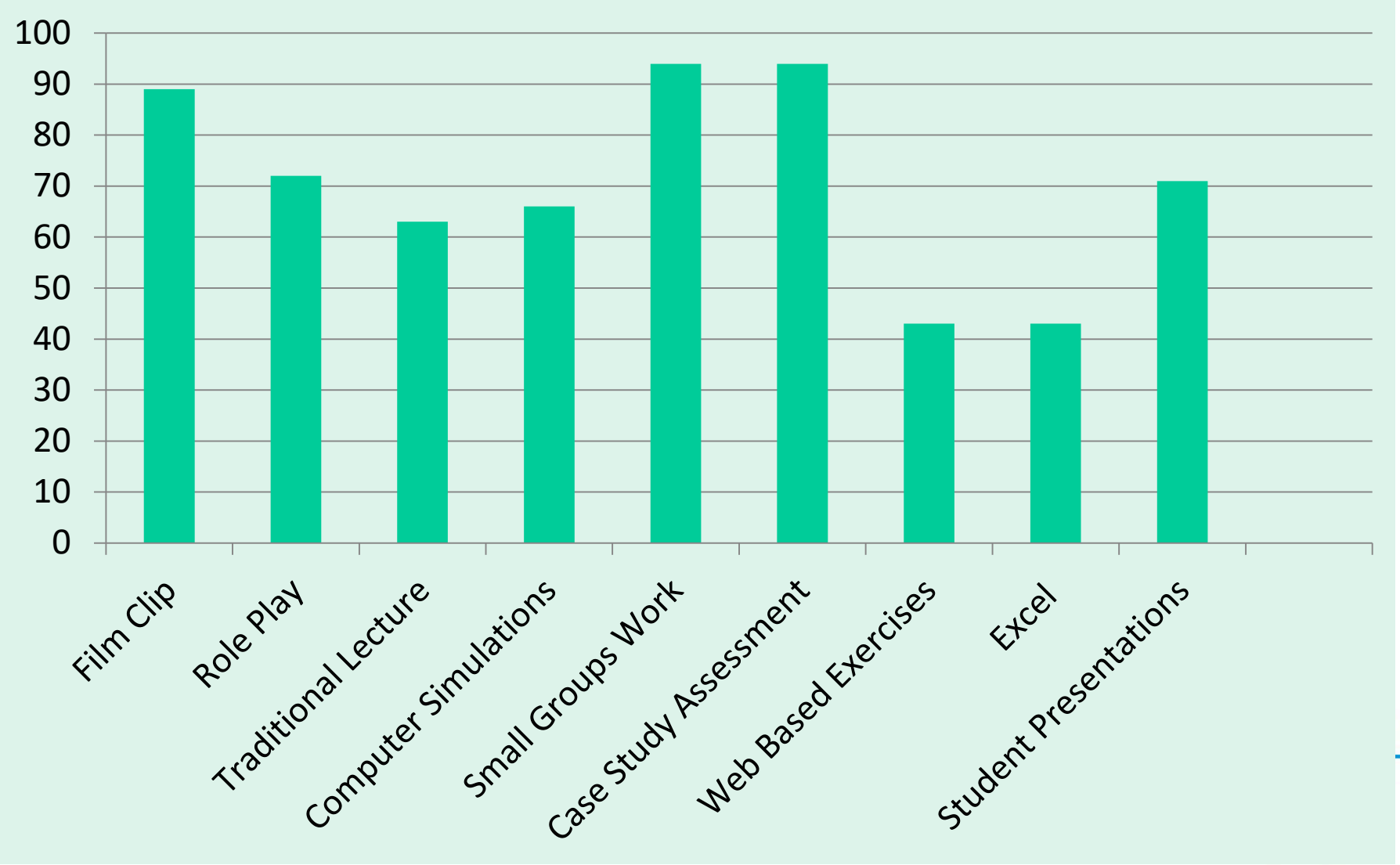
Assessment of Group Work needs to be

- **T**ransparent
- **R**ealistic
- **U**ncomplicated
- **S**cholarly
- **T**imely

Feedback to Feed-Forward – incorporate the three 'R's

- Reflection
  - What the students did well
  - What was missing / not correct
- Reliability
  - All groups assessed using the same / a comparable Rubric / Marking Schedule
- Reflexivity
  - How students can use their knowledge to move forward
  - What to do next

Some stats to think about: What learning approaches do students find useful?



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Workshop 2: Working in Groups – Learning in Large Groups: Managing Student Expectations / Accounting for Students' Perspectives & Life-View

Dr Jane Andrews

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Workshop Outline

- What do students think about working in small groups?
- Managing diversity and multi-culturalism in group work
- Group dynamics
- Large group teaching or crowd control?

What do students' think about group work…

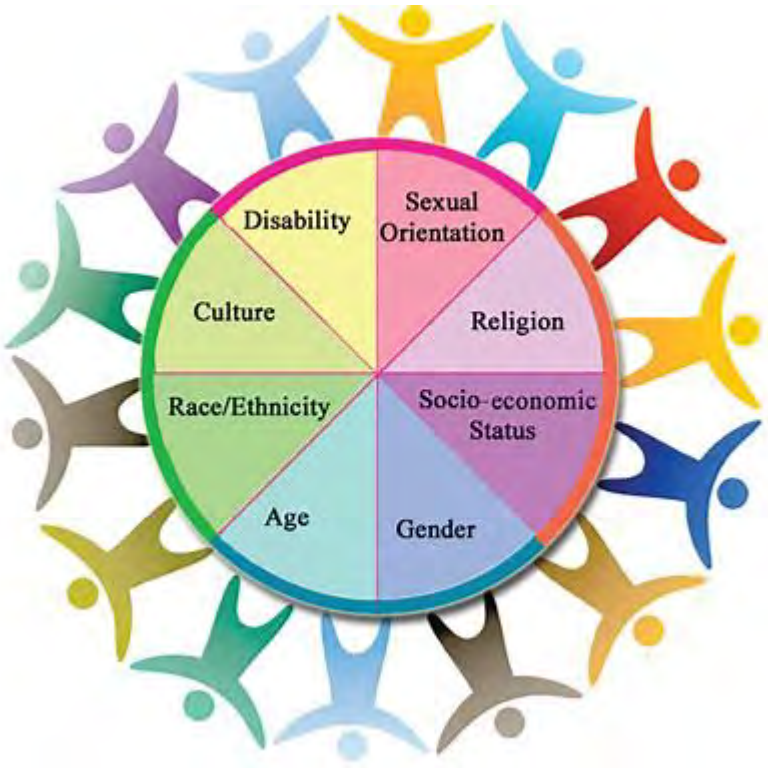
- *I hate it.*
- There's always someone who's what you might call a "free-rider", why should I carry someone?
- *It's my degree why do I have to work with others who aren't as smart as me?*
- I always end out doing most of the work as I don't work well with others so I do it all myself.
- *It's OK providing I can pick who I work with*
- In the first year it was a good way of making friends.
- *It's one way of getting English students to talk to us*
- It's not too bad providing I'm not the only girl in my group
- *Whilst I understand why we have to work in groups, it shouldn't carry a large weighting as you get an individual degree*

Working within the UK Law:

Protected Characteristics

What does this mean in reality when teaching large groups / dividing students into small groups?

How much of this applies to South Africa (legally, ethically, culturally)



Whole Group Discussion

DISCUSSION: You have 120 students, their demographic / educational make up is:

- 80% BME
- 60% Islamic:
- 20% Sikh:
- 20% Female:
- 10% 'Mature Students' (o25)
- 90% 'Working Class'
- 10 % "Triple 'A'
- 40% Previous Foundation Entrants
- 25% Overseas (outside Europe – of which half are Chinese and the rest African and Indian).

How do you divide these students into small groups to make sure no one is advantaged or disadvantaged?

2 of the male students are openly gay and in a relationship with each other.

2 of the students are of a Jewish background

10 have a declared learning disability (6 dyslexia / 2 dyspraxia / 2 autistic spectrum - Asperger's – 1 of whom has a 'carer' with him)

2 have declared a physical disability (one is blind with a dog, the other a student with C.P. who uses a wheelchair)

Break Out Activity: Religion

- **Group 1:** How and why should and does religion matter when dividing students into groups.
- What issues might arise when working with large groups of students from diverse religious backgrounds?
- How can we as lecturers ‘manage’ issues which might be result from working in an environment where the majority of students are from one particular religious group (meaning that the minority are of no religion or from other groups)

Break out activity: Ethnicity

- **Group 2**: How and why should and does ethnicity matter when dividing students into groups.
- What issues might arise when working with large groups of students from diverse religious backgrounds?
- How can we as lecturers 'manage' issues which might be result from working in an environment where the majority of students are from one particular ethnic group?

What does ethnicity / ethnic group mean in South Africa – how do you classify yourself?

Break out Activity: Social Class

- **Group 3**: How and why should and does social class matter when dividing students into groups.
- What issues might arise when working with large groups of students from diverse religious backgrounds?
- How can we as lecturers 'manage' issues which might be result from working in an environment where the majority of students are from one particular social class group (meaning that the minority are from another social class)

Is social class an issue in South Africa – or do other demographic characteristics remain more divisive?

When dividing students into groups

- **NO BUT IT DOES**
  - Gender
  - Culture
  - Ethnicity

Should Religion matter??

Should Ethnicity matter??

- **NO BUT IT DOES**
- Gender
- Tradition
- Age
- Miàn zi [Face]

What about Social Class why does that make a difference?

- The majority of working class students in the UK ‘work’ to support their studies, live in the cheapest available accommodation and rely most heavily on state funding.
- Time is money
- Working class students may not be able to afford to buy basic materials
- Previous educational backgrounds, privilege differs across social classes
- First in family to attend university

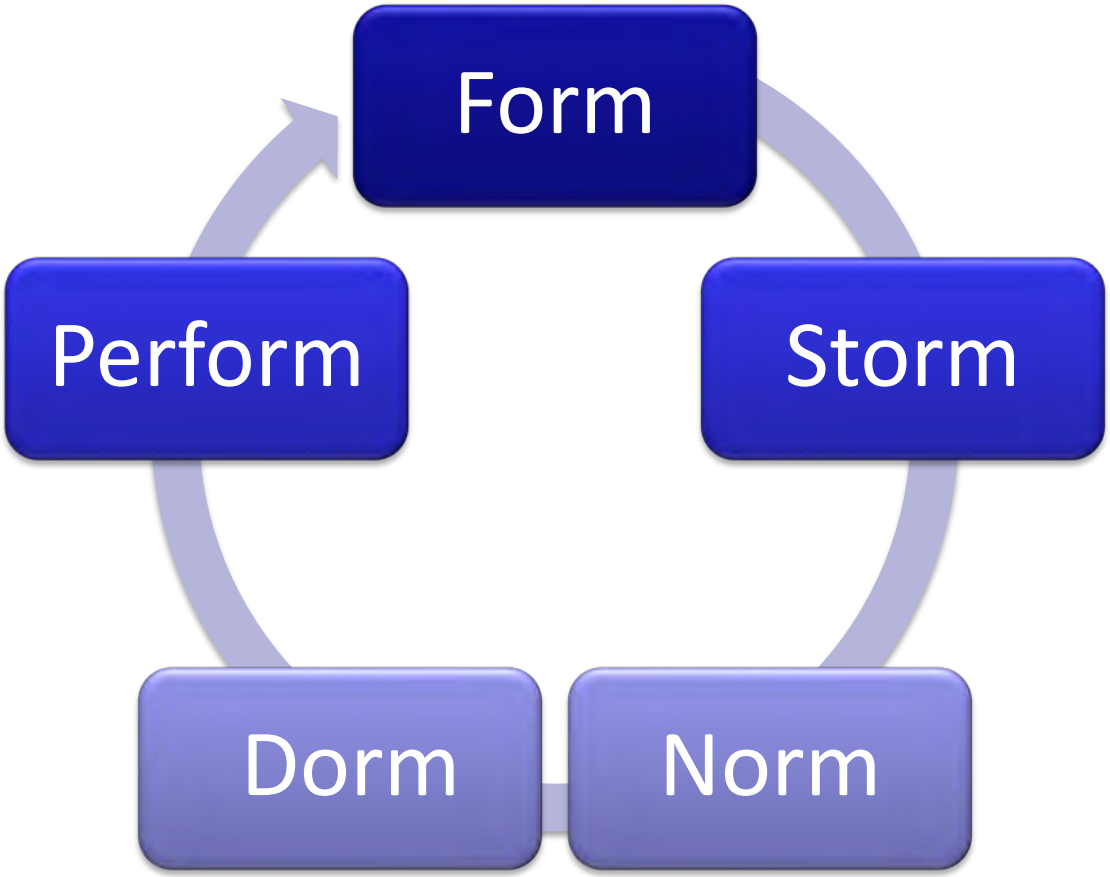
What about Gender, surely in the 21st Century what sex you are shouldn't matter to the teacher (or students)

- In the UK there remains a significant gender pay gap. Men earn 20% more than women in similar occupations.
- Only 9% of the Engineering workforce are women
- Only 1 in 4 Engineering students are female
- Girls are 9.5% more likely to achieve top grades in all subjects except Maths at age 16

Reflections on dividing large groups of students into small groups

- Never leave a student 'isolated' within a group (always make sure there's someone of a similar background, ethnicity, religion in each group)
- Allocated female students in pairs to groups
- Have a policy / written of what to do if the group falls apart
- **TEACH GROUP DYNAMICS**
- Mix up 'attainment' levels so that the high achievers are spread amongst the groups
- Make sure that the students know the 'group work' rules
- Involve students in setting the 'rules'
- Decide whether to spread 'mature students' or clump together

Group Dynamics



Adapted from Tuckman (1965)

Large Group Teaching or Crowd Control?

Students' Views

- *It's easy to hide in a large group. I just sit at the back and pretend to be listening*
- If there's a big group I like to sit near the front so I can hear properly
- It's easy not to be noticed if I decide to give a lesson a miss
- I don't mind being in a big class, providing I can sit by my mates
- *It's horrible. The lecturer has no control of the class and people just mess about*
- I can never hear what's being said cos the room is so big it echoes
- *It's too embarrassing to ask questions*
- You look like a right jerk when the teacher asks you something you don't know
- *It's mostly chaos. Particularly in the large lecture theatre. Can't see. Can't hear. Don't learn.*
- There's lots of us crammed into the Lab. How are we supposed to learn when the lecturer has such a quiet voice?

Constructive alignment (Biggs, 1999)

Discussion

Thinking about this morning's discussion about scholarship, what are the most important points to consider when teaching in large groups?

Five Steps to Effectively Managing Large Group Teaching

1. **Make learning interactive** (Gibbs et al, 1992; Biggs & Tang, 2007)
2. **Good class management** **(Exley and Dennick, 2009 state students' prefer lecturers to challenge poor behaviour, talking etc in class)**
3. **Schedule & Structure Lectures Strategically** (Biggs & Tang, 2007)
4. **Use technology appropriately** (Instant feedback – User-response systems promotes engagement & gives instant feedback / feedforward (Bruff, 2009) – engendering deep learning (Fry et al, 2003)
5. **Consider adopting a Constructivist – Scaffolding approach** (Vygotsky, 1998 – construct each learning session to scaffold knowledge which can then be applied to real-life situations.

What to consider in designing a module

1. Who are my students?
2. What are the learning aims and intended learning outcomes?
3. What long-term benefits do I want the students will gain?
4. What do I want to assess?
5. How do I want to assess?
6. What segments of content do I think are essential building blocks for students
7. What teaching and learning strategies do I want to use?
8. In what mode(s) will I deliver the course?
9. Is what I want to do ‘doable’
10. Is what I want to achieve practical?

Rank the following teaching tools / approaches in order – starting with what you believe would work best when:

1. **You're teaching a technical subject in a 2 hour slot, to 150 first year students, in a single tiered lecturer room**
2. **You're teaching Health & Safety in a 3 hours slot to 100 graduate engineering students in a flat classroom**
3. **You have 80 1st year students in a lab working on benches of 6 all day**

- Buzz groups
- Activity based learning
- Mini-quizzes - instant feedback
- Individual tasks
- Live demonstrations
- Short films
- Small group work
- Traditional lecturing
- Flipped learning
- Case-study handouts

Be prepared to discuss why you have ranked the tools / approaches in a particular order.

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Logistics of Large Class Project Based Learning

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Project Based Learning……

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Reflections on practicalities of large scale PBL……

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Reflections on practicalities of large scale PBL……

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Several iterations later……

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Scenario…..

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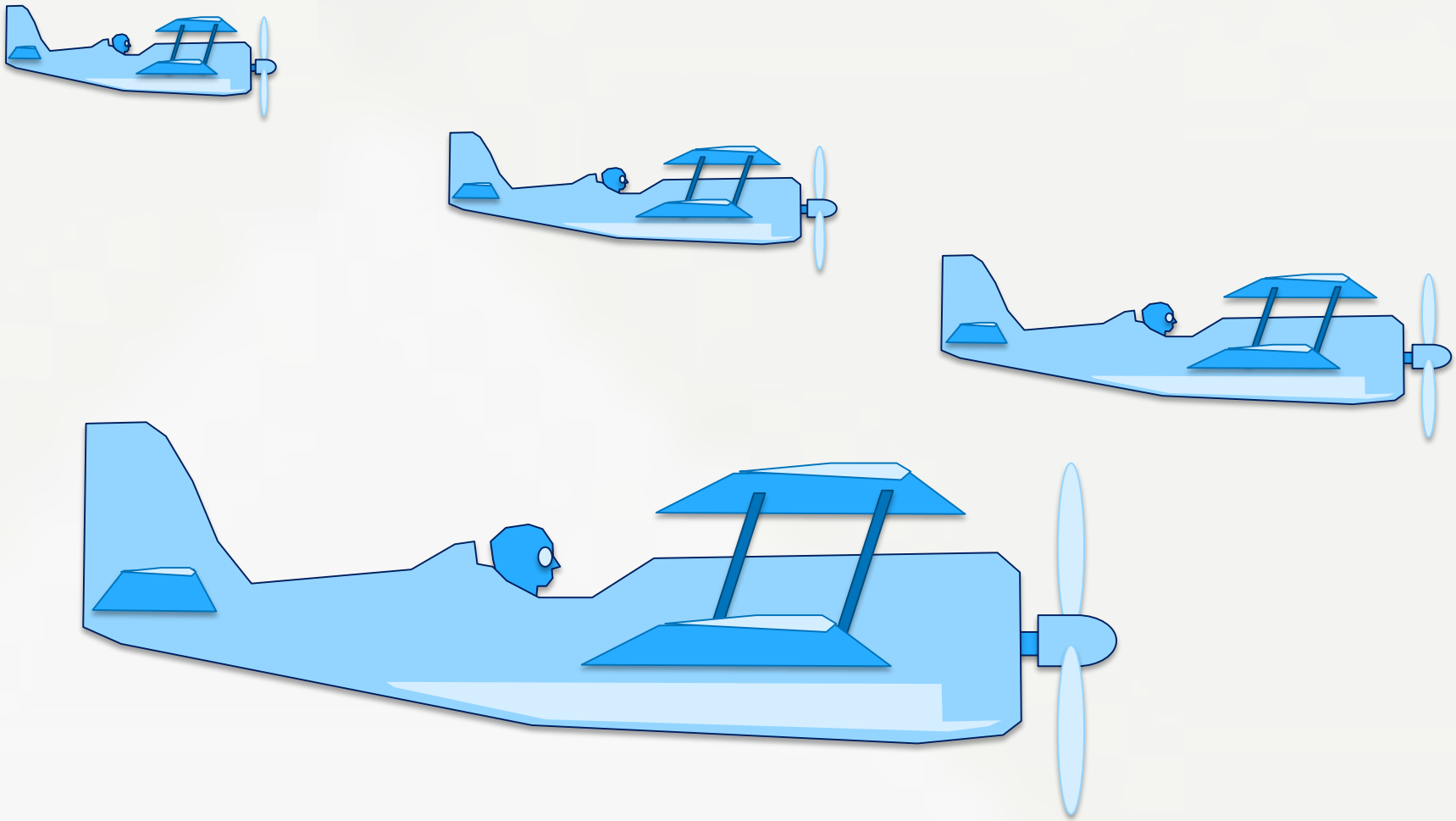

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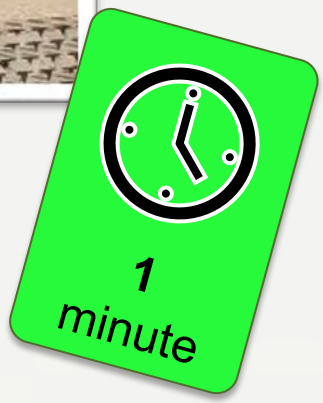

Sketch a flyable model aircraft !!!

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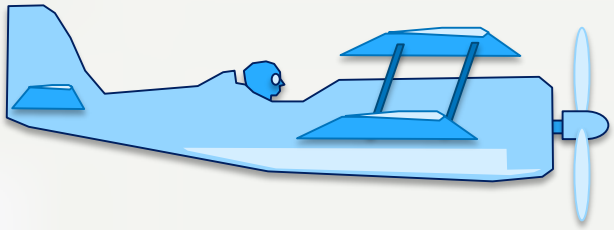
Introductory Aeronautics Engineering Module…..



Consider you have been asked to deliver an active project based learning to 180 first year engineering students.

The key learning outcomes are that students should :

- Understand key aerodynamic principles (lift, drag, thrust, control surfaces)
- Demonstrate and be able to produce and use key engineering communication tools and documents (drawings, sketches, parts lists, specifications etc.)
- Be able to work effectively in a team to complete a project on time and on budget

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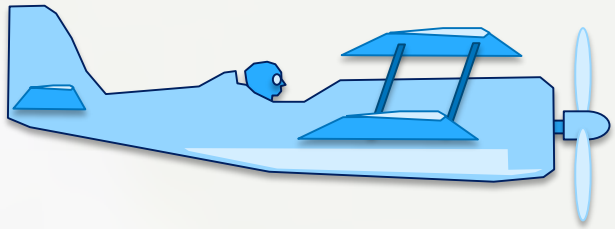

This will run a day a week for a semester and will be centred around the design, build and test of some form of aircraft.

Your particular role in the run-up is to consider and plan for the logistics.

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Introductory Aeronautics Engineering Module…..

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What do we need to consider to ensure activity matches learning ?

Post – It !!!

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Getting the balance right…..

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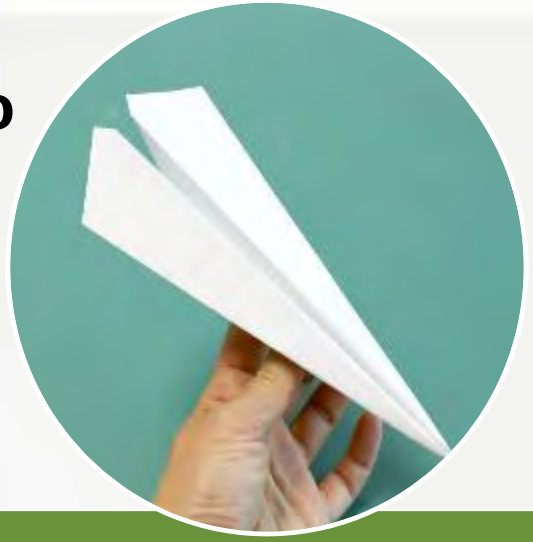
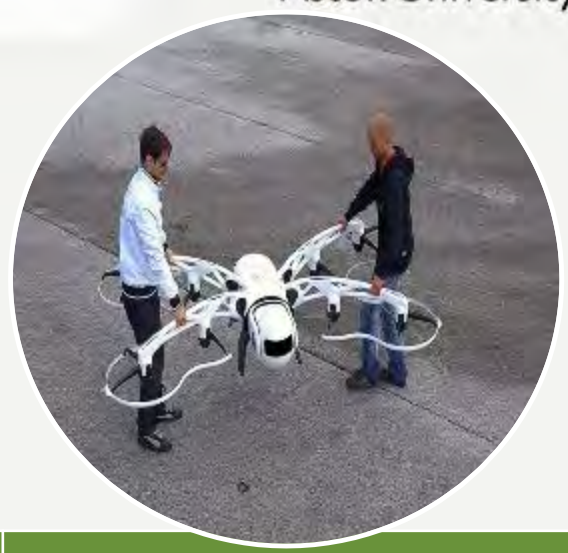
What do we need to consider to ensure activity matches learning ?





Overall	Simple	Complex
Prior knowledge and learning opportunities / variations	Low prior and learned knowledge, limited variation of knowledge	High prior and learned knowledge, high variability of knowledge
Challenge	Low	High
Others…. ????		

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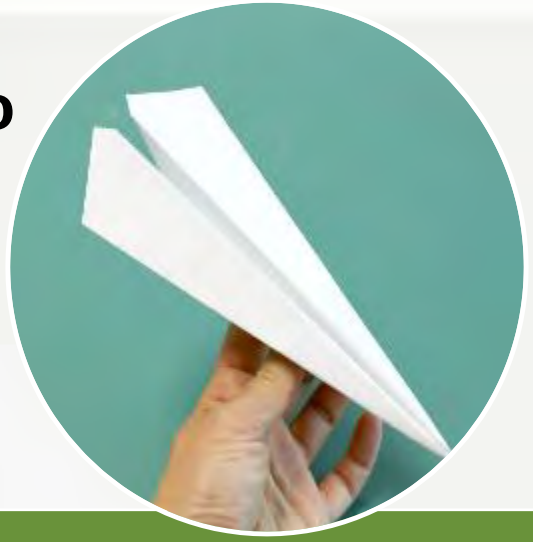
What do we need to consider to ensure activity matches learning ?



Overall	Simple	Complex
Prior knowledge and learning opportunities / variations	Low prior and learned knowledge, limited variation of knowledge	High prior and learned knowledge, high variability of knowledge
Challenge	Low	High
Learning from failure	Opportunity to fail and iterate	Limited failure opportunity
Accessibility	Limited Fear	Fear Factor
Output Variability	Possibly limited / derivative	Varied (could be derivative)
Group size	Individual or very small	Normally larger
Others…. ????		

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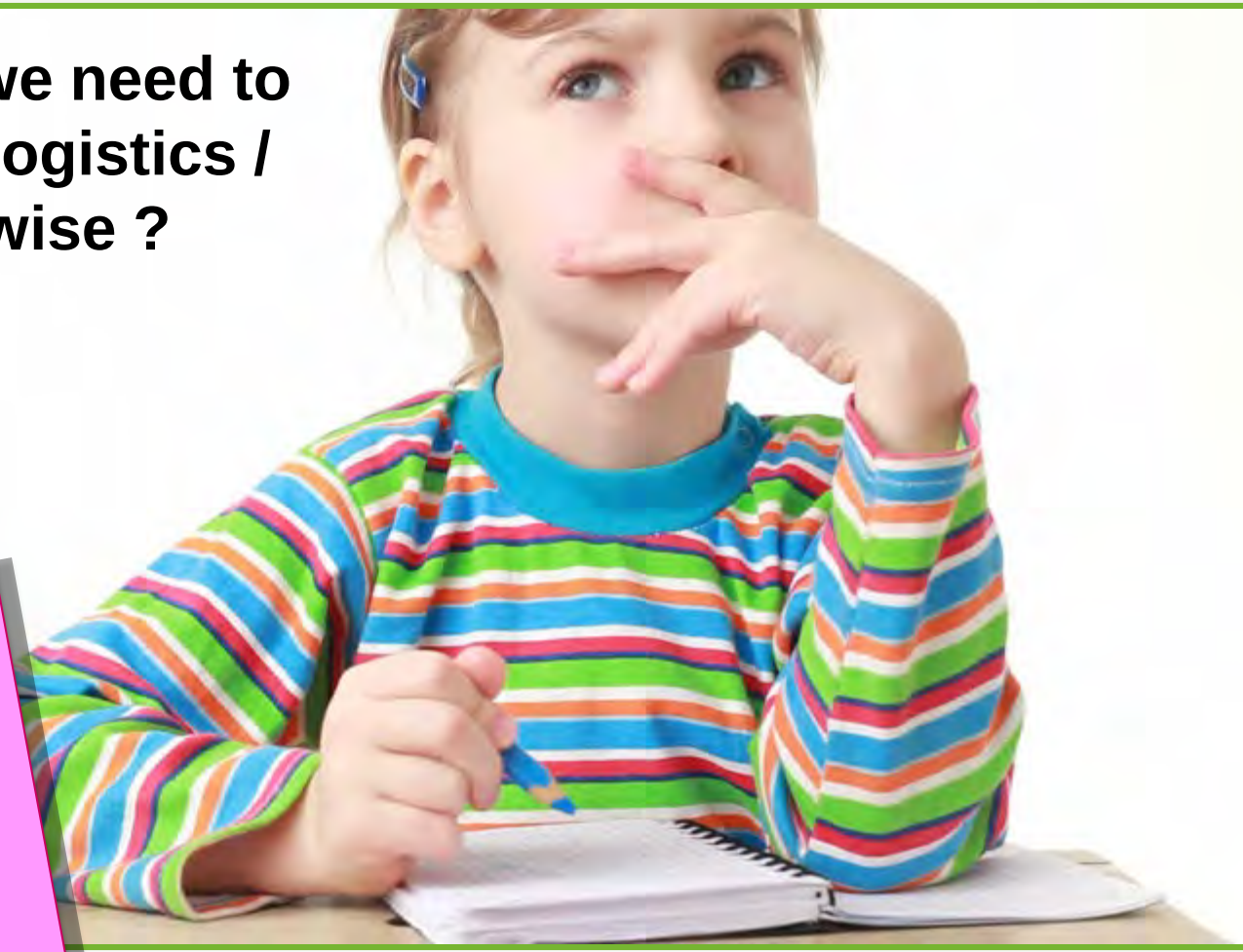
What do we need to consider logistics / practical wise ?



Post – It !!!

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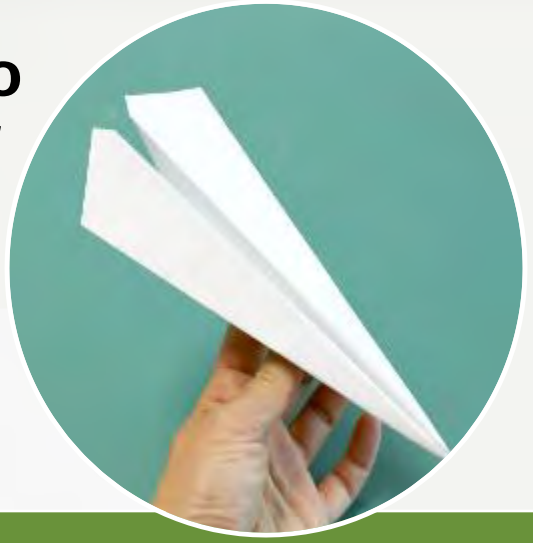
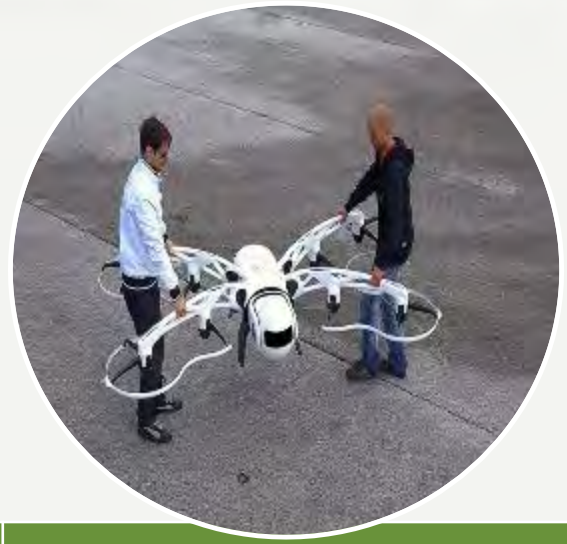
What do we need to consider logistics / practical wise ?





Overall	Simple	Complex
Staffing	Could be modest	Extensive support
Consumable variation	Very low	Very high
Physical resources	Low cost / disposable	High cost / reusable ?
Tooling	Simple manufacture	Complex manufacturing
Budget	Minimal	Significant
WIP Storage	Minimal	Significant
Others….????		

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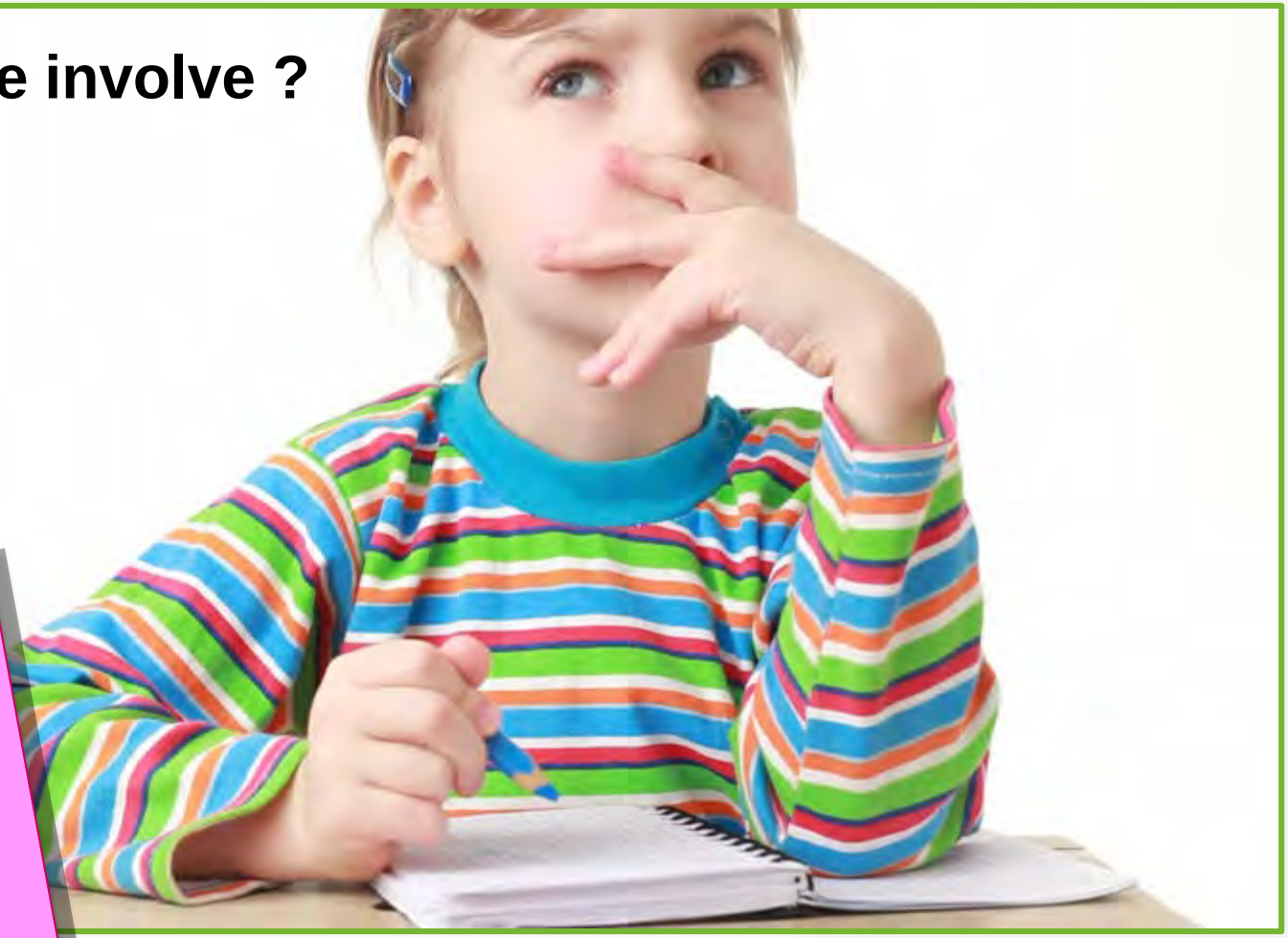
Who do we involve ?



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Getting the balance right…..

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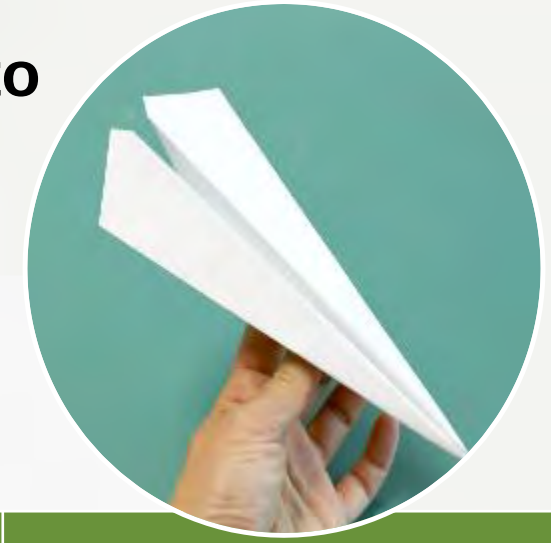
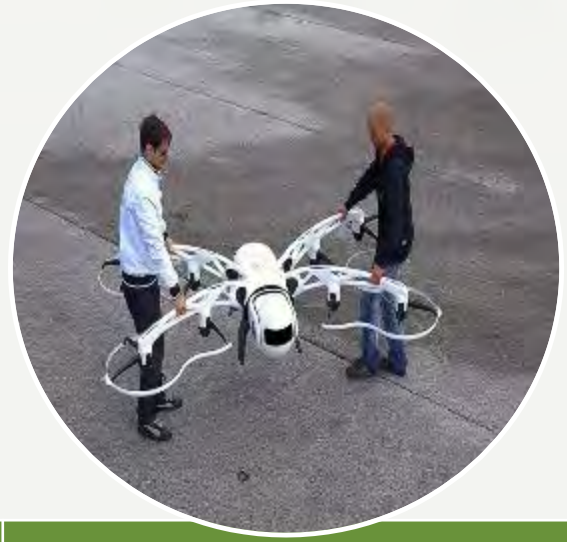
What do we need to involve ?





Overall	Simple	Complex
Students		
Teaching Staff		
Technicians		
Ordering system		
Estates ???		

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Our experiences….

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Our experiences….standardising key components

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Our experiences….limiting tools required.

Pillar Drill with 9.2mm bit

13mm a/f spanners

Tennon and hack saws

Marking out tools

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Our experiences….limiting component variations

All fasteners
based around M8

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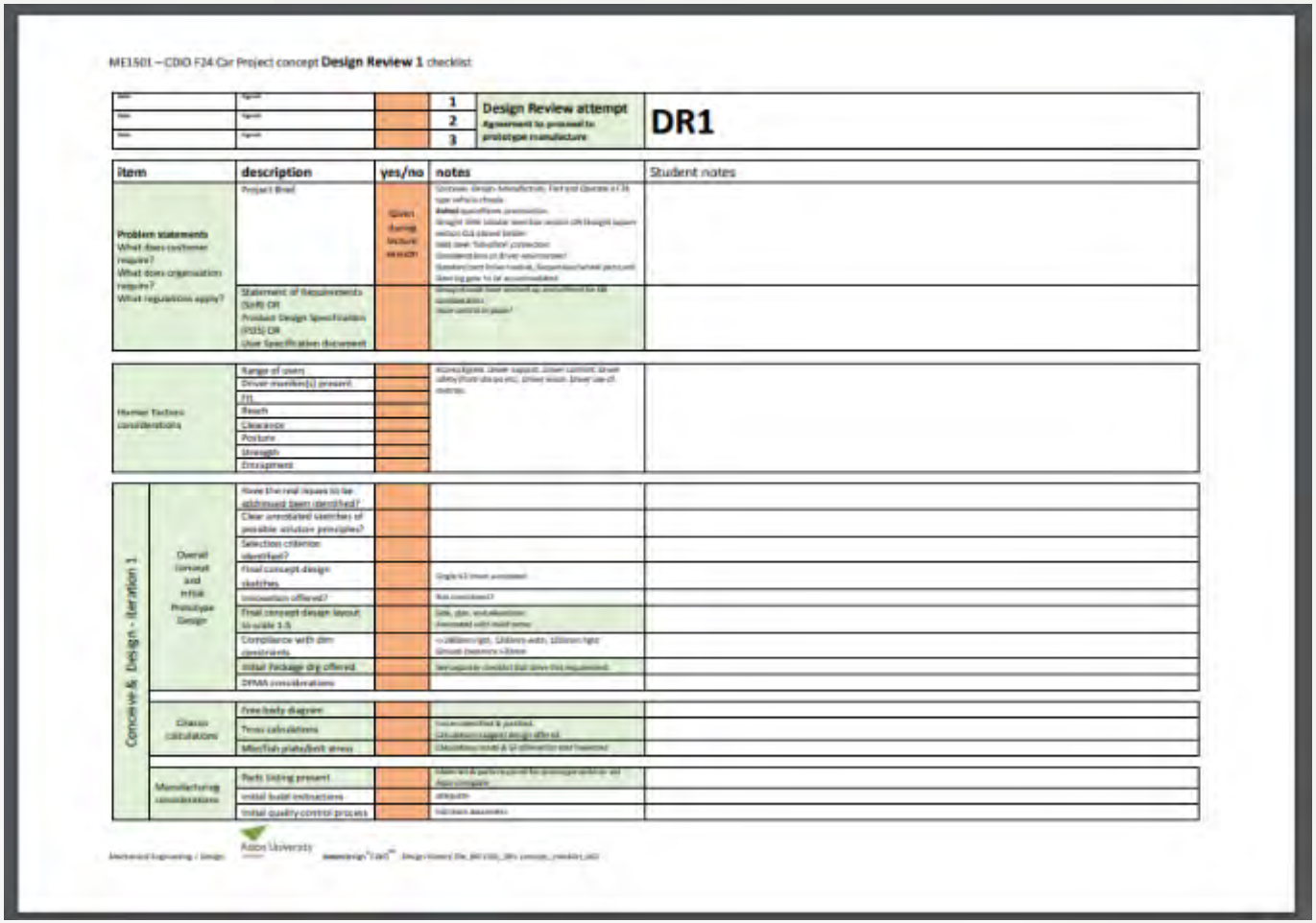
Our experiences….standardising processs



ME1501 – CDIO F24 Car Project concept **Design Review 1** checklist

			1	**Design Review attempt**	**DR1**
			2	**Agreement to proceed to prototype manufacture**	
			3		

item		description	yes/no	notes	Student notes
Problem statements What does customer require? What does organisation require? What regulations apply?		Project Brief	Given during lecture session		
		Statement of Requirements (SoR) OR Product Design Specification (PDS) OR User Specification document			
Human factors considerations		Range of users			
		Driver member(s) present			
		Fit			
		Reach			
		Clearance			
		Posture			
		Strength			
		Entrapment			
Concept & Design - Iteration 1	Overall concept and initial Prototype Design	Have the real issues to be addressed been identified?			
		Clear annotated sketches of possible solution principles?			
		Selection criterion identified?			
		Final concept design sketches			
		Innovation offered?			
		Final concept design layout to scale 1:5			
		Compliance with dim constraints			
		Initial Package dig offered			
		DFMA considerations			
	Chassis calculations	Free body diagram			
		Tress calculations			
		Min/Tish yield/Brit stress			
	Manufacturing considerations	Parts listing present			
		Initial build instructions			
		Initial quality control process			

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Our experiences….standardising processs

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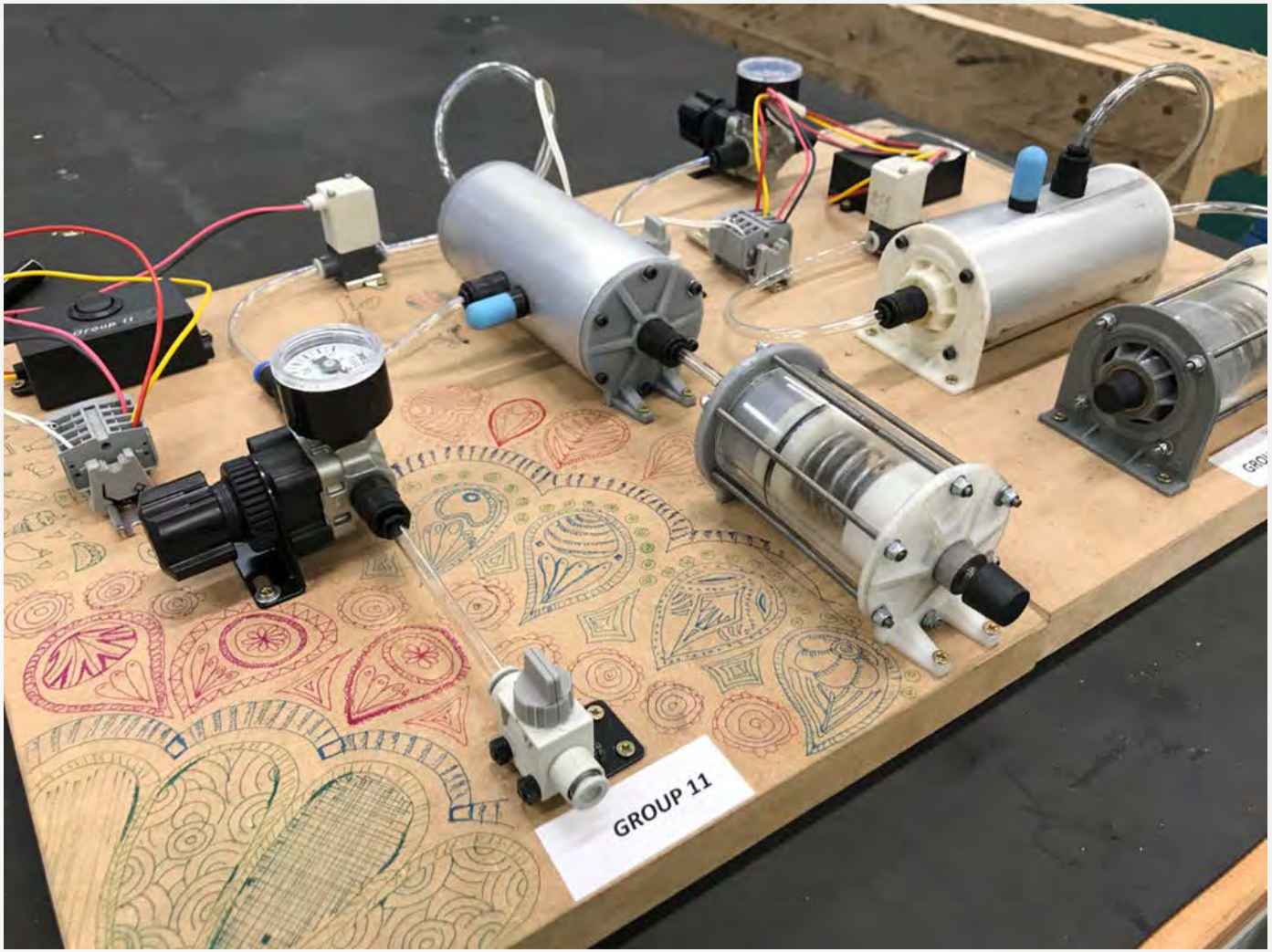

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Early days – low cost and simple

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Paper and card Rube Goldberg machine

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Early days – low cost and simple

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Bridge from coffee stirrers and broken down pallets bound together with string

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Assessment in Large Class Settings

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The efficiency metric….

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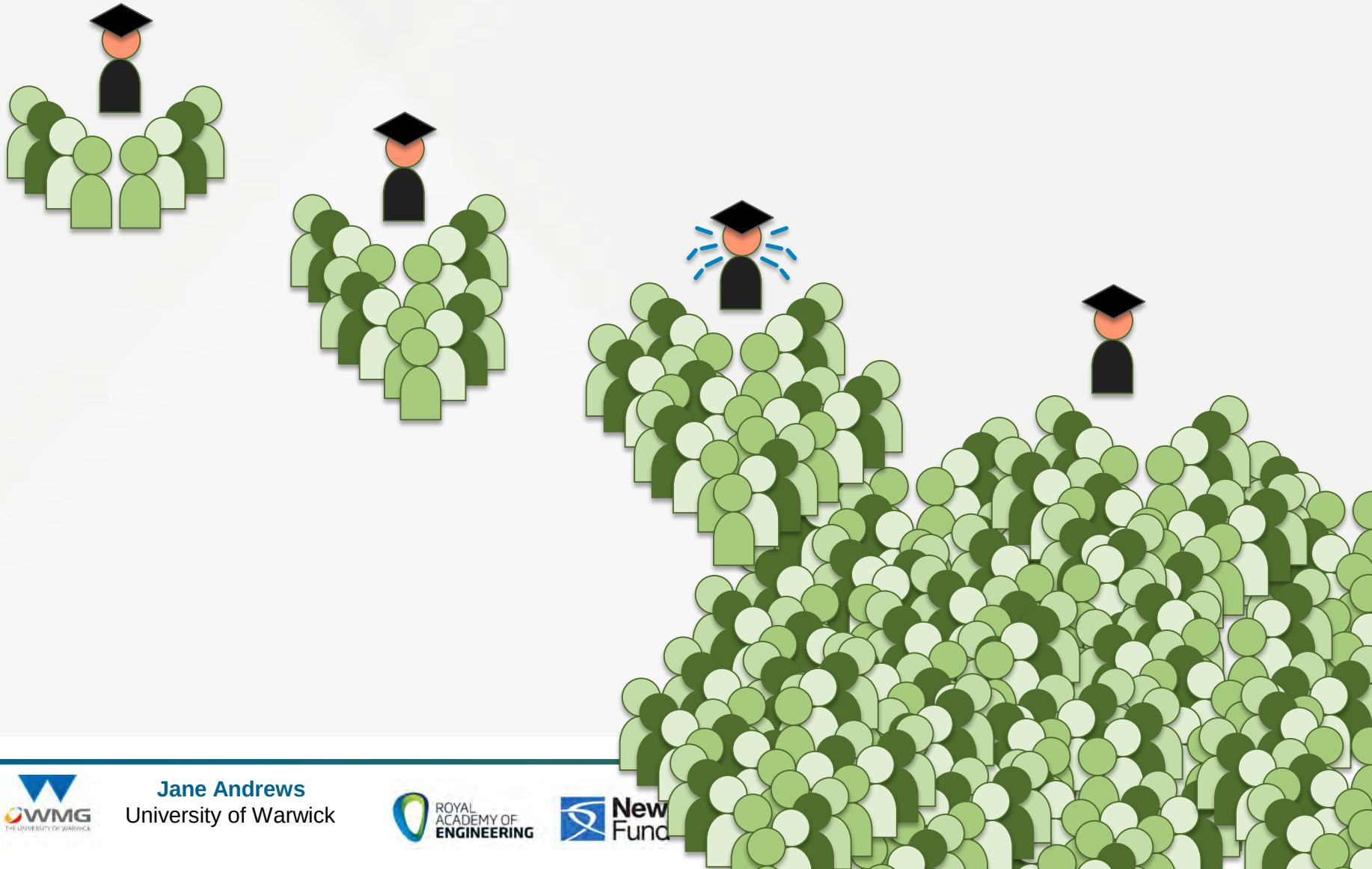

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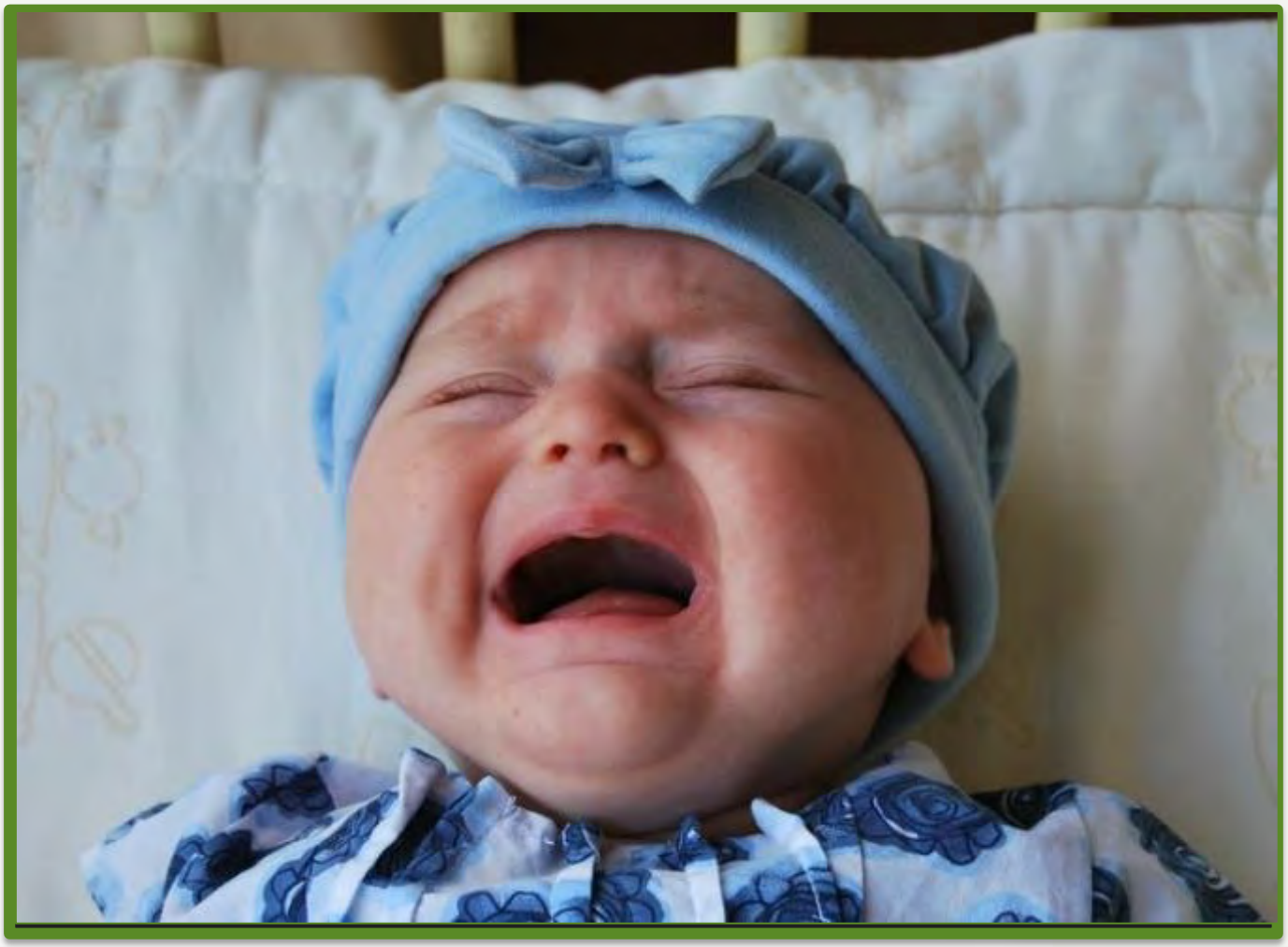

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The marking journey…(or at least mine !)

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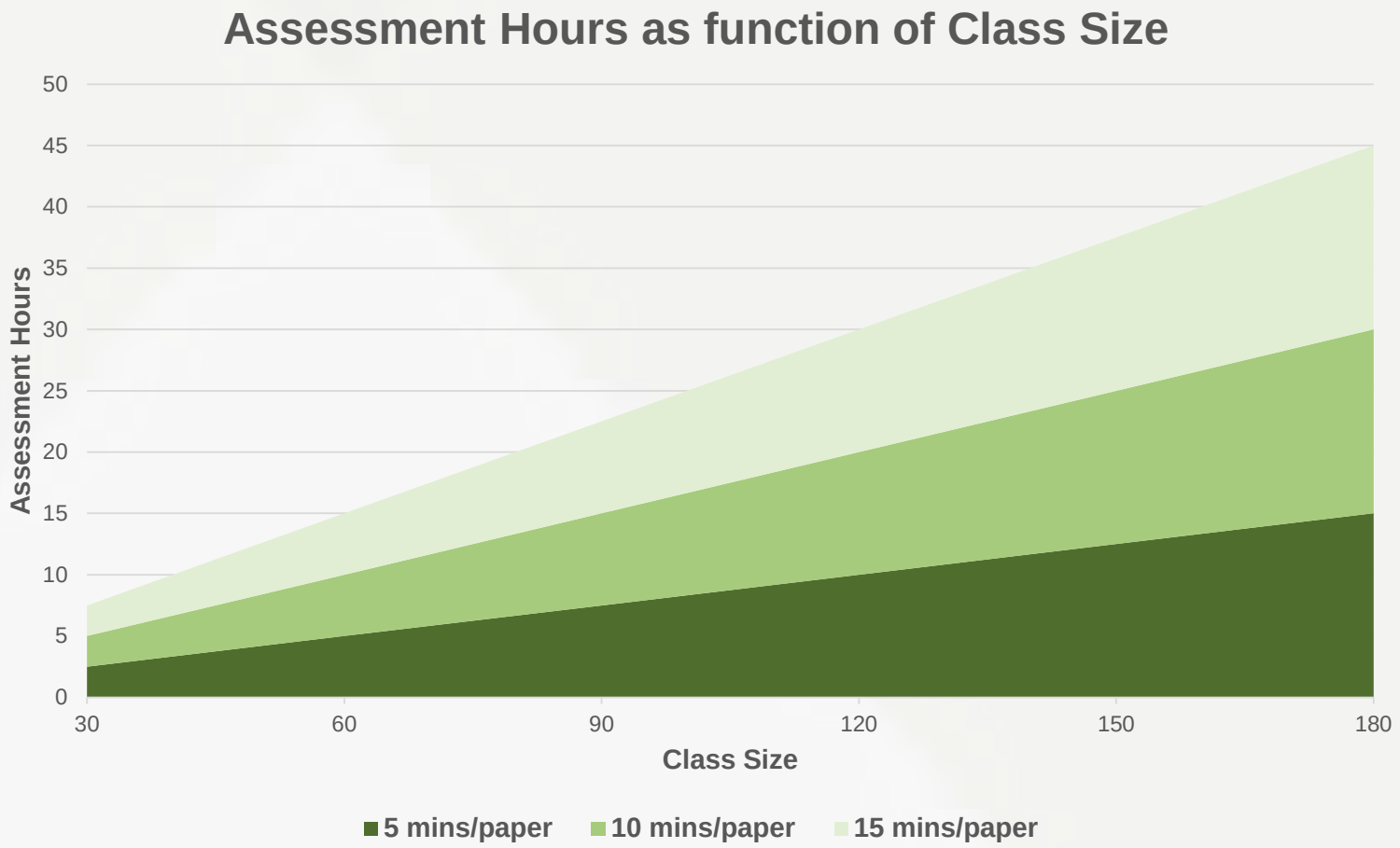

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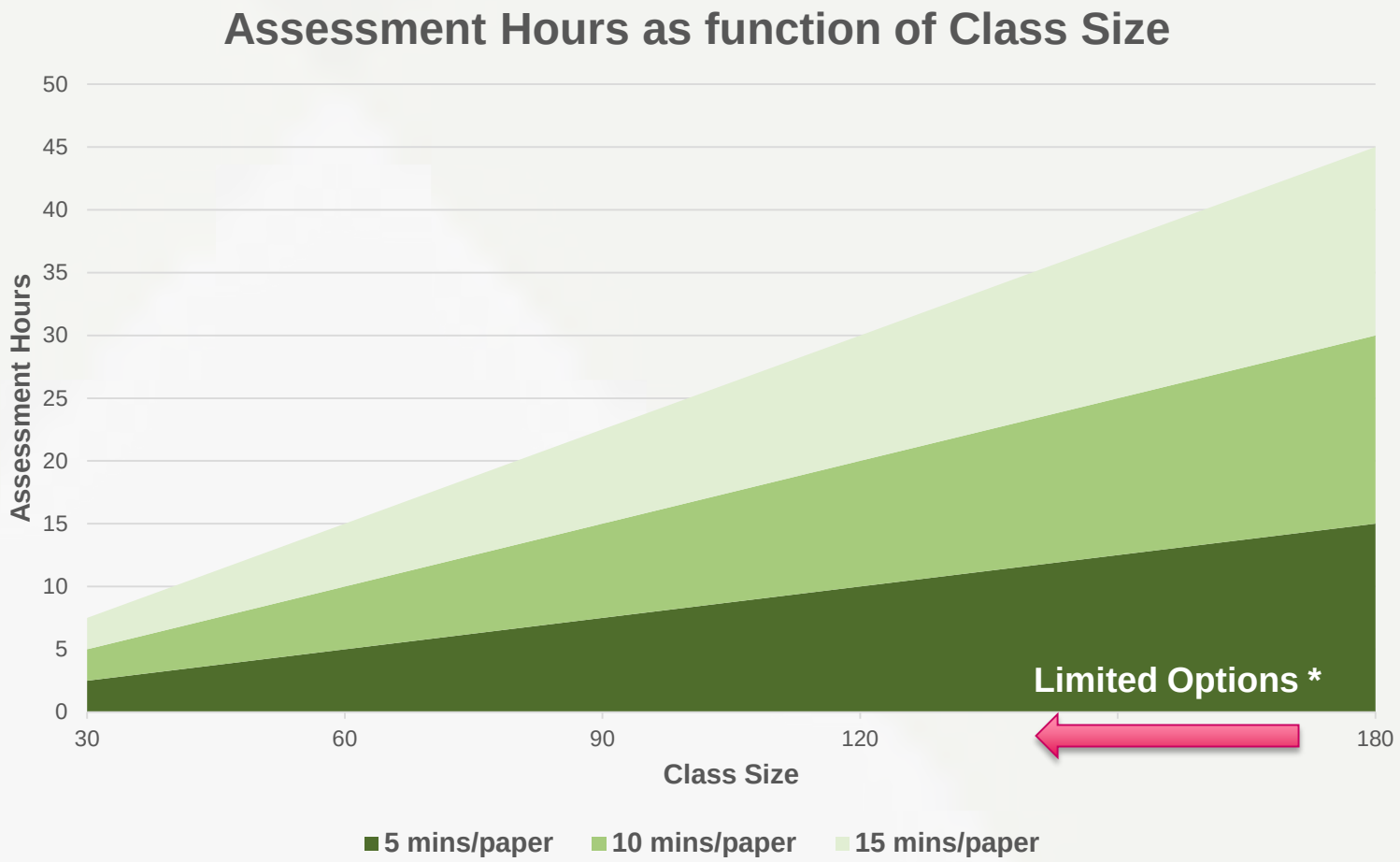

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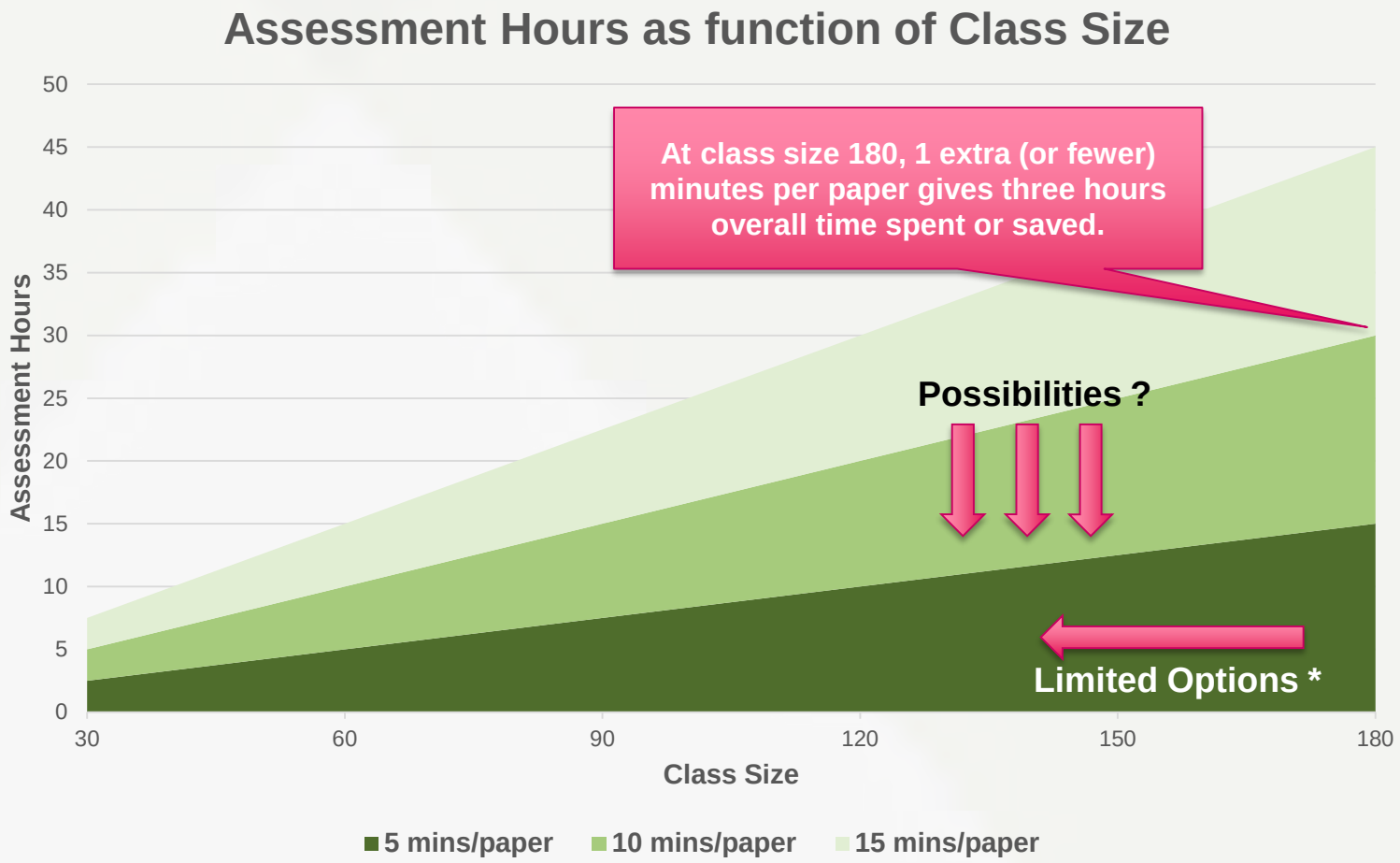

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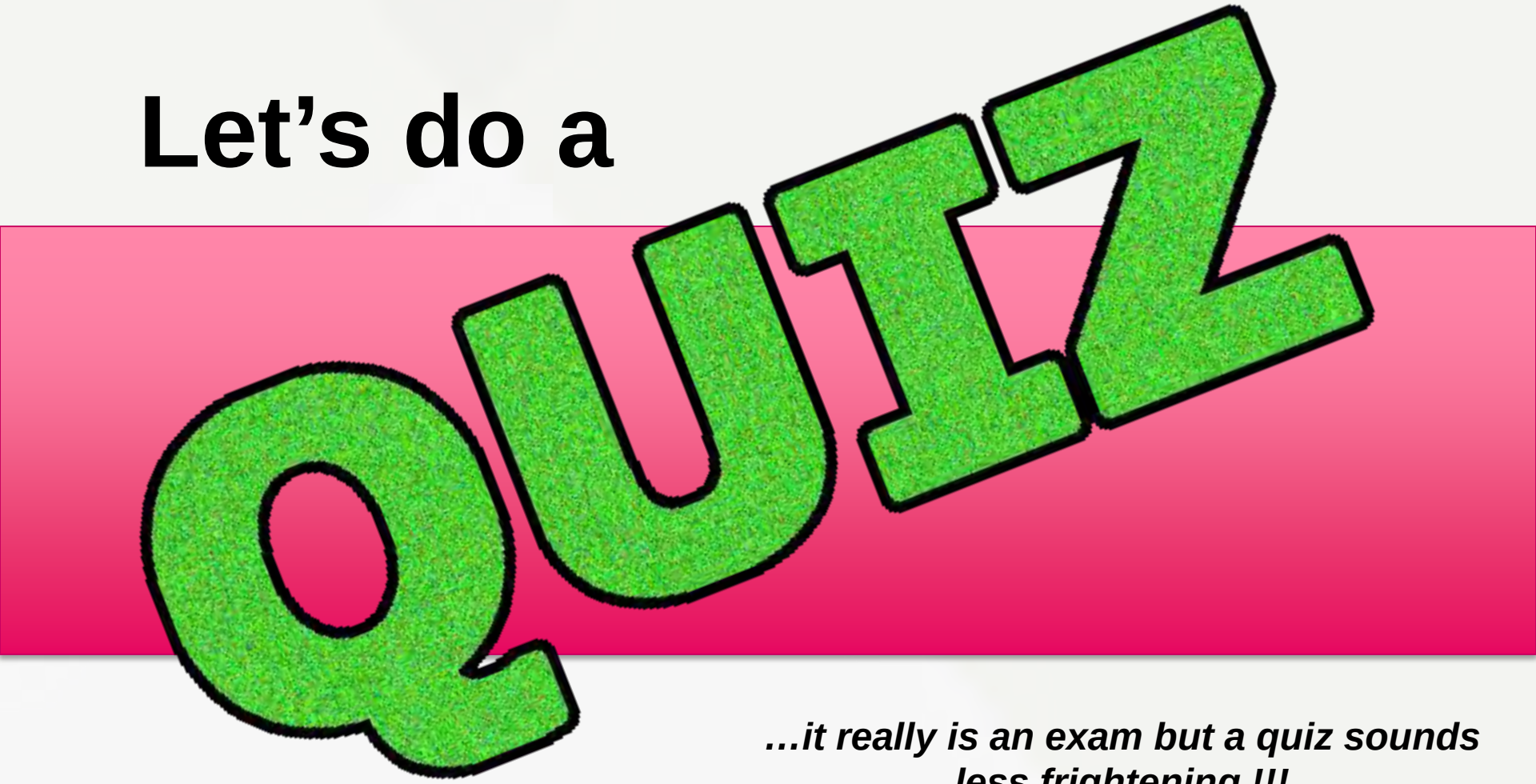
Let's do a



…it really is an exam but a quiz sounds less frightening !!!

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1 : My accent is from :

a) Northern Ireland
b) England
c) Scotland
d) Wales
e) New Zealand
f) Canada

[1]

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2 : Which of the following are mechanical fasteners ?

a) Rivet
b) Bolt
c) Conduit
d) Flex
e) Grommet

Indicate all that apply

[3]

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2 : What is a if :

$$b = 4$$

$$3\,(a + b^2) + 2\,a = 68$$

a) 2
b) 4
c) 8
d) $\sqrt{8}$
e) $\sqrt{2}$

[1]

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So what do we think about multiple choice ????

fast

knowledge

facts

guess

automated

binary

limited

focussed

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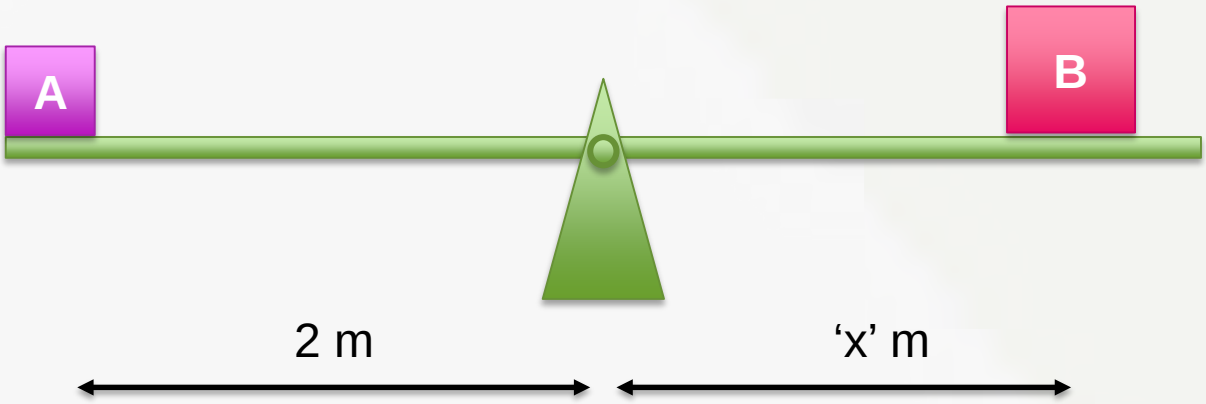
4 : What value of ‘x’ would put the scale in balance – show your working.

[6]

A
50 mm cube
Material of density
4D

B
100 mm cube
Material of density D



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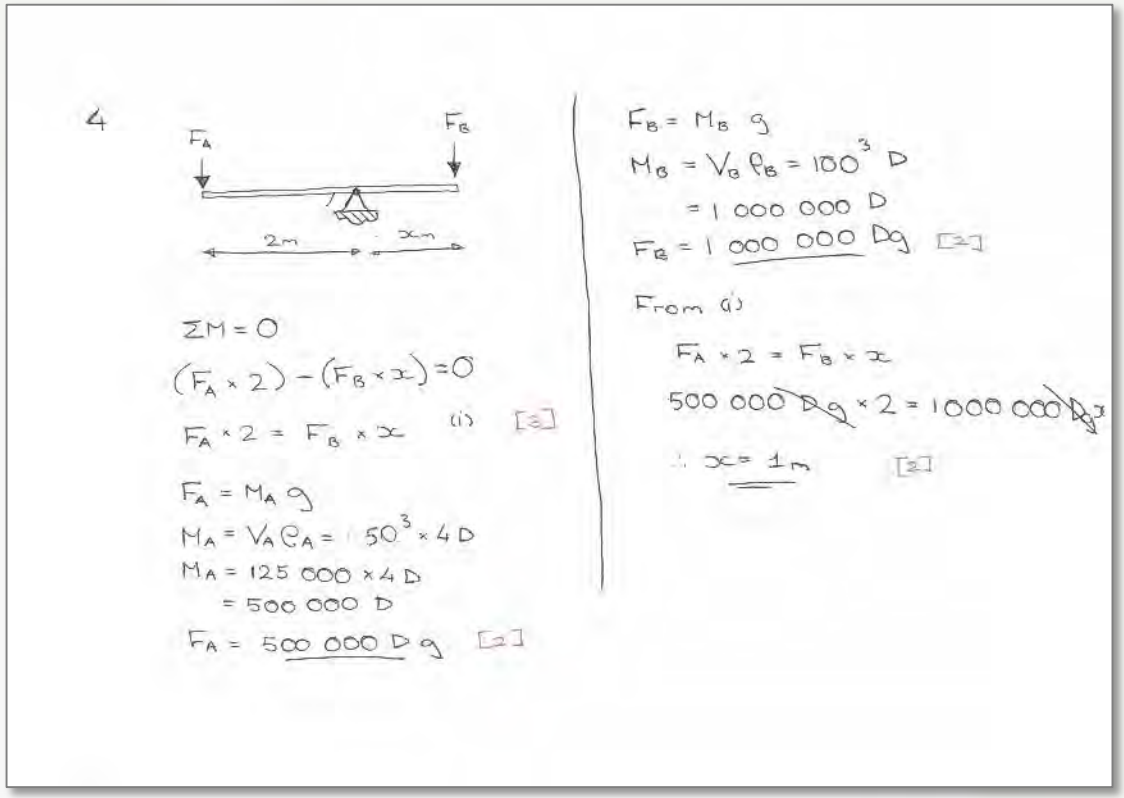
4 : What value of ‘x’ would put the scale in balance – show your working.

[6]



4

$\Sigma M = 0$

$(F_A \times 2) - (F_B \times x) = 0$

$F_A \times 2 = F_B \times x$ (i) [2]

$F_A = M_A g$

$M_A = V_A \rho_A = 50^3 \times 4D$

$M_A = 125\,000 \times 4D$

$= 500\,000\,D$

$F_A = 500\,000\,D\,g$ [2]

$F_B = M_B g$

$M_B = V_B \rho_B = 100^3 D$

$= 1\,000\,000\,D$

$F_B = 1\,000\,000\,Dg$ [2]

From (i)

$F_A \times 2 = F_B \times x$

$500\,000\,Dg \times 2 = 1000\,000\,Dg$

$\therefore x = 1\,m$ [2]

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4 : What value of ‘x’ would put the scale in balance – show your working.

[6]

Different approaches – can slow assessment down ?

Could guide students to ensure consistent approach but detracts from fundamental problem solving…

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4 : Describe the key flight control interfaces available to an aircraft pilot, how they act on elements of the aircraft and how this influences the behaviour of the aircraft in flight

[9]

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4 : Describe the key flight control interfaces available to an aircraft pilot, how they act on elements of the aircraft and how this influences the behaviour of the aircraft in flight

[9]

Sandbags - Drop them - Go up

Gas - Let out - Go down

Give me my 9

Marking Matrices ????

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	3	2	1	0	Mark
Range of Controls	Control column, throttles and rudder pedals clearly identified	Control column, throttles and rudder pedals identified but not correctly named	Partial identification of control column, throttles and rudder pedals	No terms named or named incorrectly	
How they act on aircraft	Clear indication of how flight surfaces and engines respond to inputs	Indication of how flight surfaces and engines respond to inputs but may lack some clarity or accuracy.	Limited indication of how flight surfaces and engines respond to inputs.	No indication of how flight surfaces and engines respond to inputs.	
How this influences flight	Clear discussion of how engine and flight surface changes cause alterations to movement of aircraft.	Indication of how engine and flight surface changes cause alterations to movement of aircraft.	Limited indication of how engine and flight surface changes cause alterations to movement of aircraft.	No indication of how engine and flight surface changes cause alterations to movement of aircraft.	
				Total	

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Department: Higher Education and Training
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Marking Matrices ????

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	3	2	1	0	Mark
Range of Controls	Control column, throttles and rudder pedals clearly identified	Control column, throttles and rudder pedals identified but not correctly named	Partial identification of control column, throttles and rudder pedals	No terms named or named incorrectly	3
How they act on aircraft	Clear indication of how flight surfaces and engines respond to inputs	Indication of how flight surfaces and engines respond to inputs but may lack some clarity or accuracy.	Limited indication of how flight surfaces and engines respond to inputs.	No indication of how flight surfaces and engines respond to inputs.	1
How this influences flight	Clear discussion of how engine and flight surface changes cause alterations to movement of aircraft.	Indication of how engine and flight surface changes cause alterations to movement of aircraft.	Limited indication of how engine and flight surface changes cause alterations to movement of aircraft.	No indication of how engine and flight surface changes cause alterations to movement of aircraft.	2
				Total	6

Rapid - Systematic – Shared Marking Easier – Intrinsic Feedback

Not all elements of approach fall into pre-determined boxes
Box-filling by students (no self structuring / questioning)

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Marking Matrices – Online Reports

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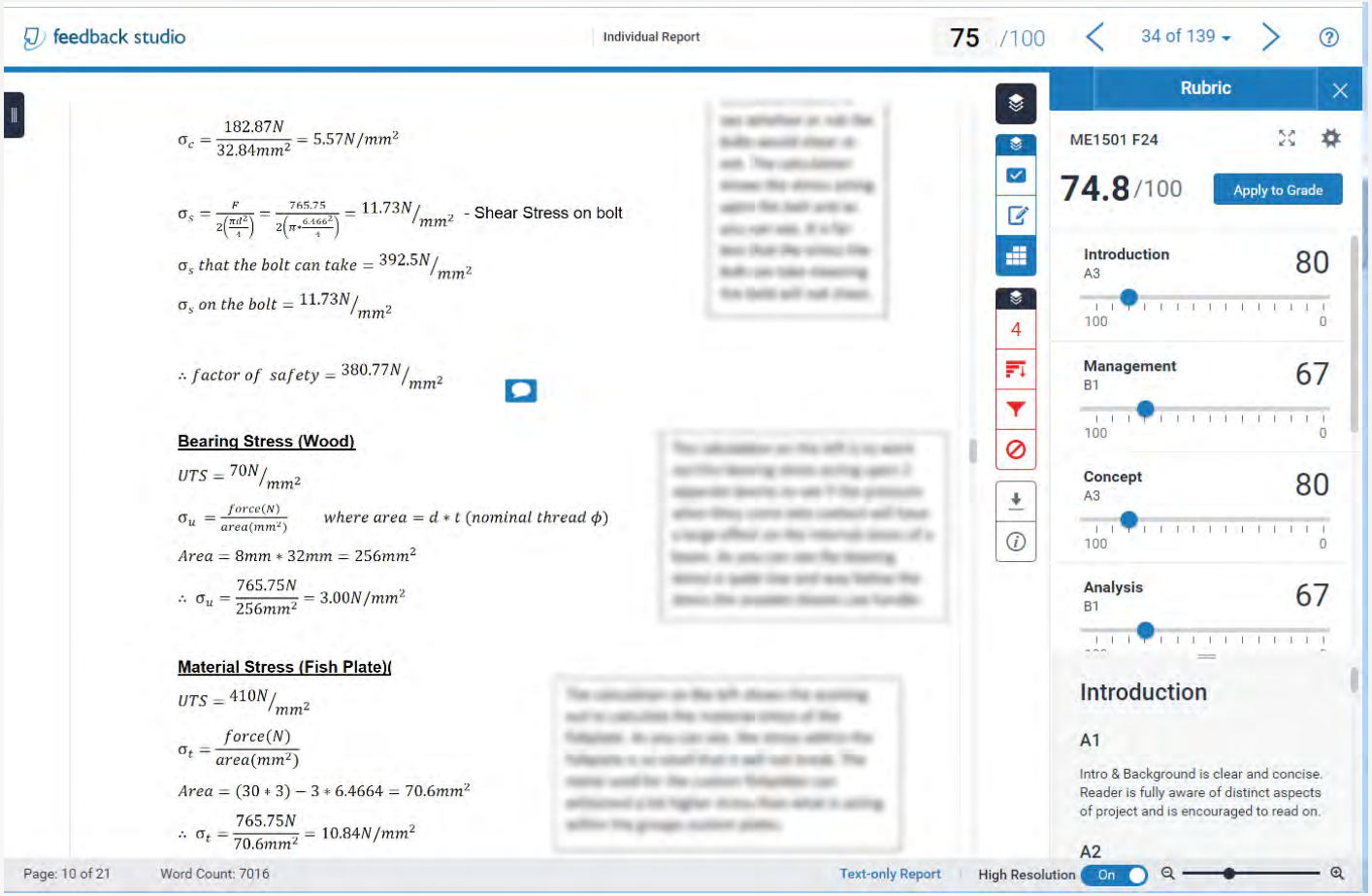

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Marking Matrices – Log Books : Mail Merge

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Student Name: ME1501 – CDIO **Log Book Matrix**

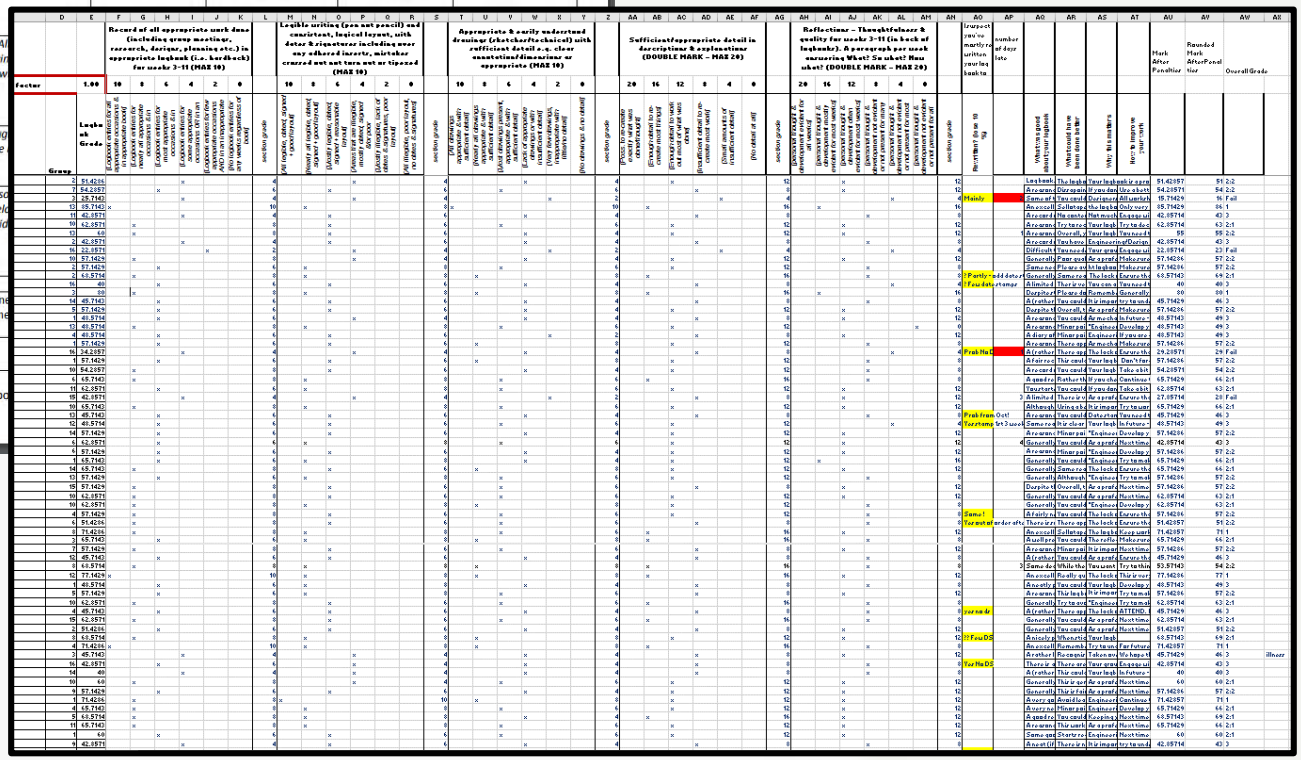
	Perfect - 10	Very Good - 8	Good - 6	Poor - 4	Unsatisfactory - 2	Unavailable - 0
Record of all appropriate work done (including group meetings, research, designs, planning etc.) in appropriate logbook (i.e. hardback) for weeks 3-11 (MAX 10)	*[Logbook entries for all appropriate occasions & in appropriate book]*	*[Logbook entries for nearly all appropriate occasions & in appropriate book]*	*[Logbook entries for most appropriate occasions & in appropriate book]*	*[Logbook entries for some appropriate occasions OR in an inappropriate book]*	*[Logbook entries for few appropriate occasions AND in an inappropriate book]*	*[No logbook entries for any weeks regardless of book]*
Legible writing (pen not pencil) and consistent, logical layout, with dates & signatures including over any adhered inserts, mistakes crossed out not torn out or tipexed (MAX 10)	*[All legible, dated, signed + good layout]*	*[Nearly all legible, dated, signed + good layout]*	*[Mostly legible, dated, signed + good layout]*	*[Areas that are illegible, mostly dated, signed &/or poor layout]*	*[Mostly illegible, lack of dates & signatures, poor layout]*	*[All illegible, poor layout, no dates & signatures]*
Appropriate & easily understood drawings (sketches/ technical) with sufficient detail e.g. clear annotation/dimensions as appropriate (MAX 10)	*[All drawings appropriate & with sufficient detail]*	*[Al drawi & w*				
Sufficient/appropriate detail in descriptions & explanations (DOUBLE MARK – MAX 20)	*[Poss. to re-create exactly what was done/thought]*	*[Enoug create*				
Reflections – Thoughtfulness & quality for weeks 3-11 (in back of logbooks). A paragraph per week answering What? So what? Now what? (DOUBLE MARK – MAX 20)	*[personal thought & development evident for all weeks]*	*[persc develo evid*				

Penalty for late submission @ 5% per day.

☐ I suspect you've mostly re-written your log book to make it ne see a less neat logbook that we know was written in real-time

Additional Comments:

Any grades stated here are provisional and subject to change upc



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Group Working

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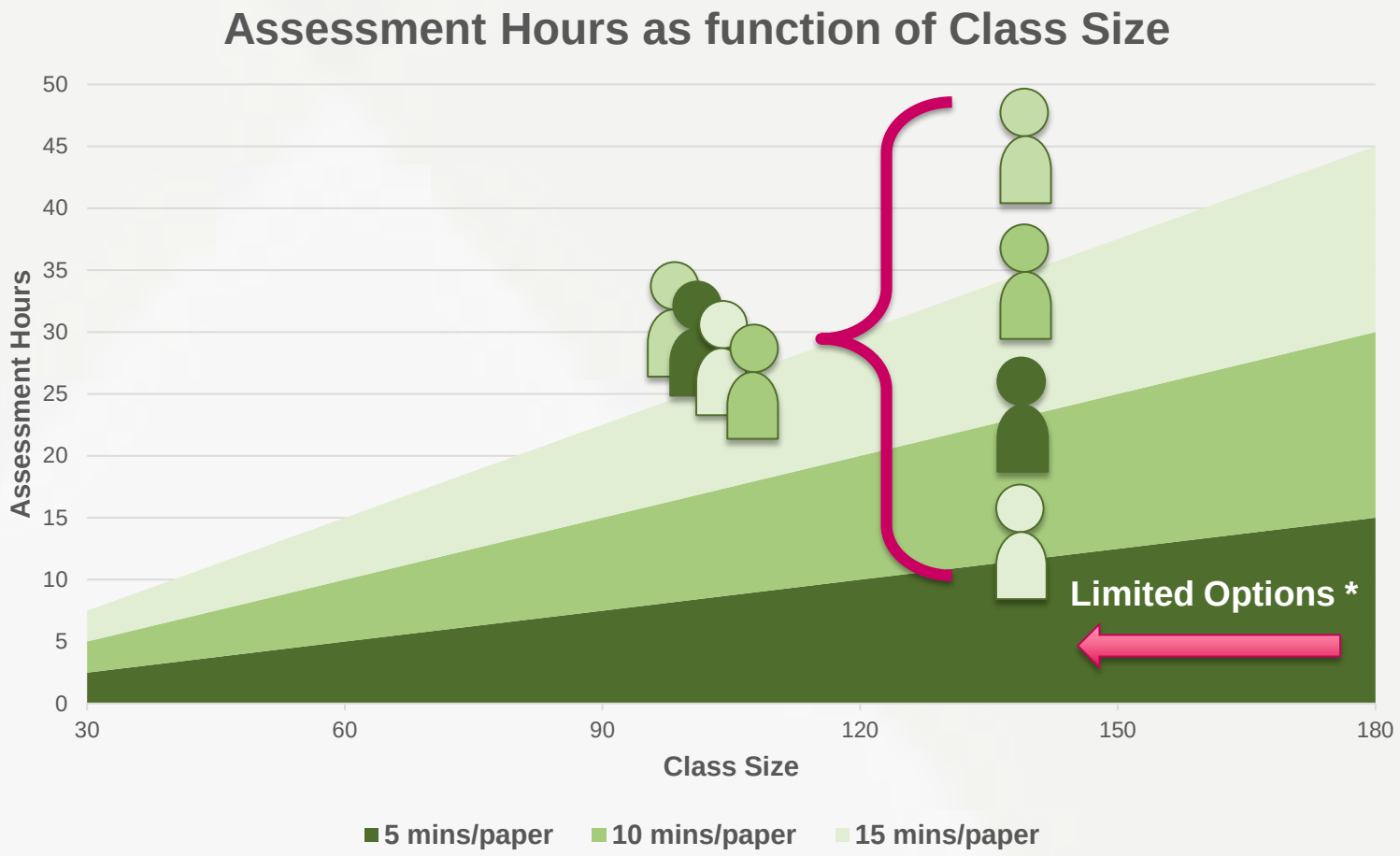

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Group Working – Peer Review

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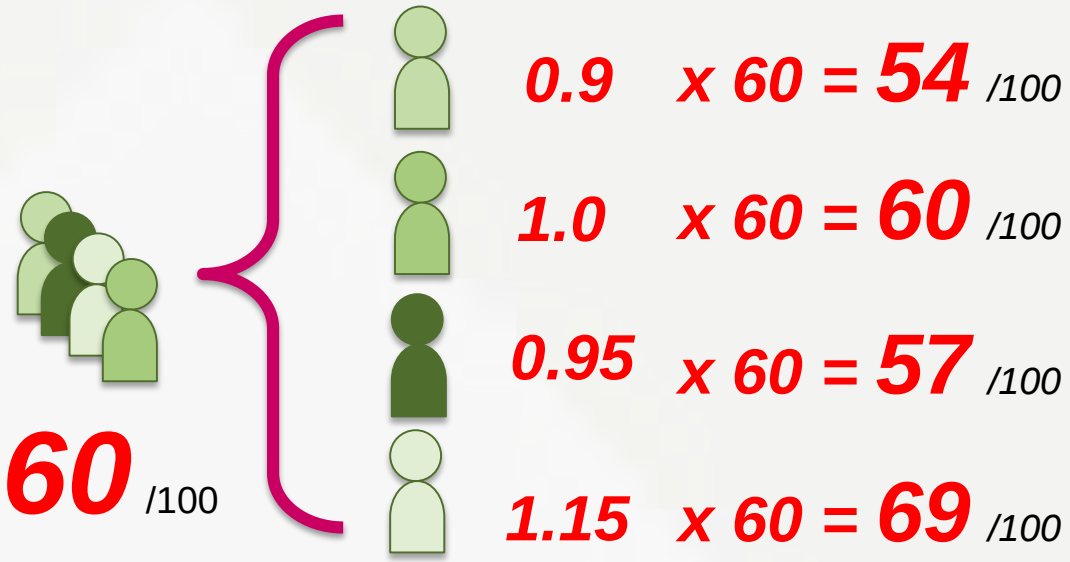

Group Working – Peer Review

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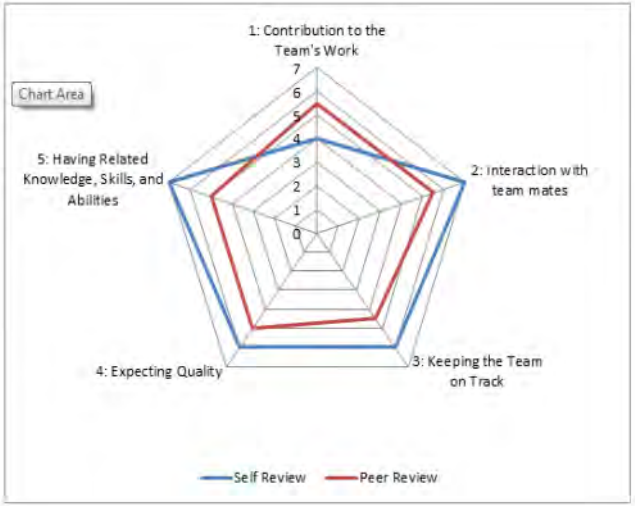
ME1501 Peer Review Feedback

Name:

Group Mark: **25**

Individual Grade:

	Self Review	Peer Review
1: Contribution to the Team's Work	4	5.5
2: Interaction with team mates	7	5.5
3: Keeping the Team on Track	6	4.5
4: Expecting Quality	6	5
5: Having Related Knowledge, Skills, and Abilities	7	5



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Group Working – Peer Review

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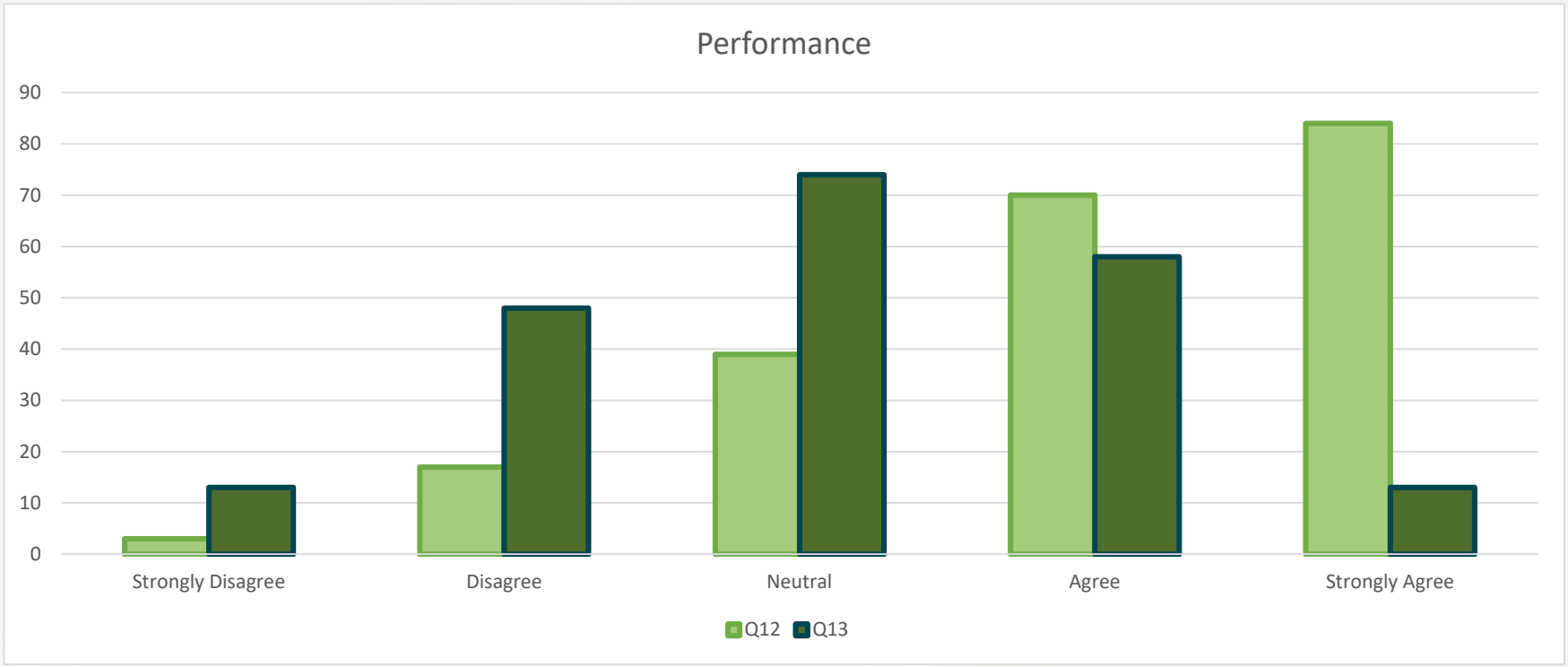

Q12: I feel I am equally committed to a project regardless of whether peer review is to be used or not.

Q13: I feel my team mates are equally committed to a project regardless of whether peer review is to be used or not.

Student Perceptions And Reflections In Peer Review Of Group Projects, Gareth Thomson, Daniel Spooner, Nikola Chalashkanov
Proceedings of the 11th International CDIO Conference, Chengdu University, China, June 8-11, 2015.

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Non-traditional assessments

Aston University

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Non-traditional assessments

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Questions ?

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Gareth Thomson
Aston University

Project title :

_____

Leaders :

Budget : $ $$ $$$

Class Size

Number of Groups ? **x Students / Group ?**

Complexity Needed

SKETCH OF POSSIBLE SOLUTION

Materials Needed ?

Tools Needed ?

Space Needed ?

Support Needed ?

(Academic & Tech Support)

ACTIVITY WORKSHOP 1: 9/5/19:

ASSESSMENT, FEEDBACK AND FEEDFORWARD IN LARGE GROUPS: ISO 26000[1]

The Seven Key Principles, advocated as the roots of Socially Responsible Behaviour, are:

1. Accountability
2. Transparency
3. Ethical behaviour
4. Respect for stakeholder interests (stakeholders are individuals or groups who are affected by, or have the ability to impact, the organization's actions)
5. Respect for the rule of law
6. Respect for international norms of behaviour
7. Respect for human rights

The Seven Core Subjects, which every user of ISO 26000 should consider, are:

1. Organizational governance
2. Human rights
3. Labour practices
4. Environment
5. Fair operating practices
6. Consumer issues
7. Community involvement and development

Intended Learning Outcomes

- An outcome is a result or consequence of an action or process
- A Learning Outcome results from a learning process (some of which will not be intended!!)
- Intended Learning Outcomes are statements which predict what learners will have gained as a result of learning on a particular module, course or programme (different level ILOs)

Constructive Alignment & ILOs

- Knowledge and understanding
- Intellectual skills
- Practical skills
- Key/transferable skills
- Outcomes

[1] ISO 26000 https://www.iso.org/iso-26000-social-responsibility.html

Writing Learning Outcomes

ACTIONS	AIMS	UNDERSTANDING
• Outline • Distinguish between • Choose • Assemble • Identify • Solve • Apply • Describe • Analyse • Synthesise	• Know • Understand • Determine • Appreciate • Grasp • Become familiar	Minimal understanding – sufficient to deal with basic terminology – *memorise, identify, recognise*. Descriptive understanding – knowing about several topics – classify, describe, list Integrative understanding – relating facts together and understanding basis theory – apply to known contexts – integrate,

GROUP 1: THE SCHOLARSHIP OF DISCOVERY

- Focused on *Process* not simply on *Outcomes*
    - In engineering this can be problematic – how to assess the process of teamwork if the output doesn't work or isn't fit for purpose?
    - Should an assessment of process involve student / peer assessment, how can this be done fairly?
    - How do we decide which aspect of the 'process' is worth what mark / grade?
- Involves Disciplined Investigation
    - Does this simply involve engineering investigative skills?
    - Where and when does context fit?
- The pursuit of knowledge central to finding innovative and workable solutions
    - Are solutions testable / tested
- Closely related to research
- Involves the application of **research findings** to teaching (with regards to discipline specific issues)

WORKSHOP ACTIVITY

Taking the subject of 'CSR' and / or 'Sustainability' in Engineering: Develop an Assessment Framework / Rubric that encapsulates the Scholarship of Discovery by…

1. Identifying the main barriers and challenges associated with embedding the concept of 'Scholarship of Discovery' in large group teaching and assessment
2. Considering what 'the Scholarship of Discovery' might incorporate in terms of teaching CSR / Sustainability in an Engineering Education setting
3. Discussing what EDUCATIONAL, ENVIRONMENTAL, and ENGINEERING factors you need to take account so as to include the Scholarship of Discovery when developing a suitable Assessment Framework / Rubric when an 'Active Learning' approach is being used with a group of 80 or more students.

GROUP 2: THE SCHOLARSHIP OF INTEGRATION

- Conceptual linkages across disciplines
- Involves thinking 'out of the box'
- The 3i Approach to teaching engineering:
    - Interdisciplinary – engineering is not simply a single discipline in the same way as maths or science, it encapsulates a number of different disciplines, approaches and concepts
    - Integrated – student engineers need to be able to simultaneously apply theoretical concepts from a range of disciplines to a given engineering problem.
    - Interpretative – engineers need to be able to interpret complex mathematic and scientific concepts and theories and apply them to problems

WORKSHOP ACTIVITY

Taking the subject of 'CSR' and / or 'Sustainability' in Engineering: Develop an Assessment Framework / Rubric that encapsulates the Scholarship of Discovery by…

1. Identifying the main barriers and challenges associated with embedding the concept of 'Scholarship of Integration' in large group teaching and assessment
2. Considering what 'the Scholarship of Integration' might incorporate in terms of teaching CSR / Sustainability in an Engineering Education setting
3. Discussing what EDUCATIONAL, ENVIRONMENTAL, and ENGINEERING factors you need to take account so as to include the Scholarship of Integration when developing a suitable Assessment Framework / Rubric when an 'Active Learning' approach is being used with a group of 80 or more students.

GROUP 3: THE SCHOLARSHIP OF APPLICATION

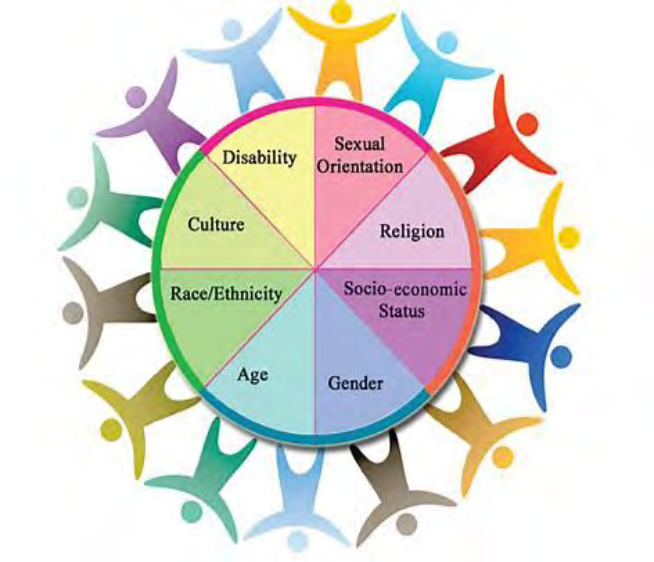
- Applying discipline specific skills to improve lives
    - This could include: Engineering Problem Identification: Discipline Specific Engineering Knowledge: Building / Making Things: Ability to Make things Work: Optimisation Abilities: Competence in Applying Technical Engineering & Scientific Knowledge
- Application of 'softer' skills, knowledge & insights
    - Softer skills may include: Creative Design: Ability to be Adaptable: Critical Problem Solving: Spatial Visualisation: Systems Thinking: Ability to Contextualise Engineering within Society: Communication (written and verbal, including virtual communication)
- Understanding and explaining *key models and theories to real-life problems and challenges.*

WORKSHOP ACTIVITY

Taking the subject of 'CSR' and / or 'Sustainability' in Engineering: Develop an Assessment Framework / Rubric that encapsulates the Scholarship of Application by…

1. Identifying the main barriers and challenges associated with embedding the concept of 'Scholarship of Application' in large group teaching and assessment
2. Considering what 'the Scholarship of Application' might incorporate in terms of teaching CSR / Sustainability in an Engineering Education setting
3. Discussing what EDUCATIONAL, ENVIRONMENTAL, and ENGINEERING factors you need to take account so as to include the Scholarship of Application when developing a suitable Assessment Framework / Rubric when an 'Active Learning' approach is being used with a group of 80 or more students.

WORKSHOP 2: 9/5/19: MANAGING DIVERSITY IN THE CLASSROOM



You have 120 students, their demographic / educational make up is:

- 80% BME
- 60% Islamic:
- 20% Sikh:
- 20% Female:
- 10% 'Mature Students' (o25)
- 90% 'Working Class'
- 10 % "Triple 'A'
- 40% Previous Foundation Entrants
- 25% Overseas (outside South Africa – of which half are Chinese and the rest European and Indian).

Intersectionality: *"the interconnected nature of social categorizations such as race, class, and gender as they apply to a given individual or group, regarded as creating overlapping and interdependent systems of discrimination or disadvantage."* **Oxford Dictionary**

GROUP 1: How and why should and does religion matter when dividing students into groups. How can we as lecturers 'manage' issues which might be result from working in an environment where the majority of students are from one particular religious group (meaning that the minority are of no religion or from other groups)

GROUP 2: How and why should and does ethnicity matter when dividing students into groups. How can we as lecturers 'manage' issues which might be result from working in an environment where the majority of students are from one particular ethnic group?

GROUP 3: How and why should and does social class matter when dividing students into groups. How can we as lecturers 'manage' issues which might be result from working in an environment where the majority of students are from one particular social class group (meaning that the minority are from another social class)