Engineering Education Workshop:
"Tips and Tricks" for new engineering lecturers

Dr Sarah Junaid & Dr Ian Tuersley
Cape Town, 17th – 18th October 2018

Provisional schedule

DAY 1	DAY 2
Introductions & plan, HEI objectives	Intro to CDIO, CDIO Team challenge, Warwick Experience
SHORT BREAK	SHORT BREAK
Teaching frameworks	Professional skills
LUNCH	LUNCH
Teaching techniques	Topics Raised/Education research
SHORT BREAK	Reflection & workshop wrap up
Exercise, reflection & wrap up	END

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Electronic Voting

▶ If you have a smartphone, download the following from the app store or Google play:

▶ https://www.turningtechnologies.com/turningpoint-app/

▶ Region: select Europe

▶ Sign in as Guest and type your name

▶ Select the 'prevent Auto-lock' option

▶ Type in the session ID
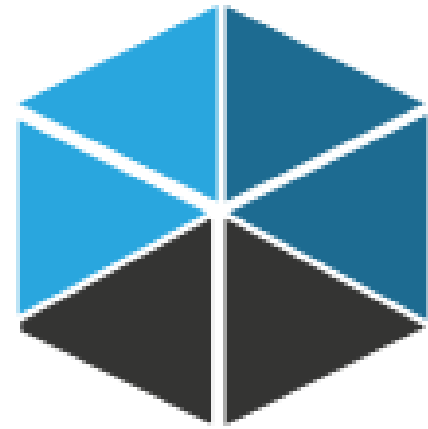
Introductions & Workshop Day 1 Objectives

- Higher Education objectives & OBE

- Teaching methods: Active vs passive learning

- Know your students: learner types

- Learning techniques & assessment types

Also…what would you like to achieve at the end of the two days?

Introductions…

- Introduce yourself

- Your teaching experience

And…

- Something unique about yourself

Ian Tuersley, PhD

Associate Professor

Warwick Manufacturing Group

University of Warwick, UK

Sarah Junaid, PhD

Lecturer in Mechanical Engineering & Design

Aston University, UK

How many years have you been teaching in HEI?

A. Never!

B. Less than 1 year

C. 1-3 years

D. 4-6 years

E. Over 10 years

Why did you choose to come to this workshop?

Jot down on a post-it

Use more if needed

Workshop Goals(from attendees)

► **[List from post-it Exercise]:**

► Some inspiration from how things are done elsewhere

► To be inspired by new and interesting ideas

► Enhance my knowledge about engineering education with the plan of starting a PhD

► See how other people see teaching, because it is very refreshing and inspiring

► To get new perspectives from the UK

► European learning vs African learning, sharing best practices

► Involve students in my teaching

► Learn new teaching techniques

► Get Aha! Faster in lectures and tutorials

► Learn about engineering education concepts

► Your approach to teaching engineering ethics

► To have my current paradigms challenged

► Tips on how to motivate students especially when they are feeling that engineering is difficult for them

► To enhance my teaching experience and improve on teaching methods

► To learn and Share things that work

► To be able to connect engineering to education…there has been a clash between engineers & education practitioners

► To help prepare my teaching portfolio/philosophy

► To build as part of engineering education community

► Would like to meet people from other universities who use maths in their engineering courses, so that I can see what to concentrate on.

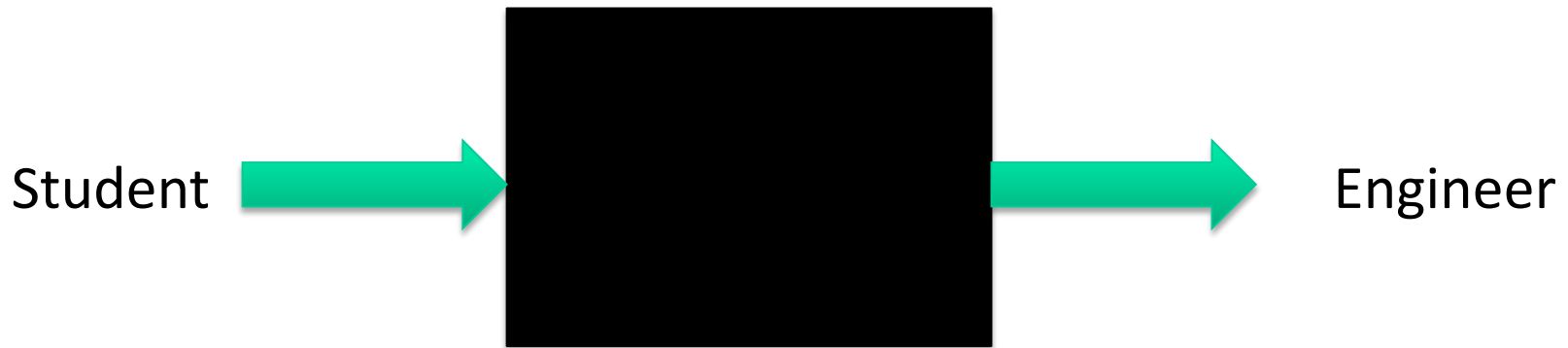► To maintain continuity with the workshops since the beginning of the year

What are your objectives as an educator?
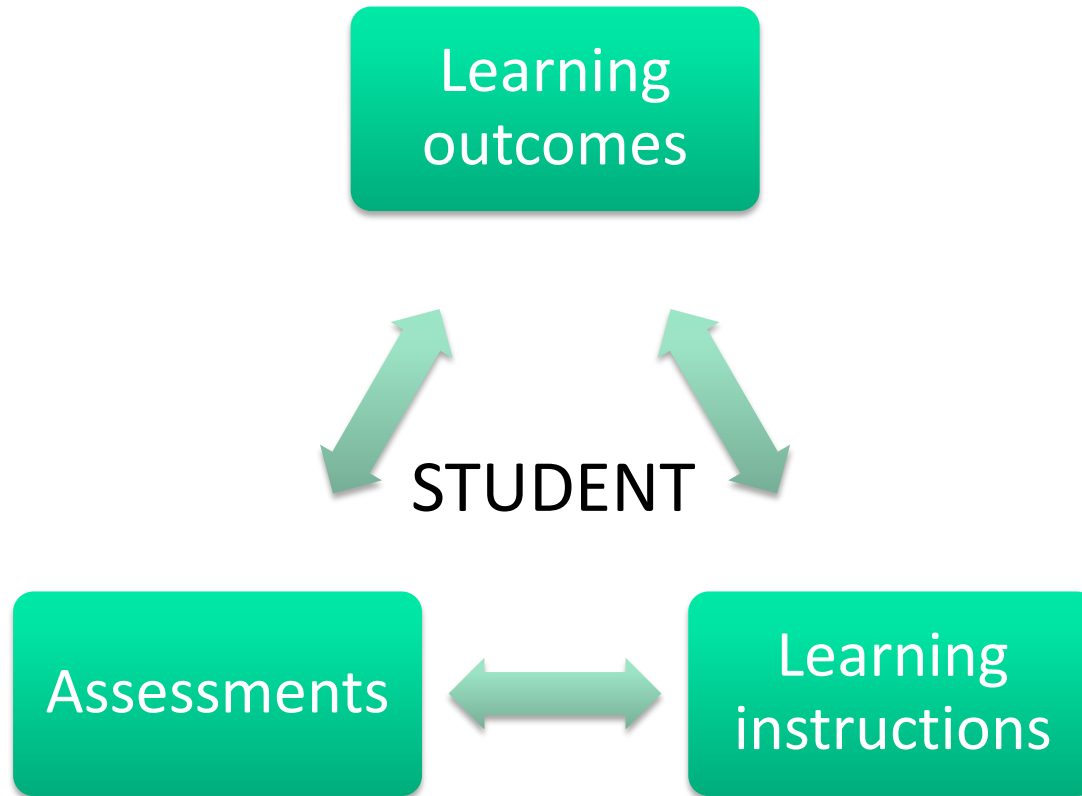
▶ Black box exercise:

RAW MATERIAL   PROCESS   PRODUCT

Student ➡ [black box] ➡ Engineer

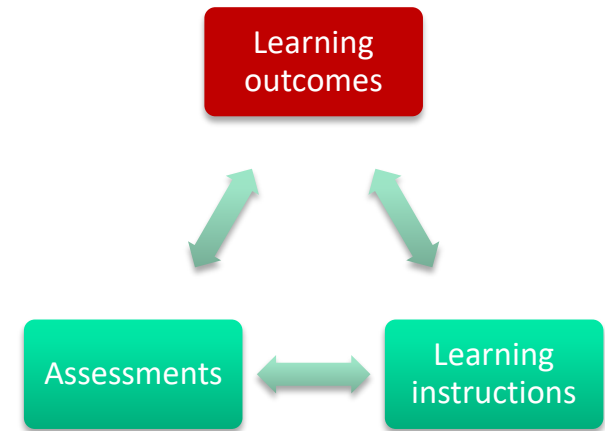Need to understand all three to make it work.

Outcome Based Education (OBE)

Learning Outcomes

How do you agree on the learning outcomes for the degree?

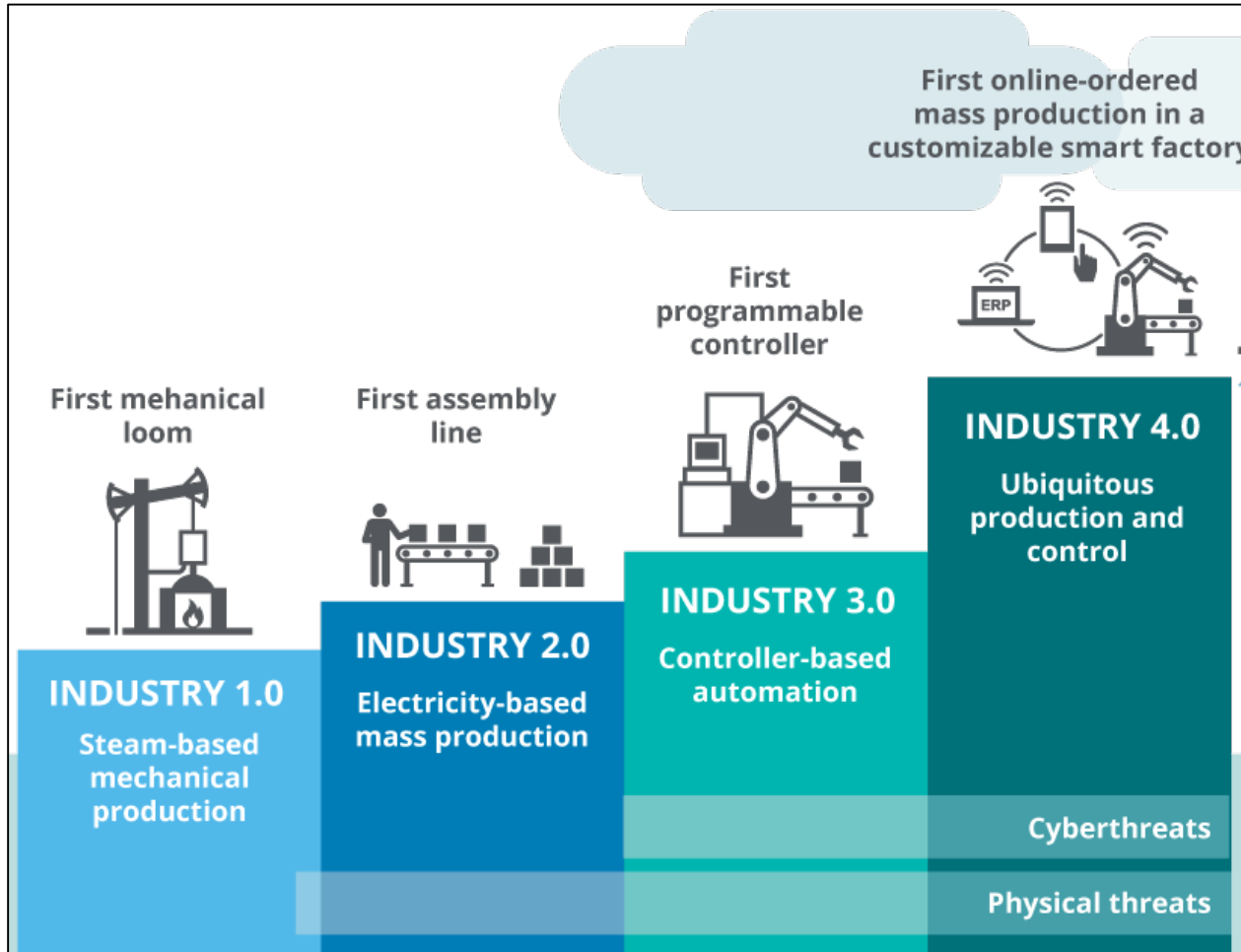Discuss in your group.

Engineering Curriculum

Driven by:

▶ Industry?

▶ Society?

▶ Challenges?

http://www.undp.org/content/undp/en/home/sustainable-development-goals.html

Industry 4.0

Japan: Society 5.0

▶ https://www.youtube.com/watch?v=yF38rc-0EnI

▶ Interview

▶ https://www.youtube.com/watch?v=yDkqvnrV5YY

Washington Accord

▶ International Engineering Alliance

▶ http://www.ieagreements.org/accords/washington/

ECSA Accreditation:

► **Learning Outcome 1:** Define, investigate and analyse **complex engineering problems**.

► **Learning Outcome 2:** Design or develop solutions to **complex engineering problems**

► **Learning Outcome 3:** Comprehend and **apply advanced knowledge** of the widely-applied principles underpinning good engineering practice, specialist knowledge and knowledge specific to the jurisdiction and local conditions.

► **Learning Outcome 4: Manage** part or all of one or more **complex engineering activities**

► **Learning Outcome 5:** Recognise and address the reasonably foreseeable **social, cultural and environmental effects of complex engineering activities**.

► **Learning Outcome 6:** Meet all legal and regulatory requirements and protect the health and safety of persons in the course of his or her **complex engineering activities**.

► **Learning Outcome 7:** Conduct his or her engineering activities **ethically**.

► **Learning Outcome 8:** Exercise **sound judgement** in the course of **complex engineering activities**.

► **Learning Outcome 9:** Be responsible for **making decisions** on part or all of **complex engineering activities**.

► **Learning Outcome 10: Communicate** clearly with others in the course of his or her engineering activities

► **Learning Outcome 11:** Undertake **professional development activities** sufficient to maintain and extend his or her competence

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Exercise

▶ Who are your stakeholders?

▶ Who is the 'customer'?

Exercise: the customer

▶ Were your answers different?

▶ Discuss in your teams, defend your position or would you change it?

Take home from the exercise

▶ The people you will work with will have different customers in mind.

What was your most unpleasant/unproductive learning experience?

▶ [think, pair, share exercise]

What was your most memorable learning experience?

▶ [think, pair, share exercise]

Share

Most enjoyable learning experience	Least enjoyable learning experience
Incentivised learning	No connection between lecturer and students
Interactive problem solving during lecture	Waste of time – no learning
Applying theory and realising whether you get it or not	Learning a subject I don't like
Building connection with students	Didn't teach well, not inspiring – dictating notes. Not competent
Mapping the learning journey	Chalk & talk – reading from slides
Being able to use what was taught	Lecturer does not engage with students
Sign posting learning	No sense of audience
Clarity and engagement	No interactive sessions
The human factor – compassion between students and teacher	Lecturers didn't care
Relating on a human level	No application
	Driven by fear and survival
	Lack of learning outcomes or goal

Active Learning

▶ All our positive learning experiences
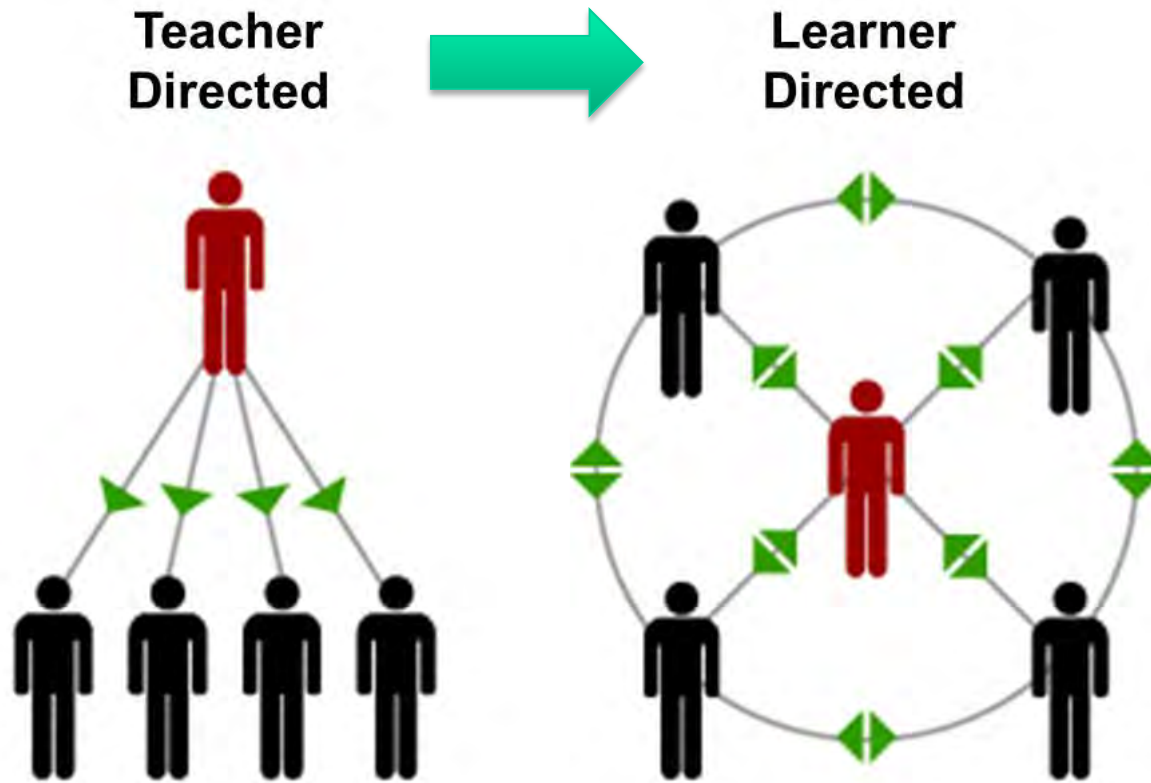   → active learning involved

Teaching Evolution?

A village school painting by William III Bromley (1835-1888)
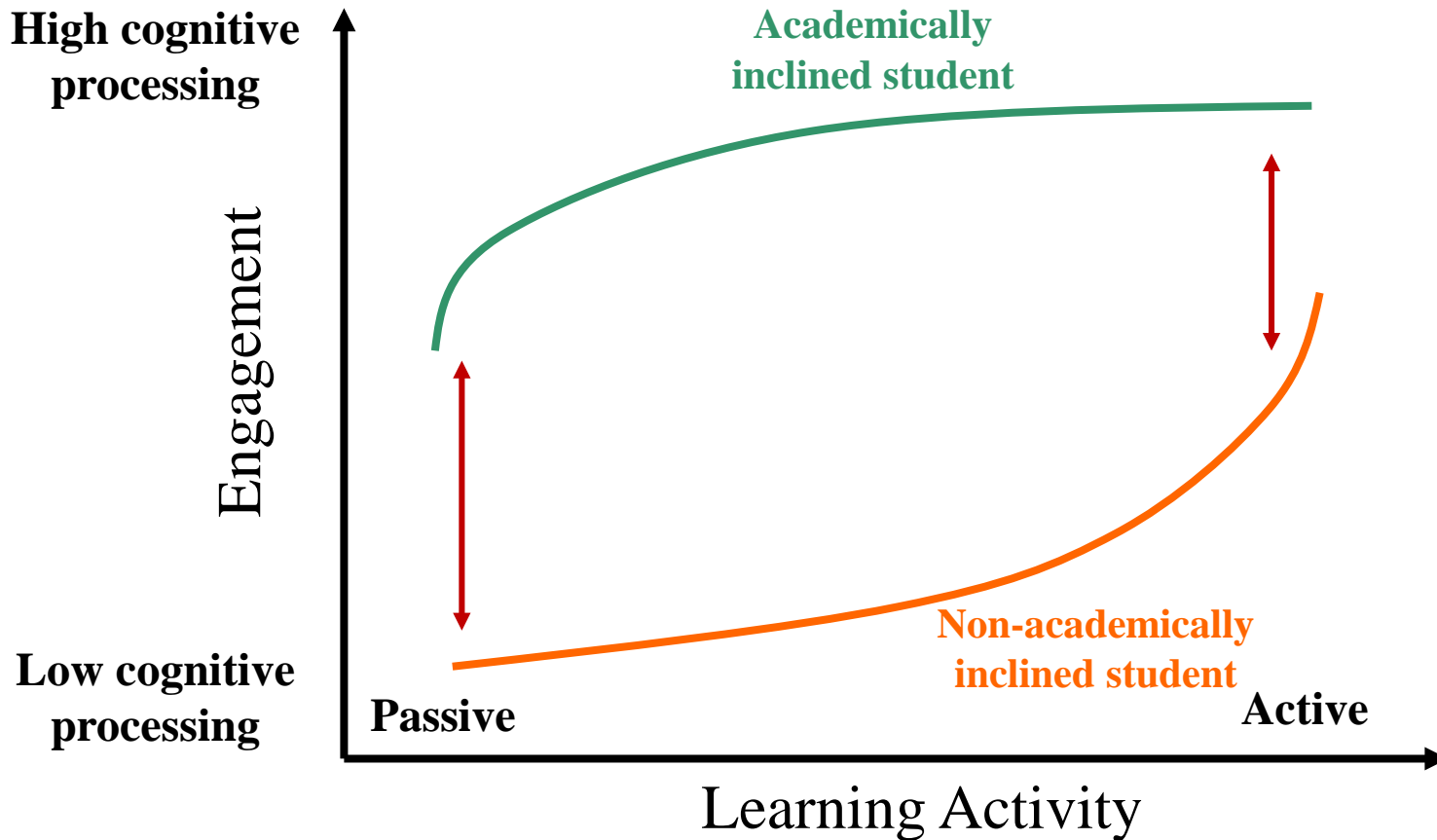
HE Teaching today

https://www.istockphoto.com/

Paradigm shift in teaching model

Paradigm shift in learners

CEE Book Series: Effective implementation of student centred learning, Part 1: Engaging learners through active learning. Yusof et al. 2016. Figure adapted from Fig 2.3 [Biggs & Tang 2007]

During Lecture

Figure Adapted
Reference: What's the Use of Lectures? (Jossey-Bass Higher and Adult Education (Paperback)) Paperback – 3 Jan 2000 by Donald A. Bligh
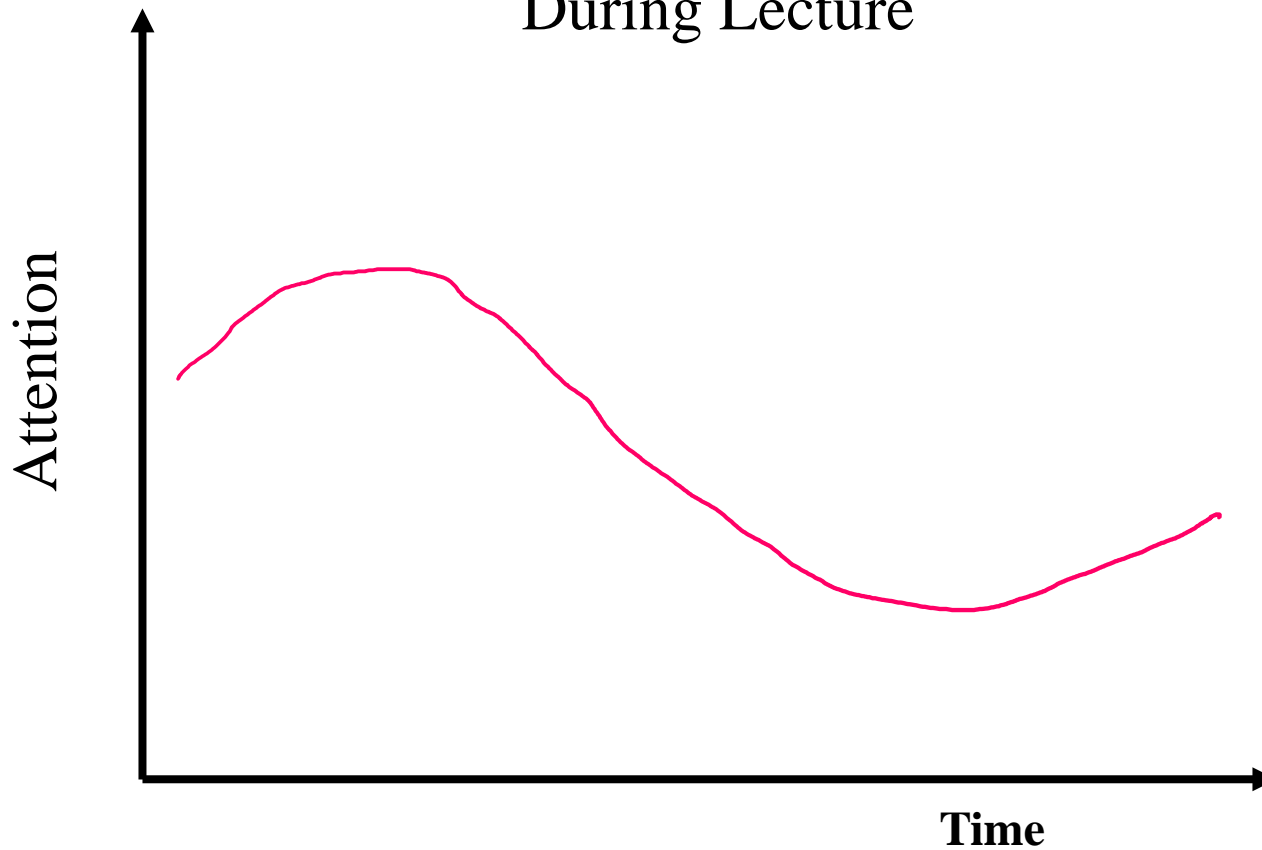
During Lecture
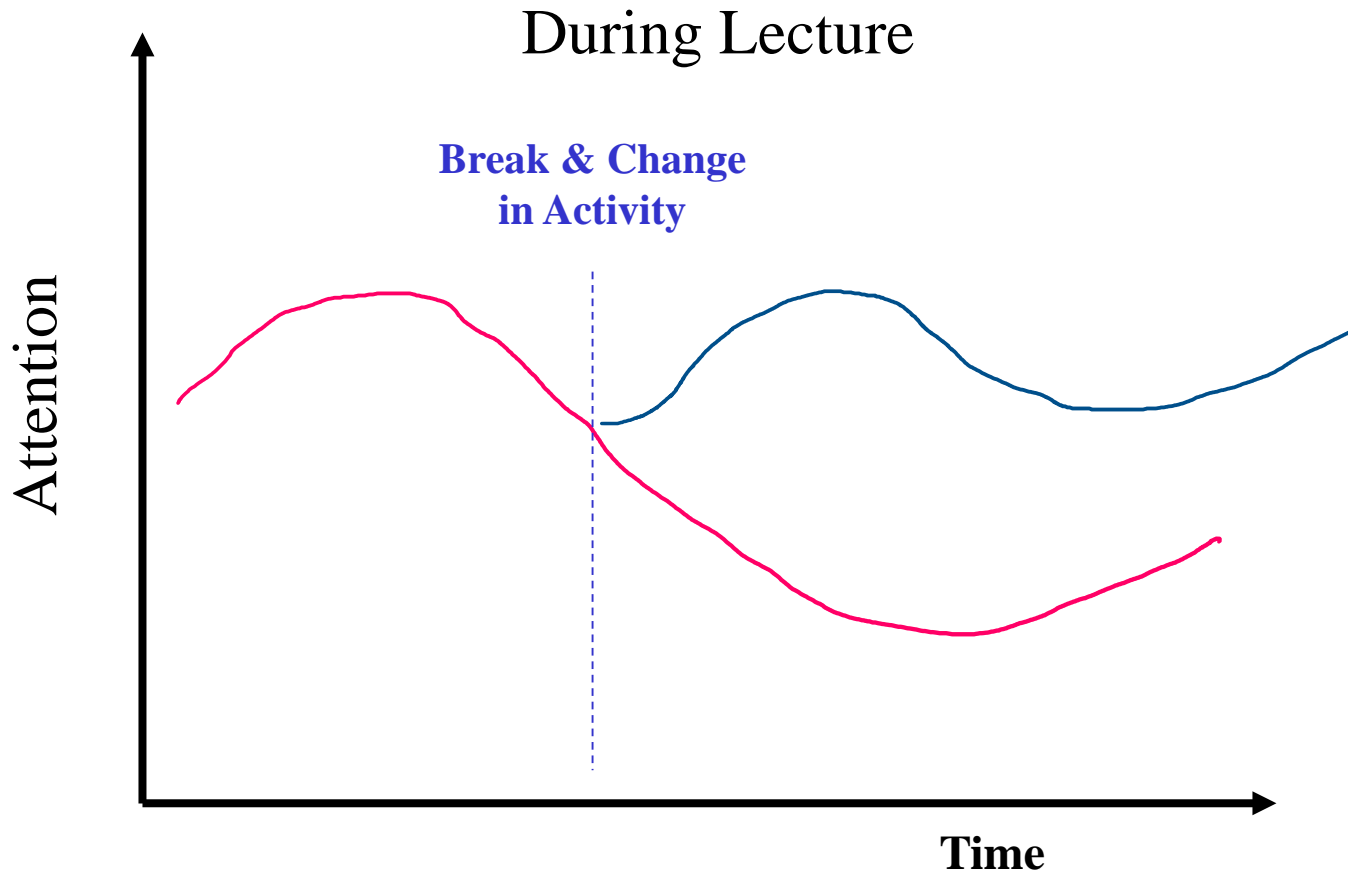

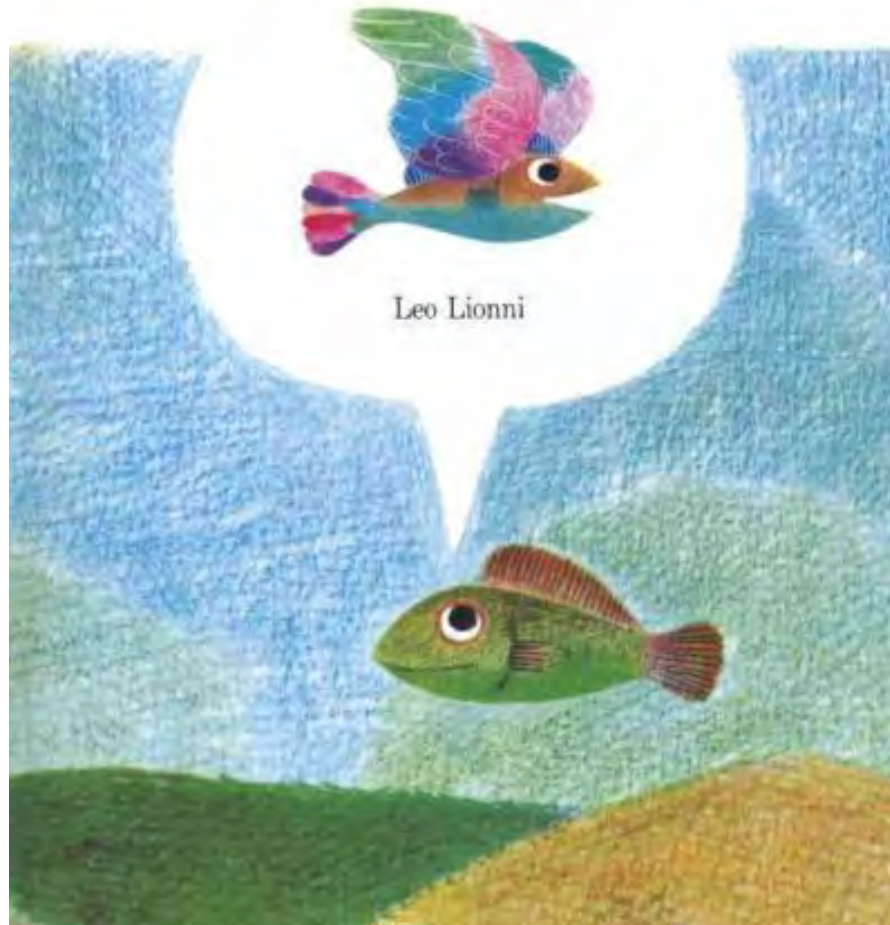Figure Adapted
Reference: What's the Use of Lectures? (Jossey-Bass Higher and Adult Education (Paperback)) Paperback – 3 Jan 2000by Donald A. Bligh
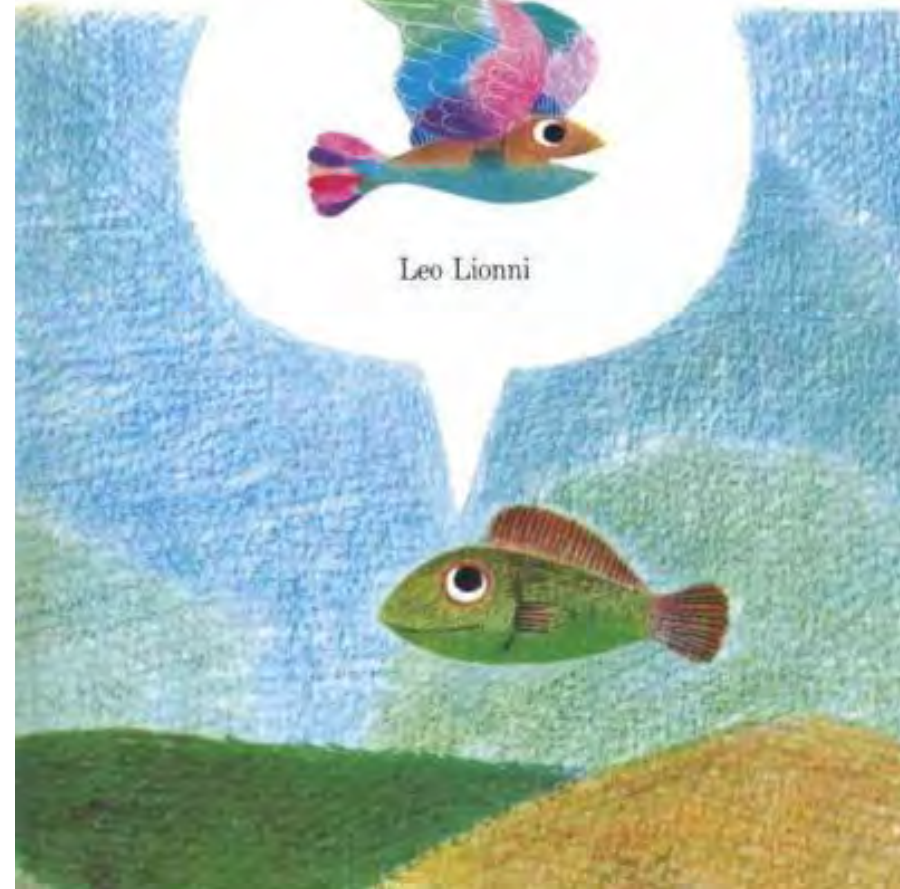
Remember: they don't know what you know

Fish is Fish

Leo Lionni

Exercise:

In teams of 4-5, take the following attributes and rank them (out of 10 – so one will need to be discarded!) according to your perception of their importance to a 'good teacher';

Kind	Reflective
Enthusiastic	Learner
Honest	Open
Inclusive	Prepared
Attentive	Creative

You may add up to _two_ additional attributes of your choice – but you can still only include 9 in your ranking!

Fundamentally have we changed the way we learn?

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Learning theory & learning types?

Auditory Learners
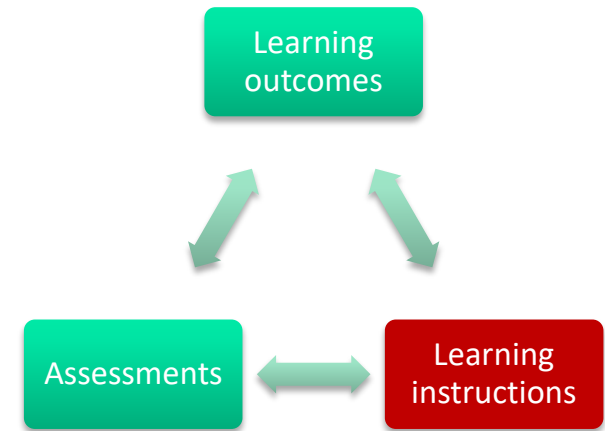
Visual Learners

Reading/Writing Learners

Kinesthetic Learners (hands-on, experiential, doing)

Learning Instructions

How

Discuss in your group.

Teaching & Learning Techniques

▶ List as many as you can

▶ Differentiate into teacher centred vs student centred

Teaching & Learning Techniques

LIST of (largely) student-centred methods:

- Mindmaps
- Videos/audio, podcasts
- Group discussion & conversations
- PBL – problem based learning, IBL – Inquiry Based Learning
- Practical applications
- Project based learning
- Presentations
- Simulation
- Site visits, industrial visits

- Presentations
- Oral or written reports
- Lecturing (teacher centred)
- One to one questions
- Question prompts
- E-voting
- Seminar
- Workshops
- Practicals
- Studio based learning
- TBL – Team Based Learning

Assessment

How

Discuss in your group.
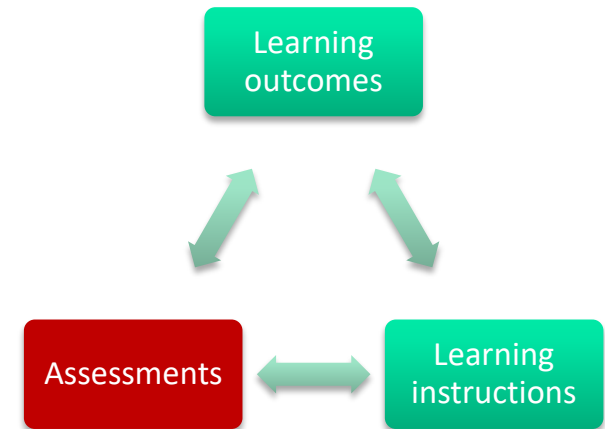
Assessment Types

▶ Formative

▶ VS

▶ Summative

▶ Can you list as many types as possible?

Assessment Types

▶ Formative:

▶ MCQs

▶ Conceptual Questions

▶ Tutorial based assignments

▶ Questions derived from reading

Formative Assessments

Assessment type	Pros	Cons
Conceptual questions MCQs Tutorial based assignments Questions derived from students Continuous assessment Critical writing Meetings		

Assessment Types

▶ Summative:

▶ MCQs

▶ Attendance based marking

Summative Assessments

Assessment type	Pros	Cons
Exam MCQ Attendance!		

Assessment Types

▶ In your group, decide on a topic that one of you plans to teach

▶ Draw a schematic to explain your form of student centred learning & assessment allocated

▶ Be creative and do not put any text.

▶ Pin up your posters when you are finished.

▶ 20 minutes

Gauging understanding in large classrooms?

▶ Too late to wait until assessments!

Gauge understanding

Asking if anyone has any questions at the end of the lecture…
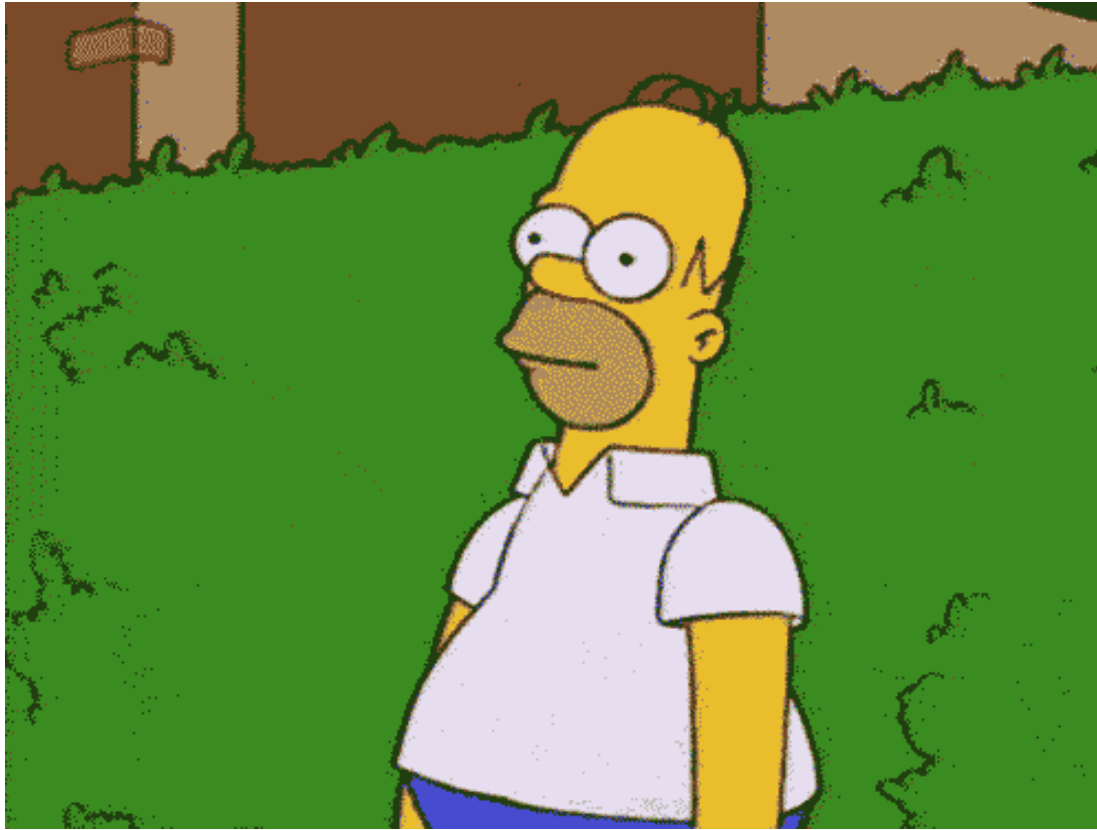
Gauge understanding

Turning Technologies

https://www.turningtechnologies.com/

TurningPoint

There are several other systems too…

Meetoo

TOP HAT

Forms

socrative

Gauge understanding

Let their understanding guide the pace

- Can use concept questions

- Can work through increasingly complex and technical questions

▶ Ask class: observe feedback

▶ Adjust teaching appropriately: skip, stop, move on

▶ Peer learning: invaluable in this process

Concept questions

- ▶ Assesses their understanding of the underlying principle
- ▶ Avoids detailed calculations...checks their grounding is correct
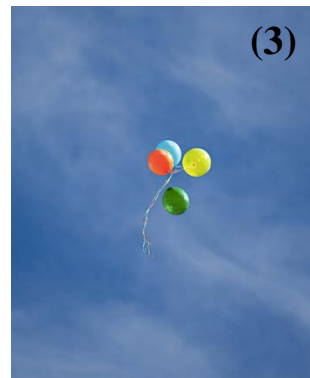
Concept Question Example:

According to Newton's law of action-reaction, which of these objects should have a reaction force acting on it?

A. 1

B. 2

C. 3

D. 4

(1)

(2)

(3)

(4)

Teaching Feedback

Can be used to gauge:

▶ Theory pace

▶ Difficulty

▶ Speed of speaker

Topics Raised from this morning

Review

What has been most useful today?

Action: will you do as a result of today?

Identify a SMART goal

- ▶ Specific
- ▶ Measurable
- ▶ Achievable
- ▶ Realistic
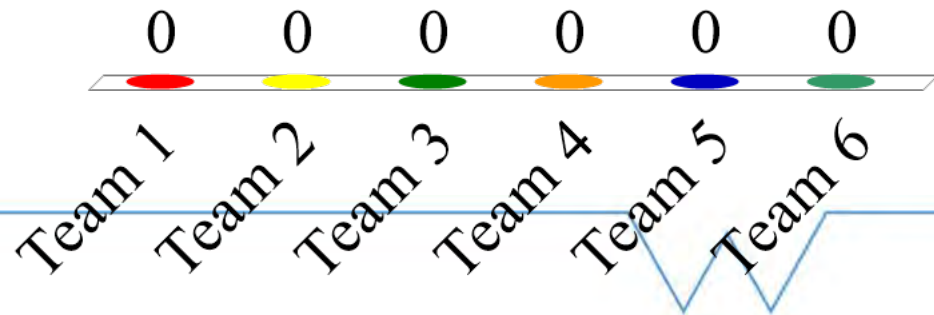- ▶ Timely

DAY 2

▶ Team Based Learning

Re-cap & Workshop Day 2 Objectives

- Higher Education objectives & OBE

- Teaching methods: Active vs passive learning

- Know your students: learner types

- Learning techniques & assessment types

▶ Team based learning & the Aston way

▶ The Warwick Experience

▶ Self evaluation & Module Development

▶ Pedagogical research

Select the team you are in

A. Team 1

B. Team 2

C. Team 3

D. Team 4

E. Team 5

F. Team 6

A way of engaging with students using games and competition…

0   0   0   0   0   0

Team 1   Team 2   Team 3   Team 4   Team 5   Team 6

Why CDIO?

https://topnotchteaching.com/wp-content/uploads/2013/06/FunnyPhoto3.jpg

CDIO – The Aston Way

The Aston Way: Team Based Learning (TBL)

▶ Integrated Project Module

▶ Year 1 : Semester 1

▶ https://www.youtube.com/watch?v=uy0HX6Y4iJU

▶ https://www.youtube.com/watch?v=9mje-u8CSlo

Year 1		Year 2	
Sem 1	Sem 2	Sem 1	Sem 2
Racing car	Wind Turbine	Medical Device	Valve & Actutator

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A CDIO Exercise

▶ **TASK:** In your teams, build the highest spaghetti tower with the tools given and balance a marshmallow at the top

▶ **Tools:** A4 Card base, bundle of spaghetti, cello tape, blue tack & a marshmallow.

▶ **Time limit:** 20 minutes.
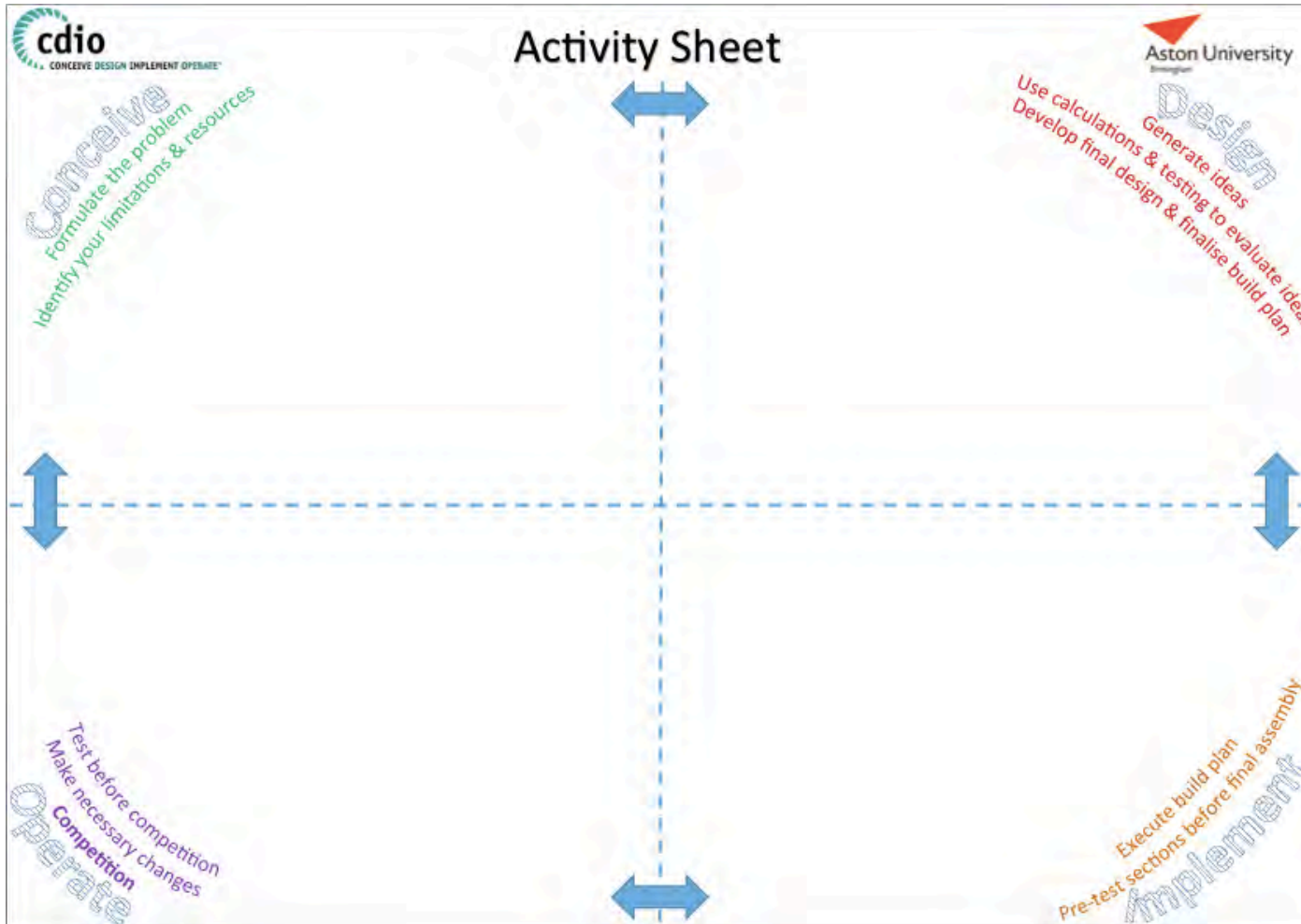
A CDIO Exercise

▶ **TASK:** Now do it again…
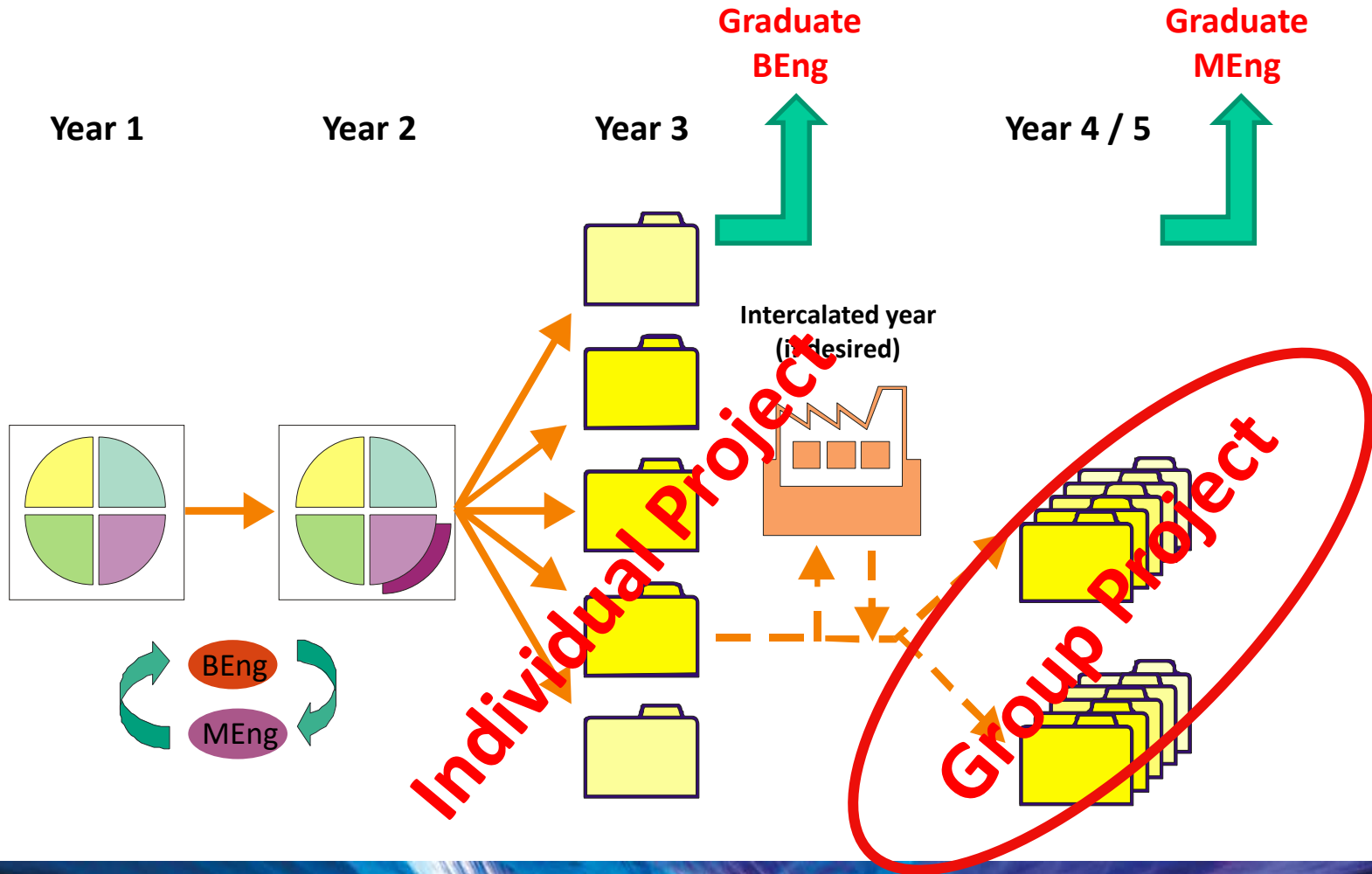
▶ **Time limit:** 15 minutes

Outcomes & Lessons Learned

▶ Iteration is key (testing ideas and prototyping)

▶ Keeping track of time

▶ Organising the team

▶ Logistics!

▶ Leadership

▶ Limited resource (tape)

The Warwick Experience

Case Study:

"Enhanced contextual problem solving by engagement in design and build competitions: A case study-based review."

Engineering Degree Streams Offered at Warwick:

- Engineering (General)
- Automotive Engineering
- Civil Engineering
- Electronic/Electrical Engineering
- Mechanical Engineering
- Manufacturing & Mechanical Engineering
- Systems Engineering

- Engineering and Business Management
- Engineering and Business Studies

Typical 4th Year Group Projects:

- Improving the Sustainability of Warwick University's District Energy System

- Additive Manufacturing of electronic circuits, electronic devices and sensors

- Demonstrator for outreach activities in biomedical engineering

- WUSAT – Warwick Satellite

- Analysis of Vibrations on Lightweight Footbridges Caused by Passing Trains

- Appropriate technology for hearing loss in lower income countries

- Mobile Robotics ('Rescue Robots')

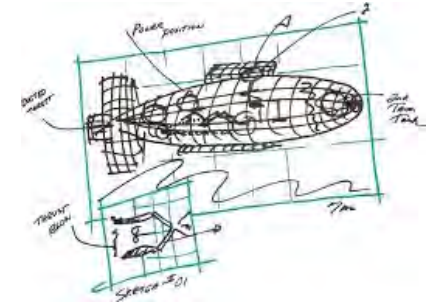- Formula Student (Racing cars)

- ………
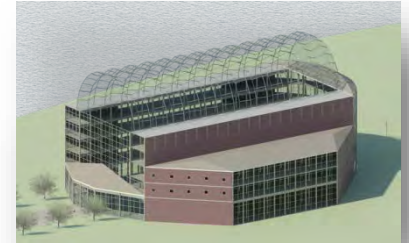
Warwick Human-Powered Submarine:

- Objective is to design and build a human-powered submarine according to the ISR /eISR competition regulations
  - Annual Competition, alternating between US (ISR) and Europe/UK (eISR).

Warwick Human-Powered Submarine:

- ISR is sponsored by the US Foundation for Underwater Research & Education (FURE) and hosted biennially by the Naval Surface Warfare Centre at Carderock, MA. Judges include Admirals and NASA astronauts

- eISR sponsored by the IMarEST, Babcock International, DE&S (Defence Equipment & Support, part of the UK MoD), QinetiQ and other companies.

- Both events attract truly international competition, from countries as far afield as New Zealand, Canada, USA, Netherlands, Germany, Mexico and of course the UK.

- https://www.youtube.com/watch?v=GlNfoLm4aYQ&t=10s
- https://www.youtube.com/watch?v=DbSPOgm7YpQ

Perceived Benefits to the Students;

- Authentic Assessment (Frey et al, 2012)

- Enhanced student engagement through creative practices (Zepke & Leach, 2010)

- Experiential Learning

- Legitimate Peripheral Participation (LPP)

- Real-World experience of sponsors, outreach, media coverage (marketing/promotion)

- … all delivered in an environment of *supportive* competition.

Evidence of benefits?

Project marks against non-competition based projects:

Group Project Average Marks 2013-17
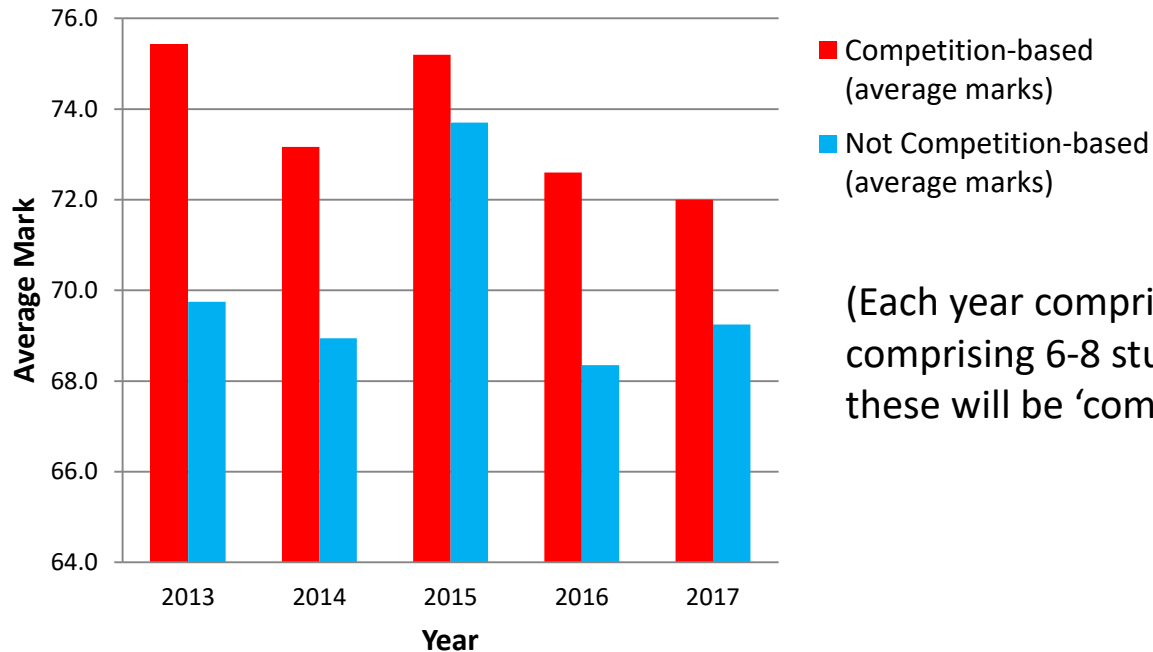
(Each year comprises a total of ~25 projects, each comprising 6-8 students. Typically, about 20% of these will be 'competition based')

Paired t-testing suggests a *very highly significant* difference between the average marks – importantly, across the 1st/2(i) grade boundary.

Evidence of benefits?

Student feedback:

Verena Oetzmann, (2016/2017 team leader):

"In addition to all the challenges that we women in engineering face, being the female leader of an otherwise all male team was a demanding but very rewarding role. The lessons I have learnt throughout my time, coupled with the many skills procured along the way, have been invaluable as preparation for working life after university.

Despite being the most difficult venture that I have undertaken at university, it is certainly among the most enjoyable, rewarding and memorable experiences I have ever had."

Evidence of benefits?

Staff (Project Directors) feedback:

- Consistently elevated level of student engagement;
  - the end goal is 'real' (and often high-profile)

- Enhanced employment opportunities;
  - Reports of 'competitive' projects being a highlighted feature of job interviews. Many engineering companies and organisations now target these events for graduate recruitment and 'future leader' programmes
  - Establishes strong links with sponsor companies. A number of these students have gone straight into related internships or jobs as a direct result of their involvement with the project.

- Significantly improved 'key skills', such as;
  - Problem solving, team-working, planning/time management, budgetary awareness etc.

Possible Drawbacks?

- Competitive element may encourage 'gaming';

  - research being conducted into improved 'peer assessment' methodologies

- Misplaced priorities;

  - enjoyment of competitive elements can lead to too much time being spent to the detriment of other, higher-stakes assessments.

Driving Teaching Excellence - How?

- We recommend the use of team-based projects in STEM teaching environments.

- We recommend that such projects engage with (external) competition events wherever possible

  - Providing LPP via enforced deadlines , budgets and assessment.

- If such competitions don't exist?

  - Create them! (potential for profile-raising engagement). We would be very interested and willing to discuss opportunities.

    (ian.tuersley@warwick.ac.uk)

Engagement: Zepke and Leach (2010)

Table 1. A conceptual organizer for student engagement

| Research Perspectives	Proposals for Action
Motivation and agency (Engaged students are intrinsically motivated and want to exercise their agency)	1. Enhance students' self-belief 2. Enable students to work autonomously, enjoy learning relationships with others and feel they are competent to achieve their own objectives
Transactional engagement (Students and teachers engage with each other)	3. Recognize that teaching and teachers are central to engagement 4. Create learning that is active, collaborative and fosters learning relationships 5. Create educational experiences for students that are challenging, enriching and extend their academic abilities
Institutional support (Institutions provide an environment conducive to learning)	6. Ensure institutional cultures are welcoming to students from diverse backgrounds 7. Invest in a variety of support services 8. Adapt to changing student expectations
Active citizenship (Students and institutions work together to enable challenges to social beliefs and practices)	9. Enable students to become active citizens 10. Enable students to develop their social and cultural capital

Teaching Team Work Skills (TBL)

Ethical Action

Communication

Mindfulness

Self

Goal setting & Strategy

Team
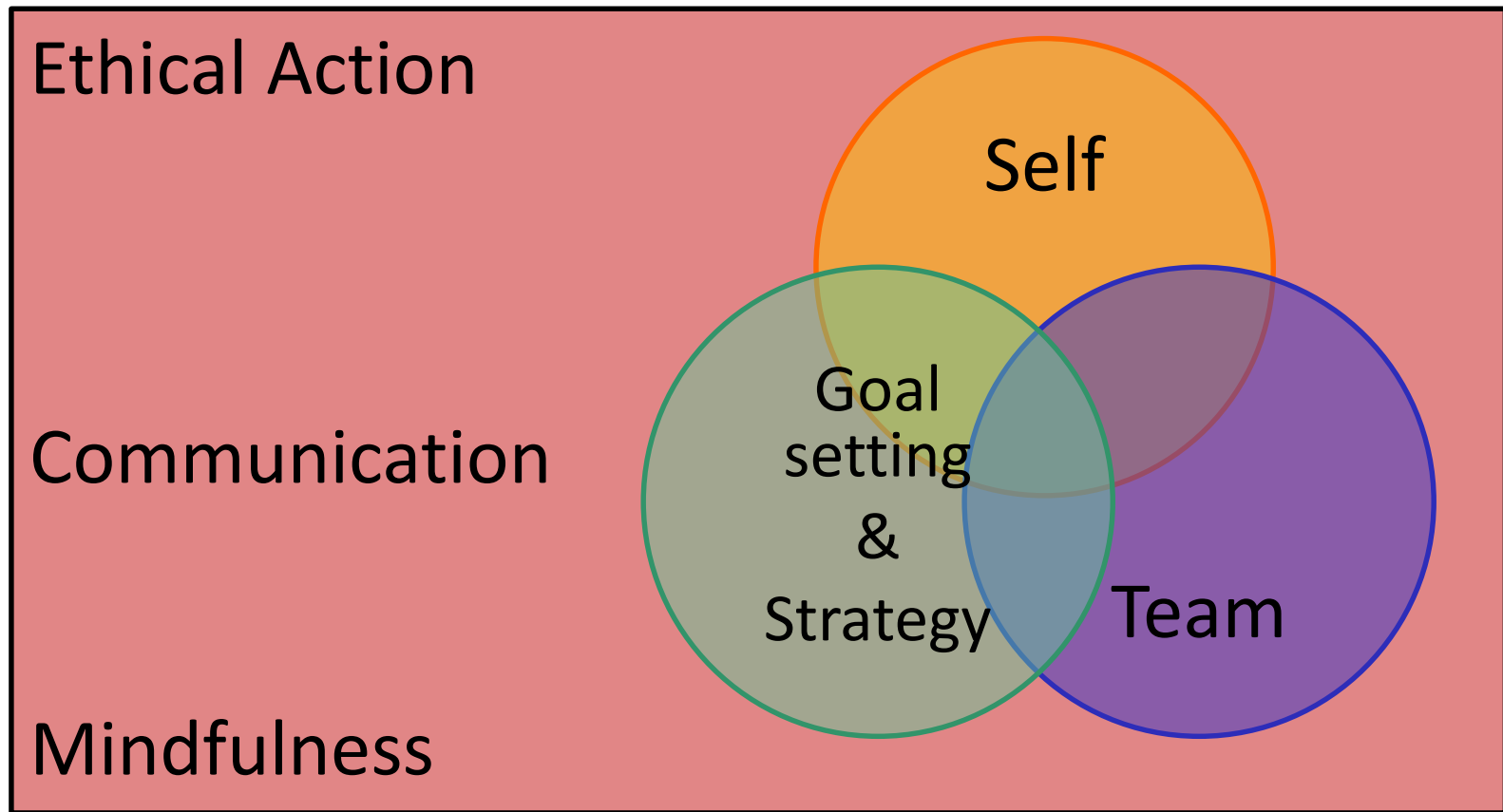
Self

Self-reflection proves difficult:

Self

▶ **Self reflection**

▶ Performance evaluation

▶ Peer review

▶ Goal setting

Self: Kolb's Learning Cycle
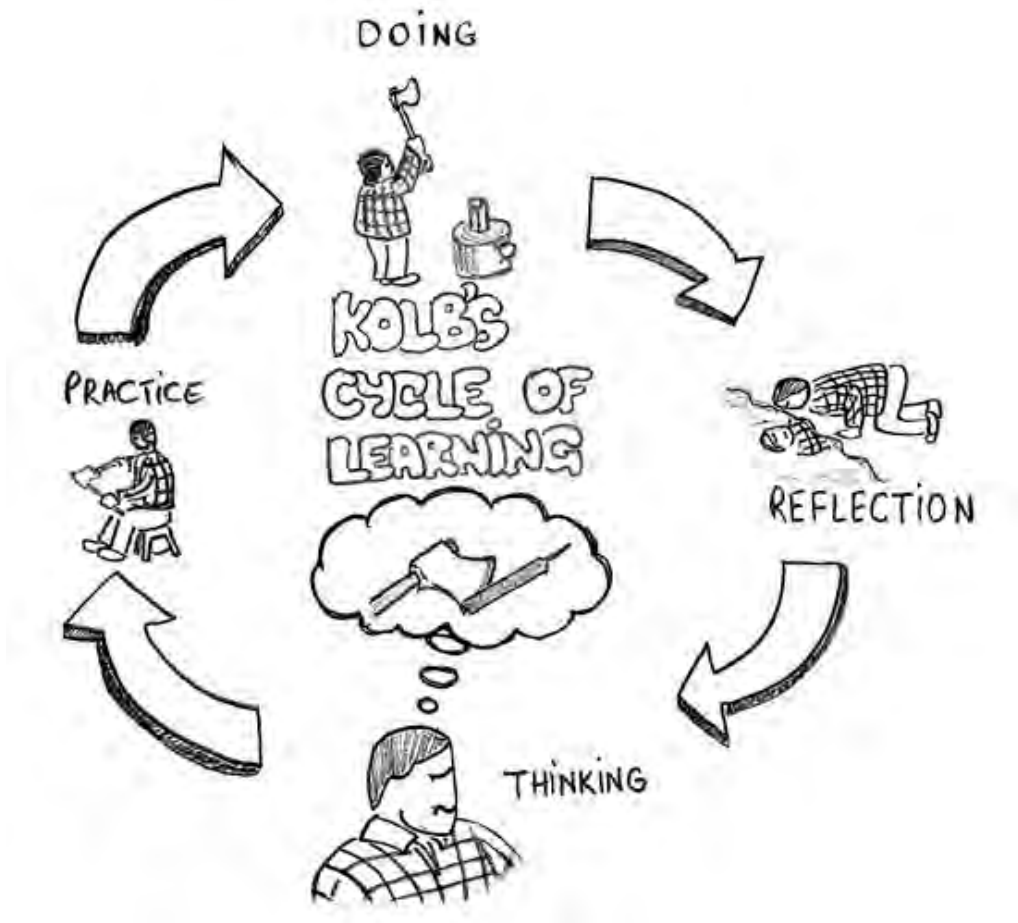
Self Reflection template (printed)

Critical Reflection

Action or Task
(Concrete learning experience)
Reflect on a skilled action you did (e.g. CAD, sketching, research, writing a piece, video editing):
What did you do? How did you do it?

Reflection
(Reflective observation)
Reflect on the skilled action you did:
Did you enjoy it? What was the outcome? How could you improve the outcome? What are your options?

Planning
(Abstract conceptualisation)
Reflect on the skilled action you did:
What changes are you planning to make? What have you decided?

Practice
(Active experimentation)
Reflect on the skilled action you did:
What do you need to do to implement the changes? Did the practice or changes make a difference?

Kolb's experiential learning cycle

Exercise

▶ Use the template provided and spend 5 minutes reflecting on an occasion where you enjoyed teaching.

- Perhaps a eureka moment with a student or you felt particularly good about a teaching session.
- It may be an ad-hoc meeting etc.

Exercise

▶ Now use the same template and reflect on an occasion where you didn't enjoy teaching.

– Perhaps it was a disaster or you felt particularly low about a teaching session?

Which initiated change?

Team

https://thereelteamnewsletter.files.wordpress.com/2010/02/communication.jpg

Team

▶ **Communication**

▶ Collaboration

▶ Conflict Management

▶ Peer review

Team

▶ Team agreements: signed

Team

▶ 9 Belbin team roles:

▶ Can ask students to self identify (not take test)

▶ Make it relevant e.g. using famous movie/TV characters

Team Role		Contribution	Allowable Weaknesses
Plant		Creative, imaginative, free-thinking. Generates ideas and solves difficult problems.	Ignores incidentals. Too preoccupied to communicate effectively.
Resource Investigator		Outgoing, enthusiastic, communicative. Explores opportunities and develops contacts.	Over-optimistic. Loses interest once initial enthusiasm has passed.
Co-ordinator		Mature, confident, identifies talent. Clarifies goals. Delegates effectively.	Can be seen as manipulative. Offloads own share of the work.
Shaper		Challenging, dynamic, thrives on pressure. Has the drive and courage to overcome obstacles.	Prone to provocation. Offends peoples feelings.
Monitor Evaluator		Sober, strategic and discerning. Sees all options and judges accurately.	Lacks drive and ability to inspire others. Can be overly critical.
Teamworker		Co-operative, perceptive and diplomatic. Listens and averts friction.	Indecisive in crunch situations. Avoids confrontation.
Implementer		Practical, reliable, efficient. Turns ideas into actions and organises work that needs to be done.	Somewhat inflexible. Slow to respond to new possibilities.
Completer Finisher		Painstaking, conscientious, anxious. Searches out errors. Polishes and perfects.	Inclined to worry unduly. Reluctant to delegate.
Specialist		Single-minded, self-starting, dedicated. Provides knowledge and skills in rare supply.	Contributes only on a narrow front. Dwells on technicalities.

Team

▶ Organisation & Documentation:

- Minutes

- Actions and tasks

- Regular meetings

- Technical documentation

- VERSION CONTROL

Team

- Peer review models? Examples:

- Using a multiplication factor from peer review and apply across team average

- 50 % team average 50 % peer reviewed mark

- Team lead peer reviews throughout project

- Setting marking criteria for peer reviews e.g. quality of work, professionalism (timely, attends meetings), team player etc.

- Use online peer review systems e.g. https://www.itpmetrics.com

Team

▶ Tools for team working: e.g. SUITs method

▶ S – Sharing: jot down and share

▶ U – Understand: query points

▶ I - Integrate: combine ideas

▶ T– Team decision: final group decision

Reference: https://www.itpmetrics.com

Team

- ▶ Brainstorming
- ▶ 6 thinking hats
- ▶ Ishikawa Diagram - "fishbone"

Goal setting & Strategy

"An admirable plan, Mr Gribbs, but short on detail"

http://blog.smallbusinessadvocate.com/wp-content/uploads/2014/04/business-plan-cartoon.jpg
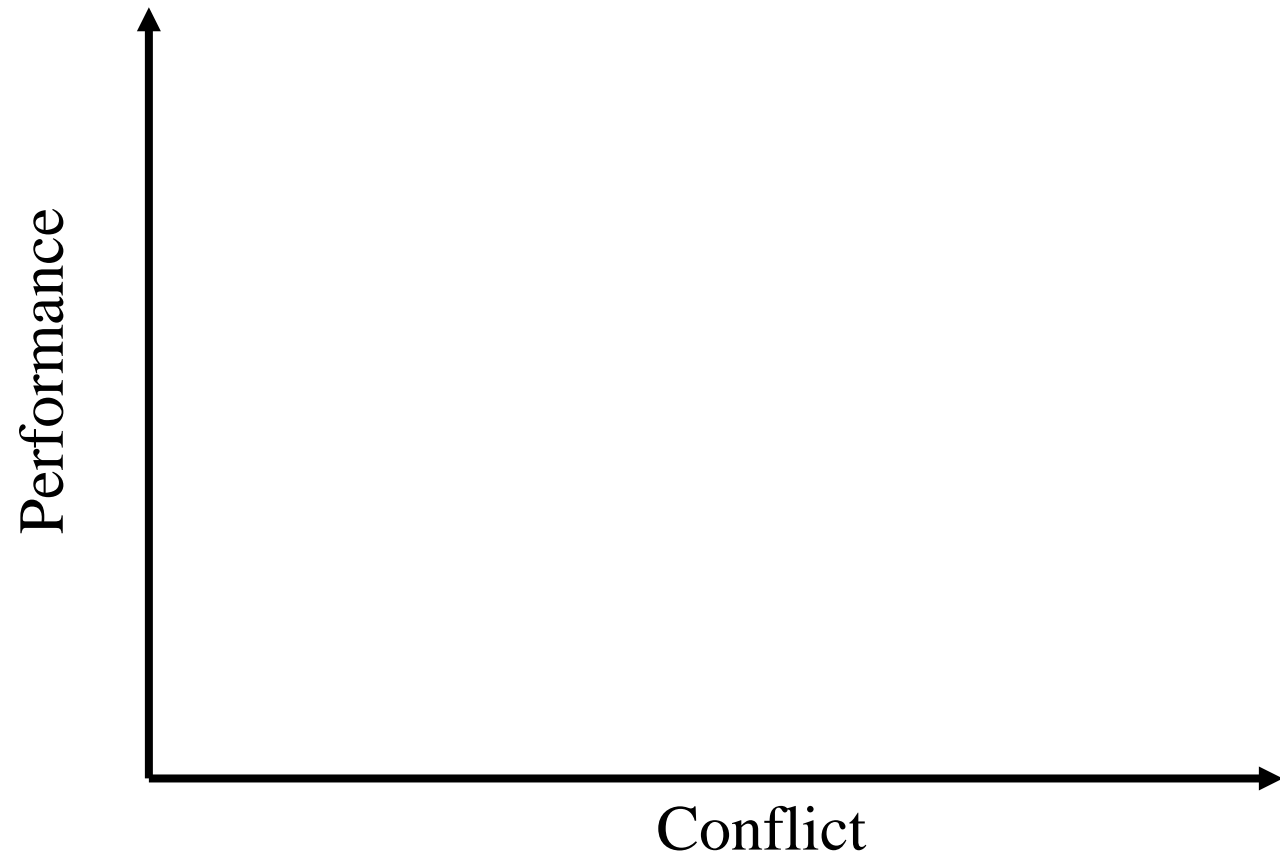
Goal setting & Strategy

▶ **Planning**

▶ Self-reflection (team roles)

▶ Group reflection

▶ Milestones & Performance Indicators

Teaching Tools

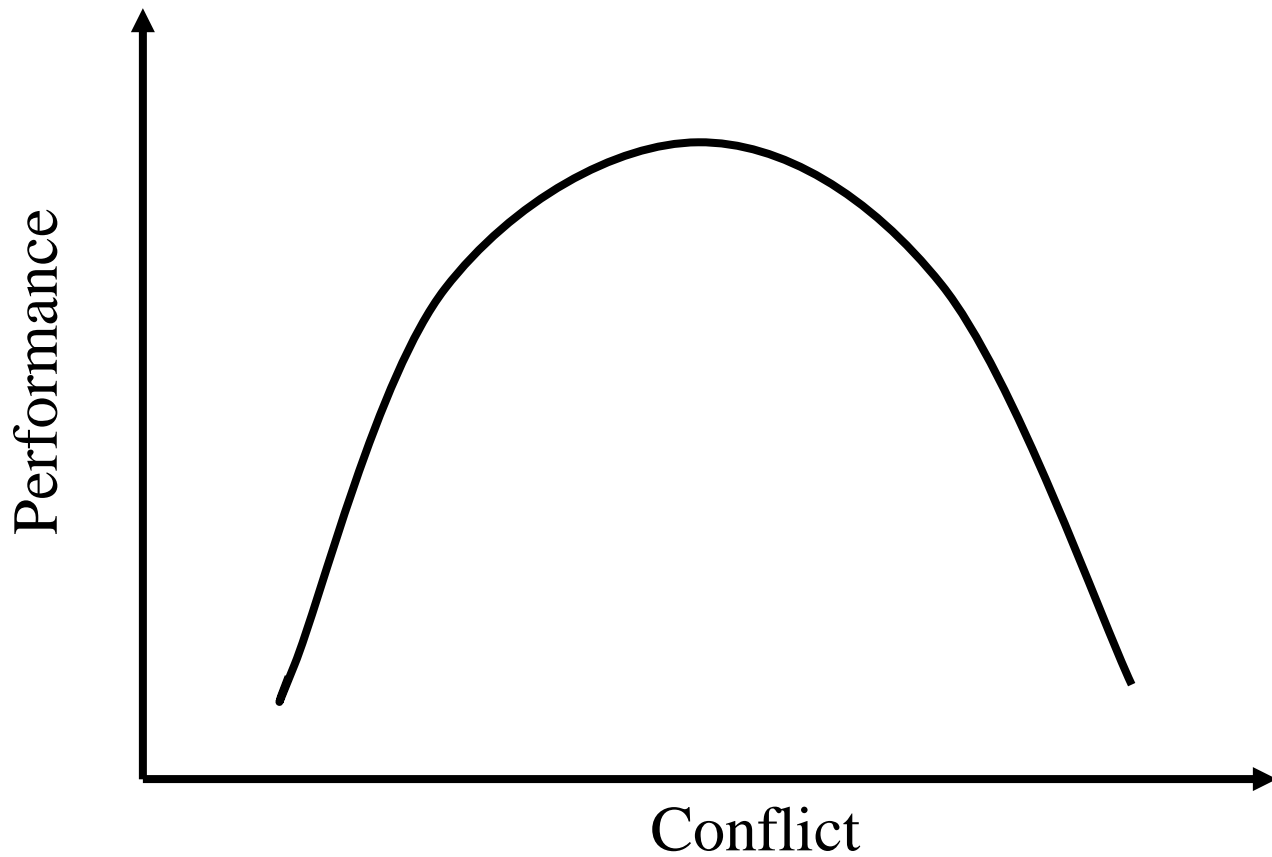▶ Conflict management strategies

▶ Rahim & Bonoma 1979 models

▶ Also other models out there…

Exercise

- ▶ What kind of curve would result?
- ▶ Work in your teams and agree on a final relationship
- ▶ Draw it on your flipchart

Teaching Tools

► Individual & Team Performance Lab

► https://www.itpmetrics.com

► Assessments

Teaching Tools

▶ Normative ethics & ethical frameworks:

▶ Stanford dictionary of philosophy

▶ Radio4 introduction to ethics:

▶ Consequentialism/Utilitarian ethics

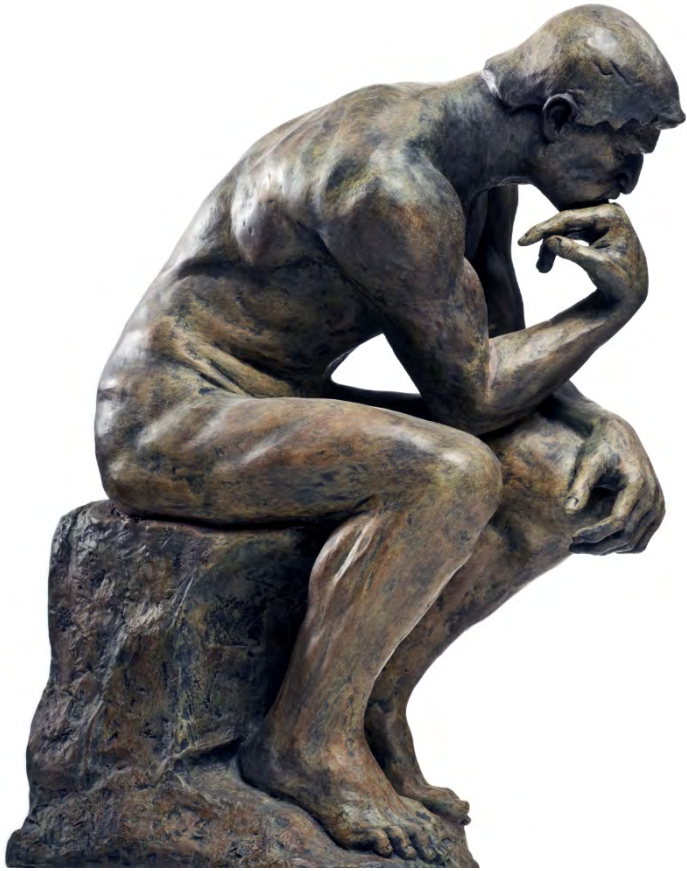▶ Deontology/Kantian ethics

▶ Virtue ethics

Teaching Tools

- Mindfulness
- Not covered currently but researching into it…

Mind Full, or Mindful?

But wait a minute…

…we're not ethicists/behavioral psychologists/[*insert word for other social science stuff*]

http://norsight.connectivitybiz.com/wp-content/uploads/2010/11/Thinking-Man-Stock_000005908297Medium11.jpg

Teaching Tools

▶ Collaborate with other specialists...bounce your ideas

▶ Currently working with an ethicist to check my material and my understanding

Exercise 1: TBL Troubleshooting

▶ A team have established a peer review system carried out on a weekly basis. However, as the weeks progressed the group were increasingly unhappy about the performance of one of the members. Towards the end of the project it was apparent that although the team where peer reviewing this particular member and each other, they did not share their peer review with him thus he was left unaware. The member came to complain to you regarding his poor peer review mark.

▶ As the academic lead how do you deal with this problem?

Exercise 2: TBL Troubleshooting

▶ A student has transferred into the second year from another local university. Thus CDIO is new to him. He has joined a team and has been working through the team tasks, attending meetings and submitting work due by the team. However, at the end of the project he was given a very poor peer review mark by the rest of the team. He comes to complain to you about this.

▶ As the academic lead how do you deal with this problem?

Summary

► Team working is HARD

► Managing a teaching program that incorporates team working which is also equitable and fair is EVEN HARDER!

► Share practices, go to L&T conferences, read the wealth of material out there…

Lessons to take away on Team Based Learning & developing Teamworking skills

http://cobaltpm.com/wp-content/uploads/2012/06/lessons-learned.jpg

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Lessons to take away

▶ Time management is KEY to success, whether for individual or collaborative work

▶ Get students to practice self awareness and reflection

▶ Communication – HUGE area, use tools to develop skills such as empathy, conflict management, mindfulness

▶ Processes, processes, PROCESSES: establish these to ensure accountability and paper trails. E.g. shared spaces, minuted actions, work documentation, issue numbers etc etc.

▶ Make sure you get student feedback and review your material

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Self Evaluation & Module Development

▶ What methods could we use to improve our teaching practice?

▶ [Group discussion & list collation]

Self Evaluation & Module Development

▶ Self-reflection

▶ Student feedback

▶ Peer feedback

▶ Module outcomes

▶ Student performances

▶ Explore the vast literature on learning & teaching…

I see and I forget.
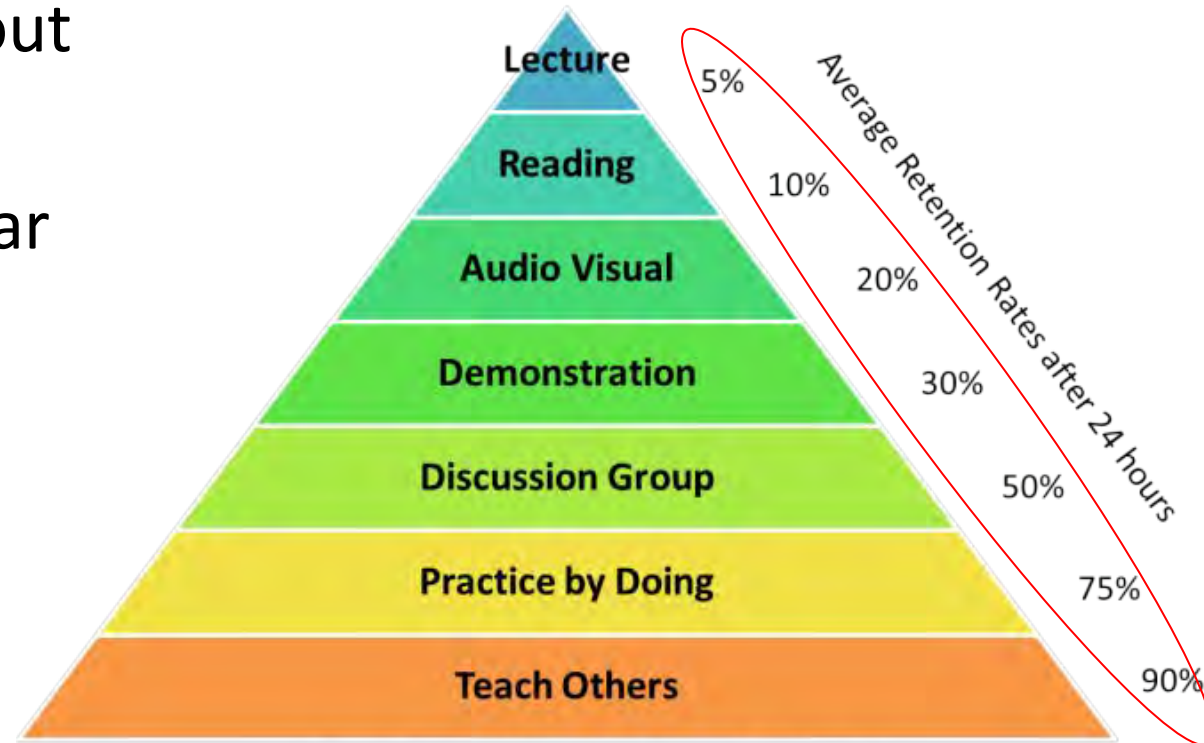I hear and I remember.
I do and I understand.
Confucius

Tell me and I will forget.
Show me and I will remember.
Involve me and I will learn.
Benjamin Franklin

Not hearing is not as good as
hearing, hearing is not as good as
seeing, seeing is not as good as
knowing, knowing is not as good as
acting; true learning continues
until it is put into action.
Confucius

The Cone of Learning

- ▶ Many variations out there…

- ▶ Attributed to Edgar Dale (1969)

- ▶ However quantitative % (circled) not from Dale 1969.

The Learning Pyramid

Lecture — 5%
Reading — 10%
Audio Visual — 20%
Demonstration — 30%
Discussion Group — 50%
Practice by Doing — 75%
Teach Others — 90%

Average Retention Rates after 24 hours

Source: National Training Laboratories, Bethel Maine

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The Cone of Learning: figures adapted over the years. Quantitative numbers should be taken with some caution
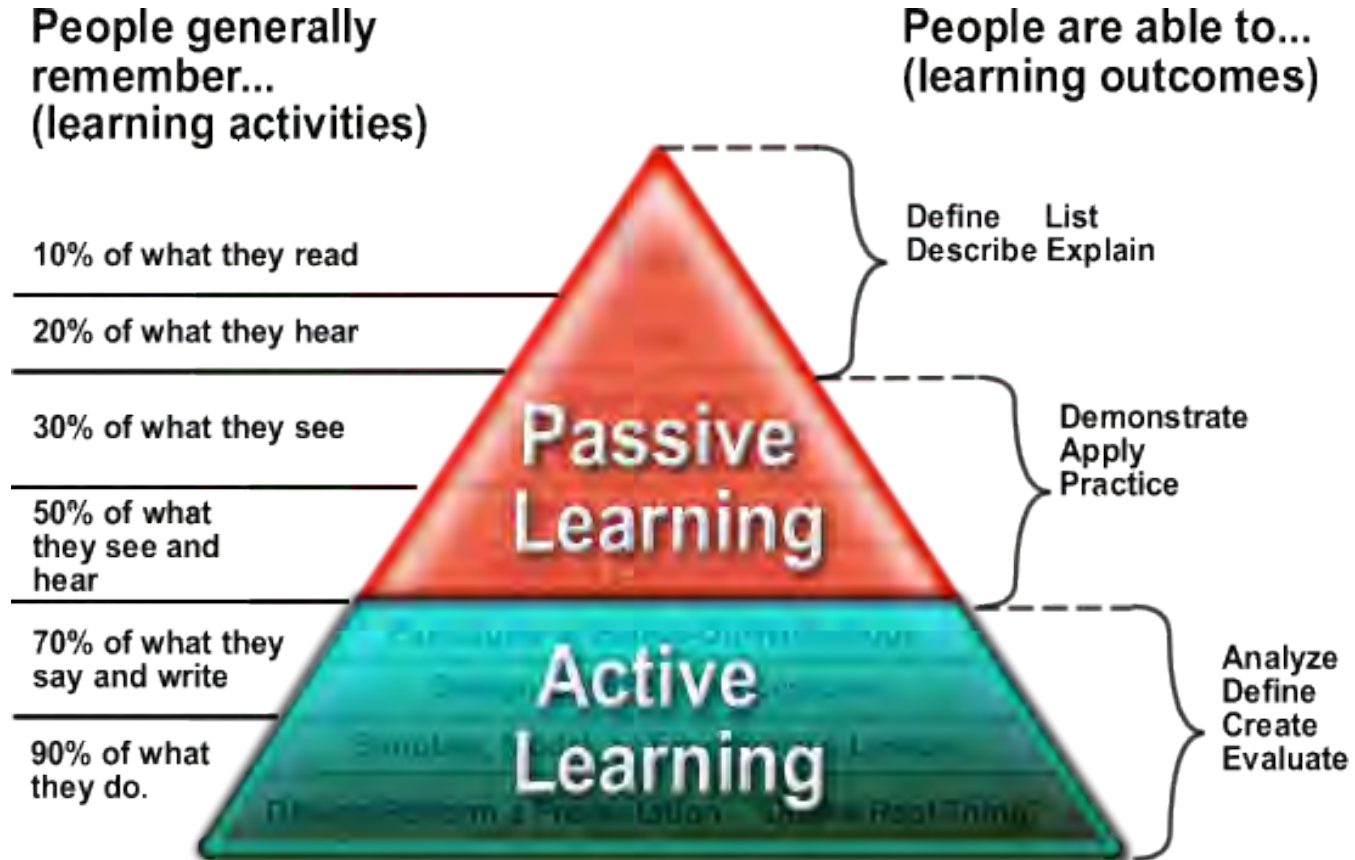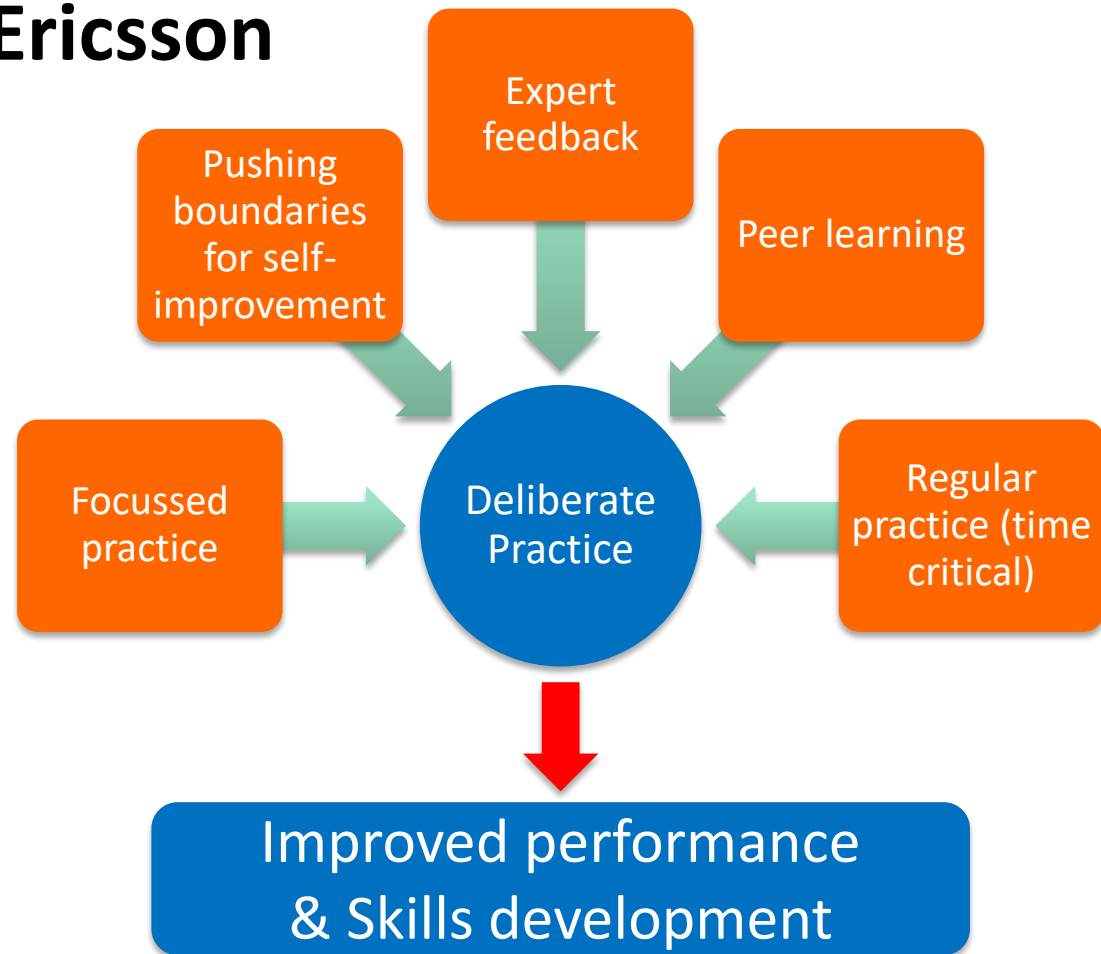

https://mathsimulationtechnology.files.wordpress.com/2012/02/cone_of_learning_web.png

At Aston and Warwick…

▶ Pedagogical Research:

– Metacognitive & skills development

– Logbook keeping skills development

– Skills confidence in Final Year Students

– Warwick International Higher Education Academy (WIHEA)

Aston study: Based on work of Anders Ericsson

REFERENCES: Ericsson et al. (1993). *Psychological Review*, *100*(3), 363-406.
Nandagopal & Ericsson (2012). *Learning and Individual Differences*, *22*, 597-609.

CAD & drawing skills learning

Previous intervention

CAD modelling & Engineering Drawing instruction

→

Weekly CAD practice & exercise for self-study

- No. students = 126

→

Two Assessments:
1) Engineering Drawing &
2) GA Assembly

CAD & drawing skills learning

CAD modelling & Engineering Drawing instruction

Exercises analogous to CDIO project

New intervention

Mindset theory

Weekly CAD practice & exercise for self-study

- No. students = 146

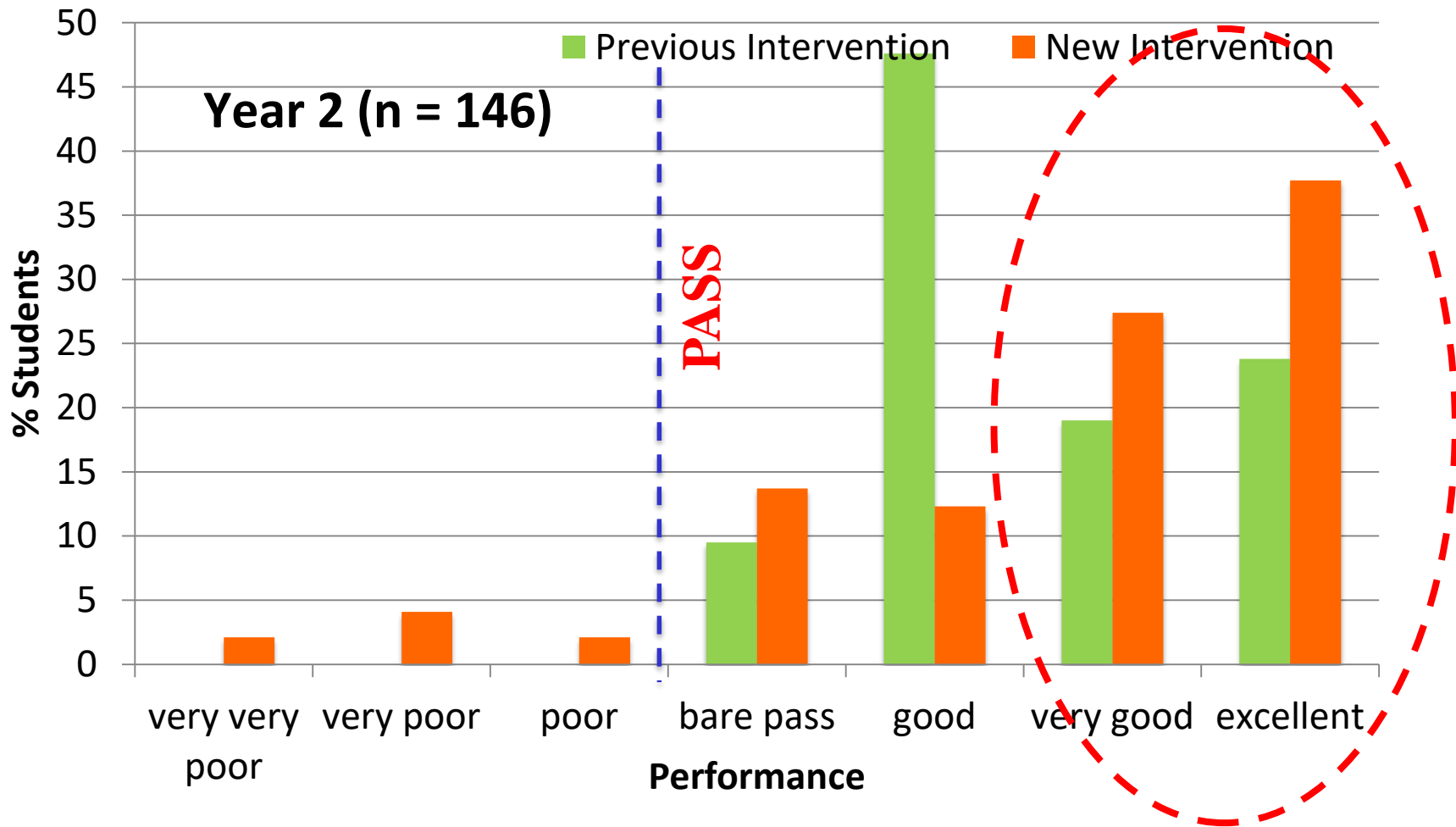Two Assessments:
1) Engineering Drawing &

2) GA Assembly

Individual CAD assessment improved

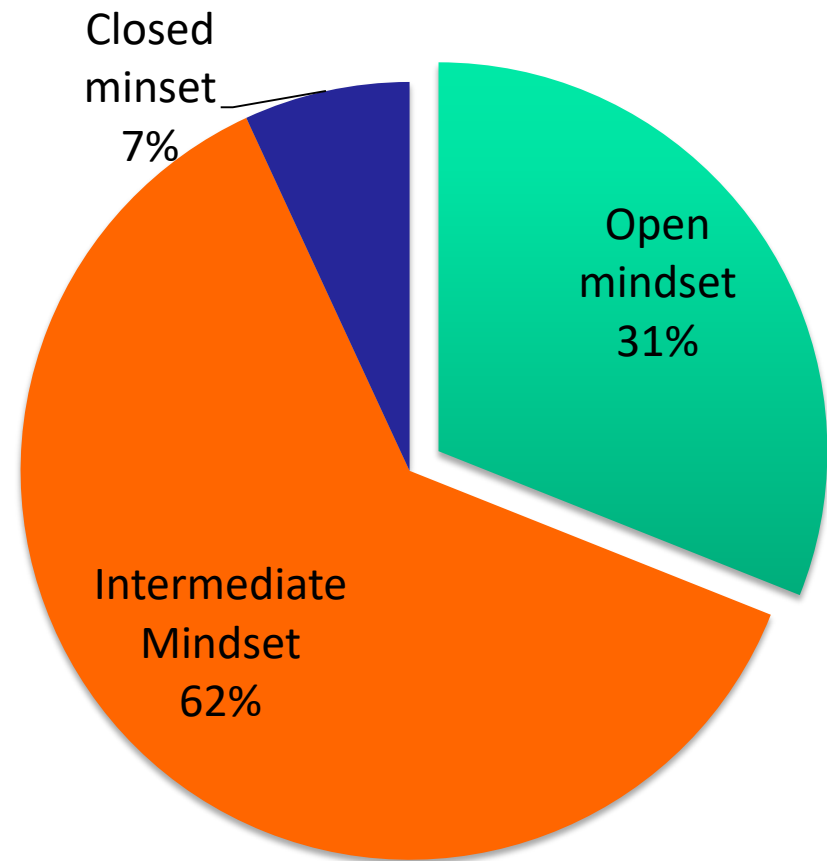1st Assessment: Engineering Drawing
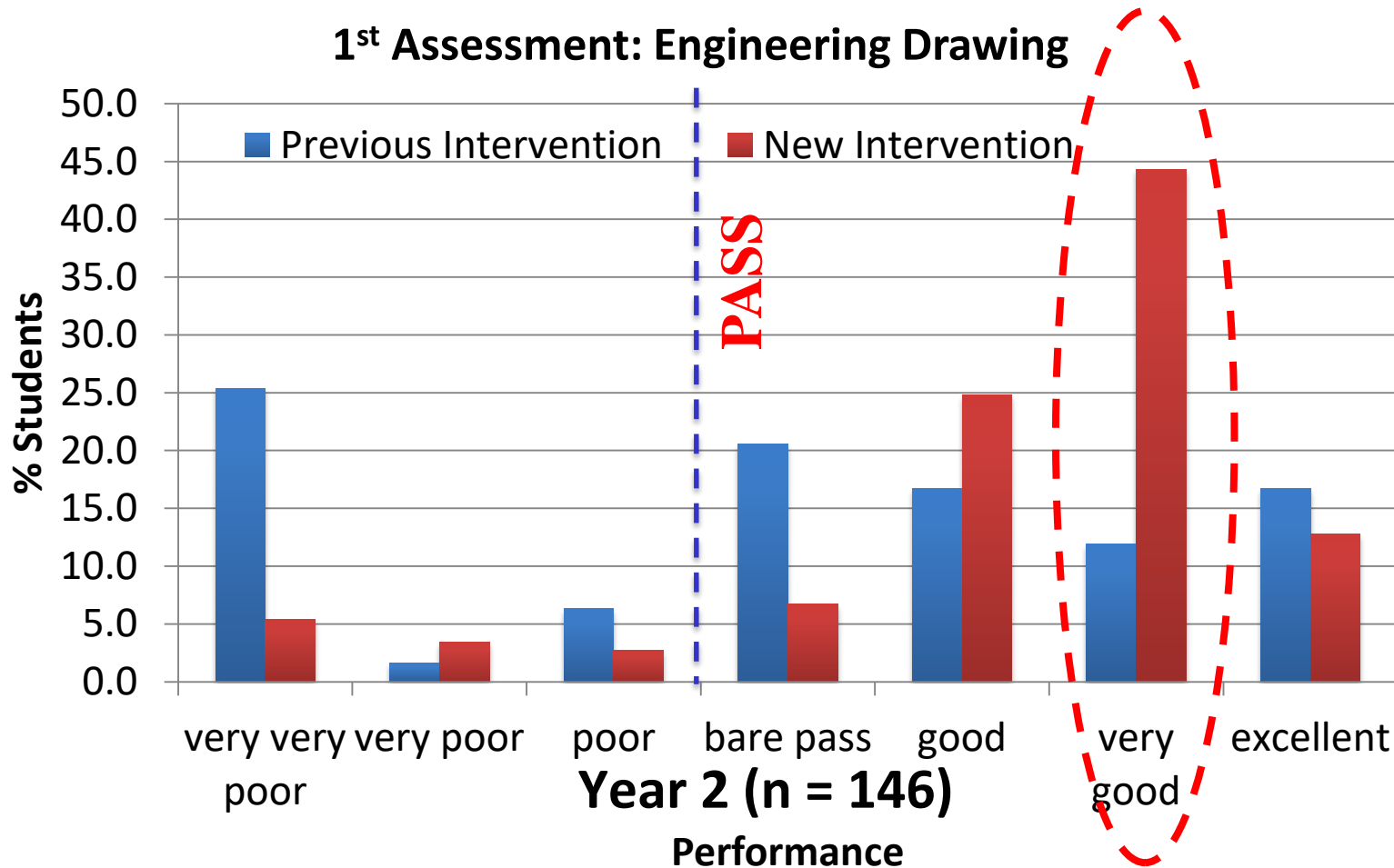
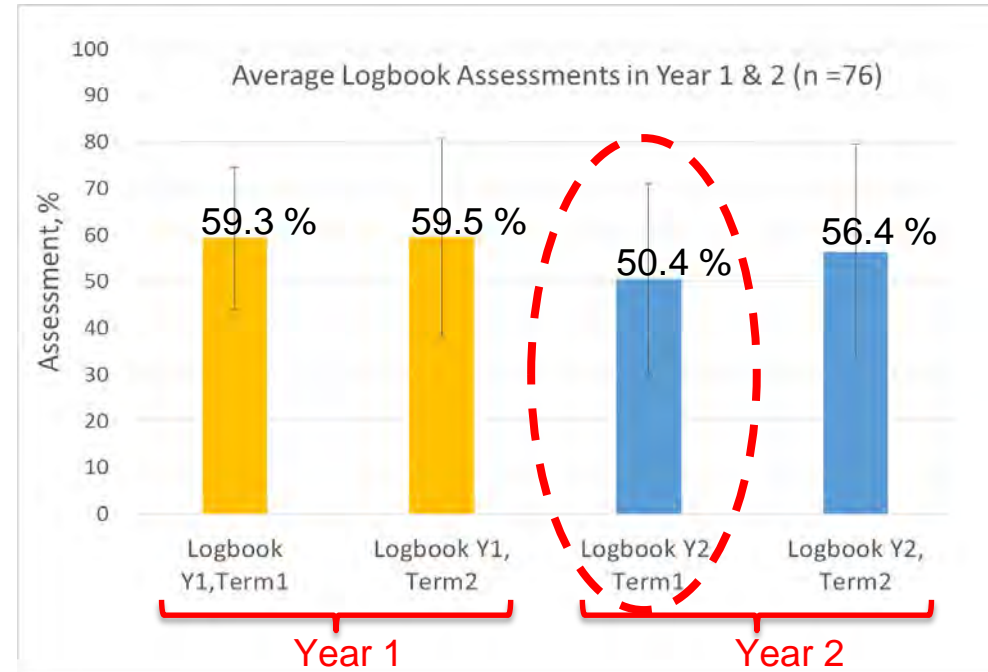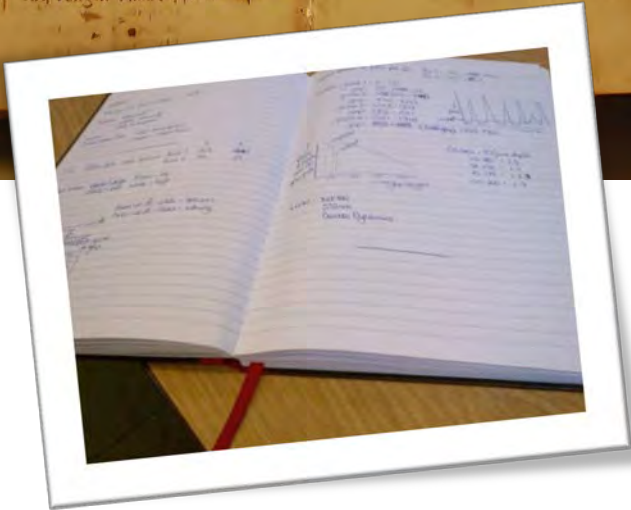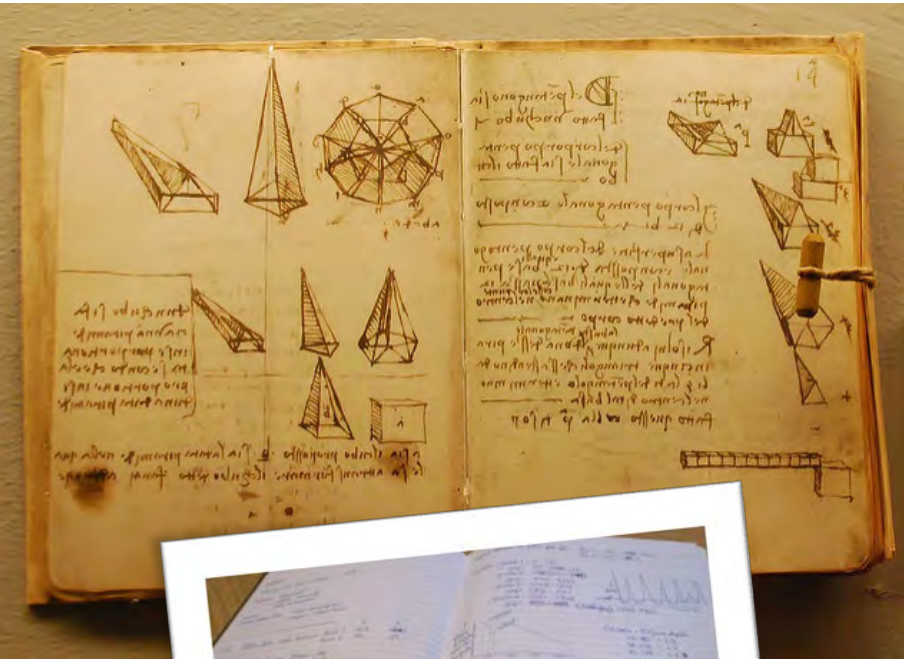# Team Build Assessment *also* improved

Mindset Survey Results

▶ 20 % response rates at end of project: n = 29

Survey

▶ Developed & validated by Project for Education Research that Scales (PERTS)

▶ https://survey.perts.net/

Closed minset 7%

Open mindset 31%

Intermediate Mindset 62%

Developing Logbook keeping as a professional skill

Average Logbook Assessments in Year 1 & 2 (n =76)

- Logbook Y1,Term1: 59.3 %
- Logbook Y1, Term2: 59.5 %
- Logbook Y2, Term1: 50.4 %
- Logbook Y2, Term2: 56.4 %

Year 1
Year 2

From Group to Independent Project Work: Does CDIO prepare learners?

Degree Class of Planners versus Tried to plan

QNR2 "Did you use CDIO in your Project?" % of students in category
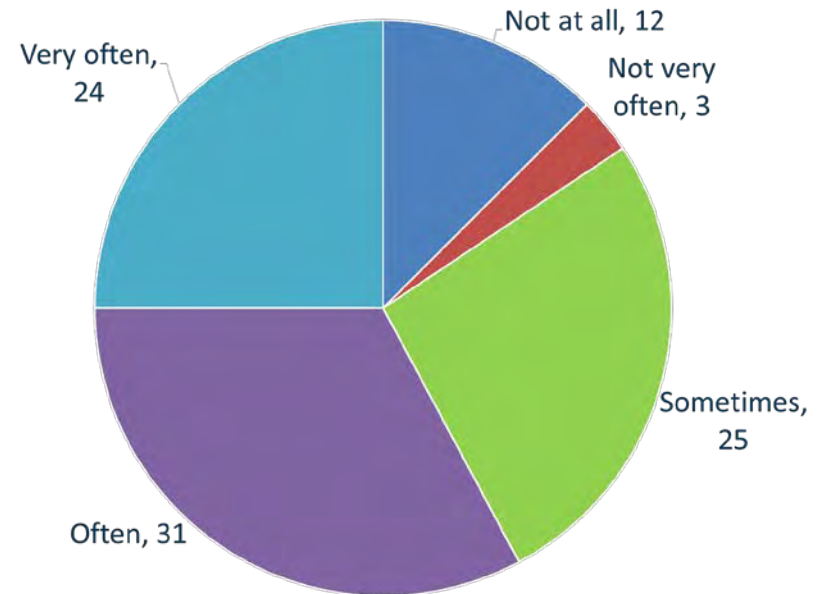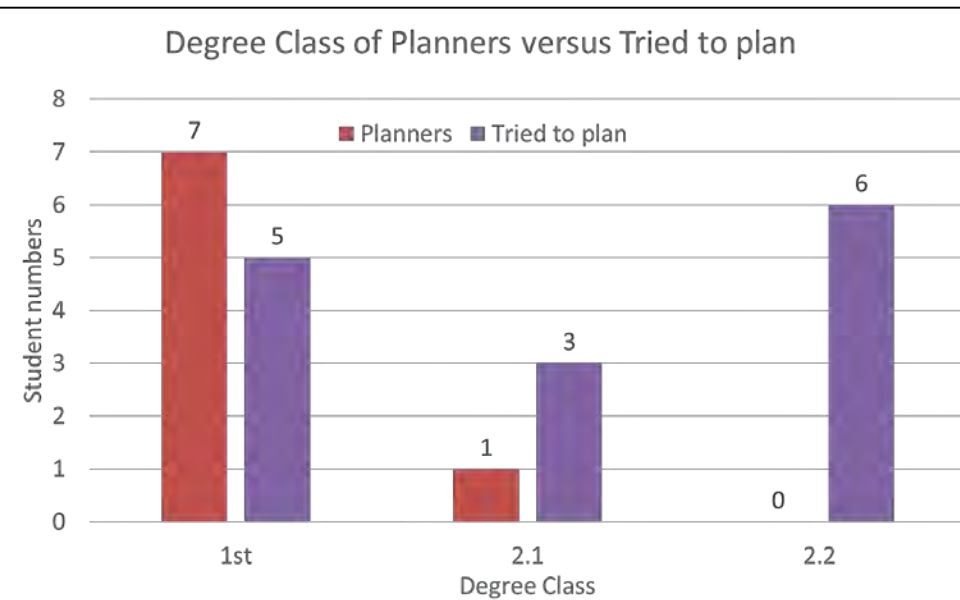
88 % of students said they used CDIO in their Project

What are the future challenges?

▶ Multidisciplinary, global teams

▶ Complex problem solving

▶ …

▶ [Group discussion & list collation]

If I were to advise my younger self...

http://cobaltpm.com/wp-content/uploads/2012/06/lessons-learned.jpg

Lessons to take away

- Be brave and embrace failure
- Learn and absorb from everyone
- Sometimes more important to be likeable than know everything!
- Empathy is essential
- Your role is to advise and nurture not instruct
- Look after your team (peers) not just students

Requested from Workshop: Engineering Education Research Conferences/Papers

- **Research in Engineering Education Symposium (REES)**, 10-12 July
- Cape Town, South Africa
- Abstract deadline: 16th November 2018
- http://www.rees2019.com/venue.html Organised by Research in Engineering Education Network (REEN)

- **CDIO International Annual Meeting**, 25-27 June 2019
- Aahrus, Denmark
- Abstract deadline: 15th November 2018.
- http://cdio.org/meetings-events/15th-international-cdio-conference-aarhus-university

- **American Society for Engineering Education (ASEE) annual conference**, 15-19 June 2019
- Tampa, Florida, USA
- Abstract deadline: 15th October 2018 (passed)
- https://www.asee.org/conferences-and-events/conferences/annual-conference/2019

- **World Engineering Education Forum (WEEF)** November 2019,
- TBC at WEEF-GEDC2018 conference
- Abstract deadline: TBC
- Website: see http://www.ifees.net for latest update. Organised by International Federation of Engineering Education Societies

Requested from Workshop: Engineering Education Research Conferences/Papers (UK/European Meetings)

- **European Society for Engineering Education (SEFI) Annual Conference**, September 2019
- Budapest, Hungary
- Abstract deadline: TBC
- https://www.sefi.be/activities/events/annual-conference/
- **UK & Ireland Engineering Education Network**, November 2019
- TBC, UK
- Abstract deadline: September 2019.
- https://hefocus.raeng.org.uk/events/ Affiliated with the Royal Academy of Engineering

Requested from Workshop: Engineering Education Research Conferences/Papers

Organisations:

- **IFEES -** International Federation of Engineering Education Societies

- **ASEE -** American Society for Engineering Education

- **CDIO –** Conceive Design Implement Operate

- **REEN -** Research in Engineering Education Network

- **SEFI (European) –** European Society for Engineering Education

Topics Raised from workshop

Review

What has been most useful today?

Action: will you do as a result of the workshop?

Identify a SMART goal

- ▶ Specific
- ▶ Measurable
- ▶ Achievable
- ▶ Realistic
- ▶ Timely

Organise your teaching? Speak to someone? Find a collaborator? Explore engineering education literature? Etc etc

Team Scores

Points	Team		Points	Team

Team MVP

Points   **Team**   **Participant**

Participant Leaders

Points	Participant	Points	Participant

Fastest Responders

Seconds	Participant		Seconds	Participant

Can associate prizes at the end of session or term...

Thank you!

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